Do banks appraise internal capital markets during credit shocks? Evidence from the Greek crisis

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Abstract

Using data of bank loans to Greek firms during the Greek crisis, we provide evidence that affiliated firms, having access to the internal capital markets of their associated group, are less likely to default on their bank loan during a credit shock. Furthermore, banks appraise the firm's access to internal capital markets positively. In particular, banks are less likely to downgrade the credit profile and demand lower loan collateral coverage from affiliated firms. Such favorable terms are conditional on the bank's overall relationship with the group. Finally, banks are more likely to show forbearance against affiliated firms with non-performing loans.

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1 Introduction

In economies with inefficient markets, business groups function as an intermediary organizational form, capable of sharing internal resources while containing contagion risk through limited liability. Thus, affiliated firms have access to both the internal capital market provided by the group's network of firms and external capital markets. For example, affiliated firms of multinational companies use more internal debt financing in countries where external financing is restricted or expensive (Desai et al. 2004; Claessens et al. 2006). The group's internal capital market enables affiliated firms to share risks by smoothing out income flows (Khanna and Yafeh 2005) and reducing the risk of insolvency (Gopalan et al. 2007).

In this paper, we study how economic agents that are external to the firm perceive this hybrid organizational form between firm and market (Khanna and Yafeh 2005). In particular, we use a proprietary data set of bank loans to Greek firms for the period 2008-2015 to examine empirically the impact of firm's access to internal capital markets on the firm's relationship with its bank, when external financing suffers a severe contraction. The deep and protracted recession of the Greek economy, following the outbreak of the sovereign debt crisis in 2010, culminated in a severe banking crisis. Greek banks lost access to the interbank market, suffered significant deposit outflows and recorded large losses from their exposure to sovereign debt, following the public debt restructuring of 2012. With banks unable to provide new credit, both households and companies faced severe restrictions on external financing. In particular, the credit contraction experienced during the Greek crisis by domestic firms is unprecedented for a developed banking system: outstanding bank credit to nonfinancial companies has declined by 35% whereas the outstanding stock of short-term loans with maturities up to one year fell by as much as 39% from the peak of the observation period. It is reasonable to expect that the economic value of internal capital markets

is greater when external finance dries up. The crisis has also provided additional incentives to banks to monitor their borrowers closely and prioritize their business by focusing on the profitable borrowers. Thus, the Greek crisis offers a unique opportunity to examine whether banks appraise the risk sharing property of affiliated firms during a period of severe restrictions on external financing. In addition, since the credit shock is exogenous to the private sector, as it was triggered by the losses incurred by Greek banks from their public debt holdings, this setting allows us to examine the role of firm affiliation using an econometric approach that aims at addressing endogeneity concerns.

We start by showing that firms affiliated to groups are less likely to default on their loans, compared to unaffiliated firms during the period of the credit shock. In particular, access to internal capital markets reduces, on average, the probability of default by 3.17 percentage points. That is approximately a 30% decline of the underlying default risk. The results confirm earlier studies that provide similar evidence of the risk-sharing effect (Gopalan et al. 2007; Santioni et al. 2017).

Next, we show that banks appraise positively the availability of internal capital markets by offering improved financing terms to affiliated firms. In particular, we find that banks are less likely to downgrade the credit profile of affiliated firms, due to the credit shock, compared to unaffiliated firms. Specifically, the probability of a credit downgrade of affiliated firms is, on average, 2.57 percentage points lower. Because loan interest rates offered to firms are correlated with the firm's credit score, the enhanced credit evaluation of affiliated firms is likely to translate to more competitive loan rates. Moreover, we find that banks require a lower collateral coverage of loans to affiliated firms during a credit shock. Specifically, collateral coverage of a loan to an affiliated firm is, on average, 8.12 percentage points lower compared to an unaffiliated firm.

There are two broad, non-mutually exclusive, motives for banks' preferential handling of affiliated firms. First, banks may take into account the safety net provided to affiliated firms by the group which reduces default risk as shown earlier. Alternatively, banks may offer enhanced terms to affiliated firms during periods of financial distress, aiming to preserve or even strengthen their relationship with the entire group. Our findings in additional analysis provide empirical support on the second interpretation. In particular, we show that improved terms offered to affiliated firms are conditional on the strength of the overall relationship between the bank and the group. Equivalently, banks offer similar terms to unaffiliated firms and to firms affiliated to groups with weak relationship with the bank despite the risk-sharing property that the latter firms enjoy.

Lastly, we find empirical evidence that banks are more likely to shun legal action against defaulted affiliated firms compared to defaulted unaffiliated firms. In particular, defaulted affiliated firms have, on average, 12.1 percentage points lower probability of facing legal action compared to defaulted unaffiliated firms. As before, forbearance toward affiliated firms is conditional on the strength of the relationship between the bank and the group. These findings provide further support on the banks' motives. In particular, banks may refrain from terminating a loan contract because they would like to avoid any negative spill overs into their relationship with the group. However, it is equally likely that banks seek to delay additional loan charge-offs and loss provisions for the entire group exposure which would reduce their earnings and capital ratios.

We run a number of robustness tests to ensure that the above findings are attributed to the existence of the internal finance market rather than a permanent quality differentiation between affiliated and unaffiliated firms. These tests include employing the heterogeneity in groups' integration level as a proxy for access to internal capital markets. In particular, we show that our empirical findings hold only for firms affiliated to high integrated groups (i.e. groups where parent

control of affiliates through ownership is tight), while firms affiliated to low integrated groups (i.e. groups where parent control of affiliates through ownership is loose) do not differ from unaffiliated firms. Furthermore, we estimate the models on a matched sample and we apply a placebo test with an economic crisis with no credit shock. In all cases, we have strong evidence to reject the alternative explanation that our findings are due to some unobserved intrinsic quality differentiation between affiliated and unaffiliated firms.

Our paper contributes to the business group literature and to the literature on relationship lending. While the existing business group literature has provided evidence on the value of internal capital markets (Khanna and Yafeh 2005, 2007; Gopalan et al. 2007; Santioni et al. 2017), to the best of our knowledge, there is no evidence yet on how banks appraise internal capital markets, especially during periods of severe contractions of external financing. Thus, our paper's main contribution to the business group literature is to show that banks are favourable to alternative organizational forms that reduce market frictions. Furthermore, the relationship between the group's level of integration (i.e. the level of parent control over affiliates through ownership) and the risk sharing property has not been studied before. Thus, we further contribute to business group literature by presenting evidence of the importance of the group's integration level on the affiliate's default risk. Finally, with one exception (Santioni et al. 2017), the empirical evidence in the business group literature focuses on the investment related to intragroup capital allocations (Almeida et al. 2015) or examines the internal capital markets assuming external markets are available (Gopalan et al. 2007). Hence, our study also contributes to the literature by exploring the operation of internal capital markets as a means of intragroup risk management conditional on an exogenous, to the private sector, shock to external financing.

Moreover, our findings on the role of group-bank relationship contribute to the literature on relationship lending. In particular, there has been little evidence so far on the impact of group-bank relationship on the affiliates-bank relationship. Our study provides empirical evidence of the informational advantage of relationship banking (Berger and Udell 1995; Bolton et al. 2016) and extends it to networks of affiliated firms. Equivalently, our findings replace the traditional firm-bank relationship to group of firms-bank relationship and show that networks of affiliated firms are likely to share the same benefits of relationship lending.

The remainder of the paper is structured as follows: In section 2, we provide a brief literature review and highlight further the contribution of the present study. In section 3, we develop the theoretical framework and the research hypotheses. Section 4 provides a brief description of the Greek economic crisis and the institutional background. Section 5 describes the data and the methodology used in the empirical analysis. The empirical results are presented in section 6. We conclude with a discussion of our findings and their implications for banks, firms and supervisory authorities in section 7.

2 Literature review

The academic literature has attempted to shed light on the economic impact of the organisational form of a group of firms, with the majority of studies utilising data mainly from emerging markets.[6] Among the different strands in the literature that are more related to the current study, we focus on the risk sharing property of group affiliation.

Chang and Hong (2000) show that business groups in Korea use internal business transactions such as debt guarantees, equity investments, and internal trades for cross-subsidization

[6] For a review of the literature see Locorotondo et al., 2012 and Khanna and Yafeh, 2007.

purposes. Khanna and Yafeh (2005), using data from 12 countries, find substantial evidence of co-insurance by Japanese, Korean, and Thai groups only and little evidence of it elsewhere. Using Indian business groups, Gopalan et al. (2007) find that intragroup loans are used to support member firms that are in financial difficulties in order to avoid the negative spill over into the rest of the group. Furthermore, affiliated firms enjoy higher debt capacity (Ferris et al. 2003) and reduced cost of debt (Byun et al. 2013). In particular, Byun et al. (2013) find that the economic value of group affiliation is greater when affiliated firms have poor credit quality, opaque financial statements, and when the economy is in a downturn. More recently, Almeida et al. (2015) conclude that Korean chaebols used the internal capital markets to mitigate the negative effects of the Asian financial crisis in 1997 on corporate investment.

