The Maturity Rat Race and Short-Termism

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Abstract
The global economic financial crisis has rekindled great public interest in one of the oldest questions in finance. That is, what's the connection between firms' value and their financial policies? The rationality of debt maturity shortening and managerial short-termism has been at the forefront of the debate. This paper examines the "maturity rat race" proposition in a group of financially distressed firms during the recent crisis in Portugal. We find significant debt maturity shortening before firm default - a finding robust to various empirical specifications. Furthermore, we show that short-term debt overhang leads to managerial myopic behaviors (i.e., short-termism) and the pattern is even more prominent in financially distressed firms. Firms who hold a larger proportion of short-term debt are more prone to invest in short-term assets and engage in earnings management. (JEL: G3, G20, G21, G32, G33)

Introduction

The global economic financial crisis has rekindled great public interest in one of the oldest questions in finance: what's the connection between firms' value and their financial policies? The rationality of an excessively short debt maturity structure of firms and managerial short-termism, was at the forefront of the debate. Specifically, researchers find that firms financing a great portion of their assets with short-term debt during the crises diminish debt capacity (Acharya *et al.* (2011)) and tend to default at a higher fundamental threshold due to the fact that they are exposed to higher rollover risk (e.g., He and Wei (2012b)). There is also evidence that short-termism, i.e., managerial incentive to inflat short-term results at the expense of long-term interests, played a crucial part in the 2007-2009 subprime crisis in US. Bank CEOs with myopic incentives allowed their firms to engage in mortgage-related fraud during the subprime boom while cashing out of their stock and option holdings earlier during the crisis (see Bebchuk *et al.* (2010), Bhagat and Bolton (2014), Kolasinski and Yang (2018)). Especially, managerial

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myopic behaviors are likely influenced by capital market short-termism (e.g., Attig *et al.* (2012), Milbradt and Oehmke (2015), Jordan *et al.* (2016)). Despite abundant evidence in debt maturity shortening and short-termism, the link between the two, reflecting correlated short-term horizons from two related parties, creditors and firms, is rarely explored.

The most widely used frameworks in analyzing the debt maturity decision are Leland (1994, 1998) and Leland and Toft (1996). It is a static analytical framework by its nature in which firms decide the maturity structure of their debt by making cost-reward tradeoffs. This is, however, at odds with the empirical evidence holding that firms manage their debt maturity actively (Graham and Harvey (2001), Krishnamurthy (2010), Mian and Santos (2018), Chen *et al.* (2013)). A recent line of research highlights that the coordination problems among creditors can exacerbate when credit conditions deteriorate, causing excessive short-term debt usage. Especially, the "maturity rat race" proposition by Brunnermeier and Oehmke (2013) points to an inefficient equilibrium of short-term debt financing. They argue that if the interim information coming out at the rollover dates is negative, a borrower may have an incentive to shorten the maturity of an individual creditor's debt for it diminishes the relative claim of the remaining creditors. In anticipating this problem, the remaining creditors will choose an even shorter maturity for their contacts, causing a "maturity rat race". Analogously, He and Wei (2012a) discuss debt run risk in a dynamic setting and their results suggest that in fear of future runs by other creditors, all creditors will end up raising the rollover threshold on the borrower. In their model, a firm´s fundamental varies over time and the rollover decision of a specific creditor is made based on his/her anticipation of the future maturing creditors´ rollover decisions. If the creditor anticipate that the next creditors are likely to run (i.e., using a higher rollover threshold for the firm´s fundamental value), he will have a higher incentive to run now in order to protect himself against the increase in firm's future rollover risk. He and Milbradt (2016) extend Leland's framework by modelling joint determination of endogenous default, endogenous dynamic maturity and bond prices. They show that when firm fundamentals and economic conditions deteriorate, debt maturity shortening will occur together with earlier default. In a framework of information asymmetry, König and Pothier (2016) model the situation when solvency risk is not observable or uncertain. They conclude that the equilibrium debt maturity structure tends to be inefficiently short, given the "excess elasticity" of long-term interest rates plus the redistribution of refinancing gain from bad to good firms.

