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Bank Systemic Risk and Corporate Investment

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ABSTRACT

We develop a simple two-period model in which a bank's investment is influenced by short-term financing and a probability of a financial crisis. The presence of moral hazard problems in banks and firms causes (1) banks to take on riskier loans, (2) bank systemic risk to increase, and (3) firms to invest in riskier projects. We measure "bank systemic risk" using three measures that capture (1) bank funding maturity and (2) bank asset commonality. We document that in a sample of firms in 10 emerging markets and advanced economies bank systemic risk is positively associated with the firm-level investment ratio after controlling for the country's cross-sectional mean ratio of total loans to total assets of banks, country-level and firm-level variables until the start of the financial crisis of 2007. The effect becomes negative after 2007. We show that bank systemic risk strengthens the sensitivity of corporate investment to growth opportunities.

JEL Classification: E22; E44; G21; G31

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1. Introduction

One of the fundamental questions facing financial market regulators and bank supervisory authorities around the world following banking crises, and in particular, the recent global financial crisis of 2007-2008 is whether variation in bank systemic risk is positively associated with booms in credit markets (e.g., bank loans) that lead to firms' overinvestments (e.g., in capital expenditures).[1] The degree of overinvestment of firms will subsequently pose risk to financial systems as well as the economy. In this paper, we empirically test whether corporate investment is influenced by bank systemic risk, which is broadly conceptualized as a situation in which a large number of financial institutions (e.g., banks) fail due to a common stock or a contagion process (see e.g., Acharya et al., 2011) and is measured along two dimensions: (1) bank funding maturity and (2) bank asset commonality.[2]

Given the prevalent findings in the literature that banks' behaviors (e.g., bank revenue diversification and bank capitalization) contribute to bank risk[3], which in turn affects systemic risk of the financial sector, we develop a simple two-period model in which corporate investment (at the firm level) is associated with the degree of bank systemic risk that is driven by the excessive use of short-term financing and/or asset commonality across banks. A primary explanation for the relationship between bank systemic risk and corporate investment is that the presence of the moral hazard problem in banks and firms simultaneously causes (1) banks to take on riskier loans, which lead to an increase in the supply of credit provided by the banking system[4], (2) the level of bank systemic risk to increase, and (3) firms to invest in riskier projects (given that banks are now willing to

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[1] See e.g., Myers (1977) and Stulz (1990) for discussion about overinvestments.

[2] Bank systemic risk has been measured in a number of ways such as CoVaR (Bernal et al., 2014), Marginal Expected Shortfall (De Jonghe et al., 2015), and funding maturity (Allen et al., 2012a).

[3] See, e.g., Demirgüç-Kunt and Huizinga (2010), Cohen et al. (2014), and Cubillas and González (2014).

[4] Leth-Petersen (2010) finds the significant response of total expenditure to an exogenous increase in credit in Denmark.

finance higher risk investments than they were previously used to), which lead to economic growth as well as macroeconomic instability.[5]

A key feature of our theoretical model is that when a probability of bank runs or financial crises (hereafter "financial crises") is positive and banks *ex ante* internalize the cost of financial crises, the level of banks' investment (e.g., loans) is smaller, relative to a case where the probability of financial crises is zero. When banks *ex ante* expect to be bailed out during financial crises, they do not necessarily internalize the cost of financial crises. Consequently, the banks' investment is not constrained by the degree of bank systemic risk. In the sense that the supply of bank loans made available to firms encourage firms to make new investments, which simultaneously increase the level of systemic risk in the banking sector due to (1) the way in which banks finance their investment using more short-term debt and/or (2) the increase in asset commonality amongst banks. As a result, bank systemic risk and corporate investment are positively correlated.

In this study, we empirically test our main hypotheses using a panel data set of publicly listed firms in 10 emerging markets and advanced economies (i.e., Brazil, Germany, Indonesia, Japan, Malaysia, South Korea, Switzerland, Thailand, the United Kingdom, and the United States) over the period 1991–2013. On the one hand, Germany, Japan, South Korea, Switzerland, the United Kingdom, and the United States are chosen in our study to represent advanced economies. On the other hand, Brazil, Indonesia, Malaysia and Thailand are selected to represent medium-sized developing economies. Using this set of countries, we are arguably in a reasonable position to test not only the effect of bank systemic risk on corporate investment but also the asymmetric effects of bank systemic risk on corporate investment in developed and developing countries.

[5] Levine and Zervos (1998) show that financial markets (e.g., stock market liquidity and banking sector development) stimulate economic growth.

We document that an increase in bank systemic risk leads to more investments (the investment rate) in a sample of 10,231 firms (130,750 firm-year observations). After controlling for firm-level (e.g., cash, size, liquidity, profitability, operational risk) and country-level (GDP growth rate, banking sector development, export, stock market returns, banks' loan-to-asset ratio and banks' income diversification) variables, bank systemic risk (measured as the ratio of short-term debt to long-term debt (hereafter "SYSRISK1"), which could be seen as a measure of "bank funding maturity", is not associated with the investment rate; however, when bank systemic risk is measured as (1) the inverse of the cross-sectional standard deviation of the ratio of total loans to total assets (hereafter "SYSRISK2") or (2) the inverse of the cross-sectional standard deviation of a share of non-interest income to net revenue (hereafter "SYSRISK3"), the relation between bank systemic risk and the investment ratio is positive and highly significant. SYSRISK2 and SYSRISK3 could be viewed as a proxy for "bank asset commonality". In a closely related study, Panousi and Papanikolaou (2012) report that idiosyncratic risk is negatively associated with the investment rate of firms in the United States. We also show that bank systemic risk moderates the sensitivities of investment to growth options. When we split the sample into pre- and post- financial crisis periods, we find that the effect of bank systemic risk is positive in the pre-crisis period (i.e. during 1991-2007) and is negative in the post-crisis period (i.e. during 2008-2013). We document that the effect of bank systemic risk on the excess investment rate is negative.

Our paper is broadly related to two streams of the literature, namely: (1) corporate investment (see e.g., Denis and Sibilkov, 2010; Hackbarth and Mauer, 2012; Julio and Yook, 2012; Panousi and Papanikolaou, 2012; Titman, 2013) and (2) bank systemic risk (Allen et al., 2012a; Allen et al., 2012b; Anginer et al., 2014; Billio et al., 2012; Gauthier et al., 2012). In this paper we extend prior studies by combining these two streams of research. Broadly speaking, the corporate finance literature focuses on the firm-level analysis in single-country (e.g., the United States) studies and typically does not incorporate macro-level variables in the models (see e.g., Aivazian et al., 2005; Billett et al., 2011; Denis and Sibilkov, 2010; Foucault and Fresard, 2014; Jovanovic and Rousseau, 2014; Panousi and Papanikolaou, 2012)[6], whereas the banking literature mainly focuses on how banks' activities/behaviors create idiosyncratic (bank-specific) and systemic risk (of the banking system) and generally does not analyze the effect of bank-level factors on firm-level investment (see e.g., Allen et al., 2012a; Anginer et al., 2014; Bedendo and Bruno, 2012; Billio et al., 2012; Calmès and Théoret, 2014; Duran and Lozano-Vivas, 2014). Therefore, our study complements both streams of research by providing new empirical evidence on the influence of bank systemic risk on firm-level investment in a multi-country setting. In addition, our paper is also closely related to prior studies such as those of Bianchi (2011) and Lorenzoni (2008), who examine the effects of credit booms on corporate investment.

In policy terms, the model indicates that to ameliorate the positive impact of bank systemic risk on corporate investment, financial markets regulators and/or banking supervisory authorities should address the fundamental question of how to impose banks to internalize the costs of a financial crisis that is caused by a high degree of bank systemic risk contributed by each bank in the system. In our model, we show that a bank's investment is smaller when a probability of a financial crisis is positive. Therefore, we argue that banks are more inclined to internalize these costs when a probability of not being bailed out by the central bank during a financial crisis is sufficiently high; consequently, the level of bank systemic risk will be smaller. Overall, our arguments are generally resonant with those of Diamond and Rajan (2005) and Farhi and Tirole (2012).

[6] The work of Julio and Yook (2012) is one of multi-country studies on corporate investment. However, the majority of the multi-country studies such as Ndikumana (2005) uses the aggregate-level investment data.

The rest of this paper is organized as follows. In Section 2 we provide a brief overview of related studies and present hypotheses. In Section 3 we describe our data and research methodology. In Section 4 we report and discuss our empirical results and implications for the banking and corporate finance literature. In Section 5 we conclude the paper.

2. Related literature and hypothesis development

2.1. Rollover risk, systemic risk and corporate investment

As noted by He and Xiong (2012), a firm faces roll over risk of not being able to roll over matured short-term debt with the issuance of new short-term debt.[7] They also argue that the firm's rollover risk is affected by debt maturity because the rollover losses of all bonds with shorter maturity at a certain date causes equity holders to suddenly absorb rollover losses, and the effect of debt maturity on rollover risk is magnified by the degree of market liquidity. In the model of Acharya et al. (2011), a sudden "market freeze" phenomenon, which refers to a situation in which a sudden collapse of firms' ability to borrow short-term, causes the firms to fail to rollover their short-term debt. Acharya et al. (2011) show that with a sufficiently short tenor of the debt, the debt capacity of an asset, which is the maximum amount of borrowing that an asset can support and is equal to its NPV or fundamental value in efficient markets, and the minimum possible future value of an asset can be identical. The collapse of short-term debt markets (e.g., interbank markets) is arguably considered to be one of the key drivers of the 2007–2008 global financial crisis (Acharya et al., 2011; Iyer et al., 2014).

[7] He and Xiong (2012) note that the firm may suffer rollover losses when the value of new debt issuance is less than the value of the maturing debt, which may affect the value of existing equity.

Rollover risk typically increases with systemic risk. According to Allen et al. (2012a), the term "systemic risk" traditionally refers to (1) a situation in which a large number of financial institutions (e.g., banks) fail due to a common stock or a contagion process, (2) the connections between financial institutions, and (3) financial institutions' funding maturity. Schotter and Yorulmazer (2009) note that many static two-period models on bank runs view a bank-run problem as an equilibrium selection problem and focus the analysis on whether in the presence of a probability of a run on a bank, deposit contracts are optimal arrangements. Therefore, they develop a dynamic four-period bank-run model that focuses on the dynamics and severity of bank runs. One of the key insights resulting from their model is that money stays longer in the banking system in the presence of insider information (i.e. those who are informed about the soundness of the banks and those who are uninformed); that is, withdrawals tend to be made later when there are insiders, relative to when there is no insider.

In the model of Allen et al. (2012a), when banks use long-term debt, the welfare is not affected by the asset structure of the banks, but when short-term debt is used, the asset structure affects systemic risk. The differential effect of the asset structure on systemic risk is attributed to a signal of banks' future insolvency that investors receive at the intermediate date. When investors detect a signal of banks' future insolvency[8], they do not roll over the short-term debt, forcing all banks into early liquidation of their assets. In this context, systemic risk in the banking system is due to the banks' failure to roll over their short-term debt. López-Espinosa et al. (2012) find that short-term wholesale funding determines a

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[8] An investor's decisions are influenced by (1) information contagion, where news regarding one financial firm's problem(s) is correlated with negative shocks at other financial institutions because they are exposed to common risk factors, or (2) counterparty contagion, where one financial firm's trouble directly causes other financial institutions' problems (see e.g., Helwege, 2010).

bank's contribution to systemic risk, and that banks with high levels of short-term funding are more interconnected to other banks and more vulnerable to changes in market conditions and liquidity risk. Furthermore, Uhde and Michalak (2010) show that the variation in European banks' systemic risk can be explained by credit risk securitization.