The support of group affiliated firms has a profound effect on riskiness and bankruptcy costs. Gopalan et al. (2007) find a significantly higher probability of failure for stand-alone firms compared to affiliated firms with no prior bankruptcy, the difference arising primarily because of intragroup loan inflows. Beaver et al. (2016) show that, compared to stand-alone entities, group subsidiaries are less sensitive to sudden increases in default risk. Santioni et al. (2017), using Italian data during the 2004-2014 period, show that affiliation with business groups helped firms survive the Euro crisis. In particular, they show that firms in large business groups are approximately 11 percentage points more likely to survive the economic downturn, compared with unaffiliated firms. Firms in small groups are also more likely to survive, although the difference is smaller. Finally, they show that the value of group affiliation becomes stronger during the crisis years and that firms turn to internal capital market when the banking system becomes distressed.

Consistent to Santioni et al. (2017), Kuppuswamy and Villalonga (2015) examine two channels through which financial crises increase the intrinsic value of corporate diversification:

(1) better access to credit markets than stand-alone firms, as a result of the debt co-insurance provided by conglomerates; and (2) access to, and more efficient use of, internal capital markets. Finally, Matvos and Seru (2014) suggest that diversified conglomerates are more likely to share resources across the internal capital market when external finance is costly. In particular, they show that improved resource allocation in internal capital markets has offset financial market stress during the recent financial crisis by between 16% and 30% relative to firms with no access to internal capital markets.

Despite the extensive research on the impact of internal capital markets, there are research questions that remain unexplored. For example, current evidence about the behaviour of external capital providers toward affiliated firms is limited to the Japanese structures of keiretsu, where the member banks evergreen loans to the weakest firms, especially when their reported capital ratio approaches their required capital ratio (Peek and Rosengreen 2005). However, this study provides evidence only for firms affiliated directly to the banks where the incentives to treat affiliated borrowers favourably are too obvious. Moreover, the extant literature has offered no evidence of the role of the group's integration level on the risk sharing property. Finally, the majority of research is concentrated in East-Asian and emerging market economies, which leaves a gap on the role of group affiliation in developed European economies.

Our study aims to provide empirical answers to these unexplored research questions. First, we provide empirical support of the co-insurance effect on affiliated firms when external financing is severely restricted. Second, we study whether banks explicitly acknowledge this co-insurance effect and how they manage their relationship with the affiliated firms. Third, we examine bank's decision to voluntarily disclose the private information about the firm's delinquency status and to take legal actions. Fourth, we explore whether the banks' motives relate to the economic value of

co-insurance effect or if the banks' business with the group is behind their preference to affiliated firms. Finally, we examine whether access to internal capital markets is related to the integration level of the group. In the next section, we present the theoretical framework and develop the research hypotheses in detail.

3 Hypotheses development

The first hypothesis is related to the theoretical model of internal capital markets channelling limited resources to different uses (Stein 1997). In particular, throughout a financial crisis, external markets become too costly because of heightened information asymmetries between borrowers and lenders. Internal capital markets, on the other hand, are facilitated by the exchange of private information between the affiliated firms through the formal channels of cross-shareholdings and inter-firm transactions and the informal ones of social relations and personal friendship (Granovetter, 1994; Khanna and Rivkin, 2001).

These channels reduce information asymmetries, making internal debt contracts more accessible (Hoshi et al. 1990). Groups that have private information regarding their subsidiaries' investment opportunities are likely to fund subsidiaries when external lenders are unable to do so. Furthermore, groups support financially their subsidiaries as a result of explicit or implicit agreements, such as guarantees and comfort letters, or because they face significant direct and indirect costs in the event of subsidiary bankruptcy. In addition, groups provide financial support to affiliated firms if they are concerned about revealing negative information about the group, especially to lenders, a development that may impede the access of the other firms of the group to external capital, further damaging the group's investment prospects and its solvency as a whole. Therefore, our first hypothesis *(H1)* is that *during a credit shock, groups have strong incentives to*

support distressed subsidiaries to avoid default contagion; hence we expect affiliated firms to have a lower default risk compared to their unaffiliated peers.

The next three hypotheses focus on banks' reaction towards affiliated firms and derive from theoretical financial intermediation models that view the economies of scale in information production as the key source of the benefits for lenders (Greenbaum and Thakor, 1995). In particular, if information is proprietary and reusable, theory suggests that relationships would be associated with a lower cost of information production for subsequent lending and service provision decisions. Hence, the relationship lender gets the opportunity to capture the future lending business of its borrower (Bharath et al, 2007). In addition, the hypotheses are related to the theoretical model of the informational advantage of relationship banking during a crisis (Bolton et al, 2016).

The risk sharing property of affiliated firms is an important piece of information to the banks. In particular, banks base their evaluations not only on hard, verifiable information but also on soft private information gathered through their relationship with the borrower (Petersen and Rajan 1994). Hence, banks are likely to consider positively the implicit group support and give an enhanced credit evaluation to affiliated firms. Furthermore, banks extract private information about the prospects of affiliated firms from their relationship with other firms of the group. The stronger the relationship with the group, the greater the credit availability to the firm (Berger and Udell 1995). Moreover, the bank's informational advantage through its relationship with the group may generate a higher probability of selling information-sensitive products to other affiliates (Bharath et al, 2007). As such, banks have strong incentives to appraise positively the affiliated firms and their appraisal will be proportional to the strength of the bank's relationship with the group. Hence, our second hypothesis *(H2)* is that *during a credit shock, lenders are less likely to*

downgrade to a lower credit score (higher risk) affiliated firms compared to their unaffiliated peers and their decision is conditional on the strength of the bank's relationship with the group.

Another way for banks to solve information asymmetries is by setting loan contract terms, such as the interest rate charged or the collateral requirements to improve borrower incentives (Berger & Udell 1995). If banks know that group membership transpire financial support and they are able to resolve information asymmetries by collecting soft information from the network of affiliated firms, then they will display higher flexibility in setting the loan terms of an affiliated firm and in particular on the collateral coverage. In the hypothesis (*H2*) above, the enhanced credit evaluation is likely to yield a lower loan rate. Equivalently, we expect that group membership will be a substitute for loan collateral. As previously, the bank will capitalize the firm's access to the internal market proportionally to the strength of the bank's relationship with the group. Hence, our third hypothesis *(H3)* is that *during a credit shock, lenders will require a lower loan collateral coverage from affiliated firms compared to their unaffiliated peers and their decision is conditional on the strength of the bank's relationship with the group.*

The "single risk" approach of the regulatory provisions is likely to influence the bank's business approach toward the financially distressed affiliated firms, especially during periods of financial turmoil.[7] Banks will seek to delay additional loan charge-offs and loss provisions for the entire group, which would negatively influence their, already impaired, earnings and capital ratios. The larger the bank's exposure to the group, the bigger is the impact and, hence, the stronger the incentive to avoid the occurrence of these costs. It is equally likely that banks may refrain from terminating a loan contract through legal action because they would like to avoid any negative spill

[7] According to the "single risk" approach of financial supervision in the EU, banks are required to consider connected clients as a single risk, see discussion in the following section.

overs into their relationship with the entire group that will undermine future business (Bharath et al 2007). Thus, our fourth hypothesis *(H4)* is that *during a credit shock, lenders are less likely to take any legal action against a defaulted affiliated firm compared to an unaffiliated firm and bank's forbearance toward the affiliated firms is conditional on the strength of their relationship with the group.*

In the following paragraphs, we take the above research hypotheses to the data. But before that, we briefly review the history of the Greek crisis that supports our decision to use it as a credit shock in the empirical analysis. In addition we outline the institutional background that characterizes the operations of business groups in Greece as well as some regulatory requirements for banks' calculation of risk and capital requirements for 'groups of connected clients' in EU Member States.

4 Institutional background and the Greek crisis

Following the global financial crisis of 2008, the Greek economy entered a deep and protracted recession during which real GDP declined by 26% and the unemployment rate peaked at 27% in 2014, up from less than 8% in 2008. The recession turned into a severe banking crisis, due to the occurrence of several factors. First, following the downgrades of the Greek sovereign by rating agencies, Greek banks faced severe liquidity constraints as they were gradually excluded from the interbank market and lost nearly half of their customers' deposits. Second, the sharp decline in GDP and the significant increase in unemployment affected negatively the income of households and businesses and consequently the ability of borrowers to service their debt obligations. As a result, non-performing loans (NPLs) increased from 5% in 2008 to more than

35% in 2015, with corporate NPLs, the focus of this study, increasing from 4.2% in 2008 to 34.3% in 2015.[8]

The surge in NPLs, in conjunction with the losses from the restructuring of Greek public debt in early 2012, has put significant pressure on domestic banks, which were forced to raise additional capital in three consecutive years (2013-2015) and to proceed with a heavy deleveraging of their balance sheets. In anticipation of the losses from the sovereign debt restructuring, banks cut off the credit channel to private sector. Thus, the provision of credit contracted significantly and the annual percentage rate of credit turned negative from October 2011 and remained negative thereafter (see Figure 1). Based on the above and given that the effect of a credit shock on loans' performance appears after 90 days, we define the years 2012-2015 as the period of the credit shock while the years 2008-2011 represent the pre-credit shock period.

