Misallocation of investment in Europe: Debt overhang, credit market distress, or weak demand?

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Abstract

Using a pan-European firm-bank matched dataset, we find weak evidence of investment misallocation in Europe. Firms with higher debt overhang invest significantly less, in particular in sectors that are facing good global growth opportunities. We also find that firms with higher debt overhang are more likely to invest if they borrow from undercapitalized banks, and this effect is particularly strong in industries facing good global growth opportunities, suggesting a misallocation of investment associated with "zombie lending". Our results are consistent with theories of investment misallocation due to agency problems at firms and at banks.

JEL classification: E22, E44, G21, H63

Keywords: Investment misallocation, Debt overhang, Banking crises, Aggregate demand

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1. Introduction

Corporate investment was arguably among the biggest casualties of the twin financial and sovereign crises in Europe, with the decline in investment between 2008 and 2012 double that in the US and in Japan during the same period (EIB, 2013). A number of explanations for this collapse in investment have been put forth, including debt overhang at the firm level, bank balance sheet weaknesses, sovereign stress, and economic uncertainty (Campello, Graham, and Harvey, 2010; Kahle and Stulz, 2013; Bloom, 2014; Kalemli-Ozcan, Laeven, and Moreno, 2014; Acharya, Eisert, Eufinger, and Hirsch, 2015).

In this article, we test for the potential contribution to the decline in aggregate investment in Europe of a misallocation of investment across industrial sectors. We are motivated by a well-established theoretical literature which has suggested that agency problems between managers and shareholders and between firms and investors can lead firms to shift investment away from the most productive projects available (Jensen and Meckling, 1976; Myers, 1977; Berkovitch and Kim, 1990; Kim and Maksimovic, 1990; Holmstrom and Tirole, 1998; Greenwood, Sanchez, and Cheng, 2010; Fuchs, Green, and Papanikolaou, 2016). Prior empirical evidence points to persistently high investment misallocation resulting from financial frictions, both in emerging markets and in developed economies (Banerjee and Duflo, 2005; Peek and Rosengren, 2005; Buera, Kaboski, and Shin, 2011; Kalemli-Ozcan and Sorensen, 2012).

In order to address the question of the impact of financial frictions on investment misallocation, we construct a uniquely comprehensive dataset covering 8.4 million individual firms, operating in 30 industrial sectors, with credit relationships to 5195 individual bank in 22 EU countries over the period 2004—2013. The dataset used in the analysis combines information from three individual sources. The firm-level information comes from Amadeus, the European branch of the Orbis database. It contains an exhaustive set of firm-specific balance sheet items, which allows us to create reliable empirical proxies for investment, sales, operating revenue, cash flow, total assets, sector of operation, and debt. Furthermore, the data allow us to distinguish between short-term and long-term debt. For about 10 percent of the firms in the dataset, we also observe a link to the firm's main creditor(s). This allows us to combine the firm-level data from Amadeus with

bank-level data from Bankscope. Consequently, we can calculate a firm-specific proxy for creditor balance sheet strength. Finally, using the firm's sector of operation reported in Amadeus, we match our data with data on sector-specific time-varying global price-to-earnings (PE) ratios, from Thomson Reuters. Similar to Bekaert, Harvey, Lundblad, and Siegel (2007), we assume that if a sector is exhibiting a high global PE ratio in a particular year, this signals a good global growth potential in the near future. Conversely, a low PE ratio signals that investors expect the sector's profitability to decline in the future. Economic theory then tells us that under reasonable assumptions, otherwise identical firms should be more likely to invest in good-global-growth-opportunity sectors.

The resulting matched firm-bank dataset allows us to study the impact of financial frictions, in the form of debt overhang and of association with a weak creditor, on firm investment depending on the global growth opportunities that the firm is currently facing. In particular, a case for misallocation of investment can be made if the econometrician observes relatively lower investment by firms facing better global growth opportunities. Crucially, we are able to address a number of immediate endogeneity concerns. First, by calculating global growth opportunities at the sectoral level instead of firm-specific investment opportunities from observable balance sheet variables, we are eliminating the concern that the firm's investment opportunities may be jointly determined with the firm's debt level, generating a spurious correlation between debt and investment efficiency. Second, the structure of the dataset allows us to include in the regressions country-sector-year fixed effects. These absorb the effect of unobservable factors related to demand or to technology that are common to all firms in a particular sector in a particular country at a particular point in time. Investment misallocation is thus identified off differences in investment between identical firms in the same sector, country, and year which have different levels of debt overhang and are associated with creditors of different strength.

Our key findings are twofold. First, we find evidence that debt overhang at the firm level results in lower investment, more so in sectors facing good global growth opportunities. To get an intuition of the magnitude of the effects we uncover, for the sample-mean debt-to-assets ratio, investment by a firm at the 75^{th} percentile of global price-to-earnings ratio in a particular year is lower by 0.12 of the sample mean relative to a firm at the 25^{th} percentile of global price-to-earnings

ratio in that same year. This result is related to a number of well-understood theoretical mechanisms that predict a negative link between debt overhang and investment efficiency. For example, risk shifting away from more productive assets can take place if the firm's stock of debt is too high (Jensen and Meckling, 1976). Alternatively, if the firm is close to bankruptcy, creditors bear most of the return to any additional investment, and as a result, equity holders may benefit from investing in risky, but value-decreasing projects (Myers, 1977). Finally, levered firms can increase the use of inputs that can be monitored and are collateralizable, shifting investment away from more efficient and profitable uses, as in Kim and Maksimovic (1990).

Second, we find that indebted firms associated with weak banks—proxied by low total capital ratios—invest relatively less if they operate in sectors facing good global growth opportunities. This result is related to theoretical models in which firms face external financing constraints, which can tighten due to shocks to creditors' balance sheets, and which prevent them from undertaking all good investment opportunities (Holmstrom and Tirole, 1998; Eisfeldt and Rampini, 2007), as well as to prior evidence that undercapitalized banks prefer to keep lending to weak firms as they prefer to not recognize any credit losses on their loan portfolios (e.g., Peek and Rosengren, 2005).

Our paper is motivated by a large theoretical literature on the relationship between the firm's capital structure and its investment decisions. There are broadly two classes of models which generate conflicting predictions on how debt financing affects investment efficiency, depending on the nature of the agency cost involved. The first class of models predicts a positive correlation between debt and investment efficiency. For example, in Grossman and Hart (1982), the capital structure of the firm is used to discipline managers who would otherwise waste firm's resources on perks. By taking on more debt, the firm becomes more susceptible to bankruptcy, which provides the manager with an incentive to make sound investments and boost the firm's cash flow, thus reducing the probability of bankruptcy. Therefore, this class of models predict that higher debt levels increase the firm's incentives to invest in value-enhancing projects, thus increasing allocative efficiency.

A second class of models predicts a negative correlation between debt and investment efficiency. Myers (1977) shows that existing debt can act as a tax on the proceeds of the new investment because part of any increase in value generated by the new investment goes to the

existing lenders and is therefore unavailable to repay those claimants who put up the new money. This gives rise to a "debt overhang" problem whereby highly leveraged firms will be likely to forego some positive-NPV projects, resulting in an underinvestment. Jensen and Meckling (1976) show that the entrepreneur can divert part of the investment funds to pay for personal perks. Equity funding provides incentives to underinvest and instead divert funds, because the manager has to share the future return to any current investment with the shareholders, while by virtue of requiring a state-independent stream of payments, debt overcomes this problem. However, excessive debt leads to asset substitution whereby the managers of highly leveraged firms, acting in the interest of their shareholders, prefer to make risky investments even if they have negative expected returns because equity holders keep the profits if the investment succeeds, while debtholders stand to lose if the investment fails. Most related to our paper is the paper by Berkovitch and Kim (1990) who develop a unified model of debt overhang and asset substitution in the presence of heterogeneous industry-specific investment opportunities. They argue that the underinvestment effect *a la* Myers (1977) is more severe in high-growth industries where equity holders need to invest more in the firm, while the overinvestment problem *a la* Jensen and Meckling (1976) is more severe in low-growth industries where firms have a high cash flow that belongs to the debtholders. Excessive debt in these models, therefore, is associated with a decline in investment efficiency whereby firms invest too little, in particular when they face good investment opportunities. Our paper provides a direct test of these theories, and our evidence shows that indeed underinvestment is more severe in sectors facing better global growth opportunities.