Recent studies provide evidence for the relation between bank revenue diversification and variation in bank income. For instance, Calmès and Liu (2009) show that the variance of aggregate operating-income growth can be explained by the share of the noninterest income to total income in a sample of Canadian banks, and thus argue that engaging in non-core banking activities may not necessarily bring about diversification benefits to banks. In addition, a bank's revenue diversification contributes to its risk exposure (Vallascas and Keasey, 2012).

In the corporate finance literature, the firm's investment and financing decisions in the dynamic models differ from those of static models. For instance, Mauer and Triantis (1994) propose a dynamic model in which a firm has the flexibility to manage both investment and financing decisions over time. Childs et al. (2005) show that in a dynamic model with conflicts over investment policy (of the growth option) between debt holders and equity holders[9], financial flexibility, which is the ability to adjust the debt level over time, tends to encourage the use of short-term debt, which mitigates the under- and over-investment incentives and hence increases firm value. In a recent study, Bolton et al. (2011) emphasize the important role of the marginal value of liquidity (cash and credit line) in a dynamic model of investment, financing, and risk management for firms with financial constraints. They argue that for financially constrained firms, investment is determined by the ratio of marginal q to the marginal cost of financing, rather than by the marginal q (as in e.g., Lucas and

[9] The conflicts arise when a growth option exercise decision to maximize the market value of equity is preferred to a decision to maximize the market value of the firm.

Prescott, 1971). In addition, Hirth and Viswanatha (2011) show that the relation between liquidity (e.g., cash holdings) and investment is U-shaped for financially constrained firms.

The literature also reveals the influence of market liquidity on the firm's behavior. For example, Lemmon and Roberts (2010) show that in a sample of non-financial firms during the period 1986–1993 the firm's investment and financing are affected by shocks to the supply of credit given that a fall in net debt issuance and a decline in net investment are almost in equal proportion, as substitution to bank debt and other sources of capital is limited. Campello et al. (2011) show how firms substitute credit lines and internal liquidity (cash and profits) when they encounter a severe shock to the supply of credit during the 2008–2009 financial crisis. In addition, using a sample of firms in Europe during the 2008–2009 financial crisis, Campello et al. (2012) show that firms with relatively less restricted access to credit tend to draw less funds from their line of credit, relative to firms with more restricted access to credit, and also document that credit lines play an important role with respect to investments during the crisis.

2.2. A two-period model

In this section, we present a simple two-period model of a bank's investment (i.e., with time t = 0, 1 and 2). I denotes a bank's total investment. I_L denotes a bank's long-term financing. I_S denotes a bank's short-term financing. r_L is the long-term interest rate or equity yield rate. r_S is the short-term interest rate, whereas r_{SC} is the short-term interest rate during a financial crisis period. $F(I)$ denotes a bank's gross profit realized at time t = 2. $\sigma(I_S)$ is a probability of a financial crisis during a period between times t = 0 and t = 1.

If the bank invests I at time t = 0, the bank receives gross profits $F(I)$ at time t = 2. To this end, the bank finances its investment using a combination of short-term and long-term financing. Suppose that the bank's long-term financing (I_L) is fixed, implying that the issue cost of equity and long-term bond is sufficiently high. However, the bank is not required to make any payment to long-term financing until time $t = 2$. The bank raises the remaining amount $I - I_L = I_S$ by issuing the short-term debt. If the bank uses the short-term debt, it must rollover the short-term debt at time $t = 1$; that is, that bank needs to make the interest payment $r_S I_S$ and raises I_S at time $t = 1$. If a financial crisis does not occur, the bank can finance this additional amount $(1+r_S)I_S$ by the normal short-term interest rate r_S. Thus, the bank pays $(1+r_S)(1+r_S)I_S = (1+r_S)^2 I_S$ at time $t = 2$. However, if a financial crisis occurs, the bank must raise this additional amount $(1+r_S)I_S$ by accepting capital injection by the financial regulator (e.g., the central bank), issuing short-term junk debts with a higher short-term interest rate r_{SC} (where $r_{SC} > r_S$)[10], or selling the assets. If the financial regulator does not bail out the bank and the bank does not sell its illiquid assets at potentially fire sale prices (see, for example, Diamond and Rajan (2011) regarding a more detailed discussion about fears of fire sales and liquidity shocks in the banking system), the bank must therefore pay $(1+r_{SC})(1+r_S)I_S$ at time $t = 2$.

To make the subsequent analysis meaningful, we impose the following assumptions.

Assumption 1: $F'(I) > 0$ and $F''(I) < 0$.

Assumption 2: $\sigma'(I_S) > 0$.

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[10] In this sense, the increase in the interest rate during a financial crisis that is due to the fact the bank might be willing to pay higher for new short-term deposits could be thought of as one of three predictions in Diamond and Rajan (2005) with respect to how the bank may response to a shortage of the aggregate liquidity at an interim date (i.e. time $t = 1$ in our model).

Assumption 1 is the standard assumption about the production function. Assumption 2 implies that a probability of a financial crisis during a period between times t = 0 and t = 1 is larger if the bank issues more short-term debt to finance its investment (i.e. loans made to firms in our model). That is, Assumption 2 suggests that due to the presence of rollover risk of a bank, systemic risk of the banking system is larger when the bank's short-term financing is larger.

Similar to Diamond and Rajan (2005), we suppose that the bank's long-term financing I_L is fixed and cannot demand payment at time t = 1. We next discuss the optimal short-term financing decision of the bank. We begin with the benchmark case in which the probability of a financial crisis during a period between times t = 0 and t = 1 is independent of the bank's short-term financing amount, that is, $\sigma'(I_S) = 0$. Then, the bank's optimization problem is represented as follows.

$$\underset{I_S}{\text{Max}}\,(1-\sigma)\{F(I_S+I_L)-[r_S+(1+r_S)^2]I_S-r_L I_L\}$$
$$+\sigma\{F(I_S+I_L)-[r_S+(1+r_{SC})(1+r_S)]I_S-r_L I_L\}.$$

Solving this problem, we obtain the following first-order condition with respect to I_S.

$$F'(I_S+I_L)=r_S+(1-\sigma)(1+r_S)^2+\sigma(1+r_{SC})(1+r_S)\equiv\Phi.$$

Thus,

$$I=I_S+I_L=F'^{-1}(\Phi). \tag{1}$$

We next analyze a case in which the probability of a financial crisis during a period between times t = 0 and t = 1 is an increasing function of the bank's short-term financing amount, that is, $\sigma'(I_S) > 0$. Then we obtain the following first-order condition with respect to I_S.

$$F'(I_S + I_L) = \Phi + \sigma'(I_S)(\Pi_N - \Pi_C).$$

where

$$\Pi_N \equiv F(I_S + I_L) - [r_S + (1+r_S)^2]I_S - r_L I_L ,$$

$$\Pi_C \equiv F(I_S + I_L) - [r_S + (1+r_{SC})(1+r_S)]I_S - r_L I_L .$$

Hence,

$$F'(I_S + I_L) = \Phi + \sigma'(I_S)(1+r_S)(r_{SC} - r_S) > \Phi. \tag{2}$$

Comparing Equations (1) and (2) with $F''(I) < 0$ from Assumption 1, we now show that the bank's total investment level when $\sigma'(I_S) > 0$ is smaller than that when $\sigma'(I_S) = 0$. Thus, if systemic risk of the banking system is positively related to the bank's short-term financing, the bank's total investment is smaller. This result means that if the bank *ex ante* attempts to reduce a probability of (1) facing a higher interest rate in the second period due to a financial crisis and/or (2) failing to receive a bailout from the central bank, the bank will *ex ante* have to internalize these costs and lower its investment. However, if the bank *ex ante* expects to be bailed out by the central bank, the bank's total investment is not constrained by a positive probability of a financial crisis (for a more detailed discussion about collective moral hazard, maturity mismatch, and expectations of systemic bailouts by financial authorities, please see Farhi and Tirole (2012)).

Behind this model, there are three agents: bank depositors (hereafter "depositors"), commercial banks (hereafter "banks"), and firms in different industries (excluding the banking industry). Consistent with the financial intermediation literature as in Diamond and Rajan (2000) and Diamond and Rajan (2005), we assume that depositors make a short-term (demand) deposit at one or more banks, given the market deposit interest rate (r_{dep}) prevailing at time $t = 0$.

We have already discussed the financing problem of banks. The bank uses short-term financing (i.e., deposits) to invest in risky assets by lending to firms at the market lending interest rate (r_l), conditioned on the risk profile of the firms, at time $t = 0$. The bank may also want to diversify its portfolio of risky assets (e.g., making loans to firms in different industries) to reduce portfolio risk. If all banks diversify their portfolio, in equilibrium their portfolio tends to be identical. This asset commonality, together with the higher dependence on short-term financing, in turn gives rise to systemic risk.

A firm finances its investment using its initial equity (with an initial required rate of return on equity (r_e)) and a loan from a bank (with an initial cost of debt = $r_d = r_l$) at time $t = 0$. In equilibrium, the firm chooses the amount of investments (and projects) whereby the marginal return on the investment equates its marginal cost (i.e. the weighted average marginal costs (WACC)) at time $t = 0$. However, under the presence of asymmetric information between the bank and the firm, the firm may rationally overinvest whereby a "marginally" negative NPV project with a large positive return, which is known to the firm but is unknown to the bank, is undertaken and is financed by bank loans.

2.3. Hypotheses

During periods of economic expansion and credit booms, firms are more likely to exhibit a higher degree of investment, as banks are willing to finance their investments. Given that all banks tend to use short-term financing and to hold an identical portfolio of loans, which is optimal to individual banks, the level of asset commonality amongst banks is therefore expected to increase the level of systemic risk in the banking system. As a result, variation of corporate investment is correlated with not only financial market conditions (e.g., credit booms) but also with the level of bank systemic risk. However, in equilibrium, the effect of bank systemic risk on banks' investments (e.g., loans) and firms' investments depends on whether banks *ex ante* internalize the costs of potential financial crises.

In fact, it is widely known that moral hazard problems may arise when the agent's (in this paper, "managers") action is not verifiable, or when the agent receives private information after the relationship has been initiated (see Hart (1995) for the general agency problem and Diamond and Rajan (2000) for the agency problem of banks). In our paper, risk shifting is not verifiable from outside. Or we can even say risk shifting is the manager's private information. If the authority bails out an insolvent bank in the financial distress and if many bank managers anticipate the bailout policy, many bank managers prefer more profitable but risky investments because their banks are bailed out even though their banks are insolvent as a result of their investment's failure. This moral hazard behavior of bank managers will increase in banks' investments and corporate investments, thereby increasing the systematic risk and the likelihood of the financial crisis. Indeed, once many bank managers expect that the authority will not help their banks, their optimistic beliefs are converted into pessimistic ones. The banks' investments fall concurrently, which result in a fall in liquidity for firms. As a result, a financial crisis subsequently ensues from liquidity shocks to financial markets.

When the externality of bank systemic risk is not internalized, the influence of bank systemic risk on corporate investment, credit cycles, and business cycles is more likely to be substantial. However, once the externality of bank systemic risk is internalized, the bank's total investment may be reduced substantially, which leads to severe recessions. Evidence of banking crises, and especially, the global financial crisis of 2007-2008 points to the notion that collectively banks do not substantially internalize the cost of a financial crisis. Building upon prior studies and above discussions, we argue that bank systemic risk positively affects firms' investment and that firms with growth opportunities are more likely to invest more than those with limited growth opportunities during periods of high degrees of bank systemic risk. In sum, we propose two testable hypotheses:

Hypothesis 1: There is a positive relationship between bank systemic risk and corporate investment.