Regarding the institutional environment, Greek law provides for a variety of legal forms for carrying out business. Despite the prominent economic role of business groups in Greece, there is no particular law that regulates their operation since individual firms that may be part of a group maintain their independence. The law provisions relevant to business groups are related to the preparation of consolidated financial accounts. There is no dominant type of a business group formation (e.g. pyramid or cross-holding forms) and the vast majority of business groups do not have any affiliation to banks, making them distinct from the Japanese Keiretsu. Furthermore, there is sufficient variability among Greek business groups with respect to the level of corporate control (integration) of their affiliates, measured by the percentage of ownership, albeit the majority of groups display high levels of integration. Finally, the Greek economy shares all the institutional

[8] From 2014 onwards, Bank of Greece monitors non-performing exposures of banks, i.e. loans 90 days past-due plus loans that are deemed unlikely to be repaid. Under this more strict definition, the percentage of non-performing exposures over total exposures increased to 44% at the end of 2015.

inefficiencies that the literature has identified as key conditions for group affiliation to be an effective organizational form, i.e. a legal framework that offers weak protection to investors, small and developing capital markets and an inadequate credit information sharing framework.

Regarding bank regulation in the European Union, it is important to highlight that supervisory authorities advocate the concept of the 'single risk' in risk measurement and in the calculation of the bank's capital requirements. The single risk approach implies that, despite the limited liability property, banks are required to treat two or more business clients as a "group of connected clients" (i.e. a single risk) when there is a significant control relationship or economic interconnection between them.[9] According to the recent European Banking Authority (EBA) Guidelines (2018) on connected clients, financial institutions should make use of their clients' consolidated financial statements in order to assess connections based on control. The EBA Guidelines develop a non-exhaustive list of indicators to determine whether two or more clients constitute a group of connected clients such as ownership of more than 50% of the shares of another entity, power to decide on the strategy or direct the activities of another entity, power to decide on crucial transactions or ability to coordinate the management.

5 Data and sample

We perform the empirical analysis using a unique proprietary database of business loans, based on data submitted by commercial banks to the Bank of Greece. The loan database contains

[9] "Group of connected clients" means any of the following: (a) two or more natural or legal persons who, unless it is shown otherwise, constitute a single risk because one of them, directly or indirectly, has control over the other or others; (b) two or more natural or legal persons between whom there is no relationship of control as described in point (a) but who are to be regarded as constituting a single risk because they are so interconnected that, if one of them were to experience financial problems, in particular funding or repayment difficulties, the other or all of the others would also be likely to encounter funding or repayment difficulties (Committee of European Banking Supervisors, 2009).

annual data over the period 2008 to 2015 on outstanding corporate loans exceeding 1 million euro for companies domiciled in Greece.[10] For the purposes of the analysis, we exclude off-balance sheet items, such as letters of guarantee and loan exposures that are reported by non-banking financial institutions (e.g. leasing, factoring) or subsidiaries. Furthermore, a firm with loans from multiple banks will have more than one observation per year in our sample.

The information in the database includes the loan amount and if any, the amount that is 90 days past due. Following the regulatory guidelines, a bank defines a loan as non-performing if its payment is delinquent for more than 90 days. To mitigate the possibility of incorrect submission or potential overestimation of delinquent payments, if the non-performing exposure of the bank to a company is relatively small in comparison to the total exposure of the borrower (i.e. less than 3%), we do not denote the exposure as non-performing. Furthermore, once a loan is reported as non-performing in a particular year, the bank continues reporting it as non-performing in all following years unless the loan recovers. In line with the discrete-time hazard model framework applied below, we define a firm loan at year *t* as *defaulted* if the loan is non-performing at year *t* and was performing until year *t-1*. After defaulting at year *t,* the loan is no longer considered in the analysis of the following years.

The database includes the value of associated collateral pledged to the loan, primarily tangible assets (e.g. real estate), although financial collateral is also included. We define firm *i*'s *loan collateral coverage* as the ratio of the value of the associated collateral to the firm's loan exposure to the bank. Furthermore, the dataset includes the credit score assigned by the bank to the borrower with the lower score of 1 representing the lowest credit risk and the highest score of

[10] Banks report total exposures per business customer provided that they exceed 1 million euro. According to the Bank of Greece's Governor Acts, if one of the connected borrowers has an exposure that exceeds 1 million euro, banks report the exposures of all the connected borrowers, irrespective of the size of individual exposures.

7 representing the highest credit risk. Based on this credit score scale, we define that firm's *credit score is downgraded* at year *t* if the firm's credit score has deteriorated (higher credit risk) at year *t* compared to firm's credit score in the previous year *t-1*.

Furthermore, we calculate the *firm's dependence on the bank* measured as the ratio of the firm's loans contracted with the specific bank to the total loans of the firm. If a firm has loans from only one bank, then the ratio equals to one, indicating strong dependence on the bank. Finally, we calculate the *bank's relationship with the group*, measured as the ratio of the bank's loans to the group over the bank's total loans scaled by 100.

The loan database is supplemented with financial and business information retrieved from ICAP, a Greek business information provider. The ICAP database includes accounts and ratios from the published annual financial statements of the companies. It also includes information about the group membership, identified by the reported consolidated financial statements which combine the financial statements of the parent company and its affiliates.

After merging the two databases, our loan sample comprises 46,191 firm-bank-year observations that correspond to 5,322 unique firms contracted with 35 different banks. Loans to group affiliated firms account for 17,465 observations that correspond to 1,135 unique firms and 30 different banks, while loans to unaffiliated firms account for 28,726 observations that correspond to 4,187 unique firms and 34 different banks. In terms of coverage, our sample accounts for approximately 60% of total outstanding corporate loans in Greece.

Table 1 contains the summary statistics of the loan sample and specifically the firm-bank level and group-bank level variables for affiliated and unaffiliated firms separately for the pre-credit shock period (i.e. 2008-2011) and during the credit shock period (i.e. 2012-2015). First, we

observe that affiliated firms have, on average, larger loan amounts compared to unaffiliated firms. Second, the increase in the average loan amounts after the credit shock is an artifact attributed to the mergers and acquisitions that took place in 2012-2013 that reduced the number of banks. Thus, although firms' total loan exposures have dropped significantly due to the credit contraction (the numerator of the ratio), the simultaneous decrease in the number of banks (the denominator of the ratio) yields a higher average loan exposure per bank.

The default rate during the pre-shock period is 2.78% for affiliated firms and 3.05% for unaffiliated and the t-test between the two default rates ($t = 1.25$) is statistically insignificant. The default rate during the credit shock is 6.86% for affiliated firms and 9.19% for unaffiliated and the t-test between the two default rates ($t = 5.26$) is statistically significant.

The credit score downgrade rate during the pre-shock period is 54.7% for affiliated and 58.7% for unaffiliated firms and the t-test of their difference ($t = 6.56$) is statistically significant. The downgrade rate during the credit shock period is 36.1% for affiliated and 39.9% for unaffiliated firms and the t-test between the two downgrade rates ($t = 5.20$) is statistically significant. The findings suggest that the banks have been pro-active in downgrading borrowers' credit score at the outset of the crisis in anticipation of the credit contraction.

Finally, the average loan collateral coverage required by banks at the pre-shock period is 21.6% for affiliated and 38.6% for unaffiliated firms and the t-test between the two values ($t = 24.8$) is statistically significant. The average loan collateral coverage set by banks during the credit shock is 27.3% for affiliated and 45.6% for unaffiliated firms and the t-test between the two values ($t = 26.76$) is also statistically significant.

Moreover, we retrieve legal actions data (e.g. issued orders of payments, liquidation auction announcements and filings for bankruptcy, among others) from the Default Financial Obligation System of Tiresias SA, the official provider of credit profile data in Greece. However, legal actions data is available only for 40% of the firms with non-performing loans. Given that the defaulted firms also constitute a smaller proportion of the sample, the number of observations with legal data is low (i.e. 1,835 observations). If there is some legal event in the system related to the firm's loan, then the variable *legal action* takes the value of one, while if there is no event in the system the variable is set to zero. Table 1 contains the legal action rates. The probability that a bank takes legal action against a defaulted firm before the credit shock is 45.6% for affiliated firms and 42.6% for unaffiliated firms and the t-test between the two probabilities (t = -0.64) is not statistically significant. During the credit shock, the probability is 69% for affiliated firms and 71.14% for unaffiliated firms and the t-test between the two probabilities (t = -0.77) is not statistically significant.