Our paper is also motivated by the literature on the link between the bank capital and risk taking. In one class of models, when owners put more equity in the bank's capital structure, this reduces their risk taking incentives as more of the owners' personal wealth is now under risk (Kim and Santomero, 1988). An empirical implication of this class of models is that banks with higher capital have incentives to allocate its lending to less risky projects with higher average expected return. On the other hand, asking owners to provide more capital can lead them to compensate for the loss of utility by selecting a riskier investment portfolio (Koehn and Santomero, 1980; Buser, Chen, and Kane, 1981; Rochet, 1992). The "charter value" effect goes in the same direction: lower capital today implies that the bank will be more profitable in the future, thus increasing the cost of

failing in the current period, and making the bank less risk-loving. Therefore, higher capital in these models makes the bank choose riskier loans. Our paper is a direct test of these conflicting hypotheses whereby we test for whether indebted firms with credit relationships with better capitalized banks are more or less likely to invest more if they face better growth opportunities.

The extant empirical literature has provided a large body of evidence that credit frictions can lead to misallocation of investment away from its most profitable use. Banerjee and Duflo (2005) present extensive evidence on the misallocation of capital in developing countries and argue that credit constraints play a significant role in this misallocation. They argue that credit frictions depress TFP growth because they decrease efficiency of capital allocations across existing heterogeneous firms, and they distort the entry and exit decisions of firms. Kalemli-Ozcan and Sorensen (2012) study capital misallocation within and across 10 African countries. They document high variation in firms' marginal product of capital, both across countries and within countries, and relate these differences to firm-specific difficulties in accessing external finance. Gilchrist, Sim, and Zakrajsek (2013) develop an accounting framework that allows them to exploit the difference in borrowing costs between firms subject to financing frictions and those that are less affected like firms with access to capital markets. They find a modest productivity loss due to resource misallocation on the intensive margin—about 2 percent of TFP. Greenwood, Sanchez, and Cheng (2013) find sizable effects of financing frictions on economic development, and argue that differences in financial systems can account for about 30 per cent of cross-country differences in per-capita GDP. Midrigan and Xu (2014) find fairly small losses from misallocation on the intensive margin of about 5 to 10 per cent, due to the ability of firms to accumulate own funds and rely on internal finance. However, they find potentially large losses from inefficiently low levels of entry and technology adoption that may amount to as much as 40 per cent. The mechanism at plays is related to the fact that technological choice entails large upfront costs that have a long payback period and are difficult to finance without significant reliance on external finance. We contribute to this literature by specifying two sources of friction—debt overhang and agency problems in banks—and then quantifying their impact on firms' investment across industrial sectors facing heterogeneous growth opportunities.

Our work also relates to the literature on the link between the firm's capital structure and its investment decisions. For example, Lang, Ofek, and Stulz (1996) document a negative relation between leverage and future growth at the firm level. Furthermore, they find that leverage does not reduce growth for firms known to have good investment opportunities, but is negatively related to growth for firms whose growth opportunities are either not recognized by the capital markets or are not sufficiently valuable to overcome the effects of their debt overhang. Hennessy (2004) provides evidence of significant underinvestment by firms resulting from debt overhang. Ahn, Denis, and Denis (2006) find that the negative impact of leverage on investment is significantly greater for high-*q* than for low-*q* segments within diversified firms, and argue that the disciplinary benefits of debt are partially offset by the additional managerial discretion in allocating debt service that is provided by the diversified organizational structure. Gan (2007) uses a source of exogenous variation in collateral value provided by the land market collapse in Japan and shows that a shock to collateral value influences firms' debt capacities and corporate investments. Chava and Roberts (2008) identify debt covenants and the transfer of control rights as a mechanism through which financial frictions impact corporate investment. In particular, they show that capital investment declines sharply following a financial covenant violation, when creditors use the threat of accelerating the loan to intervene in management. Relative to these papers, we use a large international sample of public and private firms, therefore we can identify a link between debt and misallocation for non-listed firms, too.

We also address the literature on the impact of bank balance sheet weaknesses on investment misallocation. For example, Peek and Rosengren (2005) use data on bank loans to individual firms in Japan and show that the incentives of weakly capitalized banks to continue lending to the weakest firms—so that they could keep paying interest on existing loans and banks would not have to recognize credit losses—resulted in substantial misallocation of investment. Studying the same mechanism, Caballero, Hoshi, and Kashyap (2008) find that such "zombie lending" allowed inefficient firms to continue operating, preventing more efficient firms from entering the product market and reducing industrial competitiveness and productivity. Giannetti and Simonov (2013) show that insufficient capitalizations of weak banks in Japan sustained the practice of ever-greening of loans to insolvent borrowers in order to avoid a write-down in book capital. Buca and Vermeulen (2015) show that during the global financial crisis, firm investment

became highly sensitive to bank debt. Acharya, Eisert, Eufinger, and Hirsch (2015) show that after the announcement of the ECB's OMT program, creditworthy firms in industries with a prevalence of zombie firms suffered significantly from the credit misallocation, which slowed down the economic recovery.

Our paper also contributes to the broader literature on the link between access to finance and the firm's investment choice (Fazzari, Hubbard, and Petersen, 1988; Lamont, 1997; Kaplan and Zingales, 1997, 2000; Cleary, 1999; Alti, 2003; Love, 2003; Moyen, 2004; Rauh, 2006; Brown, Fazzari, and Petersen, 2009; Denis and Sibilkov, 2009; Fee, Hadlock, and Pierce, 2009; Faulklender and Petersen, 2012; Popov, 2014). We contribute to this literature by identifying jointly the effect of two separate financial frictions, one coming from high levels of firm debt and another coming from low levels of bank capital.

Our paper is also related to the extensive literature on the finance-and-growth nexus. For example, Rajan and Zingales (1998) show that industries that rely more on external finance grow faster in more developed financial systems. Many extended this analysis, piling up more evidence that indeed financial development has a disproportionately large impact on industries and firms that are more dependent on external finance relative to others and that it relaxes external financing constraints. For instance, Wurgler (2000) shows that in countries with more developed financial systems growing industries increase investment more and declining industries decrease investment more than those in countries with less developed financial systems. Claessens and Laeven (2003) show that weak property rights reduce growth by leading to a suboptimal allocation of resources. Beck, Demirguc-Kunt, Laeven, and Levine (2008) emphasize the removal of obstacles to growth for small firms. They show that industries that are naturally composed of small firms grow faster in countries with more developed financials systems. A number of firm-level studies provide some evidence on the allocation of capital and economic development. Demirguc-Kunt and Maksimovic (1998) show that firms in financially more developed countries are able to better exploit profitable opportunities and grow faster than peers in less financially developed economies, while Beck, Demirguc-Kunt, Levine, and Maksimovic (2001) confirm these findings using an extended sample of firms. Love (2003) and Beck, Demirguc-Kunt, and Maksimovic (2005) argue that financial development reduces financial constraints, particularly for small firms. Most related to our

paper are the studies by Bekaert, Harvey, Lundblad, and Siegel (2007) and by Fisman and Love (2007) which show that financial development and financial liberalization have a relatively higher impact on growth in industries facing good global growth opportunities.

The rest of the paper is organized as follows. In Section 2, we present the dataset. In Section 3, we formulate our empirical model and discuss identification. Section 4 summarizes the empirical results. Section 5 discussed robustness tests and extensions. Finally, Section 6 concludes with some policy implications.