Although the existing theoretical models are more ready to apply to financial institutions, they also have important implications for non-financial firms. Brunnermeier and Oehmke (2013) mention that, unlike financial institutions, firms do not need to tap capital market very frequently and they can prevent the maturity rat race by employing covenants or creditor protective provisions. However, covenants and provisions are not

a free lunch, as the subsequent monitoring may be undesirable, especially during the crises. In particular, when credit conditions and information environment deteriorated, firms would naturally prefer to maintain more financial flexibility (e.g., Duchin *et al.* (2010), He and Wei (2012b), Gopalan *et al.* (2014)). Moreover, despite the fact that the fundamentals of non-financial corporations do not vary substantially in "good times", this may not hold true in "bad times", which corroborates the two main assumptions in the model of He and Wei (2012b), i.e., illiquid asset and time-varying fundamentals.

Understanding the potential mechanisms of firms using excessively short-term debt and its potential consequences, notably short-termism, is of particular interest in the aftermath of the recent crisis. The Portuguese banking system and the private sector provide an interesting setting to analyze this issue. Firstly, small and medium-sized enterprises (SMEs) account for a significant share of the private sector and are essential to economic activities in Portugal. However, under information asymmetry short-term debt is often used as a sorting device by creditors. Although a short debt maturity exerts a valuable role in mitigating firm's risk shifting behaviors and allows creditors to sort out low-quality firms in normal times, it may not be desirable in bad times, especially for SMEs. Higher fundamental volatility during crises tends to exacerbate the coordination problem, leading to "maturity rat race" even when the firm is still solvent. The noticeable increase in the occurrence of default events during the recent crisis, as shown in Figure 1, may have been partly driven by the "maturity rat race". Secondly, corporate governance practices may not have been given equal importance to performance pressures by the shareholders of SMEs and this may further foster managerial myopic behaviors. In particular, the recent global crisis was characterized not only by high refinancing risk but also by the prevalence of managerial risk sharing behaviors, such as underinvestment and employment reduction (Almeida *et al.* (2012), Martins (2016)).

This paper investigates the maturity race issue by first tracking the evolution of debt maturity structure around firm default and then examining whether the excessive reliance on short-term financing leads firms to engage in myopic behaviors.

The rest of the paper is organized as follows. Firstly, we review the related literature. Secondly, we describe the data and discuss the variables of interest. Thirdly, we present the econometric model and discuss the empirical results. Finally, we conclude.

Literature

Debt maturity has been an active research area in finance. In a perfect capital market implied by Modigliani and Miller (1958) and Stiglitz (1974), debt maturity choice is irrelevant to the valuation of a firm. The subsequent

literature stresses the relevance of debt maturity decisions by accounting for a variety of financial frictions faced by firms such as agency conflicts, asymmetric information, credit risk and taxation. In general, researchers contend that the appeal of short-term debt originates from firm's concerns of synchronizing investment demand, disciplining managers, and refinancing at more favorable terms while waiting for credit upgrades (e.g., Myers (1977), Barnea *et al.* (1980), Harris and Haviv (1991), Aivazian. *et al.* (2005), Diamond (1991)). Conversely, long-term debt is more desirable when firms are exposed to high refinancing risk (e.g., Diamond (1991, 1993), Jun and Jen (2003)). Some frictions may be more important for some type of firms in certain circumstances, but of little relevance to others. Closely related to this paper are the models pointing to short-term debt favoritism and its outcomes.

The first type of debt maturity model emphasizes the role of short-term debt in disciplining managerial risk taking behaviors such as underinvestment (i.e., renouncing profitable investment projects) and asset substitution (i.e., investing in very risky projects). Myers (1977) shows that with a long-term debt overhang at the moment of exercising growth options, firms possibly forgo profitable projects, for otherwise the future benefits of growth options will go partly to the creditors. This is known as the debt overhang problem and a solution proposed by Myers (1977) is to finance the asset-in-place with debt that matures before the growth option will be exercised, that is, short-term debt. Equity holders also have incentives to increase their wealth at the expense of debt holders by investing in very risky projects. Barnea *et al.* (1980) and Jensen (1986) elucidate the role of short-term debt in supervising managerial over-investment behaviors and aligning the interests of shareholders and those of managers. Specifically, by shortening the maturity structure of debt, creditors are provided with an option to monitor frequently their borrowers.