Hypothesis 2: Bank systemic risk strengthens the sensitivity of corporate investment to growth opportunities.

3. Data and methodology

3.1. Data and sample construction

Our initial sample comprises 11,356 publicly listed non-financial firms in Brazil, Germany, Indonesia, Japan, Malaysia, South Korea, Switzerland, Thailand, the United Kingdom, and the United States over the period 1991-2013 with special emphasis on the potential effect of the global financial crisis of 2007-2008 on the relation between systemic risk and corporate investment. The initial sample includes all non-financial firms[11] that are listed from January 1, 1991 to December 31, 2013, excluding all IPOs during January 1, 2011 and December 31, 2013. This selection procedure ensures that firms included in our sample have a minimum of three-year observations required for regression analyses. We retrieve financial data on banks and firms from Datastream. To compute values for our bank systemic risk variables for each country in our study, we similarly construct our sample of publicly listed banks in each country using the same procedure.

3.2. Methodology and key variables

Following Allen et al. (2012a), there exists the idea that the degree of bank systemic risk can be measured by using two proxies: the debt maturity of banks and the clustered asset structure of banks. The main idea is that the use of short-term debt by banks may increase the information contagion in the event of a run on one bank. When banks have the identical composition of the asset structure, an adverse shock to one bank (e.g., unfavorable information about one bank) might be interpreted as a signal of potential adverse shocks to all other banks in the system due to the similarity in the asset structure.

The debt maturity, measured as the ratio of short-term debt to long-term debt[12], indicates how banks finance their assets. The high proportion of the short-term debt to total debt increases a bank's rollover risk attributable to the shorter debt maturity (in additional to the bank's rollover risk due to deposits). Therefore, we use the cross-sectional average debt maturity of banks as a first measure of systemic risk (SYSRISK1). A high value of

[11] We exclude firms classified in the following industries: banks, financial services, life insurance, non-life insurance, and unclassified industries, according to the industry classification of Datastream.

[12] Deposits are not included in both short-term and long-term debt.

SYSRISK1 implies the shorter debt maturity, which indicates a high level of bank systemic risk due to rollover risk of the banks.

To measure the level of clustered asset structure (or asset commonality) of banks, we use two variables. Following the work of Calmès and Théoret (2014), we use the inverse of the cross-sectional standard deviation of the ratio of total loans to total assets, which is denoted SYSRISK2, and the inverse of the cross-sectional standard deviation of a share of non-interest income to net revenue, which is denoted SYSRISK3, as two measures of bank systemic risk in terms of the banks' clustered asset structure. The basic idea is that when banks mimic their peers' asset portfolio (e.g., loans), variation in the ratio of loans to assets becomes smaller, and hence, the standard deviation of the ratio of loan to assets is small, which implies that bank systemic risk is high. For ease of interpretation, we use the inverse of the cross-sectional standard deviation so that a high value of the RISK variable(s) corresponds to a higher level of bank systemic risk.[13]

Following prior studies, such as Denis and Sibilkov (2010), Julio and Yook (2012) and Foucault and Fresard (2014), we measure a firm's investment as the ratio of capital expenditure to one-period lagged total assets. A firm's excess investment rate (EXCAPEXTA) is the country-year adjusted investment, which is computed as the natural logarithm of the ratio of a firm's investment (CAPEXTA) to a country's average investment (MEANCAPEXTA). We compute a country's average investment rate (MEANCAPEXTA) as the cross-sectional average of investment rate (CAPEXTA) of firms in country *m* at time *t*.

[13] While we also consider the use of the level of clustered asset structure by using the cross-sectional standard deviation of (1) Commercial & Industrial Loans/Assets, (2) Consumer Loans/Assets, or (3) Agricultural Loans/Assets, we find that the required availability of these time series variables are limited prior to 2000 and are not available for all countries in our sample. Therefore, we do not use them.

Similar to prior studies such as Aivazian et al. (2005) and Denis and Sibilkov (2010), we include a number of firm-level variables to control for factors that have been found to affect corporate investment. Firm size is measured as the natural logarithm of real total assets in million US dollars. We deflate the book value of total assets in USD by US CPI (CPI = 100 in 2010). Leverage (LEV) is computed as the ratio of total debt to total assets. Cash/Assets (CASHTA) is the ratio of cash to total assets. Current Assets/Current Liabilities (CACL) is the ratio of current assets to current liabilities. Market-to-book ratio (MBV), computed as the ratio of the market value of equity to the book value of equity, is used as a proxy for a firm's investment or growth opportunities. Return on Assets (ROA) is measured as the ratio of EBIT to total assets. Risk taking (RISKTAKING), which is also known as earnings volatility, is measured as the three-year moving standard deviation of ROA for each firm and is used as a proxy for operational risk.

To control for country-level economic conditions that may affect firms' investment, we include the GDP growth rate (in %), the share of export to GDP (in %), the return on the stock market (in %), measured as the first difference in the natural logarithm of the stock market index[14], in all regressions. To control for the availability of bank loans in the system, we include two indicators: (1) LOANTA, which is the cross-sectional average ratio of total loans to assets of banks in each country in the sample, and (2) SNONINT, which is the cross-sectional average share of non-interest income as a percent of net revenue of banks in each country in the sample.

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[14] More specifically, we use the Brazil Bovespa Index, the DAX 30 index, the IDX Composite Index, the NIKKEI 225 index, FTSE Bursa Malaysia KLCI, the KOSPI Index, the SMI index, the SET index, the FTSE 100, and the S&P 500 index to compute the annual stock returns for Brazil, Germany, Indonesia, Japan, Malaysia, South Korea, Switzerland, Thailand, the United Kingdom, and the United States, respectively.

3.3. Descriptive statistics

Table 1 reports descriptive statistics for all bank systemic risk variables by country. While the mean value for SYSRISK1, which is the cross-sectional average ratio of short-term debt to long-term debt of banks, is comparable across all countries in our sample, South Korea has the smallest mean value of SYSRISK1 (0.28), whereas India has the largest mean value of SYSRISK1 (214.33). With respect to SYSRISK2, which is the inverse of the cross-sectional standard deviation of the ratio of total loans to total assets, Thailand has the largest mean value of 0.23. With respect to SYSRISK3, which is the inverse of the cross-sectional standard deviation of a share of non-interest income to net revenue, Switzerland has the smallest mean value of SYSRISK3, whereas India has the largest mean value of SYSRISK3. In the subsequent regression analysis, we use the natural logarithm of the bank systemic risk variables.

[INSERT TABLE 1 ABOUT HERE]

Consistent with the literature, we winsorize all firm-level variables at the 1% and 99% levels in order to reduce the effect of outliers. Table 2 reports summary statistics for all firm-level variables. Panel A of Table 2 provides summary statistics for all firms in the full sample, while Panels B and C of Table 2 report summary statistics for large firm and small firm subsamples, respectively. Large firms are defined as observations with the value of real total assets larger than the cross-sectional median value of real total assets at the country level. Compared to large firms, small firms perform poorer on average (the mean value of ROA for small firms is 0.51%; the mean value of ROA for large firms is 3.62%) and have lower leverage (the mean value of LEV for small firms is 19.13%; the mean value of LEV for large firms is 26.09%).

Table 3 presents correlation coefficients for the firm-level variables. Correlation coefficients for all explanatory variables are generally below 0.40 (however, the correlation between CACL and CASHTA and the correlation between CASHTA and CATA are about 0.55); therefore, multicollinearity is not of great concern in our study.[15] We are thus confident that using a full set of firm-level control variables should not result in a serious multicollinearity problem.

[INSERT TABLE 2 ABOUT HERE]

[INSERT TABLE 3 ABOUT HERE]

4. Empirical results

4.1. Panel OLS estimations of investment

In this section, we empirically test our prediction that bank systemic risk is positively associated with corporate investment by estimating a series of the panel OLS regressions of the investment rate on measures of bank systemic risk:

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[15] Low correlations among the right-hand side variables means that the efficiency of the estimation of the fixed-effects model is less likely to be affected by the low correlations between the explanatory variables. Excluding CASHTA from regressions does not alter our findings.

$$CAPEXTA_{i,m,t} \equiv \frac{CAPEX_{i,m,t}}{TA_{i,m,t-1}} = b_0 + b_1 RISK_{m,t-1} + \delta \mathbf{FCON}_{i,m,t-1} + \gamma \mathbf{CCON}_{m,t-1} + u_i + v_t + \varepsilon_{i,m,t}, \tag{3}$$

$$CAPEXTA_{i,m,t} \equiv \ln\left(\frac{CAPEX_{i,m,t}}{TA_{i,m,t-1}}\right) = b_0 + b_1 RISK_{m,t-1} + \delta \mathbf{FCON}_{i,m,t-1} + \gamma \mathbf{CCON}_{m,t-1} + u_i + v_t + \varepsilon_{i,m,t}, \tag{4}$$

where i, m, t index firm, country, and year, respectively. $CAPEXTA_{i,m,t}$ denotes the investment rate of firm i in country m at time t, which is defined as the ratio of investment rate (*CAPEX*) to one-period lagged total assets (*TA*). We empirically compute the investment rate (*CAPEXTA*) as the natural logarithm of the ratio of investment ($CAPEX_{i,m,t}$) to one-period lagged total assets ($TA_{i,m,t-1}$). In order to control for endogeneity and to establish causality, all right-hand variables are one-period lagged. $RISK_{m,t-1}$ denotes bank systemic risk variable for country m at time t-1. $\mathbf{FCON}_{i,m,t}$ is a vector of firm-level control variables at time t-1; $\mathbf{CCON}_{m,t-1}$ is a vector of country-level control variables at time t-1; u_i are firm-fixed effects; and v_t are period-fixed effects. In term of inference, the estimate of the effect of bank systemic risk on corporate investment obtained from OLS regression (e.g., Regression (4)) is unbiased when the measure of bank systemic risk is uncorrelated with other determinants of corporate investment. We find that all three measures of bank systemic risk are not highly correlated with other firm-level and macro-level variables in the model. More specifically, the correlation coefficients between each measure of bank systemic risk and firm-level and macro-level variables are generally below 0.20, many of which are below 0.05, suggesting that the issue of multicollinearity is not of great concern.

We include firm fixed effects and period fixed effects in panel OLS regressions to control for any unobserved time invariant firm-level effects and unobserved time variant effects, respectively. In some specifications, we include country dummies, industry dummies[16], interaction terms between country dummies and YEAR, which is a time trend variable, and interaction terms between industry dummies and YEAR, to control for any unobserved time invariant country-level effects, unobserved time invariant industry-level effects that are similar in the industry across countries, unobservable time variant country-level effects, and unobservable time variant (global) industry-level effects, respectively. For all estimations, standard errors are robust to heteroskedasticity and serial correlation and are clustered at the firm level. We also test the robustness of our results by using country-fixed effects and period-fixed effects and find that the pattern of our results is generally insensitive to the use of firm-fixed or country-fixed effects.

We estimate a series of panel OLS regressions of Equation (4).[17] Table 4 displays the regression estimation results of Equation (4). In column (1) of Table 4, we regress the investment rate, which is computed as the natural logarithm of ($CAPEX_{i,m,t}/TA_{i,m,t-1}$), on a full set of firm-level and country-level control variables for a full sample of 119,665 firm-year observations. The sign of the estimated coefficients is generally consistent with the literature. For instance, the positive and significant estimated coefficients on, the current-assets-to-total-assets ratio (CATA), the market-to-book-value ratio (MBV), the return on asset ratio (ROA), and the dividend-to-assets ratio (DIVTA) imply that firms with less fixed assets, more investment opportunities, good performance and more dividends, respectively tend to invest more. The negative and significant coefficients on the cash-to-assets ratio (CASHTA), the current-assets-to-current-liabilities ratio (CACL), and the leverage ratio (LEV) mean that firms with more cash, more liquid assets, and higher leverage, respectively, tend to invest

[16] Industry dummies are based on the Level 2 (28 business sectors) classification of the Thomson Reuters Business Classification system.