2. Data

2.1. ORBIS Dataset

Our firm-level data come from the ORBIS dataset provided by Bureau van Dijk (BvD). ORBIS contains financial and ownership data for more than 170 million firms from more than 100 countries world-wide. Financial data include balance sheet information and income statements, while ownership data contains information about the shareholders of the company. The database has been compiled since 2005 by BvD and is currently updated quarterly. Every vintage contains a history of up to ten years of financial information for an individual firm. In addition to this product, BvD offers to link the latest vintage with historical vintages going back to 2005. The analysis in this paper is based on the vintage as of the second quarter of 2005 linked with all historical files available from BvD.[1]

A common case in ORBIS is that financial information for a given firm and year is updated from one vintage to the next. When constructing the historical files, special care is taken to put the latest available information for any given year and company. The resulting dataset contains many more firm-year observations than are available in the latest vintage. This is because there are more years of data for many firms. In addition, there are about 30 percent more companies in the historical files compared to the latest vintage. The reason is that BvD deletes companies that do not

[1] Specifically, the following vintages are used 07/2006, 10/2007, 08/2008, 10/2009, 10/2010, 10/2011, 10/2012, 04/2013, 07/2013, 10/2013, 12/2013, 03/2014, 07/2014, 10/2014, 12/2014, 03/2015.

report for a certain period from each vintage. Such companies are nevertheless included in the linked historical files thereby reducing the survival bias that is present in a single vintage. At this stage the dataset contains about 100 million firm-year observations, but about a quarter of those relate to firms that have not provided financial information in any given year.

For our analysis, we take companies with financial data in the period 2004–2013 and we work with unconsolidated accounts. Table 1 reports the number of firms by country and year over the sample period. We start with a total of 46,080,758 firms, with the number of firms varying significantly by country. For example, there are on average 372 firms per year in Cyprus, and 664,469 firms per year in France. In Table 2, we compare these data with data on number of firms available from Eurostat Structural Business Statistics. We then drop countries for which Orbis coverage, relative to Eurostat, is below 10%. These countries are Cyprus (1% coverage), Czech Republic (8% coverage), Greece, Lithuania (5% coverage), Malta (4% coverage), and Poland (3% coverage), and so we are left with the remaining 22 EU countries.

In terms of firm-specific information, we make use of the following variables: total assets, tangible fixed assets, intangible fixed assets, cash, long-term debt, loans, creditors and other current liabilities, cash flow, sales and EBITDA.[2] These are first checked for consistency and inconsistent firm-year observations are dropped. Our consistency checks make sure that balance-sheet identities hold within a small margin and entries are meaningful from an accounting point of view. Following Kalemli-Ozcan, Laeven, and Moreno (2015), we drop firm-year observations in which total assets, fixed assets, intangible fixed assets, sales, long-term debt, loans, creditors, other current liabilities or total shareholder funds and liabilities have negative values.

Furthermore, we drop firm-year observations for which some basic accounting identities are violated by more than 10%.[3] We also drop country-specific sectors, such as agriculture and mining; sectors with high government ownership, such as public administration; and heavily regulated

[2] Earnings before taxes, interest payments, depreciation and amortization.

[3] Specifically, we drop observations if the following ratios are larger than 10% in absolute value: (total assets – total shareholder funds and liabilities)/total assets; (total assets – fixed assets – current assets)/total assets; (current liabilities – loans – creditors – other current liabilities)/current liabilities.

sectors, such as finance. For our analysis we retain only firms in Manufacturing (NACE Rev. 2 section C), Construction (F), Wholesale and retail trade (G), Transportation and storage (H), Accommodation and food service activities (I), Information and communication (J), Professional, scientific and technical activities (M) and we drop firm-year observations if there are less than 10 firms in each NACE Rev. 2 digit 4 sector. In addition, we remove firm-year observations that have loans or long-term debt exceeding total liabilities. Then we drop all firms for which we do not have at least 5 years of consecutive non-missing observations of tangible assets. Finally, we winsorize all variables at the 1% level. After applying all these procedures, we are left with 8,427,633 unique firms over the sample period 2004 – 2013, and a maximum of 44,701,224 firm-year observations for the 22 EU Member States considered.

Table 3 presents summary statistics on all relevant variables used in the empirical tests. In general, there is a good deal of variation in the variable of interest whose impact on investment we seek to identify. For example, while the net investment ratio is a positive 34 percent on average, it varies widely with a standard deviation of 227 percent, a minimum value of -100 percent, and a maximum value of 1769 percent. Firm leverage also varies widely with a large fraction of firms have close to zero or no long-term debt and with short-term debt on average larger than long-term debt. Banks financial capitalization also varies markedly, despite bank regulation, with the regulatory capital ratio varying from a low of 8 percent to a high of 28 percent, and is on average of 13.7 percent. Price-to-earnings ratios vary substantially across industries, with a minimum of 8.7 and a maximum of 45.1, for an average of 17.8. In terms of country-specific variables, there is substantial heterogeneity across countries, too: annual GDP growth varies between -23 percent and 31 percent; the unemployment rate varies between 3.4 percent and 24.8 percent; and the countries in our sample are in a systemic banking crisis 49 percent of the time.

2.2. Merging ORBIS with PE ratios from Datastream

We collect data on global PE ratios for the period 2004-2013 from Datastream for 39 industrial sectors. These industrial sectors are then matched to 662 four-digit industries as defined in NACE Rev. 2 classification and are subsequently merged to ORBIS. Mapping the two classification results in the merging of a number of sectors, leaving us with 30 unique sectors. For our analysis we retain only firms in Manufacturing (NACE Rev. 2 section C), Construction (F), Wholesale and retail

trade (G), Transportation and storage (H), Accommodation and food service activities (I), Information and communication (J), Professional, scientific and technical activities (M). Appendix Table 1 lists all sectors used, and it presents the matching key between Orbis and Datastream.

We classify a sector as "High-PE" or "Low-PE" based on whether it is in the top half or in the bottom half, respectively, of the sector price-to-earnings distribution for each particular year. Doing this for each year rather than classifying sectors based on average price-to-earnings values over the sample period is important because sectors tend to move up and down in the ranking. Appendix Table 2 presents the list of final sectors, and it shows whether they switched from the high-PE to the low-PE category or the other way around between 2004 and 2013 (the last year of our sample period). As the table shows, 12 of the 30 sectors switch during this period.

2.3. Merging ORBIS with Bankscope

We make use of a variable called "BANKER", available from Orbis through Kompass, which displays the name of the banks with which the firm has a relationship. Following Kalemli-Ozcan, Laeven, and Moreno (2015), we use OpenRefine and Reconcile-CSV to match bank names to the BvD ID numbers of banks and we subsequently match these bank names with bank information on Total Capital Ratios from Bankscope. If a firm reports more than one bank, we create an average of the reported banks' Total Capital ratio, which we subsequently use in our main specification. Moreover, we link each bank to its Global Ultimate Owner (GUO) through information provided in Bankscope. Specifically, we use the variable "Global Ultimate Owner"; if this variable is not available, we use the variables "Entity Type" and the "BvD Independence Indicator" to determine whether a bank is a GUO itself or whether it is a branch or a subsidiary. We use the Total Capital Ratios of the Global Ultimate Owner bank in our sample robustness tests.

Table 4 reports the percentage of firms in our sample that are associated with one or with multiple banks. On average, 35% of firms have a credit association with one bank only, but this varies significantly across countries, with a low of 11 percent in Bulgaria and a high of 99 percent in Slovenia.

3. Empirical strategy and identification

We estimate a difference-in-differences specification for the level of investment, comparing investment by firms in high- versus firms in low-growth-opportunities industries, and distinguishing firms by their degree of debt financing and by the degree of capitalization of the creditors they are associated with. The specification allows for the inclusion of country-sector-year fixed effects. This combination of fixed effects absorbs any time-varying shocks to demand or to technology that are specific to a particular sector in a particular country (e.g., car manufacturing in Italy). In this way, identification is achieved from comparing two otherwise identical firms in the same country-sector during the same year that only differ in their level of indebtedness and in the degree of capitalization of their creditor.