The second type takes into account the role of private information in affecting the manner in which firms raise funds. The key to this line of literature lies in the "adverse selection" issue, characterized by the undervaluation of high quality firms and the overvaluation of low quality ones under information asymmetry. Short-term debt is less sensitive to mispricing as it provides lenders with the possibility of updating a firm's credit information at high frequency. Consider a situation when the creditworthiness of borrowers is private information. As creditors cannot tell high quality borrowers from the low quality ones, an industry-average risk rating will be assigned to both types of firms. Before favorable private information is disclosed to the market, high quality firms have no choice but to borrow at the same cost as low quality firms. As a result, high quality firms will prefer short-term debt in order to wait for a better moment to tap the market, while low quality firms will prefer to issue long-term debt to benefit from market overvaluation. As soon as low quality firms realize that long-term debt issuance signals bad image, they will imitate high quality firms to

issue short-term debt. This leads to a "pooling equilibrium", as defined by Flannery (1986), where all firms choose to issue short-term debt.

However, in the presence of high refinancing costs, only high quality firms can afford to signal the real state through refinancing short-term debt, resulting in a "separating equilibrium" where high quality firms issue short-term debt and low quality firms issue long-term debt. In a sequential games framework, Kale and Noe (1990) show that a "separating equilibrium" exists even without transaction costs. Diamond (1991) highlights the liquidity risk induced by rolling over short-term debt at the time when refinancing is expensive or unavailable. In his model, low quality firms are screened out of the long-term debt market because creditors are not willing to offer long-term debt given the high asset substitution risk. Meanwhile, most creditworthy firms will continue to issue short-term debt in order to signal favorable private information. In equilibrium, only medium-quality firms who are more sensitive to credit downgrading and refinancing unavailability will use long-term debt, while both high and low-quality ones will continue to issue short-term debt.

Another strand of the literature discusses how coordination problems among creditors drive short-term debt usage, based on equilibrium models of bank runs (i.e., the dynamic coordination among multiple creditors concerning the decisions of debt rollovers and liquidations). He and Wei (2012a) discuss debt run risk in a dynamic setting, accounting for time-varying fundamentals and staggered debt structures. They show that each creditor will raise the rollover threshold in fear of future runs by other creditors, leading to runs by all creditors on a firm. Brunnermeier and Oehmke (2013) derive that short debt maturity is a result of maturity race among multiple banks. A borrower who cannot commit to an aggregate maturity structure has an incentive to shorten the maturity of an individual creditor's debt for it diminishes the relative claim of the remaining creditors and dilutes their payoffs. In anticipating this problem, the remaining creditors will choose a shorter maturity for their contacts, so that in equilibrium all the creditors only accept to offer debt with very short maturities, so-called "maturity rat race".

Besides the mechanisms that drive debt maturity shortening, the consequences of using very short-term debt have also been discussed recently. Brunnermeier and Oehmke (2013) argue that the maturity rat race is actually inefficient because the excessive reliance on short-term funding leads to undesirable asset-debt maturity mismatch and intensified rollover risk. Besides the role of debt maturity in intensifying credit risk, exacerbating information asymmetry and agency problems, other researchers examine how short-term debt outstanding can affect firm's investment decisions. Diamond and He (2014) provide a formal test showing that short debt maturity can in fact exert more severe debt overhang than long-term debt if firms´ fundamentals decrease after the short-term debt is issued. Milbradt and Oehmke (2015) examine the feedback from financial frictions to asset maturity.

Their results suggest that credit rationing leads firms to invest inefficiently in short-term projects instead of choosing the first-best investment project. This is consistent with the perception of asset maturity shortening during downturns (e.g., Dew-Becker (2012)) and the criticisms of firms being overly short-term oriented. For example, firms tend to focus on projects that can bring immediate "return" to shareholders, engage in earnings management and stock buybacks, while underinvest in projects that maximize profit in the long run, for example, innovation and employment training (e.g., Graham *et al.* (2005)). Notably, existing research has shed light on how short-term market pressure from institutional investors, financial analysts has shaped managerial myopic behaviors (e.g., Attig *et al.* (2012), He and Tian (2013), Jordan *et al.* (2016)). If so, firms who face refinancing pressure induced by the maturity race will also have incentives to adopt short-term horizons. To make frequent payments for the maturing debt, it is likely they invest more in short-term oriented projects which normally require less money and bring fast cash. While short-termism is not a novel topic, this is the first paper that empirically examines how a special channel, i.e., debt maturity shortening, can lead to distorted incentives in corporate investment, namely myopic behaviors or short-termism.