[Insert Table 1 About Here]

In addition to the loan and legal actions data, we employ accounting data to capture firms' financial conditions. Specifically, to detect signs of financial distress that would imply an imminent likelihood of default, we use a z-score measure that converts key financial ratios into a single score. In particular, we employ Altman's z-score modified for non-listed, non-US companies (Altman 2000) that evaluates the firm's working capital (WC), retained earnings (RE), earnings before interest and taxes (EBIT), expressed as a percentage of the firm's total assets (TA), and the book value of equity (BE) over total liabilities (TL):

$$z = 3.25 + 6.56 \times \frac{WC}{TA} + 3.26 \times \frac{RE}{TA} + 6.72 \times \frac{EBIT}{TA} + 1.05 \times \frac{BVE}{TL}.$$

Furthermore, we measure *firm's size* using the logarithm of its reported total assets and *firm's age*, measured as the number of years since establishment. Note that, along with the firm's financials, we have access to group-level financial performance data through the consolidated financial statements and, in particular, the group's consolidated total assets. Table 2 contains the annual summary statistics of the firm data separated for unaffiliated and affiliated firms for the entire observational period. Affiliated firms are, on average, larger compared to unaffiliated firms (average total assets €151m vs €23m). In addition, affiliated firms have, on average, a lower z-score (i.e. are more risky firms) compared to their unaffiliated peers (3.22 vs 3.90).

[Insert Table 2 About Here]

The firms in our sample come from different sectors excluding financial services. We classify firms into industries at a level equivalent to the four-digit standard industrial classification (SIC). Then we apply the Bank of Greece broader classification groups which in our sample entails 13 sectors. Table 3 presents the distribution of the firms in these sectors separately for affiliated and unaffiliated firms and in total. We observe slight differences in the distribution between affiliated and unaffiliated firms. Manufacturing and commerce are the biggest sectors followed by hotels, construction and real estate.

[Insert Table 3 About Here]

6 Empirical Analysis

6.1 Group affiliation and non-performing loans

In this section, we provide empirical evidence on the first hypothesis that affiliated firms with access to internal capital markets are less likely to default on their loan during a credit shock compared to unaffiliated firms.

We test the hypothesis empirically by estimating a discrete-time proportional hazard model with time varying covariates. Because time is measured in discrete intervals (years), the hazard rate at year *t* is expressed conditional on the survival in previous years, i.e. in order to survive to year *t* the firm must first survive year *t-1*, and so on. In discrete time models, this hazard rate is equivalent to the annual default probability which is calculated using the logistic function (Santioni at al. 2017). Furthermore, by introducing time-varying covariates, we allow the firm's default probability to change over time and we estimate the covariates' coefficients using the logistic regression model. In particular, given a set of loan covariates X_{ijt} and firm covariates Z_{it}, the conditional probability, $pd_{ijt}=P(Def_{ijt}=1 \mid X_{ijt}, Z_{it})$, that firm *i* defaults on loan from bank *j* at year *t* is estimated by the logistic regression model*:*

$$ln\left(\frac{pd_{ijt}}{1-pd_{ijt}}\right) = \beta_0 + \beta_1 Group_i + \beta_2 Shock + \beta_3 Group_i \times Shock$$

$$+\gamma X_{ijt} + \gamma' Z_{it} + T_t + I_{it} + B_j + u_{ij} + \varepsilon_{ijt}$$

where $Group_i$ is the indicator that takes the value of one if the firm is affiliated to a group and zero if it is unaffiliated; *Shock* takes the value of zero for years 2008-2011, when bank credit flow was positive and the value of one for years 2012-2015, when bank credit was contracting; *T* are year fixed effects; *I* are industry fixed effects; and *B* are bank fixed effects; u_{ij} is the within firm-bank variation (random effects) and ε_{ijt} is the error term that is clustered at the firm-bank level. We employ random rather than fixed effects because group membership is a time invariant firm characteristic and firm fixed effects would have subsumed the group membership effect. We included year-specific, industry-specific and bank-specific fixed effects that capture the unobserved trends in the macro-economic environment, in the industry or in the particular bank. Moreover, we control for the firm's financial conditions using the z-score, the firm's size and age

and the firm's dependence on the bank. Taken together, identification is carried out by comparing loans to affiliated and unaffiliated firms from the same industry, borrowed from the same bank, at the same year after controlling for the heterogeneity between affiliated and unaffiliated firms with respect to financial performance, size, age and dependence on the bank. Furthermore, by looking at the difference between affiliated and unaffiliated firms before and during the credit shock, our analysis removes any potential biases that could be the result of permanent time-invariant performance differences between those two firm types (see Almeida et al. 2015 for a similar treatment using the Asian crisis as an event to exacerbate the impact of internal capital market on firm's investment). Thus, the coefficient of interest is β_3 of the interaction term $Group_i \times Shock$, which measures the effect of group affiliation during the credit shock on the probability of default. The effect of group affiliation, in Table 4 column (1), is statistically significant at the 1% level, which supports our first hypothesis (*H1*) that loans to affiliated firms are less likely to default during a credit-shock compared to loans to unaffiliated firms, ceteris paribus. In particular, the marginal effect calculated at the means indicates that the affiliated firms' default probability after the shock is, on average, 3.17 percentage point lower compared to the default probability of unaffiliated firms. Theoretically, we attribute the affiliated firm's lower default rate to the co-insurance effect i.e. group affiliated firms are likely to tap to internal capital markets in order to avoid insolvency.

Although we included the firm's size measured by the log of total assets as a control variable to the model, we are still concerned if the estimated effect is due to size differences between affiliated and unaffiliated firms. We thus split equally the sample in three subsamples based on the firm's size distribution. The small size subsample includes all (affiliated and unaffiliated) firms with total assets less or equal to €12.4m. The medium size subsample includes all firms with total

assets more than €12.4m and less or equal to €41.5m. Finally, the large size subsample includes all firms with total assets more than €41.5m. Columns (2), (3) and (4) of Table 4 report the estimates for small, medium and large firms, respectively.

The results in Table 4 column (2) support the co-insurance hypothesis among the small size firms since we find evidence that the difference in default risk between affiliated and unaffiliated firms, during the credit shock, is significant at the 1% significance level. In Table 4 column (3), we observe no difference in default risk between medium sized affiliated and unaffiliated firms during the credit shock. The direct effect of group is negative and significant at 5%, indicating that the medium sized affiliated firms had on average a lower default rate than the unaffiliated firms before the credit shock. Finally, in Table 4 column (4), the difference in default risk between affiliated and unaffiliated large sized firms is significant during the credit shock, at the 1% significance level. Overall, firms belonging to a group are less likely to default during a credit shock compared to unaffiliated firms in line with the internal capital support hypothesis although for medium size affiliated firms we observe lower default risk even before the outset of the credit shock.

[Insert Table 4 About Here]

6.2 Banks appraisal of group affiliation

The preceding discussion focused on how firms cope with credit shocks using internal capital resources. Banks that monitor borrowers are likely to be aware of the internal support that affiliated firms enjoy. In this section, we investigate if banks handle favorably affiliated firms and whether business interests related to the group are behind the bank's selective approach.

Initially, we provide empirical evidence on the second hypothesis that banks are less likely to downgrade the credit score of affiliated firms due to a credit shock, compared to unaffiliated

firms and then we show that their decision is conditional on the strength of the bank's relationship with the group. We test the hypothesis empirically by estimating a logistic panel regression model. In particular, given a set of loan covariates X_{ijt} and firm covariates Z_{it}, the conditional probability $pdg_{ijt}=P(Downgrade_{ijt}=1 \mid X_{ijt}, Z_{it})$ that bank j downgrades firm i's credit score at year t is estimated by the logistic regression model:

$$ln\left(\frac{pdg_{ijt}}{1-pdg_{ijt}}\right) = \beta_0 + \beta_1 Group_i + \beta_2 Shock + \beta_3 Group_i \times Shock$$

$$+\gamma X_{ijt} + \gamma' Z_{it} + T_t + I_{it} + B_j + u_{ij} + \varepsilon_{ijt}$$

Given the inclusion of fixed effects, identification is carried out by comparing credit scores between affiliated and unaffiliated firms from the same industry, assigned from the same bank, at the same year after controlling for the heterogeneity between affiliated and unaffiliated firms with respect to financial performance, size, age and dependence on the bank.

The estimated coefficient of the interaction term, $Group_i \times Shock$, which measures the effect of group affiliation on the probability of a credit score downgrade by the bank during the credit shock, in Table 5 column (1) is negative and statistically significant at the 5% level, in support of the second *(H2)* hypothesis. In particular, the marginal effect calculated at the means indicates that the probability that a bank downgrades the credit score of a firm during a credit-shock is, on average, 2.57 percentage points lower for affiliated compared to unaffiliated firms.

Theoretically, we attributed the affiliated firm's lower probability of credit downgrade to the implicit co-insurance effect and/or the ability of banks to extract private information about the future prospects of affiliated firms from their relationship with the other firms of the group. In the case of the latter, banks handle selectively affiliated firms depending on the group-bank

relationship. Equivalently, according to *H2*, the decision to keep the credit score of an affiliated firm unchanged is conditional on the strength of the relationship between the bank and the firm's group. Table 5 columns (2) and (3) report estimates after splitting the sample of affiliated firms between groups with a strong relationship with the bank (i.e. higher than the sample median value) and groups with a weak relationship with the bank (i.e., lower than the sample median value), respectively. When we examine the sample of firms affiliated to a group with a strong relationship with the bank, the effect on the probability of a credit score downgrade in Table 5 column (2) is negative and statistically significant at the 5% level. However, when we examine the sample of firms affiliated to a group with a weak relationship with the bank, then the effect in Table 5 column (3) is statistically insignificant. Taken together, during a credit shock banks are less likely to downgrade the credit score of an affiliated firm compared to an unaffiliated peer, if the bank has material business interests with the group.