[17] We conduct Hausman-tests to compare the random and fixed effects estimation. Results suggest that the fixed-effects models are preferred.

less. Our results are consistent with prior studies such as those of Panousi and Papanikolaou (2012) and Foucault and Fresard (2014), who document that larger firms tend to invest less, as the coefficient on firm size (LNTA) is negative. However, our results are not in line with those of Bates et al. (2009); that is, firms that hold more cash do not increase capital expenditure.

Consistent with our expectation and prior empirical evidence (see e.g., Billett et al., 2011; Julio and Yook, 2012), the coefficient on ΔGDP, which is the growth rate of GDP is positive and statistically significant, thereby suggesting that firms tend to invest more during periods of economic expansion. Interestingly, the coefficient on the stock market return (MKTRETURN) is positive but statistically insignificant, suggesting that firms do not invest more following stock market booms. In contrast to prior studies, for example, as in Levine and Zervos (1998), our evidence suggests that banking sector development is negatively associated with investment, given that the coefficients on LNBSD are negative and statistically significant in some specifications.

To test the effect of bank systemic risk on corporate investment, we sequentially add LNSYSRISK1, LNSYSRISK2, and LNSYSRISK3 in columns (2), (3) and (4) of Table 4. We also add LOANTA and SNONINT in the models. Since the bank systemic risk measures do not cover the full sample period for all sample countries, the number of observations varies across specifications. In all models, the positive and significant coefficients on LOANTA suggest that the level of the country-level average ratio of total loans to total assets of banks is positively associated with firms' investment, after controlling for other firm- and macro-level variables. We find that the coefficient on SNONINT is positive and statistically significant, meaning that when banks diversify their asset portfolio by engaging more in non-traditional banking activities (and earning more non-interest income), firms tend to invest more.

The estimated coefficient on LNSYSRISK1 in column (2) is positive but statistically insignificant, implying that corporate investment is not associated with the level of bank systemic risk, when measured as the cross-sectional average ratio of short-term debt to long-term debt of banks. At first glance, this result is inconsistent with those of Iyer et al. (2014) who document that banks in Portugal that relied more on the interbank market prior to the global financial crisis of 2007 (which implies that there was a high degree of systemic risk) cut back more on loan supply to firms after the onset of the crisis in Europe in August 2007. However, their results are in essence consistent with our results for the sub-period analysis, which will be discussed in detail in Section 4.4, which show that the effect of LNSYSRISK1 is non-existent in the pre-crisis period and is negative in the post-crisis period. The coefficient on LNSYSRISK2 in column (3) is positive and statistically significant. Hence, the degree of bank systemic risk, measured as the inverse of the cross-sectional standard deviation of the ratio of total loans to total assets, is positively associated with corporate investment. As LNSYSRISK2 measures the level of clustered asset structure of banks, the result suggests that the degree of asset commonality of banks positively affect firms' investment. The coefficient on LNSYSRISK3 in column (4) is positive and statistically significant, implying that variation in bank systemic risk with respect to non-traditional banking activities is associated with firms' investment.

When we enter all bank systemic risk measures in column (5), the coefficients on LNSYSRISK2 and LNSYSRISK3 remain positive and statistically significant. To test the robustness of our findings, we estimate four additional specifications. In column (6) we replace the firm fixed effects with the country dummies to control for any unobserved time invariant country-level effects. In column (7), we add interactions between country dummies and YEAR, which is a time trend variable, to control for any unobserved time variant country-level effects. The results in column (6) and (7) are qualitatively unchanged. To control for industry effects, we use industry dummies in column (8) and find that the coefficient on LNSYSRISK2 becomes negative while the sign and statistical significance of LNSYSRISK2 remains unchanged. Given the relatively long sample period, the use of the industry-fixed effects to control for any unobservable time invariant effects might be problematic as the industry's characteristics might evolve through time. To address this issue, we replace the industry dummies with interactions between industry dummies and YEAR to control for any unobservable time variant (global) industry-level effects in column (8). We find that both LNSYSRISK2 and LNSYSRISK3 have a positive effect on the investment rate.

Overall, empirical evidence reported in Table 4 suggest that there is a positive association between bank systemic risk and firm-level investment and thus support Hypothesis 1 predicting that variation in corporate investment can be explained by bank systemic risk.

[INSERT TABLE 4 ABOUT HERE]

We now examine whether the effect of bank systemic risk on investment is asymmetric. We interact the bank systemic risk variables with a large firm size (LARGE) binary variable, which takes a value of one when a value of real total assets is larger than the country-level median value of real total assets, and zero otherwise. We compute time series of the country-level cross-sectional median value of total assets using the final sample of firms. This classification takes into account the relative size of firms in a given country at a given point in time and provides a rough indication of how a firm might be considered small or large from the perspective of banks/investors in the country at a given point in time. Consistent with the corporate finance literature, we assume that smaller firms are more financial constrained, relative to larger firms. If bank systemic risk is associated with corporate investment and small firms are relatively more financial constrained than large firms, we should observe the differential effect of bank systemic risk on investment.

Table 5 reports the results of our specifications with the interaction terms. In order to save space, we do not tabulate coefficient estimates of firm-level and country-level control variables. The coefficients on the main effects of bank systemic risk are positive and highly significant while the coefficient on the interaction between LNSYSRISK3 and LARGE is negative in three models, suggesting that firm size appears to weaken the positive effect of bank systemic risk on investment.

[INSERT TABLE 5 ABOUT HERE]

4.2. Panel OLS estimations of excess investment

In this section, we test whether the positive effect of bank systemic risk on corporate investment remains evident when we alternatively measure corporate investment as excess investment. The basic idea here is that excess investment is potentially of greater concern to investors, monetary policy makers, and bank supervisory authorities. Therefore, we investigate whether bank systemic risk is associated with excess investment.

For simplicity, we conceptually define excess investment as the ratio of a firm's investment rate (CAPEXTA) to a country's cross-sectional average investment rate (MEANCAPEXTA). This conceptualization of the excess investment rate essentially focuses on both cross-sectional and time-series dimensions. We first compute MEANCAPEXTA as the cross-sectional average of investment rate of firms within a country. We calculate a country-year adjusted investment or excess investment ratio (EXCESSCAPEXTA) for each firm as the natural logarithm of the ratio of CAPEXTA to MEANCAPEXTA. A value of larger than one for EXCESSCAPEXTA indicates that a firm's investment ratio is larger than a country's average investment ratio.

$$EXCESSCAPEXTA_{i,m,t} \equiv \ln\left(\frac{CAPEXTA_{i,m,t}}{MEANCEPEXTA_{i,m,t}}\right) = b_0 + b_1 RISK_{m,t-1} + \delta \mathbf{FCON}_{i,m,t-1} + \gamma \mathbf{CCON}_{m,t-1} + u_i + v_t + \varepsilon_{i,m,t}, \quad (5)$$

where EXCESSPEXTA, which is the country-year adjusted investment rate for each firm, is the dependent variable, and all other variables are defined as before. We estimate a series of panel OLS regressions of the excess investment rate (EXCESSCAPEXTA) on three measures of bank systemic risk. Table 6 presents the results of panel OLS regressions, in which firm-fixed effects, period-fixed effects, country-fixed effects, industry-fixed effects, interactions between country dummies and YEAR, and/or interactions between industry dummies and YEAR, are included as before.[18] The sign of the coefficients on control variables is consistent with expectations and is similar to that of Table 4. The coefficient on LNSYSRISK1 is negative and statistically significant in four models. Likewise, the coefficient on LNSYSRISK3 is negative and statistically significant in four models. These results, which mean that there is a negative relationship between bank systemic risk and the excess investment rate, might suggest that overinvestment of firms are not directly driven by the level of bank systemic risk. Importantly, our results indicate that the degree of overinvestment is decreasing in the level of bank systemic risk.

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[18] Values of the adjusted R^2 for regressions with firm-fixed and period-fixed effects in all specifications in Table 6 are around 60%. A corresponding value of the adjusted R^2 for the baseline model in column 1 without fixed effects is 12.9%.

[INSERT TABLE 6 ABOUT HERE]

[INSERT TABLE 7 ABOUT HERE]

To provide additional insights to the asymmetric effect of bank systemic risk on excess investment, we add the interaction terms between the bank systemic risk variables and LARGE in our specifications in Table 7. In order to conserve space, we do not report coefficient estimates of firm-level and country-level control variables in Table 7. The coefficients on the interaction terms are statistically significant. The results provide empirical support to the notion that firm size moderates the effect of bank systemic risk on excess corporate investment.

In summary, empirical evidence shown in this section points to the notion that the level of bank systemic risk is negative associated with excess investment. More specifically, after controlling for firm-level and country-level variables, our measures of bank systemic risk still have a negative effect on the excess investment rate.

4.3. Panel OLS estimations of excess investment for developing and developed countries

There is a question of whether the influence of bank systemic risk is stronger for firms with more growth opportunities, relative to those with limited growth opportunities. Another related question is whether bank systemic risk asymmetrically affects investment of firms operating in advanced countries, relative to those operating in developing countries. Therefore, given our data set, we attempt to provide some empirical evidence by examining whether the influence of bank systemic risk on investment is stronger for firms with better growth opportunities and for firms in developed countries.

To test whether bank systemic risk moderates the effect of growth opportunities on corporate investment, we interact the bank systemic risk variables with MBV, which is a proxy for growth opportunities. To examine the asymmetric effect of bank systemic risk on corporate investment with respect to the development of a country, we add the interaction terms between the bank systemic risk variables and the developed country (DEV) variable, which takes a value of one for firms listed in a developed country and zero otherwise.

[INSERT TABLE 8 ABOUT HERE]

Table 8 reports the panel OLS regressions of the above-mentioned specifications. In columns (1) through (4), the dependent variable is the investment rate; in columns (5) through (8) the dependent variable is the excess investment rate. In order to conserve space, we do not tabulate coefficient estimates of firm-level and country-level control variables. We find that the coefficients on the interaction term between LNSYSRISK1 and MBV are positively and highly significant in all four models, the coefficients the interaction term between LNSYSRISK2 and MBV are positively and highly significant in three models, and the coefficients on the interaction term between LNSYSRISK3 and MBV are negative and statistically significant in all four models. These findings suggest that investment opportunities moderate the effect of bank systemic risk on investment and excess investment and thus provide support to Hypothesis 2, which predicts that bank systemic risk strengthens the sensitivities of investment to growth options.

In column (3) we find that the coefficients on two interaction terms are negative and statistically significant, suggesting that the effect of bank systemic risk on corporate investment is weaker for firms in developed countries, relative to firms in developing countries. One plausible explanation is that banking regulations in advanced countries weakens the influence of bank systemic risk on corporate investment. That is, more stringent lending standards in advanced countries might limit the extent to which low quality loans can be given to firms; therefore, the positive effect of bank systemic risk on corporate investment is weaker for developed countries. To understand the effect of bank systemic risk on investment in developing and developed countries better, we estimate our baseline regressions using the investment rate as the dependent variable for both developing and developed countries subsamples. Our (untabulated) results show the coefficients on LNSYSRISK2 and LNSYSRISK3 are positive and statistically significant for the developed country sample, while only the coefficient on LNSYSRISK2 is statistically significant for the developing country sample. The results from the subsample analysis point to the notion that evidence for the positive influence of bank systemic risk on corporate investment is possibly more pronounced in the developed countries.