Data and sample selection

Data source

The objective of this paper is to examine whether maturity race exist in the Portuguese economy and, if yes, what could be the outcomes. To achieve this purpose, we confine our sample to a group of non-financial corporations in this study and employed various datasets, including the Portuguese Credit Register (Central de Responsabilidades de Crédito), the New Credit Operations Database (Informação Individual de Taxas de Juro), the Central Balance Sheet Database (Central de Balanços), and the Monetary Financial Institutions Balance Sheet Database (Balanço das Instituições Monetárias e Financeiras), all managed by Banco de Portugal.

The Portuguese Credit Register reports monthly information on credit exposures by all credit-granting institutions resident in Portugal. The dataset is organized on a borrower-by-borrower basis and provides detailed information on the breakdown of credit exposure, such as credit situation and maturity structure. This allows us to construct the aggregate debt maturity measure for each firm (defined as the proportion of debt with a remaining maturity of more than one year), the overdue intensity (the proportion of overdue credit to a firm's total credit outstanding), and bank-firm relationship variables (the size and dispersion of firm's lender pool).

The New Credit Operations Database provides information on the amount, the maturity dates, and the interest rates of new and renegotiated loans to firms.[1] We use this dataset mainly to provide additional checks. Further, to obtain additional controls (i.e., firm and bank characteristics) and to estimate ex post outcome variables (investment, employment, and managerial short-termism), we retrieved firms´ financial statement data and banks´ balance sheet data from the annual dataset of Central Balance Sheet and the monthly dataset of Monetary Financial Institutions Balance Sheet, respectively.[2]

As the maturity race is more likely to occur around great asset fluctuations (He and Wei (2012b), He and Milbradt (2016)), we examine an extreme corporate event when firms significantly default vis-à-vis the banking system. Following Antunes *et al.* (2016), we define default event as firm's failure to fulfil debt obligation that amounts to 2.5% or more of its total debt outstanding for more than three months. To eliminate confounding effects caused by further defaults, we focus on firm's first default which is likely the most relevant screening information for creditors. Default events are also computed using information from the Credit Register. We use the full period from January, 1980 to December, 2016 to identify firm's first default. But in order to analyze the evolution of firm's maturity structure around default applying a window of two years, we are only focusing on events that occurred between January, 2011 and December, 2014.[3] The final sample comprises 33 318 non-financial corporations which defaulted between 2011 and 2014. Furthermore, we eliminate extreme values by winsorizing the firm characteristic variables at the 1st and 99th percentiles. The variables used in this study are defined in Table 1.

Descriptive statistics

Figure 1 depicts the incidence of default events for non-financial Portuguese firm from January, 2011 to December, 2014. To illustrate the prevalence of firm default in the whole economy, we consider all defaulted firms, meaning that firms that have already defaulted in a previous period continue to be counted in this graph. The left axis plots the number of defaulted and non-defaulted firms in the blue and red bars. The black solid line, plotted on the right axis is the month-by-month percentage of defaulted firms, with default event defined using the parameters suggested in Antunes *et al.* (2016). The black dash line and the red solid line apply higher thresholds in order to

1. The data in the New Credit Operations Database only started to be reported in June, 2012.

2. Variables are defined in Table 1.

3. To construct the aggregate debt maturity structure of a firm, we used the variable of "residual maturity" from the Portuguese Credit Register (Central de Responsabilidades de Crédito) database. This variable is only available from 2009 on.

show the importance of heavily defaulted firms in the economy.[4] What we can immediately see from the graph is the increasing importance of defaulted firms in Portugal, confirming the relevance of using firm default as a relevant research setting for maturity race.

Table 2 illustrates the main characteristics of defaulted firms and non-defaulted firms by year. At first glance, it seems that defaulted firms are not very different from non-defaulted firms in terms of size and age, but they do show lower financial performance and growth rates. They also tend to use more debt and hold less cash in their account. In terms of bank relationships, they have a larger and more dispersed lender pool, which meets well the initial conditions in the maturity rat race proposition. More interestingly, their short-term debt ratio is not higher than non-defaulted firms on average, which makes it even more interesting to examine the issue in a dynamic setting. Note that not all these variables are included for multivariate analyses due to potential multicollinearity issues. [5]

Empirical analysis

The maturity race around firm default

In this section, we analyze in an event study framework whether there exists the phenomenon of maturity race around firm default in the Portuguese economy. The principal measure of firm's exposure to maturity race is the ratio of the firm's short-term debt amount to total debt amount, using information from the Portuguese Credit Register. An alternative measure is the time-to-maturity of new or renegotiated debt extracted from the New Credit Operations Database. As this information is only available after June, 2012, we use it for robustness checks.