[Insert Table 5 About Here]

Next, we examine if lenders require a lower loan collateral from affiliated firms compared to their unaffiliated peers during the credit shock. We test the hypothesis empirically by estimating a generalized linear panel regression model. In particular, given a set of loan covariates X_{ijt} and firm covariates Z_{it}, the firm i's loan collateral coverage, Col_{ijt}, required by bank j at period t is estimated by the generalized linear regression model*:*

$$Col_{ijt} = \beta_0 + \beta_1 Group_i + \beta_2 Shock + \beta_3 Group_i \times Shock$$

$$+\gamma X_{ijt} + \gamma' Z_{it} + T_t + I_{it} + B_j + u_{ij} + \varepsilon_{ijt}$$

Identification is carried out by comparing the loan collateral coverage between affiliated and unaffiliated firms from the same industry, requested by the same bank, at the same year after

controlling for the heterogeneity between affiliated and unaffiliated firms with respect to financial performance, size, age and dependence on the bank.

The estimate of the coefficient of the interaction term $Group_i \times Shock$, which measures the effect of group affiliation on the collateral coverage required by the bank during the credit shock, in Table 6 column (1), is negative and statistically significant at the 5% level in support of the third hypothesis. In particular, the net effect calculated at the means indicates that the collateral coverage of a loan to an affiliated firm is, on average, 8.12 percentage points lower compared to the collateral coverage of a loan to an unaffiliated firm during the credit shock.

Based on the same argument as in the case of hypothesis *H2*, hypothesis *H3* posits that this decision is conditional on the strength of the relationship between the bank and the group. When we examine the sample of firms affiliated to a group with a strong relationship with the bank (i.e. higher than the sample median value), the effect of group membership on collateral coverage in Table 6 column (2) is negative and statistically significant at 1%. Nonetheless, when we examine the sample of firms affiliated to a group with a weak relationship with the bank (i.e. lower than the sample median value) then the effect in Table 6 column (3) is statistically insignificant. Taken together, during a credit shock banks impose on average lower loan collateral coverage requirement due to a credit shock on affiliated firms compared to unaffiliated firms, if they have material business interests with the group.

[Insert Table 6 About Here]

Finally, we examine if lenders show more forbearance toward defaulted firms that are affiliated to a group. Similar to the model framework for the default rate, we employ a discrete-time proportional hazard model with time varying covariates which is analogous to estimating a logistic regression. In particular, given a set of loan covariates X_{ijt} and firm covariates Z_{it}, the

conditional probability $pla_{ijt}=P(LegalAction_{ijt}=1 \mid X_{ijt}, Z_{it})$ that bank *j* seeks legal action against the defaulted firm *i* at year *t* is estimated by the logistic regression model*:*

$$ln\left(\frac{pla_{ijt}}{1-pla_{ijt}}\right)=\beta_0+\beta_1 Group_i+\gamma X_{ijt}+\gamma' Z_{it}+T_t+I_{it}+B_j+\varepsilon_{ijt}$$

As mentioned earlier, legal action observations are limited (see section 5). The low frequency in the pre-credit shock period in particular, does not allow us to examine the effect separately before and during the credit shock. Instead, we examine if there is a difference in the probability of bank's seeking legal action between affiliated and unaffiliated firms in the entire observational period. However, the availability of the legal data raises concerns about selection bias. Thus, in unreported results, we run a two stage Heckman selection model. Initially, we use an exclusion variable and the exogenous controls to estimate the probability of legal action data availability. For an exclusion variable we use the proportion of firms in the same industry at the same year with missing legal data. At stage two, we include the inverse Mills ratio, as an additional covariate to the panel regression model. Because the coefficient of the inverse Mills ratio is not significantly different to zero, we conclude that the legal action data availability does not generate selection bias.

Furthermore, we control for the firm's financial conditions using the z-score, the firm's size, and the firm's total non-performing loan exposure (*Firm npl*) over the total loan exposure. The intuition behind the inclusion of *Firm npl* as covariate is that the bank is less likely to resort to legal action against a firm that is delinquent on only a small percentage of its liabilities. Identification is carried out by comparing the bank forbearance between defaulted affiliated and unaffiliated firms from the same industry, at the same year after controlling for the heterogeneity between affiliated and unaffiliated firms with respect to financial strength, size and the loan amount in arrears.

The effect of *Group* on the probability of legal action in Table 7 column (1) is negative and statistically significant at the 5% level. In particular, the marginal effect calculated at the means indicates that defaulted affiliated firms have, on average, 12.1 percentage points lower probability of facing legal action compared to defaulted unaffiliated firms.

Theoretically, we attribute bank's forbearance to affiliated firms to their concerns about their relationship with the other firms of the group. Equivalently, according to *H4*, the group-bank relationship determines if banks show forbearance to the defaulted affiliated firm. The results in Table 7 column (2) suggest that the effect of *Group* on the probability of the bank taking legal action against the defaulted firm is negative and statistically significant at the 1% level for firms affiliated to a group with a strong relationship with the bank (i.e. higher than the sample median value). In contrast, the results in Table 7 column (3) show that the effect of *Group* on the probability of the bank taking legal action against the defaulted firm is not statistically significant for firms affiliated to a group with weak relationship with the bank (i.e. lower than the sample median value). Consequently, banks are likely to show forbearance towards defaulted affiliated firms, compared to unaffiliated firms, if they have material business interests with the group.

[Insert Table 7 About Here]

6.3 Robustness tests

In this section we provide further evidence about the internal validity of our findings by running additional tests to address identification issues. In particular, the identification we have used in sections 6.1 and 6.2 is subject to two potential sources of criticism. First, there is a possibility of omitted variable bias, i.e. there may be some unobserved time-varying performance-enhancing characteristic (e.g., quality of management is higher among affiliated firms) that distinguishes the affiliated from the unaffiliated firms and explains the banks selective handling of

the former. Second, the reported effect of affiliated firms could be attributed to bias due to differences in the distribution of the observed performance-related covariates, despite their use as control variables, between affiliated and unaffiliated firms (e.g., bank handle affiliated firms selectively because these firms are larger in size and they can confront a credit shock more easily).

Initially, we test for omitted variable bias by exploiting the heterogeneity in the group formation. In particular, we distinguish between highly integrated group of firms (M-form), where corporate headquarters invest directly in ownership of individual group affiliates that are organized as subordinates of the parent company, which usually holds ownership shares and control rights, and network structured groups (N-Form), where the leading firm controls affiliated firms through inter-firm transactions rather than a vertical ownership structure (Yiu, et al 2007). According to Yiu, et al (2007), the management of the highly integrated groups of firms (M-form), is likely to exercise a higher level of control over its affiliated firms compared to the network structure (N-Form). As such, risk sharing through internal capital markets is more likely to be observed among firms affiliated to groups with tighter rather than loose integration. Moreover, because the level of group integration is exogenous to the affiliated firm, it is unlikely that an unobserved performance-enhancing firm characteristic correlates with this variable. Hence, if our hypotheses *H1-H4* hold for the firms affiliated to highly integrated groups but not for those affiliated to the low integrated groups, then we have evidence to reject the claim that our findings are driven by some unobserved firm-specific variable.

We calculate the level of integration using ownership data from the ICAP database. In particular, we define a group as *low integrated* if the group's average ownership of affiliates is less than 85% and, conversely, as *high integrated* if the group's average ownership of affiliates is

higher or equal to 85%.[11] The reference category is again the unaffiliated firms. The estimated coefficient of the interaction term *Low integrated group* × *Shock* in Table 8 column (1) suggests that there is no difference in the default rate between affiliated firms belonging to low integration groups and unaffiliated firms during the credit shock. In contrast, the estimated coefficient of the interaction term *High integrated group* × *Shock,* which measures the difference in the default rate between firms affiliated to high integration groups and unaffiliated firms during the credit shock, is negative and statistically significant. Similarly, results in Table 8 column (2) show that there is no difference in the credit score downgrade rate between firms affiliated to low integration groups and unaffiliated firms during the credit shock. However, firms affiliated to high integration groups have statistically significant lower credit score downgrade rate compared to unaffiliated firms, during the credit shock. Table 8 column (3) shows that there is no difference in the loan collateral coverage between firms affiliated to low integration groups and unaffiliated firms during the credit shock. However, the difference in the loan collateral coverage between firms affiliated to high integration groups and unaffiliated firms, during the credit shock, is negative and statistically significant. Finally, Table 8 column (4) shows that there is a lower probability of legal action against firms affiliated to high integration groups compared to unaffiliated firms while the probability of legal action against firms affiliated to low integration groups is not statistically different to the probability of legal action against unaffiliated firms. Summing up, the findings provide support to our hypothesis that affiliated firms are likely to receive internal support from the group, if the group's control over its affiliates is substantive. Similarly, banks evaluate

[11]About one-third of the groups have lower integration level than the threshold. In unreported results, we have used alternative ownership threshold such as 70% (one-tenth lowest) or 80% (1st quartile) ownership. The findings are similar to the reported.

positively the internal support offered to affiliated firms belonging to groups with a high level of integration.