We use several sources of identifying variation: cross-industry differences in investment opportunities, cross-firm differences in the balance sheet strength of the associate credit institution, and cross-country differences in credit market and in sovereign distress. We estimate the following regression:

$$\frac{I_{fcst}}{K_{fcst-1}} = \beta_1 GGO_{st} \times \frac{Debt_{fcst-1}}{Assets_{fcst-1}} + \beta_2 GGO_{st} \times CapRatio_{fcst-1} + \beta_4 X_{fcst-1} + \beta_5 \varphi_f + \beta_6 \eta_{cst} + \varepsilon_{fcst} \qquad (1)$$

where *I* is investment and *K* is capital. In our main specification, *GGO* is a dummy variable equal to 1 if the firm is operating in a sector which is in the top 50% of annual global price-to-earnings ratios for this particular year. We also employ alternative proxies for growth opportunities, such as average sales growth for a US particular US industry in a particular year. In the main specification, *Debt/Assets* denotes the firm's total liabilities divided by total assets. In alternative specification, we replace *Debt* with net debt, long-term debt, short-term debt, and EBITDA to total debt. *CapRatio* is the total capital ratio of the firm's bank in the previous year. *X* is a vector of control variables including the logarithm of total assets, the ratio of cash flow to total assets, and the ratio of sales to total assets. It also includes *Debt/Assets* and *CapRatio*. φ_f is a vector of firm fixed effects. η_{cst} is an interaction of country, sector, and year dummies. Finally, ε is the idiosyncratic error. We do not include the variable *GGO* on its own in the regression because its direct effect on investment is absorbed by the country-sector-year fixed effects.

The coefficients of interest are β_1 and β_2. In a classical difference-in-differences sense, the coefficients capture the impact of debt overhang and of association with an undercapitalized creditor, respectively, on investment, for the treatment group (firms in sectors facing good global growth opportunities) *relative to* the control group (firms in sectors facing poor global growth opportunities). A negative coefficient β_1 would imply that all else equal, investment declines more with firm debt in sectors facing good global growth opportunities. Similarly, a positive coefficient β_2 would imply that all else equal, investment declines more as the firm's creditor's capital decreases in sectors facing good global growth opportunities. The numerical estimates of β_1 and β_2 capture the difference in the change in the variable of interest between high-debt and low-debt firms, and between firms associated with low-capital banks and firms associated with high-capital banks, induced by switching from the control group to the treatment group. The vector of firm-level controls *X* allows us to capture the independent impact of various firm-specific developments, such as shocks to overall debt, profits, cash flow, or assets.

5. Empirical results

5.1. Main result

Table 5 presents our benchmark specification. We first estimate a version of model (1) where we exclude the bank-level information from the regression. The reason is that we have the bank-firm match for only about 15 percent of all firm-year observations in our dataset, and so we lose the vast majority of our firm-level observations once we include the bank-level information. The estimates from this regression are reported in column (1). In terms of the effect of the main firm-specific balance sheet controls, we find that firms richer in cash flow, firms with higher sales-to-assets ratios, and smaller firms invest more. The former two are standard effects relating profitability to investment, and the latter is a standard scale effect.

In terms of the main variables of interest, we first find that higher debt is associated with lower investment. This result is consistent with Kalemli-Ozcan, Laeven, and Moreno (2015) who show that higher total debt at the firm level is associated with lower average investment in a similar sub-sample of countries. This is a standard debt overhang result a la Myers (1977) whereby firms

with too much outstanding debt fail to invest in projects that yield a positive expected return because the benefits from any additional investment accrue largely to existing debt holders.

Furthermore, we also find that investment by firms with a large stock of debt, relative to assets, is even lower if firms are operating in a sector that is currently facing high global growth opportunities. This is a direct confirmation of the model in Berkovitch and Kim (1990) which predicts that the underinvestment problem identified in Myers (1977) should be more severe in high-growth industries where equity holders need to invest more of their own funds in the firm.

In column (2), we drop the variable *Debt/Assets* and its interaction with the sector specific PE ratio, and we add the variable *CapRatio* and its interaction with the sector-specific PE dummy. In doing so, we end up with 2.4 million observations rather than the 15.7 million in column (1). We find that firms invest more when they are borrowing from better-capitalized banks, but less so if they operate in sectors facing better global growth opportunities. However, both effects are insignificant in the statistical sense.

Finally, we run the full specification of Model (1) in column (3). We confirm that more indebted firms invest less, and that they are particularly likely to do so if they operate in sectors facing good global growth opportunities (albeit the second effect is insignificant). We also find that firms borrowing from banks with low capital invest less. This effect is significant at the 5% statistical level.

In all, our results provide some evidence that there is misallocation of investment due to high debt levels at the firm level and to weak creditors' balance sheets. These facts are consistent with theories of debt overhang and misallocation (e.g., Myers, 1977; Berkovitch and Kim, 1980). They also provide weak support to theories of the asset substitution effect of banks' undercapitalization (e.g., Caballero, Hoshi, and Kashyap, 2008).

5.2. Robust measures of growth opportunities

One criticism associated with using price-to-earnings ratios is that high PE ratios can result from high TFP growth and not necessarily from investment, hence, they should lead to a more efficient use of resources, but not necessarily to more capital accumulation. Moreover, PE ratios

can be high as a result of high leverage, compromising them as a proxy for growth opportunities. To address this criticism, in Table 6 we employ alternative proxies for growth opportunities. In particular, we look at look at annual sales growth over the sample period of the industries in our dataset in the United States. This approach is akin to Fisman and Love (2007) who argue that because US corporates are relatively free of financing constraints, the actual performance of US industries, in terms of sales growth, gets close to the industry's potential performance and is, therefore, a good proxy for the global growth opportunities that the industry is facing. In practice, we replace in Model (1) the PE ratio with the annual US industry sales growth, in each individual year, and re-run our main model.

We report two versions of this modification of Model (1), one without controlling for association with undercapitalized banks (column (1)), and one controlling for such association (column (2)). In both specifications, we find a very strong underinvestment effect of debt overhang, which is of similar magnitude as in previous tests. Looking at the interaction term of *Debt/Assets* with *US sales growth*, it is rather unstable, both in terms of sign and magnitude. Only in the column (2) where we include credit association, we find evidence of misallocation in that firms with a high ratio of debt to total assets and firms with a credit relationship with an undercapitalized bank are less likely to invest when operating in a good-global-growth-opportunities sector. However, both effects are not significant at any reasonable statistical level.

We conclude that the evidence on misallocation due to both debt overhang and to association with undercapitalized banks is sensitive to the proxy for growth opportunities that we employ.

5.3. Robust measures of debt overhang

In Table 7, we look at alternative measures of debt overhang. For example, Kalemli-Ozcan, Laeven, and Moreno (2015) find that only long-term debt depresses investment, while short-term debt increases it. They argue that these results are consistent with a mechanism whereby short-term debt does not deter investment because its value is less sensitive to the value of the firm and so it receives a smaller benefit from new investment (Myers, 1977). In addition to distinguishing

between short- and long-term debt, the literature is ambiguous on whether the proper proxy for debt overhang is the stock of debt or the cost of servicing debt.

In the first column of Table 7, we use net debt instead of total debt. The idea of this test is that high levels of total debt may be less of a problem to the firm if it also has a large pool of assets. The main result obtains with the same degree of statistical significance: higher debt overhang depresses investment, more so in industries facing good global growth opportunities.

The next two columns confirm that short-term debt and long-term debt do not have the same effect on investment. In column (2), we find, as do Kalemli-Ozcan, Laeven, and Moreno (2015), that only long-term debt deters investment, as predicted in Myers (1977). At the same time, higher amounts of short-term debt are associated with higher investment levels (column (3)). As long as debt is below a region where it induces an asset substitution effect, this result is consistent with the theoretical argument in Jensen and Meckling (1976) that more debt on the firm's balance sheet gives the firm's manager incentives to pursue a more efficient investment strategy. Crucially, we also find that long-term debt and short-term debt differ in their impact on investment efficiency. Higher levels of long-term debt are associated with relatively higher, and higher levels of short-term debt with relatively lower, investment in good-growth-opportunities sectors.