Taking into account the results in Sections 4.1 and 4.2 as well as those shown in this section, it is reasonable to conclude that the effects of bank systemic risk on investment are slightly different for developed and developing countries.

4.4. Panel OLS estimations of excess investment for pre- and post-global financial crisis periods

Thus far, we show that bank systemic risk is associated with the investment and excess investment rates. As our study covers the global financial crisis of 2007-2008, we now examine whether the effect of bank systemic risk alters following the global financial crisis. To do so, we divide our sample into the pre-crisis period (i.e. 1991-2007) and the post crisis period (i.e. 2008-2013) and estimate Equation (4) again for both periods.

[INSERT TABLE 9 ABOUT HERE]

Table 9 reports the results of regression estimates using the investment rate as the dependent variable for the pre- and post-global financial crisis periods. Coefficient estimates of firm-level and country-level control variables are not reported in Table 9 in order to save space. Overall, we find that the effects of bank systemic risk on the investment rate for both periods differ. In columns (1), (2), and (3), the coefficients on LNSYSRISK1 are not statistically significant, whereas in columns (4), (5), and (6), the coefficients on LNSYSRISK1 are negative and statistically significant. These results suggest that LNSYSRISK1 has no effect on corporate investment in the pre-global financial crisis but has a negative effect on corporate investment in the post-global financial crisis. We also find that LNSYSRISK3 has a positive effect on corporate investment in the pre-global financial crisis period but has a negative effect in the post-global financial crisis period. Given these results, it appears that the relationship between bank systemic risk and corporate investment changes following the global financial crisis of 2007.

4.5. Robustness checks

4.5.1. The interaction effect of asset commonality and debt maturity

As Allen et al. (2012a) argue that corporate investment is exacerbated by the interaction between banks' short-term debt and asset commonality. We therefore test whether the interaction between short-term debt and clustered assets of banks affects corporate investment. To address this question, we add the interaction terms LNSYSRISK1 × LNSYSRISK2 or LNSYSRISK1 × LNSYSRISK3 in several specifications. Our results (untabulated) show that when the dependent variable is the investment ratio, the coefficient on the interaction terms SYSRISK1 × SYSRISK3 is negative and statistically significant. Hence, our results provide some evidence for the interaction effect between short-term debt and asset commonality of banks on corporate investment.

4.5.2. The non-linear effect of bank systemic risk

To check for the non-linear effect of bank systemic risk on corporate investment, we add a squared term of the bank systemic risk variables in our baseline specifications. The (untabulated) results show that the influence of bank systemic risk on the investment ratio is non-linear as the coefficients on the squared terms of the bank systemic risk measures are highly significant. Our findings suggest that the association between bank systemic risk and corporate investment is not linear, which is consistent view the view that the relationship between the chosen debt maturity and credit quality is non-monotonic (see e.g., Diamond, 1991). In our case, the debt maturity structure is measured as SYSRISK1, while the credit quality is largely driven by the quality of bank loans.

4.5.3. The lagged-investment effect

As it has been well documented in the literature, as noted by Eberly et al. (2012), that lagged investment is the best predictor of current investment at the firm level, we add a one-period lagged dependent variable into column (4) of Table 4 and find that in the simple dynamic OLS models with firm-fixed and year-fixed effects, the positive relationship between bank systemic risk and the investment rate remains evident after controlling for the lagged-investment effect (i.e. the persistence of investment), given that the coefficient on

LNSYSRISK2 is still positive and highly significant. Overall, the results show that there is a significant relationship between bank systemic risk and corporate investment.

5. Conclusion

In this paper, we make a simple point that variation in corporate investment can be explained by bank systemic risk. Using a final sample of 10,085 firms in 10 countries over the period 1991-2013, we consistently show that an increase in bank systemic risk is connected to capital expenditures for the full sample period. Our results are consistent with prior literature that predicts the positive relationship between the degree of systemic risk in the banking sector and corporate investment. We also document mixed evidence for the relationship between bank systemic risk and the investment for the pre- and post-crisis period. On the one hand, the effect of bank systemic risk rate with respect to the clustered asset structure (i.e., our first measure of banking asset commonality) is positive during the pre-crisis period (i.e. during 1991-2007) but is insignificant in the post-crisis period (i.e. during 2008-2013). On the other hand, the effect of bank systemic risk with respect to the commonality in the share of non-interest income (i.e., our second measure of banking asset commonality) is positive in the pre-crisis period but is negative in the post-crisis period.

Our results have important implications for banking supervisory authorities and financial markets regulators. As we conclude that variation in bank systemic risk positively affects corporate investment, after controlling for a number of firm- and country-level factors, it is clear that the level of bank systemic risk can generate excessive business cycles by encouraging firms to invest more. The persistence of the positive effect of bank systemic risk on corporate investment until the start of the global financial crisis of 2007 points to a possibility that once the economy returns to healthy conditions, the positive influence of bank systemic risk on corporate investment is likely to become evident again unless financial market regulators manage to devise a new regulatory framework (e.g., macroprudential capital requirements) that effectively reduces the level of bank systemic risk or ameliorates the positive effect of bank systemic risk on corporate investment. However, we caution that our assertion that the systemic risk of the banking system affects corporate investment is mainly based on the sample of publicly listed firms in four medium-sized developing countries (Brazil, Indonesia, Malaysia and Thailand) and six developed countries (Japan, Germany, South Korea, Switzerland, the United Kingdom, and the United States) and might not necessarily be generalized to other developing and developed countries where banking regulations might substantially differ.

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Table 1 Banking systemic risk measures by country, 1991-2013.

Bank Systemic Risk 1 (SYSRISK1) is defined as the cross-sectional mean of the share of short-term debt as % of long-term debt of publicly listed banks in a country. Bank Systemic Risk 2 (SYSRISK2) is defined as the inverse of the cross-sectional standard deviation of the ratio of loan to assets (in %) of publicly listed banks. Bank Systemic Risk 3 (SYSRISK3) is defined as the inverse of the cross-sectional deviation of the share of non-interest income as % of net revenue of publicly listed banks. BR, DE, ID, JP, KO, MY, SW, TH, UK, and US denote Brazil, Germany, Indonesia, Japan, South Korea, Malaysia, Switzerland, Thailand, the UK, and the US, respectively.

	BR	DE	ID	JP	KO	MY	SW	TH	UK	US
Panel A: SYSRISK1										
Mean	5.19	2.08	214.73	28.04	0.28	28.04	3.54	16.42	2.86	9.94
Median	2.64	1.22	51.29	8.49	0.25	7.98	1.21	2.92	2.62	7.68
S.D.	5.42	1.96	356.25	55.08	0.19	55.08	8.37	45.56	1.29	7.36
Min	0.92	0.54	0.69	2.12	0.01	2.12	0.31	0.12	0.33	1.68
Max	21.98	8.34	1,355.72	247.49	0.58	247.49	38.14	189.03	5.35	28.32
N	23	23	23	23	16	23	23	23	23	23
Panel B: SYSRISK2										
Mean	0.09	0.09	0.10	0.15	0.18	0.15	0.05	0.23	0.17	0.08
Median	0.08	0.05	0.10	0.14	0.15	0.13	0.04	0.14	0.15	0.08
S.D.	0.04	0.08	0.06	0.04	0.08	0.05	0.03	0.21	0.11	0.01
Min	0.05	0.04	0.02	0.09	0.10	0.08	0.03	0.05	0.04	0.07
Max	0.18	0.29	0.29	0.21	0.39	0.26	0.13	0.76	0.39	0.09
N	14	23	23	23	14	23	23	23	23	23
Panel 3: SYSRISK3										
Mean	0.12	0.09	0.21	0.16	0.10	0.15	0.04	0.16	0.18	0.12
Median	0.07	0.09	0.20	0.10	0.10	0.15	0.04	0.11	0.19	0.11
S.D.	0.19	0.06	0.12	0.14	0.04	0.11	0.01	0.14	0.09	0.03
Min	0.04	0.03	0.05	0.04	0.04	0.03	0.01	0.05	0.01	0.06
Max	0.84	0.30	0.51	0.54	0.19	0.40	0.06	0.74	0.33	0.18
N	16	23	23	23	15	23	23	23	23	23

Table 2 Descriptive statistics for firm-level variables during 1991-2013.

Panels A, B, and C of this table provide descriptive statistics for firm-level variables during 1991-2013 for the full sample (N = 132,037), the large firm sample (N = 65,961), and the small firm sample (N = 66,076), respectively. Investment ratio (CAPEXTA) is measured as the ratio of capital expenditure to one-year lagged total assets. Excess investment rate is measured as the natural logarithm of the ratio of a firm's investment rate to a country's cross-sectional average investment rate. TA denotes total assets in million USD. We deflate the value of total assets by US CPI. Leverage (LEV) is computed as the ratio of total debt to total assets. Cash/Assets (CASHTA) is the ratio of cash to total assets. Current Assets/Current Liabilities (CACL) is the ratio of current assets to current liabilities. Market-to-book ratio (MBV) is the ratio of the market value of equity to the book value of equity. Return on Assets (ROA) is measured as the ratio of EBIT to total assets. Dividend/Asset (DIVTA) is the ratio of dividend to total assets.

	Mean	S.D.	Q1	Q2	Q3
Panel A: Full Sample					
CAPEXTA (%)	5.48	6.63	1.40	3.39	6.86
EXCESSCAPTEXTA	1.00	1.15	0.28	0.64	1.28
Real TA in million USD	2424.50	7249.70	81.47	284.46	1177.23
CACL	2.30	2.30	1.10	1.60	2.55
CASHTA	0.17	0.17	0.05	0.11	0.22
CATA	0.51	0.22	0.36	0.52	0.67
LEV (%)	22.61	19.56	4.93	19.64	35.36
MBV	1.96	2.62	0.70	1.26	2.27
ROA (%)	3.62	16.22	1.71	5.61	10.46
DIVTA	0.01	0.02	0.00	0.01	0.01
Panel B: Large firms					
CAPEXTA (%)	5.88	6.33	1.93	4.04	7.41
EXCESSCAPTEXTA	1.08	1.09	0.38	0.77	1.39
Real TA in million USD	6,033.15	22,050.22	444.63	1,140.33	3,562.97
CACL	1.83	1.54	1.03	1.43	2.10
CASHTA	0.13	0.12	0.04	0.09	0.17
CATA	0.46	0.21	0.30	0.47	0.61
LEV (%)	26.09	18.90	10.62	24.53	38.41
MBV	1.90	2.30	0.75	1.32	2.26
ROA (%)	6.74	8.81	3.02	6.36	10.65
DIVTA	0.01	0.02	0.00	0.01	0.02
Panel C: Small firms					
CAPEXTA (%)	5.09	6.90	1.02	2.71	6.12
EXCESSCAPTEXTA	0.92	1.21	0.20	0.52	1.12
Real TA in million USD	160.14	256.09	36.59	83.53	197.03
CACL	2.77	2.79	1.21	1.85	3.13
CASHTA	0.20	0.20	0.06	0.14	0.29
CATA	0.57	0.21	0.43	0.58	0.72
LEV (%)	19.13	19.59	1.22	13.88	31.19
MBV	2.02	2.89	0.65	1.19	2.27
ROA (%)	0.51	20.72	-1.19	4.59	10.19
DIVTA	0.01	0.02	0.00	0.00	0.01

Table 3 Correlation coefficient matrix of key firm-level variables.