[Insert Table 8 About Here]

Next, we try to reduce the differences in the distribution of covariates between affiliated and unaffiliated firms by matching. Specifically, every affiliated firm's loan is matched with an unaffiliated firm's loan from the same bank at the same year and the two firms are in the same industry with similar size, financial solvency (z-score), age, dependence on the bank and total loan exposure. In our case, similarity is measured by the Mahalanobis distance, where the weights are derived from the inverse of the covariates' variance–covariance matrix. We then follow Almeida et al. (2015) and employ a difference in difference matching estimator. Specifically, using the matched sample, we calculate the difference in the outcome variables Y_{ijt} at pre-shock and during the credit shock between affiliated and unaffiliated firms, i.e.

$$Diff = E\left(Y_{ijt}\middle|Group_i = 1, Shock = 1\right) - E\left(Y_{ijt}\middle|Group_i = 0, Shock = 1\right) - E\left(Y_{ijt}\middle|Group_i = 1, Shock = 0\right) - E\left(Y_{ijt}\middle|Group_i = 0, Shock = 0\right).$$

Table 9 column (1) presents the results of the matched case-control analysis of loan default risk. In the pre-shock period, the loan default risk for both affiliated and unaffiliated firms is 2.8%, while during the shock, the loan default risk is 6.4% for affiliated and 7.9% for unaffiliated firms. Overall, the difference in default risk at the pre-shock period and during the shock period between affiliated and unaffiliated pairs of firms is 1.5 percentage points and it is statistically significant at the 1% level.

Table 9 column (2) contains the results of the matched case-control analysis of credit score downgrade. In the pre-shock period, the credit downgrade rate is 54.7% for affiliated and 53.7%

for unaffiliated firms. During the credit shock, the credit downgrade rate is 35.6% for affiliated and 37% for unaffiliated firms. Overall, the difference in firm's credit score downgrade rate at the pre-shock period and during the shock period between affiliated and unaffiliated firms is 2.3 percentage points and it is statistically significant at the 5% level.

Finally, in Table 9 column (3) we present the results of the matched case-control analysis of loan collateral coverage. In the pre-shock period, the loan collateral coverage is 19.4% for affiliated and 24% for unaffiliated firms. During the credit shock, the loan collateral coverage is 25.5% for affiliated and 32.5% for unaffiliated firms. Overall, the difference in firm's loan collateral coverage at the pre-shock period and during the shock period between affiliated and unaffiliated firms is 2.3 percentage points and it is statistically significant at the 5% level.

Furthermore, we perform a placebo test by examining the difference in the outcome variables between affiliated and unaffiliated pairs of firms at the outset of the economic crisis when, however, the credit flow, albeit lower, was still positive. In particular, in the placebo test we define the years 2008-2009 as the pre-shock period and the years 2010-2011 as the shock period. Since according to our hypotheses, the importance of internal capital markets emerges when external markets dry up, we should observe weaker differences on the outcome variables between affiliated and unaffiliated firms at a period when the banking system was still functioning and the credit flow was positive.

We begin by presenting the placebo test results of the matched case-control analysis of loan default risk in Table 9 column (4). In the pre-shock period, the default risk is 1.4% for affiliated and 1.8% for unaffiliated firms, while during the placebo shock, the loan default risk is 4.3% for affiliated and 3.8% for unaffiliated firms. Overall, there is no statistical difference in the default risk in the two periods between affiliated and unaffiliated pairs. Moreover, in the pre-shock period,

the credit downgrade rate is 66.8% for affiliated and 67% for unaffiliated firms, while during the placebo shock, the credit downgrade rate is 41.9% for affiliated and 39.7% for unaffiliated firms, see Table 9 column (5). Overall, there is no statistical difference in the downgrade rate in the two periods between affiliated and unaffiliated pairs. Finally, in the pre-shock period, the loan collateral coverage is 17.2% for affiliated and 21.1% for unaffiliated firms, while during the placebo shock, the loan collateral coverage is 21.6% for affiliated and 27% for unaffiliated firms, see Table 9 column (6). Overall, there is no statistical difference in loan collateral coverage at the two periods between affiliated and unaffiliated firms. Taken together, the results of the matched-sample differencing effect as well as the placebo test, reject the "ex-ante quality differentiation" hypothesis and provide support to the hypothesis of co-insurance effect and the bank's positive reaction to firm's access to internal capital markets during periods of credit shocks.

[Insert Table 9 About Here]

7 Concluding remarks

In this paper, we examine the performance of affiliated firms and whether banks handle selectively firms with access to internal capital markets during periods of severe contractions of external financing. In particular, by using a data set of bank loans to Greek firms and utilizing the Greek crisis as a shock to the credit flow to businesses, we show that access to internal capital markets offers financial relief to the firms and helps them stay solvent. Lenders acknowledge the benefits of affiliation and the co-insurance effect due to the availability of internal financing in multiple ways. In particular, we find that during a credit shock banks are less likely to downgrade the credit score of affiliated firms compared to unaffiliated firms, which translates to lower loan interest charge for the affiliates. Moreover, we show that banks require a lower loan collateral

coverage from affiliated firms compared to unaffiliated firms. The effects on credit score evaluation and loan collateral are conditional on the strength of the bank's relationship with the entire group. Finally, we provide evidence that, banks are more likely to show forbearance towards defaulted affiliated firms compared to defaulted unaffiliated firms. As before, the evidence on bank forbearance is conditional on the strength of the bank's relationship with the entire group.

Our findings are important to bank management. First, banks are justified to incorporate group-level information into their decisions because access to internal capital reduces the affiliates' default risk. Consequently, the results provide strong support to the "single risk" approach adopted by lenders. However, our findings suggest that only banks with a strong relationship with the group incorporate group level information including the risk sharing property of internal capital markets. Moreover, our findings show that bank management is aware that different levels of group integration yield different internal support to affiliates.

Our findings are also important to firm's management. In particular, the higher credit evaluation enjoyed by affiliated firms is likely to yield better loan terms such as a lower interest rate or longer maturities, along with a lower loan collateral requirement shown above. Thus, firm managers should be aware that organizational forms that reduce market inefficiencies yield favorable external financing terms. Equivalently, in an institutional environment with market frictions, e.g. information asymmetry, hybrid organizational forms between firm and market, that reduce these market frictions, are likely to enjoy improved loan terms. Moreover, because the favorable terms are proportional to the strength of the group's relationship with the bank, group's management is advised to seek building strong relationships with fewer banks instead of using a diverse pool of lenders in an "arm's length" type of borrowing.

Finally, our findings are of interest to the supervisory authorities. In particular, our results have three policy implications. First, we provide strong evidence in support of the adoption of the "single risk" approach by the regulatory guidelines on connected clients. Since delinquency risk of affiliated firms is dependent on the group, supervisors should advise banks to treat firms belonging to a group as one economic unit. Supervisors should also be aware of the differential handling of affiliated firms based on the bank's interests with the entire group. Second, supervisors should distinguish between highly integrated groups with strong direct ownership and low integrated groups (i.e. transaction-based) with weak direct ownership. Finally, supervisory authorities need to be vigilant for imprudent bank forbearance. Any differential treatment of defaulted firms must be based on evidence. Otherwise, banks' forbearance may jeopardize the stability of the banking system by fostering strategic default behavior of affiliated firms if they know that group membership protects them from legal liabilities in case of default. The latter is an important observation especially because loans to affiliated firms tend to have a lower level of collateralization, which implies a stronger incentive to strategic default.

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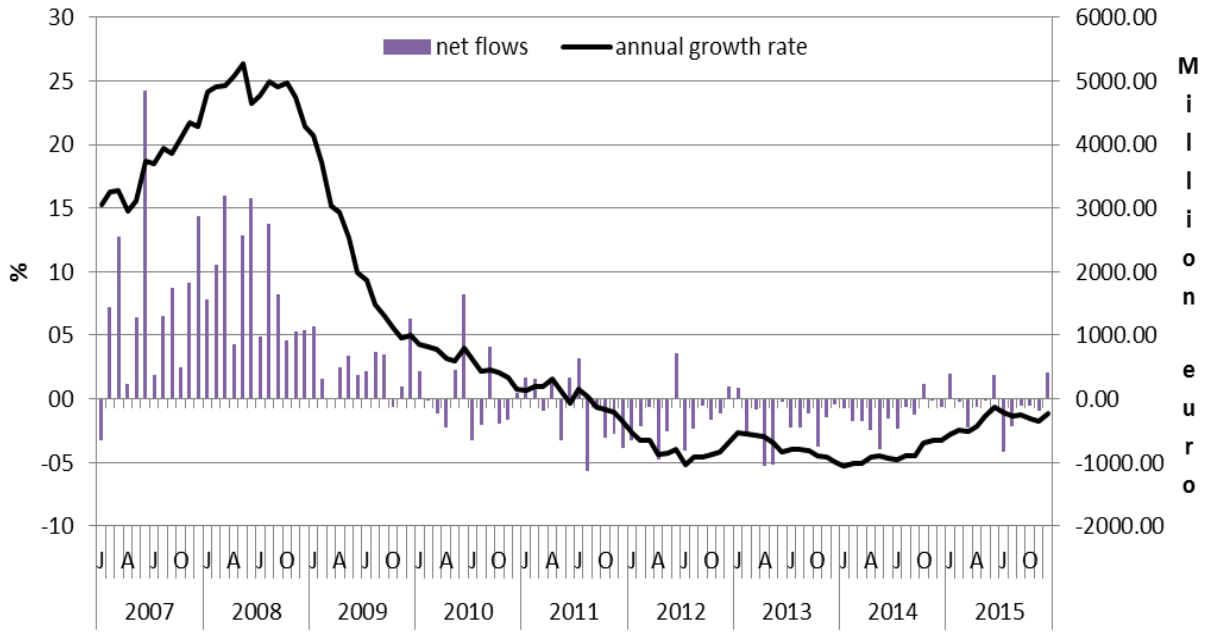
Figure 1: Bank credit to non-financial corporations
(left axis: annual percentage change; right axis: net credit flows in mn euro)



Source: Bank of Greece.