In column (4) we look at debt in relation to total earnings before interest, taxes, depreciation and amortization (EBITDA). We find that this measure of debt overhang is associated with a decline in total investment, but not with statistically significant misallocation of investment.

5.4. Robust measures of weak banks

Next, we perform a robustness check related to our definition of an undercapitalized bank. So far, we are simply classifying banks as undercapitalized if they have low total capital ratios relative to the global average. This approach can be questioned in a number of ways. The distribution of capital ratios is skewed, and it varies enormously across different countries. Two banks with identical capital ratios can be one of the best or one of the worst capitalized banks in a country, depending on the overall health of the domestic banking system. Alternatively, differences in capitalization among banks can be meaningless if all banks in the world are poorly capitalized.

Hence, comparing a bank to the world average can produce misleading results that are hard to interpret.

To address this point, in Table 8 we run a number of tests using alternative proxies for poor capitalization. In column (1), we interact the sector's current PE ratio dummy with a dummy variable equal to 1 if the firm's creditor has a total capital ratio of less than 10%. We find that firms borrowing from weak banks—according to this alternative definition—invest less on average, which confirms our previous results. We find no evidence of misallocation in that firms borrowing from such banks are not less likely to invest if they operate in sectors facing good global growth opportunities.

In columns (2) and (3), we interact the sector's current PE ratio dummy with two other dummies for weak bank, respectively: one based on the country median total capital ratio in a particular year, and one based on the global median total capital ratio in a particular year. In both cases, we register a negative effect of weak capitalization on investment. Also, in both cases we find evidence of misallocation in that firms borrowing from less-than-median capitalized banks are less likely to invest if they operate in sectors facing good global growth opportunities. However, neither the level nor the interaction effects are statistically significant.

We conclude that the evidence on misallocation due to firms' association with undercapitalized banks is sensitive to the proxy for weak bank that we employ.

5.5. Robust bank association

We next perform another robustness test related to the credit association between a firm and a bank. Many of the firms in our sample have an association with multiple banks, and so far, we have calculated an average total capital ratio based on all banks with which the firm has a credit relationship. Moreover, we have used data on each individual bank's total capital ratio instead of data on the total capital ratio of the bank's parent. Both approaches can be questionable if firms can take advantage of multiple credit relationships to circumvent their association with one particular weak bank, and if—because of reshuffling of funds within internal capital markets—the relative health of the parent is more important for loan decisions than the relative health of an individual affiliate.

To address these shortcomings of our primary empirical specification, in Table 9 we employ three alternative specifications. We first use the total capital ratio of the bank that is ordered first in the list of banks that the firm is associated with (column (1)). In column (2), we employ the capital ratio of the parent of the bank that is ordered first in the list of banks that the firm is associated with. In column (3), we use the average capital ratio of the parent banks of all the banks that the firm reports a credit association with. In all cases, we find a strong positive correlation between the bank's capitalization and investment by the firm associated with it. In the third case, this effect is also significant at the 10 percent statistical level. We also find, in all three cases, no evidence of misallocation in that firms are not statistically less likely to invest in good-global-growth-opportunities sectors if they are attached to poorly capitalized banks.

In column (4), we only look at firms with a credit relationship with a single bank. In this way, we circumvent the dual problem that firms can substitute credit if they have a relationship with multiple creditors, and that the order in which banks are reported by Orbis does not necessarily correspond to the actual hierarchy of banks in relationship to the firm. On the downside, we are now only using a sub-sample of firms which for reasons unobservable to the econometrician have chosen to be associated with one bank only, raising questions about their representativeness. The results are largely in line with the rest of the specifications.

5.6. Zombie lending

Our tests so far provide some evidence to a debt-overhang effect by firms and to a risk-taking effect by banks. In particular, we establish that high levels of debt at the firm level and low capitalization at the bank level affect the firm's investment decisions. In this section, we proceed to test for another mechanism which combines the two effects, that is, that firms can be more likely to invest in poor-growth-opportunity sectors if they have high debt levels *and* are borrowing from a poorly capitalized bank. We do so because one can expect that poorly capitalized banks will be more likely to support firms with poor growth prospects that are close to default, because they are unwilling to recognize the losses on their loan portfolio coming from these firms. This is a mechanism that goes into the direction of "zombie lending" documented in the case of weak firms borrowing from weak banks in Japan during the 1990s (e.g., Peek and Rosengren, 2005; Caballero, Hoshi, and Kashyap, 2008; Giannetti and Simonov, 2012).

To test this hypothesis, we add to our main Model (1) a triple interaction between *Debt/Assets*, the industry-specific PE ratio, and the firm-specific *CapRatio*. The point estimates from this model are reported in Table 10, and the regression includes all possible double interactions, too. We first confirm the main results of our paper related to underinvestment: firms with higher debt overhang and firms borrowing from undercapitalized banks invest on average less than identical firms with lower debt and borrowing from well-capitalized banks. The effects of low capital levels in creditor banks on firms' investment are less pronounced in sectors facing good growth opportunities, suggesting no evidence of misallocation bias coming from a bank-firm nexus. Nevertheless, we confirm the main result of the paper related to the effect of debt overhang on misallocation: firms with a high debt-to-assets ratio are less likely to invest in sectors facing good global growth opportunities. Next, we look at the impact on investment misallocation of borrowing from undercapitalized banks. We find that firms with higher debt overhang are more likely to invest if they borrow from undercapitalized banks, an effect related to theories of undercapitalized banks being unwilling to stop lending to firms that are close to bankruptcy so that they do not have to recognize any credit losses. Crucially, indebted companies with ties to poorly capitalized banks in high-growth sectors invest on average less than identical companies in low-growth sectors. This indeed suggests a misallocation of investment associated with this "zombie lending" as banks shift their lending stream to from more to less profitable sectors

We conclude that our data point to substantial misallocation of investment stemming from the credit association between indebted firms and poorly capitalized banks.

5.7. The role of aggregate demand

Our analysis so far is prone to the criticism that we have not properly accounted for demand effects. In particular, one of the most influential hypotheses for the decline in aggregate investment after the global financial crisis rests on the proposition that aggregate demand collapsed due to substantial shocks that led economic agents to increase savings, reducing the propensity to invest (Summers, 2013). SMEs in Europe routinely report "finding customers" as the most severe problem they face in the current business environment (ECB SAFE, 2015). Aggregate demand likely declines more during systemic banking crises, casting doubt over the validity of our prior estimates.

To account for this possibility, in Table 11 we enrich our specification with standard empirical proxies that should capture demand properties of the business cycles. In particular, we add to our main empirical model interactions between the firm-specific variables *Debt/Assets* and *CapRatio* with the country-specific GDP growth, the country-specific unemployment rate, the country-specific yield on 10-year domestic sovereign bonds, and a country-specific proxy for whether the country was in a systemic banking crisis last year. Data on the latter comes from the Laeven and Valencia (2012) database. Finally, we include a horse race with all interaction variables.

We find that indebted firms do not invest less in times of sovereign stress (column (1)), which suggests that the firm's own conditions, in combination with the investment prospects it faces, are more important than general sovereign conditions. However, we do find that indebted firms invest less when the unemployment rate is high (column (2)), and when GDP growth is low (column (3)). This suggests that both the underinvestment problem associated with debt overhang is more serious when demand is low. We also find that indebted firms invest less during systemic banking crises, confirming that agency problems at firms and at banks interact to depress firm investment (column (4)). Finally, the main results largely survive the "horse race" specification (column (5)).