This table presents correlation coefficients for key firm-level variables for a sample of non-financial firms in 10 countries, totaling 132,037 firm-year observations. LNCAPEXTA is the natural logarithm of CAPEXTA, which is measured as the ratio of capital expenditure to one-year lagged total assets. LNTA is the natural logarithm of real total assets in million USD. CACL is the ratio of current assets to current liabilities. CASHTA is the ratio of cash to total assets. CATA is the ratio of current assets to total assets. LEV is the ratio of total debt to total assets (in %). MBV is the ratio of the market value of equity to the book value of equity. ROA is the ratio of EBIT to total assets (in %). DIVTA is the ratio of dividend to total assets. All variables are winsorized at the 1st and 99th percentiles. Symbols ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

	1	2	3	4	5	6	7	8	9
1. LNCAPEXTA	1.000								
2. LNTA	0.237***	1.000							
3. CACL	-0.168***	-0.233***	1.000						
4. CASHTA	-0.187***	-0.240***	0.564***	1.000					
5. CATA	-0.273***	-0.280***	0.343***	0.536***	1.000				
6. LEV	0.076***	0.214***	-0.399***	-0.385***	-0.342***	1.000			
7. MBV	0.090***	0.005*	0.051***	0.176***	0.066***	-0.056***	1.000		
8. ROA	0.230***	0.282***	-0.066***	-0.182***	-0.060***	-0.078***	-0.035***	1.000	
9. DIVTA	0.096***	0.062***	0.049***	0.023***	-0.009***	-0.159***	0.148***	0.301***	1.000

Table 4 Panel OLS regressions with the investment rate as the dependent variable.

This table presents the results of panel OLS regressions of investment rate, measured as the natural logarithm of the ratio of capital expenditure to one-period lagged total assets, on bank systemic risk for a sample of non-financial firms during 1990-2013. We measure a country-level bank systemic risk using three measures. LNSYSRISK1 is the natural logarithm of SYSRISK1, which is defined as the cross-sectional mean of the share of short-term debt as % of long-term debt of publicly listed banks in a country. LNSYSRISK2 is the natural logarithm of SYSRISK2, which is defined as the inverse of the cross-sectional standard deviation of the ratio of loan to assets (in %) of publicly listed banks. LNSYSRISK3 is the natural logarithm of SYSRISK3, which is defined as the inverse of the cross-sectional deviation of the share of non-interest income as % of net revenue of publicly listed banks. All explanatory variables are one-period lagged. ∆GDP denotes the GDP growth rate (in %); LNBSD is the natural logarithm of the percentage share of domestic credit to private sector by banks to GDP. LNEXPORT is the natural logarithm of the percentage share of export to GDP; MKTRETURN denotes stock market return (in %), measured as the first difference in the natural logarithm of the stock market index; LOANTA is the average ratio of total loans to assets of banks in a country; SNONINT is the average share of non-interest income to net revenue of banks in a country. Other variable definitions are provided in Table 2. Standard errors are robust to heteroskedasticity and serial correlation and are clustered at the firm level. We report standard errors in parentheses. Symbols ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	0.935***	0.151	0.443**	-0.048	0.453**	-0.151	-19.611***	2.425***	77.193***
	(0.160)	(0.183)	(0.204)	(0.196)	(0.204)	(0.355)	(7.103)	(0.140)	(7.457)
$LNTA_{t-1}$	-0.060***	-0.068***	-0.067***	-0.069***	-0.066***	0.057***	-0.066***	0.043***	-0.080***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.005)	(0.008)	(0.005)	(0.008)
$CACL_{t-1}$	-0.034***	-0.034***	-0.034***	-0.034***	-0.035***	-0.061***	-0.035***	-0.066***	-0.035***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)
CASH TA_{t-1}	-0.141***	-0.139***	-0.134***	-0.146***	-0.135***	0.386***	-0.126**	0.472***	-0.083
	(0.050)	(0.050)	(0.050)	(0.050)	(0.050)	(0.059)	(0.050)	(0.060)	(0.050)
$CATA_{t-1}$	0.631***	0.618***	0.622***	0.623***	0.622***	-1.390***	0.618***	-1.286***	0.544***
	(0.045)	(0.045)	(0.045)	(0.045)	(0.045)	(0.043)	(0.045)	(0.045)	(0.045)
LEV_{t-1}	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.004***	-0.009***	-0.005***	-0.009***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MBV_{t-1}	0.024***	0.023***	0.023***	0.023***	0.023***	0.029***	0.023***	0.040***	0.021***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
ROA_{t-1}	0.009***	0.009***	0.009***	0.009***	0.009***	0.015***	0.009***	0.015***	0.009***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

$DIVTA_{t-1}$	1.407***	1.396***	1.381***	1.401***	1.369***	1.235***	1.453***	1.439***	1.640***
	(0.277)	(0.277)	(0.276)	(0.277)	(0.276)	(0.379)	(0.276)	(0.367)	(0.278)
$LNBSD_{t-1}$	-0.082***	-0.038	-0.041	-0.009	-0.037	-0.090**	0.046	-0.196***	0.003
	(0.022)	(0.024)	(0.025)	(0.025)	(0.025)	(0.035)	(0.036)	(0.019)	(0.025)
$LNEXPORT_{t-1}$	0.199***	0.276***	0.257***	0.315***	0.258***	0.223***	0.114**	-0.042***	0.263***
	(0.034)	(0.036)	(0.038)	(0.037)	(0.038)	(0.052)	(0.050)	(0.015)	(0.038)
ΔGDP_{t-1}	0.036***	0.036***	0.038***	0.039***	0.038***	0.044***	0.038***	0.037***	0.039***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)
$MKTRETURN_{t-1}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$LOANTA_{t-1}$		0.005***	0.003***	0.005***	0.003***	0.010***	-0.002*	0.005***	0.003***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$SNONINT_{t-1}$		0.002***	0.003***	0.003***	0.005***	0.004***	0.007***	0.001	0.004***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$LNSYSRISK1_{t-1}$		0.003			0.000	0.004	0.002	-0.069***	0.001
		(0.004)			(0.004)	(0.005)	(0.004)	(0.005)	(0.004)
$LNSYSRISK2_{t-1}$			0.057***		0.051***	0.040***	0.051***	-0.094***	0.052***
			(0.011)		(0.012)	(0.014)	(0.012)	(0.016)	(0.012)
$LNSYSRISK3_{t-1}$				0.028***	0.030***	0.101***	0.033***	0.062***	0.023**
				(0.009)	(0.010)	(0.013)	(0.010)	(0.013)	(0.010)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	No	Yes	No	No	No
Country dummies X YEAR	No	No	No	No	No	No	Yes	No	No
Industry dummies	No	No	No	No	No	No	No	Yes	No
Industry dummies X YEAR	No	No	No	No	No	No	No	No	Yes
Adjusted R^2	0.589	0.590	0.592	0.591	0.592	0.180	0.593	0.218	0.594
F-statistic	17.916***	17.897***	17.989***	17.922***	17.988***	552.788***	18.006***	499.597***	18.165***

Firms included	10,085	10,085	10,085	10,085	10,085	10,085	10,085	9,873	9,873
Observations	119,665	118,955	118,418	118,685	118,418	118,418	118,418	116,515	116,515

Table 5 Panel OLS regressions with the investment rate as the dependent variable.

This table presents the results of panel OLS regressions of investment rate, measured as the natural logarithm of the ratio of capital expenditure to one-period lagged total assets, on bank systemic risk for a sample of non-financial firms during 1990-2013. We measure a country-level bank systemic risk using three measures. LNSYSRISK1 is the natural logarithm of SYSRISK1, which is defined as the cross-sectional mean of the share of short-term debt as % of long-term debt of publicly listed banks in a country. LNSYSRISK2 is the natural logarithm of SYSRISK2, which is defined as the inverse of the cross-sectional standard deviation of the ratio of loan to assets (in %) of publicly listed banks. LNSYSRISK3 is the natural logarithm of SYSRISK3, which is defined as the inverse of the cross-sectional deviation of the share of non-interest income as % of net revenue of publicly listed banks. All explanatory variables are one-period lagged. ΔGDP denotes the GDP growth rate (in %); LNBSD is the natural logarithm of the percentage share of domestic credit to private sector by banks to GDP. LNEXPORT is the natural logarithm of the percentage share of export to GDP; MKTRETURN denotes stock market return (in %), measured as the first difference in the natural logarithm of the stock market index; LOANTA is the average ratio of total loans to assets of banks in a country; SNONINT is the average share of non-interest income to net revenue of banks in a country. Other variable definitions are provided in Table 2. Firm-fixed and period-fixed effects are included in all models. Standard errors are robust to heteroskedasticity and serial correlation and are clustered at the firm level. We report standard errors in parentheses. Symbols ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
Constant	0.549***	-0.154	-18.775***	2.437***	77.165***
	(0.205)	(0.354)	(7.101)	(0.143)	(7.454)
$LNTA_{t-1}$	-0.068***	0.056***	-0.066***	0.040***	-0.083***
	(0.009)	(0.007)	(0.009)	(0.006)	(0.009)
$CACL_{t-1}$	-0.035***	-0.061***	-0.035***	-0.066***	-0.035***
	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)
CASH TA_{t-1}	-0.132***	0.388***	-0.125**	0.474***	-0.081
	(0.050)	(0.059)	(0.050)	(0.059)	(0.050)
$CATA_{t-1}$	0.618***	-1.403***	0.615***	-1.297***	0.542***
	(0.045)	(0.043)	(0.045)	(0.045)	(0.045)
LEV_{t-1}	-0.009***	-0.004***	-0.009***	-0.005***	-0.009***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MBV_{t-1}	0.023***	0.029***	0.023***	0.040***	0.021***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
ROA_{t-1}	0.009***	0.015***	0.009***	0.015***	0.009***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$DIVTA_{t-1}$	1.386***	1.347***	1.467***	1.539***	1.647***
	(0.276)	(0.378)	(0.276)	(0.367)	(0.278)
$LNBSD_{t-1}$	-0.045*	-0.088**	0.041	-0.194***	-0.003
	(0.025)	(0.035)	(0.036)	(0.019)	(0.025)
$LNEXPORT_{t-1}$	0.242***	0.224***	0.110**	-0.044***	0.252***
	(0.038)	(0.052)	(0.050)	(0.015)	(0.038)
ΔGDP_{t-1}	0.038***	0.044***	0.038***	0.036***	0.039***
	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)
$MKTRETURN_{t-1}$	0.000	0.000	0.000	0.001***	0.000

	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$LOANTA_{t-1}$	0.003***	0.010***	-0.002*	0.005***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$SNONINT_{t-1}$	0.005***	0.003***	0.007***	0.001	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$LNSYSRISK1_{t-1}$	0.011**	0.006	0.015***	-0.069***	0.009**
	(0.004)	(0.006)	(0.005)	(0.006)	(0.004)
$LNSYSRISK2_{t-1}$	0.046***	-0.059***	0.048***	-0.186***	0.051***
	(0.014)	(0.018)	(0.014)	(0.019)	(0.014)
$LNSYSRISK3_{t-1}$	0.045***	0.198***	0.044***	0.152***	0.032***
	(0.012)	(0.016)	(0.012)	(0.016)	(0.012)
$LNSYSRISK1_{t-1} \times LARGE_{t-1}$	-0.024***	-0.004	-0.024***	-0.001	-0.017***
	(0.005)	(0.008)	(0.005)	(0.008)	(0.005)
$LNSYSRISK2_{t-1} \times LARGE_{t-1}$	0.011	0.195***	0.008	0.181***	0.004
	(0.014)	(0.021)	(0.014)	(0.021)	(0.014)
$LNSYSRISK3_{t-1} \times LARGE_{t-1}$	-0.030**	-0.193***	-0.022*	-0.180***	-0.018
	(0.013)	(0.019)	(0.013)	(0.019)	(0.013)
Firm fixed effects	Yes	No	Yes	No	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	No	No
Country dummies X YEAR	No	No	Yes	No	No
Industry dummies	No	No	No	Yes	No
Industry dummies X YEAR	No	No	No	No	Yes
R^2	0.627	0.182	0.628	0.219	0.629
Adjusted R^2	0.592	0.181	0.593	0.219	0.594
F-statistic	17.991***	524.997***	18.008***	481.216***	18.164***
Firms included	10,085	10,085	10,085	9,873	9,873
Observations	118,418	118,418	118,418	116,515	116,515

Table 6 Panel OLS regressions with the excess investment rate as the dependent variable.