Table 1. Loan sample descriptive statistics. The top panel includes bank data for group affiliated firms, the bottom panel includes bank data for unaffiliated firms. The left columns contain data during the pre-credit shock period, the right columns contains data during the credit shock period. Definitions of variables: *Loan default* if the firm has a loan over 3% of total exposure that is more than 90 days past-due, *Credit Score (CS) downgrade* if the firm's credit score assigned by the bank at year *t* indicates higher risk than the score at year *t-1*, *Legal action rate* is the percentage of defaulted firms that the bank has initiated a legal action (*legal action data is available for 1,835 observations in the sample, see section 5), *Firm's loan* is the bank's reported loan exposure to the firm (€ th), *Firm's NPL* is the bank's reported non-performing loan exposure to the firm (% loan exposure to the firm), *Firm's loan collateral* is the bank's reported collateral from the firm (% loan exposure to the firm), *Firm dependence on bank* is the firm's loan from the bank (% firm's total loans), *Firm's credit evaluation* is the credit score assigned by the bank to the borrower with the lower score of 1 representing the lowest credit risk and the highest score of 7 representing the highest credit risk, *Group bank loan* is the bank's reported loan exposure to the group (€ th), *Group-bank relationship* is the bank's loan exposure to the group (% bank's total loans). p1 is the 1%-percentile, p99 is the 99%-percentile.

Affiliated firms	Pre Credit Shock (N=10,069)				Credit Shock (N=7,396)			
Loan default rate	2.79%				6.86%			
CS downgrade rate	54.70%				36.09%			
*Legal action rate**	45.57%				69.02%			
	mean	st.dev	p1	p99	mean	st.dev	p1	p99
Firm's loan (€ th)	11,389	42,805	1,008	96,703	12,996	31,092	1,014	122,720
Firm's NPL	0.011	0.080	0	0.371	0.057	0.174	0	1
Firm's loan collateral	0.216	0.711	0	2.118	0.273	0.746	0	1.83
Firm dependence on bank	0.329	0.295	0.017	1	0.382	0.303	0.020	1
Firm's credit evaluation	3.304	1.185	1	6	4.141	1.653	1	7
Group bank loan (€ th)	23,652	59,021	1,016	240,139	35,348	71,008	1,024	322,292
Group-bank relationship(%)	0.534	2.133	0.011	6	0.505	2.187	0.008	5
Unaffiliated firms	Pre Credit Shock (N=18,348)				Credit Shock (N=10,378)			
Loan default rate	3.05%				9.19%			
CS downgrade rate	58.73%				39.90%			
*Legal action rate**	42.59%				71.14%			
	mean	st.dev	p1	p99	mean	st.dev	p1	p99
Firm's loan (€ th)	4,856	12,683	1,008	35,506	4,931	10,024	1,009	38,259
Firm's NPL	0.023	0.133	0	1.000	0.143	0.316	0	1
Firm's loan collateral	0.386	2.205	0	2.619	0.456	0.603	0	2.18
Firm dependence on bank	0.552	0.350	0.033	1	0.643	0.343	0.047	1
Firm's credit evaluation	3.482	1.227	1	7	4.390	1.664	1	7

Table 2. Firm data descriptive statistics. The top panel includes affiliated firm's annual data, the bottom panel includes unaffiliated firm's annual data. Definitions of variables: *Total assets* (€ th), *z-score* is calculated using modified Altman z-score for emerging markets (see section 5), *Age* is the difference of the founded year from the reporting year, *Group total assets* is the consolidated total assets (€ th).

Affiliated firms		(N=5,603)		
	mean	st.dev	p1	p99
Total assets (€ th)	151,000	813,000	2,244	1,430,000
z-score	3.223	4.487	-15.524	11.106
Age	23.868	16.472	2	84
Group total assets (€ th)	854,000	1,980,000	10,100	9,540,000
Unaffiliated firms		(N=15,404)		
	mean	st.dev	p1	p99
Total assets (€ th)	23,000	173,000	1,385	159,000
z-score	3.899	3.285	-7.691	11.148
Age	17.858	13.190	1	70

Table 3. Firm's industrial sectors. Initially, firms are classified into industries at a level equivalent to the four-digit standard industrial classification (SIC) and then we apply the Bank of Greece broader classification groups.

Sector	Unaffiliated (N=15,404)	Affiliated (N=5,603)	Total (N=21,007)
Agriculture	1.60%	2.55%	1.85%
Energy	2.84%	5.53%	3.56%
Manufacturing	25.49%	32.07%	27.25%
Construction	11.23%	7.59%	10.26%
Commerce	27.43%	20.45%	25.57%
Shipping (incl. coastal)	0.31%	1.04%	0.50%
Transportation	1.82%	3.48%	2.27%
Hotels	14.38%	6.44%	12.26%
Food services	0.51%	1.45%	0.76%
Telecommunication & IT	2.11%	7.19%	3.47%
Real estate	6.97%	3.77%	6.12%
Health services	1.15%	3.62%	1.81%
Other	4.15%	4.82%	4.33%

Table 4. Group affiliation and default risk. Hypothesis test of loan default risk (H1). (1) Affiliated firms have a lower loan default risk compared to unaffiliated firms during credit shock. (2) Small size affiliated firms have a lower loan default risk compared to small size unaffiliated firms. (3) Medium size affiliated and unaffiliated firms have no difference in loan default risk. (4) Large size affiliated firms have a lower loan default risk compared to unaffiliated large size firms. All models are logistic panel regression models. Robust, clustered standard errors in parentheses. **p<0.01, * p<0.05.

	(1) Default	(2) Default	(3) Default	(4) Default
Group	-0.171*	-0.0952	-0.386*	0.241
	(0.0862)	(0.208)	(0.158)	(0.148)
Credit shock	1.633**	1.835**	1.181**	1.812**
	(0.139)	(0.221)	(0.261)	(0.271)
Group *Credit shock	-0.303**	-0.809**	0.0866	-0.501**
	(0.104)	(0.252)	(0.199)	(0.192)
Firm z-score	-0.165**	-0.0957**	-0.221**	-0.248**
	(0.00719)	(0.00949)	(0.0158)	(0.0138)
Firm age	-0.000607	0.00414	-0.00532	-0.00313
	(0.00173)	(0.00334)	(0.00329)	(0.00283)
Firm size	-0.102**	-0.128	-0.00484	-0.398**
	(0.0258)	(0.0802)	(0.138)	(0.0656)
Firm dependence on bank	-0.153	-0.127	-0.0437	-0.608**
	(0.0973)	(0.164)	(0.165)	(0.217)
Constant	-1.533*	-2.213	-4.306	4.781**
	(0.632)	(1.842)	(2.627)	(1.315)
Firm random effects	yes	yes	yes	yes
Bank fixed effects	yes	yes	yes	yes
Industry effects	yes	yes	yes	yes
Year effects	yes	yes	yes	yes
Observations	43,514	13,939	14,895	14,534

Table 5. Group affiliation and bank's credit evaluation. Hypothesis test of firm's credit score downgrade (H2). (1) Banks are less likely to downgrade the credit score of group affiliated firms compared to unaffiliated firms during credit shock. (2) Banks are less likely to downgrade the credit score of firms affiliated to a group with strong relationship with the bank (higher than the sample median) compared to unaffiliated firms during credit shock. (3) Banks are equally likely to downgrade the credit score of firms affiliated to a group with weak relationship with the bank (lower than the sample median) and of unaffiliated firms during credit shock. All models are logistic panel regression models. Robust, clustered standard errors in parentheses. **p<0.01, * p<0.05.