6. Conclusion

Using a large sample of small, medium, and large firms in 22 EU countries over the period 2004–2013, we find that high levels of firm indebtedness are associated with misallocation of investment, proxied by relatively lower investment by firms operating in sectors facing good global growth opportunities. This result is consistent with theories that predict a negative effect of debt overhang on investment because managers have an incentive to pass on investment opportunities the proceeds from which will go largely to the existing debt holders (Myers, 1977). It is also consistent with theories predicting that the debt-overhang effect is stronger in high-growth industries where firms need to raise a lot of new equity (Berkovitch and Kim, 1990). We find little evidence of general misallocation of investment due to association with weakly capitalized banks. However, we find that indebted firms that are at the same time borrowing from weakly capitalized banks are less likely to invest if they are facing good global growth opportunities. This result is consistent with prior evidence from Japan during the 1990s that banks close to the regulatory

capital threshold prefer to keep lending to firms with poor growth prospects so that they do not have to recognize losses on their loan portfolio (Peek and Rosengren, 2005).

Our findings inform the debate on why business investment levels in Europe are way below their pre-crisis peak, and on what the most efficient tools are for addressing this question. While our results do not negate other concurrent mechanisms, such as weak demand, sovereign stress, or macroeconomic uncertainty, they provide strong evidence that high debt levels at firms and low capital at banks can be associated with investment misallocation, and ultimately with lower overall investment. Our findings thus speak to the importance of regulatory tools and of prudential supervision in curtailing credit booms that allow firms to become overleveraged, to the preferential treatment of tax over equity, as well as to the speedy resolution and recapitalization of banks during financial crises.

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Table 1 - Number of firms in Orbis Database

Country	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
AT	25,113	43,628	52,986	57,096	58,549	55,821	57,294	63,350	63,629	63,348
BE	189,154	194,728	202,423	210,231	218,409	224,930	230,440	236,875	241,902	241,224
BG	26,213	24,147	37,573	48,871	33,957	35,122	38,424	156,777	189,708	188,710
CY	251	493	439	455	498	465	380	322	254	161
CZ	37,577	43,583	50,063	58,697	67,427	74,182	74,659	74,349	71,389	59,757
DE	55,736	287,443	452,854	466,021	482,664	490,012	487,141	491,603	351,963	271,260
DK	52,590	53,513	58,901	64,079	67,146	67,861	68,215	69,018	68,935	70,028
EE	22,857	25,799	30,139	35,284	39,112	32,252	34,386	37,199	40,104	41,069
ES	482,958	500,935	529,520	473,572	509,162	514,835	495,893	489,575	480,542	416,188
FI	56,716	58,400	57,836	69,876	80,408	83,051	85,684	87,672	83,735	80,902
FR	567,121	591,707	621,855	653,492	685,627	698,096	715,873	723,513	721,009	666,397
GB	568,194	591,598	606,180	623,011	637,971	649,875	672,657	706,134	746,959	793,687
GR	24,196	24,793	25,143	25,163	24,535	23,561	23,795	24,260	21,240	17,853
HR	48,207	52,165	57,090	59,492	64,416	71,613	71,035	69,325	73,806	66,776
HU	147,229	157,619	50,583	100,788	104,052	161,669	159,937	158,727	173,713	180,160
IE	22,915	25,793	29,647	33,444	36,419	38,009	39,506	41,474	43,611	44,320
IT	337,770	347,053	368,824	533,410	558,450	565,993	579,232	584,098	572,818	549,429
LT	5,472	6,560	8,272	7,743	5,111	4,468	7,156	7,833	7,101	6,289
LU	1,238	2,306	3,129	3,564	4,397	5,573	5,592	5,349	5,137	4,191
LV	6,535	7,029	9,449	10,437	5,897	5,417	49,980	60,381	64,999	69,272
MT	745	892	964	1,029	1,485	1,603	1,606	1,435	938	332
NL	114,259	143,111	171,506	182,928	192,641	197,398	200,813	204,491	205,473	198,691
PL	17,491	21,710	37,101	43,624	51,309	50,781	55,546	57,702	62,660	54,636
PT	68,179	206,610	201,282	204,299	203,030	204,055	194,158	185,246	181,451	178,098
RO	280,102	320,991	308,780	408,710	370,531	332,231	338,796	366,991	396,556	457,073
SE	133,632	137,550	142,223	148,991	156,616	165,279	175,298	193,942	212,457	225,587
SI	9,103	9,808	10,762	10,547	9,884	11,119	63,490	67,955	67,057	61,111
SK	8,822	18,109	24,539	28,258	28,256	72,389	82,451	92,227	101,174	99,387
Total	3,310,375	3,898,073	4,150,063	4,563,112	4,697,959	4,837,660	5,009,437	5,257,823	5,250,320	5,105,936

Note: This table summarizes the data on the number of firms in our Orbis database over the period 2004–2013, for all countries in the sample, and for the following NACE Rev. 2 sections: (C) Manufacturing, (F) Construction, (G) Wholesale and Retail Trade, (H) Transportation and Storage, (I) Accomodation and Food Service Activities, (J) Information and Communications, (M) Professional, Scientific and Technical Activities. Source: Orbis database.

Table 2 - Orbis coverage

Country	Orbis coverage
AT	16%
BE	50%
BG	38%
DE	18%
DK	42%
EE	61%
ES	18%
FI	36%
FR	28%
GB	41%
HR	52%
HU	35%
IE	24%
IT	16%
LU	23%
LV	60%
NL	23%
PT	28%
RO	73%
SE	33%
SI	40%
SK	22%
CY	1%
CZ	8%
GR	n.a.
LT	5%
MT	4%
PL	3%
Average (excl. CY, CZ, GR, LT, MT, PL)	35%

Note: This table summarizes the average coverage of our Orbis dataset with respect to Eurostat Structural Business Statistics for selected NACE 2 sections (see Table 1). We compare the period 2008-2013 due to data availability issues in SBS data by sector. Source: Orbis database, Eurostat Business demography by size class (Table: bd_9bd_sz_cl_r2).

Table 3 - Summary Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Investment/Capital	32,921,958	0.34	2.27	-1.00	17.69
Total Debt / Assets	25,344,535	0.74	0.73	0.00	6.37
Net Debt / Assets	24,035,475	0.52	0.71	-0.90	5.14
Long Term Debt / Assets	27,606,045	0.15	0.28	0.00	1.59
Short Term Debt / Assets	31,834,870	0.18	0.27	0.00	1.45
Cash Flow / Assets	24,476,082	0.07	0.28	-1.61	0.99
Sales / Assets	24,998,164	1.82	1.89	0.00	12.13
Log(Assets)	37,548,955	12.08	2.08	5.87	17.28
Net worth / Assets	37,310,449	0.11	1.16	-9.53	1.00
Global PE	44,701,224	17.82	3.81	8.71	45.09
GDP growth	37,577,703	3.41	6.51	-22.97	31.36
US sales growth	22644106	0.05	0.08	-0.60	0.41
Unemployment rate	37,577,703	8.60	3.48	3.43	24.80
Government Bond Yield (10 Years)	35,810,006	4.36	1.59	1.50	10.78
Banking Crisis dummy	37,577,703	0.49	0.50	0.00	1.00
Total Capital Ratio (main bank)	4,887,715	13.73	3.71	8.32	28.33
Total Capital Ratio (average of reported banks)	5,647,422	13.66	3.63	8.21	28.06
Total Capital Ratio (GUO)	4,777,796	13.34	2.54	9.10	21.44
Total Capital Ratio (average of reported GUOs)	4,960,160	13.36	2.52	9.16	21.53

Note: Balance sheet variable in real terms, winsorised at the 1% level. Variables are deflated using country-specific HCPI indices. Source: balance sheet variables come from the Orbis-Amadeus database; Banking crisis dummy is constructed using information from "Systemic Banking Crisis Database" (Laeven and Valencia, 2012); data GDP, unemployment, and government bond yields come from ECB-SDW (original source of the data on government bond yields: Thomson Reuters); data on Price-to-Earnings ratios come from Thomson Reuters Datastream. Bank-level variables on Total Capital Ratio come from Bankscope.