This table presents the results of panel OLS regressions of excess investment rate, measured as the natural logarithm of the ratio of a firm's investment rate to a country's cross-sectional average investment rate, on bank systemic risk for a sample of non-financial firms during 1990-2013. We measure a country-level bank systemic risk using three measures. LNSYSRISK1 is the natural logarithm of SYSRISK1, which is defined as the cross-sectional mean of the share of short-term debt as % of long-term debt of publicly listed banks in a country. LNSYSRISK2 is the natural logarithm of SYSRISK2, which is defined as the inverse of the cross-sectional standard deviation of the ratio of loan to assets (in %) of publicly listed banks. LNSYSRISK3 is the natural logarithm of SYSRISK3, which is defined as the inverse of the cross-sectional deviation of the share of non-interest income as % of net revenue of publicly listed banks. All explanatory variables are one-period lagged. ΔGDP denotes the GDP growth rate (in %); LNBSD is the natural logarithm of the percentage share of domestic credit to private sector by banks to GDP. LNEXPORT is the natural logarithm of the percentage share of export to GDP; MKTRETURN denotes stock market return (in %), measured as the first difference in the natural logarithm of the stock market index; LOANTA is the average ratio of total loans to assets of banks in a country; SNONINT is the average share of non-interest income to net revenue of banks in a country. Other variable definitions are provided in Table 2. Firm- and period-fixed effects are included all regressions. Standard errors are robust to heteroskedasticity and serial correlation and are clustered at the firm level. We report standard errors in parentheses. Symbols ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-0.016	-0.602***	-0.828**	-5.517	-0.428***	75.168***
	(0.159)	(0.203)	(0.354)	(7.070)	(0.140)	(7.422)
$LNTA_{t-1}$	-0.067***	-0.071***	0.058***	-0.070***	0.046***	-0.085***
	(0.008)	(0.008)	(0.005)	(0.008)	(0.005)	(0.008)
$CACL_{t-1}$	-0.034***	-0.035***	-0.062***	-0.035***	-0.071***	-0.035***
	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)
CASH TA_{t-1}	-0.061	-0.067	0.417***	-0.081	0.565***	-0.014
	(0.050)	(0.050)	(0.059)	(0.050)	(0.059)	(0.050)
$CATA_{t-1}$	0.558***	0.567***	-1.394***	0.575***	-1.240***	0.492***
	(0.045)	(0.045)	(0.043)	(0.045)	(0.045)	(0.045)
LEV_{t-1}	-0.008***	-0.008***	-0.004***	-0.008***	-0.005***	-0.008***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MBV_{t-1}	0.021***	0.021***	0.027***	0.021***	0.031***	0.019***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
ROA_{t-1}	0.009***	0.009***	0.015***	0.009***	0.015***	0.009***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$DIVTA_{t-1}$	1.148***	1.183***	1.201***	1.152***	0.765**	1.455***
	(0.276)	(0.275)	(0.379)	(0.275)	(0.366)	(0.277)
$LNBSD_{t-1}$	-0.105***	-0.054**	-0.100***	0.020	-0.008	-0.017
	(0.021)	(0.025)	(0.035)	(0.035)	(0.019)	(0.025)
$LNEXPORT_{t-1}$	0.045	0.114***	0.096*	-0.012	-0.051***	0.117***
	(0.034)	(0.038)	(0.052)	(0.050)	(0.014)	(0.038)
ΔGDP_{t-1}	0.000	0.004*	0.010***	0.003	-0.014***	0.004*
	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)
$MKTRETURN_{t-1}$	0.000*	0.000	0.000	0.000	0.000	0.000

	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$LOANTA_{t-1}$		0.002**	0.008***	0.001	0.009***	0.002*
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$SNONINT_{t-1}$		0.000	-0.001	-0.001	0.005***	-0.001
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$LNSYSRISK1_{t-1}$		-0.018***	-0.015***	-0.011***	-0.006	-0.016***
		(0.004)	(0.005)	(0.004)	(0.005)	(0.004)
$LNSYSRISK2_{t-1}$		0.000	-0.012	0.014	-0.066***	0.003
		(0.012)	(0.014)	(0.012)	(0.016)	(0.012)
$LNSYSRISK3_{t-1}$		-0.017*	0.061***	-0.028***	0.031***	-0.025***
		(0.010)	(0.013)	(0.010)	(0.013)	(0.010)
Firm fixed effects	Yes	Yes	No	Yes	No	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	Yes	No	No	No
Country dummies X YEAR	No	No	No	Yes	No	No
Industry dummies	No	No	No	No	Yes	No
Industry dummies X YEAR	No	No	No	No	No	Yes
R^2	0.604	0.607	0.133	0.608	0.178	0.609
Adjusted R^2	0.567	0.570	0.133	0.571	0.177	0.572
F-statistic	16.485***	16.539***	386.089***	16.548***	386.725***	16.687***
Firms included	10,085	10,085	10,085	10,085	9,873	9,873
Observations	119,665	118,418	118,418	118,418	116,515	116,515

Table 7 Panel OLS regressions with the excess investment rate as the dependent variable.
This table presents the results of panel OLS regressions of excess investment rate, measured as the natural logarithm of the ratio of a firm's investment rate to a country's cross-sectional average investment rate, on bank systemic risk for a sample of non-financial firms during 1990-2013. We measure a country-level bank systemic risk using three measures. LNSYSRISK1 is the natural logarithm of SYSRISK1, which is defined as the cross-sectional mean of the share of short-term debt as % of long-term debt of publicly listed banks in a country. LNSYSRISK2 is the natural logarithm of SYSRISK2, which is defined as the inverse of the cross-sectional standard deviation of the ratio of loan to assets (in %) of publicly listed banks. LNSYSRISK3 is the natural logarithm of SYSRISK3, which is defined as the inverse of the cross-sectional deviation of the share of non-interest income as % of net revenue of publicly listed banks. All explanatory variables are one-period lagged. ΔGDP denotes the GDP growth rate (in %); LNBSD is the natural logarithm of the percentage share of domestic credit to private sector by banks to GDP. LNEXPORT is the natural logarithm of the percentage share of export to GDP; MKTRETURN denotes stock market return (in %), measured as the first difference in the natural logarithm of the stock market index; LOANTA is the average ratio of total loans to assets of banks in a country; SNONINT is the average share of non-interest income to net revenue of banks in a country. Other variable definitions are provided in Table 2. Firm- and period-fixed effects are included in all regressions. Standard errors are robust to heteroskedasticity and serial correlation and are clustered at the firm level. We report standard errors in parentheses. Symbols ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
Constant	-0.517**	-0.835**	-4.668	-0.437***	75.047***
	(0.204)	(0.353)	(7.068)	(0.142)	(7.420)
$LNTA_{t-1}$	-0.071***	0.058***	-0.070***	0.047***	-0.086***
	(0.009)	(0.007)	(0.009)	(0.006)	(0.009)
$CACL_{t-1}$	-0.035***	-0.062***	-0.035***	-0.071***	-0.035***
	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)
CASH TA_{t-1}	-0.065	0.418***	-0.080	0.565***	-0.014
	(0.050)	(0.059)	(0.050)	(0.059)	(0.050)
$CATA_{t-1}$	0.564***	-1.407***	0.572***	-1.251***	0.490***
	(0.045)	(0.043)	(0.045)	(0.045)	(0.045)
LEV_{t-1}	-0.008***	-0.004***	-0.008***	-0.004***	-0.008***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MBV_{t-1}	0.021***	0.027***	0.021***	0.031***	0.019***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
ROA_{t-1}	0.009***	0.015***	0.009***	0.015***	0.009***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$DIVTA_{t-1}$	1.200***	1.315***	1.167***	0.874**	1.461***
	(0.275)	(0.378)	(0.275)	(0.365)	(0.277)
$LNBSD_{t-1}$	-0.064**	-0.099***	0.014	-0.006	-0.024
	(0.025)	(0.035)	(0.035)	(0.019)	(0.025)
$LNEXPORT_{t-1}$	0.101***	0.096*	-0.015	-0.051***	0.108***
	(0.038)	(0.051)	(0.050)	(0.015)	(0.038)
ΔGDP_{t-1}	0.004*	0.010***	0.003	-0.014***	0.004*
	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)
$MKTRETURN_{t-1}$	0.000	0.000*	0.000	0.000	0.000

	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$LOANTA_{t-1}$	0.002**	0.008***	0.001	0.009***	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$SNONINT_{t-1}$	0.000	-0.001	-0.001	0.004***	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$LNSYSRISK1_{t-1}$	-0.006	-0.013**	0.001	-0.006	-0.008*
	(0.004)	(0.006)	(0.005)	(0.006)	(0.004)
$LNSYSRISK2_{t-1}$	-0.003	-0.112***	0.011	-0.160***	0.003
	(0.014)	(0.018)	(0.014)	(0.019)	(0.014)
$LNSYSRISK3_{t-1}$	-0.005	0.158***	-0.019	0.120***	-0.019*
	(0.012)	(0.016)	(0.012)	(0.016)	(0.012)
$LNSYSRISK1_{t-1} \times LARGE_{t-1}$	-0.024***	-0.004	-0.024***	0.000	-0.017***
	(0.005)	(0.008)	(0.005)	(0.008)	(0.005)
$LNSYSRISK2_{t-1} \times LARGE_{t-1}$	0.009	0.198***	0.007	0.187***	0.001
	(0.014)	(0.021)	(0.014)	(0.021)	(0.014)
$LNSYSRISK3_{t-1} \times LARGE_{t-1}$	-0.022*	-0.193***	-0.019	-0.177***	-0.010
	(0.013)	(0.019)	(0.013)	(0.019)	(0.013)
Firm fixed effects	Yes	No	Yes	No	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	No	No
Country dummies X YEAR	No	No	Yes	No	No
Industry dummies	No	No	No	Yes	No
Industry dummies X YEAR	No	No	No	No	Yes
R^2	0.607	0.135	0.608	0.179	0.609
Adjusted R^2	0.571	0.134	0.571	0.178	0.572
F-statistic	16.541***	368.077***	16.550***	373.128***	16.685***
Firms included	10,085	10,085	10,085	9,873	9,873
Observations	118,418	118,418	118,418	116,515	116,515

Table 8 Panel OLS regressions with the investment rate and the excess investment rate as the dependent variables: The asymmetrical effects of bank systemic risk.