	(1) Downgrade	(2) Downgrade	(3) Downgrade
Group	0.00636	0.0334	0.000180
	(0.0321)	(0.0405)	(0.0418)
Credit shock	-0.255**	-0.239**	-0.287**
	(0.0538)	(0.0583)	(0.0593)
Group *Credit shock	-0.121*	-0.122*	-0.106
	(0.0474)	(0.0577)	(0.0629)
Firm z-score	-0.0158**	-0.0167**	-0.0192**
	(0.00311)	(0.00347)	(0.00372)
Firm age	-0.00290**	-0.00276**	-0.00274**
	(0.000820)	(0.000916)	(0.000968)
Firm size	-0.00557	-0.0165	-0.0269
	(0.0109)	(0.0123)	(0.0145)
Firm dependence on bank	-0.0474	-0.0534	-0.0749
	(0.0423)	(0.0468)	(0.0485)
Constant	0.999**	1.121**	1.345**
	(0.294)	(0.310)	(0.373)
Firm random effects	yes	yes	yes
Bank fixed effects	yes	yes	yes
Industry effects	yes	yes	yes
Year effects	yes	yes	yes
Observations	36,030	29,556	28,232

Table 6. Group affiliation and loan collateral coverage. Hypothesis test of bank's requirements to loan collateral coverage (H3). (1) Banks request lower loan collateral coverage from affiliated firms compared to unaffiliated firms during credit shock. (2) Banks request lower loan collateral coverage from firms affiliated to a group with strong relationship with the bank (higher than the sample median) compared to unaffiliated firms during credit shock. (3) Banks request similar loan collateral coverage from firms affiliated to a group with weak relationship with the bank (less than the sample median) and unaffiliated firms, during credit shock. All models are generalized linear regression models. Robust, clustered standard errors in parentheses. **p<0.01, * p<0.05.

	(1) Loan Collateral	(2) Loan Collateral	(3) Loan Collateral
Group	-0.0614**	-0.0624**	-0.0543**
	(0.00841)	(0.0108)	(0.0103)
Credit shock	0.194**	0.194**	0.200**
	(0.00898)	(0.00950)	(0.00984)
Group *Credit shock	-0.0199*	-0.0336**	-0.00458
	(0.00902)	(0.0113)	(0.0116)
Firm z-score	0.00500**	0.00572**	0.00657**
	(0.000786)	(0.000837)	(0.000961)
Firm age	0.000246	0.000127	0.000238
	(0.000215)	(0.000231)	(0.000256)
Firm size	-0.0208**	-0.0190**	-0.0272**
	(0.00323)	(0.00353)	(0.00400)
Firm dependence on bank	0.141**	0.146**	0.138**
	(0.0122)	(0.0132)	(0.0135)
Constant	0.695**	0.662**	0.890**
	(0.116)	(0.121)	(0.188)
Firm random effects	yes	yes	yes
Bank fixed effects	yes	yes	yes
Industry effects	yes	yes	yes
Year effects	yes	yes	yes
Observations	46,190	38,505	36,410

Table 7. Group affiliation and bank forbearance. Hypothesis test of bank forbearance (H4). (1) Banks are less likely to take legal actions against affiliated compared to unaffiliated firms during credit shock. (2) Banks are less likely to take legal actions against firms affiliated to a group with strong relationship with the bank (higher than the sample median) compared to unaffiliated firms during credit shock. (3) Banks are equally likely to take legal actions against firms affiliated to a group with weak relationship with the bank (lower than the sample median) and unaffiliated firms during credit shock. All models are logistic panel regression models. Robust, clustered standard errors in parentheses. ** p<0.01, * p<0.05.

VARIABLES	(1) Legal action	(2) Legal action	(3) Legal action
Group	-0.508*	-0.690**	-0.531
	(0.209)	(0.268)	(0.276)
Firm z-score	-0.0623**	-0.0703**	-0.0878**
	(0.0155)	(0.0175)	(0.0206)
Firm size	0.171*	0.127	0.195
	(0.0848)	(0.0869)	(0.102)
Firm npl	0.769*	0.457	0.804*
	(0.314)	(0.326)	(0.352)
Constant	-3.294	-2.712	-3.690
	(1.953)	(1.960)	(2.433)
Bank fixed effects	yes	yes	yes
Industry effects	yes	yes	yes
Year effects	yes	yes	yes
Observations	1,760	1,515	1,480

Table 8. Hypotheses (H1-H4) tests using the group's integration level heterogeneity. (1) Logistic panel regression model: Only firms affiliated to high integrated groups have a lower loan default risk compared to unaffiliated firms during credit shock. (2) Logistic panel regression model: Banks are less likely to downgrade the credit score of firms affiliated only to high integrated groups compared to unaffiliated firms during a credit shock. (3) Generalized linear panel regression model: Banks require a lower loan collateral coverage only from firms affiliated to high integrated groups compared to unaffiliated firms during a credit shock. (4) Logistic panel regression model: Banks are less likely to take legal action against firms affiliated only to high integrated groups compared to unaffiliated firms. Robust, clustered standard errors in parentheses. ** p<0.01, * p<0.05.

	(1) Default	(2) Downgrade	(3) Collateral	(4) Legal action
Low integrated group	-0.539*	0.0433	-0.0954**	0.124
	(0.212)	(0.0641)	(0.0139)	(0.412)
High integrated group	-0.0983	-0.00446	-0.0535**	-0.428*
	(0.0893)	(0.0339)	(0.00893)	(0.204)
Credit shock	1.637**	-0.262**	0.194**	
	(0.139)	(0.0538)	(0.00899)	
Low integrated group *Credit shock	-0.253	0.00731	0.00729	
	(0.258)	(0.0995)	(0.0179)	
High integrated group *Credit shock	-0.298**	-0.146**	-0.0248**	
	(0.108)	(0.0500)	(0.00953)	
Firm z-score	-0.165**	-0.0154**	0.0051**	-0.055**
	(0.00716)	(0.00311)	(0.000788)	(0.0149)
Firm age	-0.00133	-0.00262**	0.000223	
	(0.00175)	(0.000828)	(0.000217)	
Firm size	-0.106**	-0.00309	-0.0211**	0.213**
	(0.0259)	(0.0109)	(0.00324)	(0.0827)
Firm dependence on bank	-0.152	-0.0470	0.142**	
	(0.0974)	(0.0423)	(0.0122)	
Firm npl				0.593*
				(0.284)
Constant	-1.451*	0.943**	0.699**	-3.302
	(0.633)	(0.295)	(0.116)	(1.862)
Firm random effects	yes	yes	yes	
Bank fixed effects	yes	yes	yes	yes
Industry effects	yes	yes	yes	
Year effects	yes	yes	yes	yes
Observations	43,514	36,030	46,190	1,819

Table 9. Matched sample and placebo test (H1-H3). The difference in the outcome variables Y_{ijt} at pre-shock and during the shock between affiliated and unaffiliated firms from the same year and industry matched by size, financial solvency (z-score), age, firm dependence on bank and total loan exposure. Similarity is measured by Mahalanobis distance, in which the weights are based on the inverse of the covariates' variance–covariance matrix. In columns (1)-(3) years 2008-2011 are the pre-shock period and years 2012-2015 are the shock period. (1) The difference in default risk pre-shock and during the shock between affiliated and unaffiliated firms is 1.5 percentage points and it is statistically significant at 1%. (2) The difference in firm's credit score downgrade rate at the pre-shock and during the shock between affiliated and unaffiliated firms is 2.3 percentage points and it is statistically significant at 5%. (3) The difference in firm's loan collateral coverage at the pre-shock and during the shock between affiliated and unaffiliated firms is 2.3 percentage points and it is statistically significant at 5%. Columns (4)-(6) involve the placebo test where the years 2008-2009 are the pre-shock period and the years 2010-2011 are the shock period. (4) The difference in the default risk at the pre-shock and during the shock between affiliated and unaffiliated firms is not statistically significant. (5) The difference in the credit score downgrade rate at pre-shock and during the shock between affiliated and unaffiliated firms is not statistically significant. (6) The difference in the loan collateral coverage at the pre-shock and during the shock between affiliated and unaffiliated firms is not statistically significant. Robust standard errors in parentheses. ** p<0.01, * p<0.05.

		(1)	(2)	(3)	(4)	(5)	(6)
		Default	Downgrade	Collateral	Default	Downgrade	Collateral
		Credit Shock: 2008-2011 vs 2012-2015			Placebo: 2008-2009 vs 2010-2011		
Before	Unaffiliated	0.028	0.537	0.24	0.018	0.67	0.211
Credit	Affiliated	0.028	0.547	0.194	0.014	0.668	0.172
Shock	Diff $(A\text{-}U)_{BCS}$	0	0.009	-0.046**	-0.004	-0.002	-0.039**
		(0.003)	(0.007)	(0.007)	(0.003)	(0.01)	(0.009)
After	Unaffiliated	0.079	0.37	0.325	0.038	0.397	0.27
Credit	Affiliated	0.064	0.356	0.255	0.043	0.419	0.216
Shock	Diff $(A\text{-}U)_{ACS}$	-0.015**	-0.014	-0.069**	0.004	0.022*	-0.054**
		(0.004)	(0.009)	(0.008)	(0.003)	(0.01)	(0.01)
	Diff $(A\text{-}U)_{ACS}$ - Diff $(A\text{-}U)_{BCS}$	-0.015**	-0.023*	-0.023*	0.009	0.024	-0.015
		(0.005)	(0.011)	(0.01)	(0.005)	(0.014)	(0.014)