The evolution of debt maturity. To explore the underlying patterns of the maturity race, we start by tracing the evolution of the short-term debt ratio around corporate default, as illustrated in Figure 2. We track the evolution

4. Specifically, the black solid line considers as a default event if a firm fails to fulfil debt obligation that amounts to 2.5% or more of its total debt outstanding for at least three months consecutively. The black dash line considers as a default event when a firm fails to fulfil debt obligation that amounts to 5% or more of its total debt outstanding for at least six months consecutively. The red line considers as a default event when a firm fails to fulfil debt obligation that amounts to 25% or more of its total debt outstanding for at least twelve months consecutively.

5. The firm-specific variables used in our multivariate analyses include firm size (the log value of total assets), profitability (earnings before interest and tax divided by turnover), leverage (total liabilities divided by total assets), cash (cash and bank deposits divided by total assets), employment growth (annual change in number of employees), loss (dummy for negative operating income) and current asset ratio (total current assets divided by total assets).

of firm's exposure to maturity race, i.e., the short-term debt ratio, using a 24-month window. We define default month as event time 0 and s month subsequent (prior) to the default month as event time s (-s). The blue line plots the mean value of the short-term debt ratio in event month, while the red line plots the median value.

Overall, the pattern revealed in the figure does imply the existence of maturity race in firms who are facing financial distresses. Notably, the curves of the short-term debt ratio increase substantially before default. For a typical firm, the short-term debt ratio continues to increase after default and the value peaks at the end of the curves. The mean/median short-term debt ratio increases from 0.49/0.46 at month -24 to 0.57/0.63 at month 0.

For robustness, we further check the evolution of debt maturity in new loans for distressed firms.[6] To do this, we first collapse loans with short and long maturities (defined using the one-year cutoff) for each firm-month and calculate the proportion of loans that matures in one year. We then trace the mean value of the short-maturity debt ratio around event time in Figure 3. As observed in the first panel of Figure 3, short-maturity debt extended to a typical "distressed" firm accounts for a significant portion of total debt and increases dramatically before its default. The caveat is that different from credit outstanding, the issuance of new loans is occasional. Therefore, it may not be straightforward to track the event-time evolution for new debt in low frequencies. In the second panel of Figure 3, we study the issue on a yearly basis and the same pattern remains. Notably, a similar pattern is observed when the average time-to-maturity is tracked, as illustrated in Figure 4. The time-to-maturity of new debt obtained by the average firm in our sample decreases from 170 days to less than 120 days in a two-year period before it went into default. Additionally, we find that the maturity shortening is concentrated in the loans that have a maturity of less than five years (see the separate analysis on the loans with different maturity categories in Figure 5).

Although intuitive, the event study results could be contaminated by the latent factors that affect debt maturity choices of distressed firms universally. To address this concern, the following section examines the maturity race issue in a multivariate analysis framework.

Multivariate regression analysis. To formally test the maturity rat race around firm default, we estimate the following specification,

$$ST_{i,m} = \varpi_k W_{i,k} + \alpha X_{i,t-1} + F_i + S_{(i)} + T_m + \varepsilon_{i,m} \tag{1}$$

where $ST_{i,m}$ is the short-term debt ratio of firm i in month m, $W_{i,k}$ is a dummy variable that accounts for the default window for firm i, in the default window k, $X_{i,t-1}$ is a set of one-year lagged firm-specific variables, F_i, $S_{(i)}$, and T_m are

6. This information is extracted from the New Credit Operations Database.

vectors of firm, industry, and month fixed effects, and $\varepsilon_{i,m}$ stands for the error term. Due to the presence of both firm and industry fixed effects, we estimate the coefficients and standard errors using the high-dimensional fixed-effects linear model (Guimarães and Portugal (2010)).