Columns (1) through (4) of this table present the results of panel OLS regressions of the investment rate, measured as the natural logarithm of the ratio of capital expenditure to one-period lagged total assets, on three measures of bank systemic risk, whereas columns (5) through (8) report the results of panel OLS regressions of the excess investment rate, measured as the natural logarithm of the ratio of a firm's investment rate to a country's cross-sectional average investment rate, on three measures of bank systemic risk. LNSYSRISK1 is the natural logarithm of SYSRISK1, which is defined as the cross-sectional mean of the share of short-term debt as % of long-term debt of publicly listed banks in a country. LNSYSRISK2 is the natural logarithm of SYSRISK2, which is defined as the inverse of the cross-sectional standard deviation of the ratio of loan to assets (in %) of publicly listed banks. LNSYSRISK3 is the natural logarithm of SYSRISK3, which is defined as the inverse of the cross-sectional deviation of the share of non-interest income as % of net revenue of publicly listed banks. All explanatory variables are one-period lagged. DEV is a binary variable, which takes a value of one for a firm that is listed in an advanced country and zero otherwise. ΔGDP denotes the GDP growth rate (in %); LNBSD is the natural logarithm of the percentage share of domestic credit to private sector by banks to GDP. LNEXPORT is the natural logarithm of the percentage share of export to GDP; MKTRETURN denotes stock market return (in %), measured as the first difference in the natural logarithm of the stock market index; LOANTA is the average ratio of total loans to assets of banks in a country; SNONINT is the average share of non-interest income to net revenue of banks in a country. Other variable definitions are provided in Table 2. Standard errors are robust to heteroskedasticity and serial correlation and are clustered at the firm level. We report standard errors in parentheses. Symbols ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

	Investment rate	Investment rate	Investment rate	Investment rate	Excess investment rate	Excess investment rate	Excess investment rate	Excess investment rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	0.660***	0.545	0.453**	-0.201	-0.431**	-0.171	-0.618***	-0.844**
	(0.206)	(0.357)	(0.207)	(0.355)	(0.205)	(0.356)	(0.206)	(0.354)
$LNTA_{t-1}$	-0.071***	0.051***	-0.066***	0.057***	-0.076***	0.052***	-0.071***	0.058***
	(0.008)	(0.005)	(0.008)	(0.005)	(0.008)	(0.005)	(0.008)	(0.005)
$CACL_{t-1}$	-0.034***	-0.061***	-0.034***	-0.061***	-0.034***	-0.061***	-0.035***	-0.062***
	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)
CASH TA_{t-1}	-0.135***	0.330***	-0.130**	0.386***	-0.068	0.363***	-0.065	0.416***
	(0.050)	(0.059)	(0.050)	(0.059)	(0.050)	(0.058)	(0.050)	(0.059)
$CATA_{t-1}$	0.613***	-1.380***	0.617***	-1.390***	0.559***	-1.385***	0.566***	-1.394***
	(0.045)	(0.043)	(0.045)	(0.043)	(0.045)	(0.043)	(0.045)	(0.043)
LEV_{t-1}	-0.009***	-0.004***	-0.009***	-0.004***	-0.008***	-0.004***	-0.008***	-0.004***

	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MBV_{t-1}	0.018***	0.013***	0.023***	0.028***	0.017***	0.012***	0.021***	0.027***
	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
ROA_{t-1}	0.009***	0.015***	0.009***	0.015***	0.009***	0.014***	0.009***	0.015***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$DIVTA_{t-1}$	1.201***	0.855**	1.343***	1.227***	1.035***	0.832**	1.170***	1.203***
	(0.276)	(0.378)	(0.276)	(0.379)	(0.275)	(0.378)	(0.275)	(0.379)
$LNBSD_{t-1}$	-0.064**	-0.162***	-0.043*	-0.090**	-0.076***	-0.169***	-0.056**	-0.098***
	(0.025)	(0.035)	(0.025)	(0.035)	(0.025)	(0.035)	(0.025)	(0.035)
$LNEXPORT_{t-1}$	0.243***	0.175***	0.258***	0.210***	0.102***	0.050	0.119***	0.093*
	(0.038)	(0.052)	(0.038)	(0.052)	(0.038)	(0.052)	(0.038)	(0.052)
ΔGDP_{t-1}	0.037***	0.042***	0.038***	0.044***	0.003	0.007***	0.004*	0.010***
	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
$MKTRETURN_{t-1}$	0.000	0.000	0.000	0.000	0.000**	-0.001***	0.000	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$LOANTA_{t-1}$	0.003***	0.009***	0.003***	0.009***	0.002**	0.007***	0.002**	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$SNONINT_{t-1}$	0.004***	0.003**	0.005***	0.005***	0.000	-0.002	0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$LNSYSRISK1_{t-1}$	-0.010**	-0.008	0.010	0.002	-0.026***	-0.026***	-0.006	-0.016**
	(0.004)	(0.006)	(0.007)	(0.008)	(0.004)	(0.006)	(0.007)	(0.008)
$LNSYSRISK2_{t-1}$	0.029**	-0.001	0.079***	0.036	-0.013	-0.044**	0.011	-0.028
	(0.014)	(0.018)	(0.019)	(0.024)	(0.014)	(0.018)	(0.019)	(0.023)
$LNSYSRISK3_{t-1}$	0.066***	0.189***	0.005	0.054**	0.011	0.140***	0.005	0.059***
	(0.012)	(0.016)	(0.016)	(0.022)	(0.012)	(0.016)	(0.016)	(0.022)
$LNSYSRISK1_{t-1} \times MBV_{t-1}$	0.018***	0.018**			0.014***	0.016**		
	(0.005)	(0.007)			(0.005)	(0.007)		
$LNSYSRISK2_{t-1} \times MBV_{t-1}$	0.030**	0.058***			0.017	0.044**		

	(0.013)	(0.019)			(0.013)	(0.019)		
LNSYSRISK3$_{t-1}$ × MBV$_{t-1}$	-0.059***	-0.144***			-0.043***	-0.129***		
	(0.012)	(0.018)			(0.012)	(0.018)		
LNSYSRISK1$_{t-1}$ × DEV$_{t-1}$			-0.017**	0.000			-0.016**	0.002
			(0.008)	(0.010)			(0.008)	(0.010)
LNSYSRISK2$_{t-1}$ × DEV$_{t-1}$			-0.057**	-0.005			-0.019	0.026
			(0.025)	(0.031)			(0.024)	(0.031)
LNSYSRISK3$_{t-1}$ × DEV$_{t-1}$			0.057***	0.080***			-0.024	-0.003
			(0.020)	(0.026)			(0.020)	(0.026)
Firm fixed effects	Yes	No	Yes	No	Yes	No	Yes	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.628	0.185	0.627	0.180	0.608	0.138	0.607	0.133
Adjusted R^2	0.593	0.185	0.592	0.180	0.571	0.137	0.571	0.133
F-statistic	18.026***	537.273***	17.988***	519.888***	16.563***	378.208***	16.535***	362.936***
Firms included	10,085	10,085	10,085	10,085	10,085	10,085	10,085	10,085
Observations	118,418	118,418	118,418	118,418	118,418	118,418	118,418	118,418

Table 9 Panel OLS regressions with the investment rate as the dependent variable: Pre- and post-global financial crisis periods.

Columns (1) through (3) of this table present the results of panel OLS regressions of investment rate, measured as the natural logarithm of the ratio of capital expenditure to one-period lagged total assets, on bank systemic risk for the pre-global financial crisis period sample. Columns (4) through (6) present the results for the post-global financial crisis period sample. We measure a country-level bank systemic risk using three measures. LNSYSRISK1 is the natural logarithm of SYSRISK1, which is defined as the cross-sectional mean of the share of short-term debt as % of long-term debt of publicly listed banks in a country. LNSYSRISK2 is the natural logarithm of SYSRISK2, which is defined as the inverse of the cross-sectional standard deviation of the ratio of loan to assets (in %) of publicly listed banks. LNSYSRISK3 is the natural logarithm of SYSRISK3, which is defined as the inverse of the cross-sectional deviation of the share of non-interest income as % of net revenue of publicly listed banks. All explanatory variables are one-period lagged. ΔGDP denotes the GDP growth rate (in %); LNBSD is the natural logarithm of the percentage share of domestic credit to private sector by banks to GDP. LNEXPORT is the natural logarithm of the percentage share of export to GDP; MKTRETURN denotes stock market return (in %), measured as the first difference in the natural logarithm of the stock market index; LOANTA is the average ratio of total loans to assets of banks in a country; SNONINT is the average share of non-interest income to net revenue of banks in a country. Other variable definitions are provided in Table 2. Standard errors are robust to heteroskedasticity and serial correlation and are clustered at the firm level. We report standard errors in parentheses. Symbols ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

	1992-2007	1992-2007	1992-2007	2008-2013	2008-2013	2008-2013
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-0.328	-2.167***	-75.976***	1.715**	2.066**	109.995***
	(0.274)	(0.482)	(11.179)	(0.673)	(0.802)	(30.437)
$LNTA_{t-1}$	-0.103***	0.024***	-0.117***	-0.109***	0.098***	-0.121***
	(0.011)	(0.005)	(0.011)	(0.020)	(0.006)	(0.020)
$CACL_{t-1}$	-0.041***	-0.060***	-0.040***	-0.019***	-0.063***	-0.019***
	(0.004)	(0.005)	(0.004)	(0.004)	(0.005)	(0.004)
$CASH\ TA_{t-1}$	-0.070	0.553***	-0.064	0.189**	0.269***	0.180**
	(0.067)	(0.069)	(0.067)	(0.089)	(0.079)	(0.089)
$CATA_{t-1}$	0.650***	-1.530***	0.651***	0.955***	-1.252***	0.922***
	(0.061)	(0.049)	(0.061)	(0.084)	(0.057)	(0.084)
LEV_{t-1}	-0.010***	-0.006***	-0.009***	-0.008***	-0.002***	-0.008***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
MBV_{t-1}	0.022***	0.026***	0.021***	0.012***	0.030***	0.011***
	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)
ROA_{t-1}	0.009***	0.015***	0.009***	0.007***	0.015***	0.007***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)
$DIVTA_{t-1}$	2.407***	0.839*	2.247***	1.132**	1.608***	1.082**
	(0.388)	(0.474)	(0.388)	(0.461)	(0.482)	(0.461)
$LNBSD_{t-1}$	0.093***	0.090**	0.009	-0.022	-0.106	-0.720***
	(0.030)	(0.041)	(0.044)	(0.126)	(0.133)	(0.180)
$LNEXPORT_{t-1}$	0.324***	0.486***	0.043	0.233***	0.190**	0.854***
	(0.056)	(0.073)	(0.076)	(0.089)	(0.093)	(0.134)

ΔGDP_{t-1}	0.053***	0.061***	0.045***	0.010**	0.014***	-0.018***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
$MKTRETURN_{t-1}$	0.000	0.000	0.000	0.000	0.000	-0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$LOANTA_{t-1}$	0.007***	0.011***	-0.003	-0.018***	-0.022***	-0.022***
	(0.001)	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)
$SNONINT_{t-1}$	0.005***	0.001	0.003**	0.003	0.004**	-0.003
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$LNSYSRISK1_{t-1}$	0.007*	0.002	0.002	-0.054***	-0.065***	-0.044***
	(0.004)	(0.005)	(0.004)	(0.011)	(0.011)	(0.012)
$LNSYSRISK2_{t-1}$	0.056***	0.053***	0.076***	0.057*	0.025	0.195***
	(0.013)	(0.016)	(0.013)	(0.032)	(0.034)	(0.037)
$LNSYSRISK3_{t-1}$	-0.015	0.066***	0.014	-0.018	0.006	-0.160***
	(0.011)	(0.014)	(0.011)	(0.025)	(0.026)	(0.030)
Firm fixed effects	Yes	No	Yes	Yes	No	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	No	Yes	No
Country dummies X YEAR	No	No	Yes	No	No	Yes
R^2	0.668	0.186	0.669	0.714	0.160	0.716
Adjusted R^2	0.619	0.186	0.620	0.649	0.160	0.650
F-statistic	13.760***	362.626***	13.814***	10.885***	328.717***	10.938***
Firms included	8,243	8,243	8,243	9,976	9,976	9,976
Observations	64,919	64,919	64,919	53,499	53,499	53,499