Table 4 – Firms' Relationship with Banks

Country	Firms reporting one bank	Firms reporting multiple banks
AT	43%	20%
BG	11%	3%
DE	52%	35%
DK	39%	4%
EE	14%	5%
ES	17%	17%
FR	30%	0%
GB	29%	1%
HR	20%	10%
HU	24%	64%
IE	73%	1%
LV	20%	8%
NL	38%	10%
PT	22%	23%
SI	99%	0%

Note: the percentage of firms reporting banking relationship refers to the number of firms after the cleaning procedure is applied. Source: "BANKER" variable, available from Kompass through Orbis database.

Table 5 - Main results

	Investment / Capital		
	(1)	(2)	(3)
Total Debt/Assets	-0.213***		-0.181***
	(0.004)		(0.013)
Total Debt/Assets x PE dummy	-0.014***		-0.014
	(0.004)		(0.012)
Total Capital Ratio		0.001	0.003**
		(0.001)	(0.001)
Total Capital Ratio x PE dummy		-0.001	-0.002
		(0.001)	(0.001)
Cash Flow/Assets	0.365***	0.398***	0.277***
	(0.005)	(0.0122)	(0.018)
Sales/Assets	0.040***	0.034***	0.043***
	(0.001)	(0.003)	(0.004)
Log(Assets)	-0.739***	-0.723***	-0.663***
	(0.003)	(0.008)	(0.010)
Observations	15,653,745	2,402,731	1,585,284
R^2	0.273	0.305	0.323
Firm FE	Yes	Yes	Yes
Country x Sector x Year FE	Yes	Yes	Yes
Firm-level clustering of SE	Yes	Yes	Yes

Note: The table reports estimates of Model 1 where the dependent variable is the value of firm-specific investment at time *t* divided by the value of firm-specific tangible capital at time *t-1*. All explanatory variables are 1-period lagged with the exception of the PE dummy. Standard errors are reported in parentheses, where * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 6 - Robust measures of growth opportunities

	(1)	(2)
	Investment/Capital	Investment/Capital
Total Debt/Assets	-0.252***	-0.213***
	(0.005)	(0.014)
Total Debt/Assets * US sales growth	0.078***	-0.107
	(0.029)	(0.083)
Total Capital Ratio		0.001
		(0.001)
Total Capital Ratio * US sales growth		0.014**
		(0.006)
Cash Flow/Assets	0.378***	0.269***
	(0.008)	(0.025)
Sales/Assets	0.050***	0.052***
	(0.002)	(0.006)
Log(Assets)	-0.802***	-0.674***
	(0.005)	(0.014)
Observations	7,963,458	974,066
R2	0.299	0.348
Firm FE	Yes	Yes
Country x Industry x Year FE	Yes	Yes
Firm-level clustering of SE	Yes	Yes

Note: The table reports estimates of Model 1 where the dependent variable is the value of firm-specific investment at time *t* divided by the value of firm-specific tangible capital at time *t-1*. All explanatory variables are 1-period lagged with the exception of the PE dummy. Standard errors are reported in parentheses, where * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 7 - Robust measures of debt – Dependent Variable: Investment/Capital

	Net debt/Assets (1)	Long-term debt/Assets (2)	Short-term Debt/Assets (3)	EBITDA/Total Debt (4)
Debt Measure/Assets	-0.373***	-0.547***	0.083***	-0.000
	(0.013)	(0.020)	(0.016)	(0.000)
Debt Measure/Assets x PE dummy	-0.001	0.006	-0.027	0.000
	(0.011)	(0.019)	(0.016)	(0.000)
Total Capital Ratio	0.003**	0.003**	0.001	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
Total Capital Ratio x PE dummy	-0.001	-0.002	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Cash Flow/Assets	0.157***	0.334***	0.393***	0.388***
	(0.019)	(0.017)	(0.013)	(0.017)
Sales/Assets	0.048***	0.031***	0.029***	0.038***
	(0.004)	(0.004)	(0.003)	(0.004)
Log(Assets)	-0.665***	-0.665***	-0.698***	-0.649***
	(0.010)	(0.010)	(0.008)	(0.010)
Observations	1,530,144	1,652,678	2,253,663	1,583,099
R^2	0.330	0.327	0.303	0.322
Firm FE	Yes	Yes	Yes	Yes
Country x Sector x Year FE	Yes	Yes	Yes	Yes
Firm-level clustering of SE	Yes	Yes	Yes	Yes

Note: The table reports estimates of Model 1 where the dependent variable is the value of firm-specific investment at time *t* divided by the value of firm-specific tangible capital at time *t-1*. All explanatory variables are 1-period lagged with the exception of the PE dummy. Standard errors are reported in parentheses, where * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 8 - Robust measures of weak bank – Dependent Variable: Investment/Capital

	TCR<10% dummy (1)	TCR<median(country,year) (2)	TCR<median(year) (3)
Total Debt/Assets	-0.181***	-0.181***	-0.181***
	(0.013)	(0.013)	(0.013)
Total Debt/Assets x PE dummy	-0.014	-0.014	-0.014
	(0.012)	(0.012)	(0.012)
TCR<10% dummy	-0.014*	-0.003	-0.011
	(0.008)	(0.006)	(0.007)
TCR<10% x PE dummy	0.008	-0.003	-0.001
	(0.010)	(0.007)	(0.008)
Cash Flow/Assets	0.277***	0.277***	0.277***
	(0.018)	(0.018)	(0.018)
Sales/Assets	0.043***	0.043***	0.043***
	(0.004)	(0.004)	(0.004)
Log(Assets)	-0.663***	-0.663***	-0.663***
	(0.010)	(0.010)	(0.010)
Observations	1,585,284	1,585,284	1,585,284
R^2	0.323	0.323	0.323
Firm FE	Yes	Yes	Yes
Country x Sector x Year FE	Yes	Yes	Yes
Firm-level clustering of SE	Yes	Yes	Yes

Note: The table reports estimates of Model 1 where the dependent variable is the value of firm-specific investment at time *t* divided by the value of firm-specific tangible capital at time *t-1*. All explanatory variables are 1-period lagged with the exception of the PE dummy. Standard errors are reported in parentheses, where * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 9 - Sample robustness test – Dependent variable: Investment / Capital

	Main bank	Main GUO	Average GUOs	One-bank relationship
	(1)	(2)	(3)	(4)
Total Debt/Assets	-0.201***	-0.211***	-0.205***	-0.224***
	(0.015)	(0.015)	(0.015)	(0.019)
Total Debt/Assets x PE dummy	-0.010	-0.010	-0.012	-0.005
	(0.013)	(0.013)	(0.013)	(0.017)
Total Capital Ratio	0.001	0.002	0.004*	0.004*
	(0.001)	(0.002)	(0.002)	(0.002)
Total Capital Ratio x PE dummy	-0.002	-0.001	-0.002	-0.002
	(0.001)	(0.002)	(0.002)	(0.002)
Cash Flow/Assets	0.279***	0.283***	0.288***	0.285***
	(0.020)	(0.020)	(0.020)	(0.025)
Sales/Assets	0.037***	0.043***	0.045***	0.028***
	(0.005)	(0.005)	(0.005)	(0.006)
Log(Assets)	-0.684***	-0.678***	-0.669***	-0.720***
	(0.011)	(0.012)	(0.011)	(0.015)
Observations	1,281,705	1,234,928	1,285,107	757,048
R^2	0.329	0.306	0.304	0.313
Adjusted R^2	0.062	0.067	0.069	0.047
Firm FE	Yes	Yes	Yes	Yes
Country x Sector x Year FE	Yes	Yes	Yes	Yes
Firm-level clustering of SE	Yes	Yes	Yes	Yes

Note: The table reports estimates of Model 1 where the dependent variable is the value of firm-specific investment at time *t* divided by the value of firm-specific tangible capital at time *t-1*. All explanatory variables are 1-period lagged with the exception of the PE dummy. Standard errors are reported in parentheses, where * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 10 – Zombie lending

	Investment/Capital	
	(1)	(2)
Total Debt/Assets x Total Capital Ratio x PE dummy	0.004*	0.004
	(0.002)	(0.002)
Total Debt/Assets x Total Capital Ratio	-0.010***	-0.010***
	(0.002)	(0.002)
Total Debt/Assets x PE dummy	-0.065**	-0.065*
	(0.030)	(0.036)
Total Capital Ratio x PE dummy	-0.004**	-0.004**
	(0.002)	(0.002)
Total Debt/Assets	-0.048*	-0.048
	(0.027)	(0.034)
Total Capital Ratio	0.009***	0.009***
	(0.002)	(0.002)
Cash Flow/Assets	0.281***	0.281***
	(0.012)	(0.018)
Sales/Assets	0.043***	0.043***
	(0.002)	(0.004)
Log(Assets)	-0.663***	-0.663***
	(0.005)	(0.010)
Observations	1,585,284	1,585,284
R^2	0.323	0.323
Firm FE	Yes	Yes
Country x Sector x Year FE	Yes	Yes
Firm-level clustering of SE	No	Yes

Note: The table reports estimates of Model 1 where the dependent variable is the value of firm-specific investment at time *t* divided by the value of firm-specific tangible capital at time *t-1*. All explanatory variables are 1-period lagged with the exception of the PE dummy. Standard errors are reported in parentheses, where * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 11 – Controlling for aggregate demand

	(1)	(2)	(3)	(4)	(5)
	Investment/ Capital	Investment/ Capital	Investment/ Capital	Investment/ Capital	Investment/ Capital
Total Debt/Assets	-0.162***	-0.072***	-0.192***	-0.153***	-0.138***
	(0.024)	(0.025)	(0.013)	(0.015)	(0.033)
Total Debt/Assets x PE dummy	-0.017	-0.016	-0.009	-0.008	-0.011
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Total Capital Ratio	0.005**	0.003*	0.002**	0.004***	0.007**
	(0.002)	(0.002)	(0.001)	(0.001)	(0.003)
Total Capital Ratio x PE dummy	-0.002	-0.002	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Total Debt/Assets x Government Bond 10 Yield (10 Years)	0.001				0.014***
	(0.003)				(0.003)
Total Capital Ratio x Government Bond 10 Yield (10 Years)	-0.000				-0.001
	(0.000)				(0.000)
Total Debt/Assets x Unemployment Rate		-0.009***			-0.007***
		(0.002)			(0.002)
Total Capital Ratio x Unemployment Rate		-0.000			0.000
		(0.000)			(0.000)
Total Debt /Assets x GDP Growth			0.007***		0.007***
			(0.001)		(0.001)
Total Capital Ratio x GDP Growth			0.000		-0.000
			(0.000)		(0.000)
Total Debt /Assets x Banking Crisis dummy				-0.054***	-0.043***
				(0.012)	(0.013)
Total Capital Ratio x Banking Crisis dummy				-0.002	-0.003*
				(0.001)	(0.002)
Cash Flow/Assets	0.256***	0.283***	0.282***	0.280***	0.262***

	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Sales/Assets	0.036***	0.042***	0.043***	0.043***	0.036***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Log(Assets)	-0.642***	-0.664***	-0.664***	-0.663***	-0.643***
	(0.011)	(0.010)	(0.010)	(0.010)	(0.011)
Observations	1,515,357	1,585,284	1,585,284	1,585,284	1,515,357
R^2	0.331	0.323	0.323	0.323	0.077
Firm FE	Yes	Yes	Yes	Yes	Yes
Country x Sector x Year FE	Yes	Yes	Yes	Yes	Yes
Firm-level clustering of SE	Yes	Yes	Yes	Yes	Yes

Note: The table reports estimates of Model 1 where the dependent variable is the value of firm-specific investment at time *t* divided by the value of firm-specific tangible capital at time *t-1*. All explanatory variables are 1-period lagged with the exception of the PE dummy. Standard errors are reported in parentheses, where * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Appendix

Table 1 – ICB classification – NACE Rev. 2 conversion

Datastream mnemonic (level 2 and above)	ICB classification code and description	NACE rev.2, 2 digits
aersp	2710 Aerospace & Defense	30
		84
autmb	3350 Automobiles & Parts	22
		27
		28
		29
		30
		33
banks	8350 Banks	*64*
beves	3530 Beverages	10
		11
chmcl	1350 Chemicals	19
		20
		26
cnstm	2350 Construction & Materials	23
		41
		42
		43
elect	7530 Electricity	*35*
eltnc	2730 Electronic & Electrical Equipment	26
		27
		29

Datastream mnemonic (level 2 and above)	ICB classification	NACE rev.2, 2 digits
media	5550 Media	*16*
		18
		58
		59
		60
		63
		85
		90
		91
		92
		93
mning	1770 Mining	*51*
		52
		71
		72
		81
		89
		99
		19
nlins	8530 Nonlife Insurance	*65*
oiles	0570 Oil Equipment, Services & Distribution	*91*
oilgp	0530 Oil & Gas Producers	*61*

		33
eqinv	8980 Equity Investment Instruments	*64*
fdrgr	5330 Food & Drug Retailers	47
fnsvs	8770 Financial Services	*64*
		66
foods	3570 Food Producers	*31*
		32
		10
fstpa	1730 Forestry & Paper	*12*
		21
		22
		23
		24
		16
		17
gnind	2720 General Industrials	23
		69
gnret	5370 General Retailers	47
		85
		93
		95
		96
gwmut	7570 Gas, Water & Multi-utilities	*35*
		36
		38
hceqs	4530 Health Care Equipment & Services	26
		32
		75
		62
persg	3760 Personal Goods	13
		14
		15
		16
		17
		32
		95
pharm	4570 Pharmaceuticals & Biotechnology	21
		38
		72
reits	8670 Real Estate Investment Trusts	42
		68
reits	8670 Real Estate Investment Trusts	*81*
rlisv	8630 Real Estate Investment & Services	41
sftcs	9530 Software & Computer Services	33
		58
		62
		63
		95
supsv	2790 Support Services	46
		63
		69
		70
		71
		73
		74
		77

		86
		87
		88
hhold	3720 Household Goods & Home Construction	31
		32
		95
inden	2750 Industrial Engineering	25
		27
		28
		30
		31
		33
indmt	1750 Industrial Metals & Mining	24
		25
indtr	2770 Industrial Transportation	49
		52
		53
leisg	3740 Leisure Goods	32
lfins	8570 Life Insurance	*65*
		78
		80
		81
		82
		85
techd	9570 Technology Hardware & Equipment	26
		28
		95
telfl	6530 Fixed Line Telecommunications	60
		61
telmb	6570 Mobile Telecommunications	61
tobac	3780 Tobacco	12
trles	5750 Travel & Leisure	50
		51
		55
		56
		79
		85

Source: Thomson Reuters Datastream, P/E Equity Indices by Market, level 2 and above following ICB sector classification (The ICB Classification can be found at this link: http://www.icbenchmark.com/Site/ICB_Structure).

Table 2 – Growth opportunities

ICB Sector code	Growth opportunities in 2004	Growth opportunities in 2013	Switch from 2004 to 2013
aersp	Low	Low	
autmb	Low	Low	
beves	Low	High	x
chmcl	Low	Low	
cnstm	Low	High	x
eltnc	High	Low	x
fdrgr	Low	Low	
foods	Low	High	x
fstpa	High	High	
gnind	High	Low	x
gnret	Low	High	x
hceqs	High	High	
hhold	Low	Low	
inden	Low	Low	
indmt	Low	Low	
indtr	Low	High	x
leisg	Low	High	x
media	High	Low	x
mning	High	Low	x
persg	High	High	
pharm	High	High	
reits	High	High	
rlisv	Low	Low	
sftcs	High	High	
supsv	High	Low	x
techd	High	Low	x
telfl	Low	Low	
telmb	Low	Low	
tobac	Low	Low	
trles	High	High	

Note: Growth opportunities are high if the global Price-to-Earning (PE) ratio in each sector in each year is higher than the median of the P/E across all sectors in each year. Global PE ratios are World PE ratios from Datastream. PE ratios are computed as the average of end of the month observations over each year.