To gauge the course of maturity race, we are particularly interested in estimating the coefficients for the default window dummies. The default windows are tracked at a monthly frequency. Figure 6 plots the regression coefficients for these dummy variables based on a two-year window (i.e., 24 months before and 24 months after a default event). We use the month -24 as the benchmark period. This means that the coefficients estimated on the other default periods should always be interpreted comparing with this specific period. As the Figure shows, there is strong evidence of maturity race in financially distressed firms. The estimates for the default window dummies are significantly positive, except for the window [-14, -3] – about one year before firm's first default. Note that we have defined default event using a 3-month lag, i.e., a firm needs to have overdue credit present for more than 3 months to be considered as in default. This means that the firm's default information is likely to be already available to other creditors at month t-3 and this could explain the peak in the coefficients before default.

Nevertheless, the increase in short-term debt ratio may be induced either by an increase in short-term debt or by a decrease in long-term debt. To understand the issue better, we further examine changes in total credit, short-term credit and long-term credit (measured using log amount) in Figure 7, Figure 8, and Figure 9, separately. An interesting pattern, in support of the maturity race hypothesis, again unfolds. There is a higher ex ante probability for these firms to obtain credit beforehand and the funds that they received are generally short-term rather than long-term. To provide further evidence, we split the sample into two groups: firms with single bank relationships and firms with multiple bank relationships. For the latter, we further divide it into two subsamples based on the concentration index of bank-firm relationships. This exercise forms three groups of firms: firms with single bank relationships, firms with a concentrated lender pool and firms with a dispersed lender pool. We then repeat the same analysis as in Figure 6 for each subsample. The estimates for the default window dummies are plotted in Figure 10, showing a more prominent maturity race in firms with multiple relationships and dispersed lender pools for which the coordination problems are likely more severe. The coefficients in firms with single bank relationships are mostly negative.

Given these results, a natural follow-up question to ask is: what are the key features of credit contracts around firm default? If the maturity race proposition holds, they should have shorter time-to-maturity in general. We address this question by estimating the following econometric model,

$$M_{i,j,m} = \varpi_k W_{i,k} + \alpha X_{i,t-1} + \beta Y_{j,t-1} + \gamma L_{i,j,m} + \delta R_{i,j,t-1} + F_i + S_{(i)} + B_j + T_m + \varepsilon_{i,j,m} \quad (2)$$

where $M_{i,j,m}$ measures the time-to-maturity of a loan that firm i obtains from bank j in month m. Besides the variables specified in equation (1), we include a set of one-year lagged bank-specific variables $Y_{j,t-1}$, a set of loan-specific variables $L_{i,j,m}$, a set of one-year lagged bank-firm relationship variables $R_{i,j,t-1}$, and a vector of bank fixed effects B_j. $\varepsilon_{i,j,m}$ is the error term.

Indeed, credit contracts that were entered into or renegotiated right before a firm's first default event have significantly shorter time-to-maturity (Figure 11). The effect is more prominent in new issued debt (see Figure 12 and Figure 13). For those who continue to obtain new debt after default, time-to-maturity actually lengthens although statistically insignificant. In unreported robustness checks, we investigate other contractual dimensions, that is, tranche amount and the pricing of the loan. We find decreasing amount and increasing interest rate around default, consistent with the view that debt capacity diminishes for distressed firms. However, we would like to draw readers´ attention to the fact that one-shot debt issuance does not necessarily reflect a firm's unalloyed financing intent. One should therefore interpret the findings from individual loan with more caution.

Short-term debt overhang and short-termism

In this section, we explore whether short-term debt overhang leads firms to take more short-term oriented decisions. The specification to estimate is as follows:

$$D_{i,t} = \beta ST_{i,t-1} + \alpha X_{i,t-1} + F_i + S_{(i)} + T_t + \varepsilon_{i,t} \quad (3)$$

where $D_{i,t}$ is the specific decision of firm i in year t, $ST_{i,t-1}$ is the short-term debt overhang measure for firm i at year $t-1$, $X_{i,t-1}$ is a set of firm-specific variables at year $t-1$, F_i, $S_{(i)}$, and T_t represent firm, industry, and year fixed effects. $\varepsilon_{i,t}$ is the error term.

To generalize the results, we start by including all firms with available information on all the regression variables. We control for financial distress of firms by incorporating $Overdue\ Intensity$, measured by total overdue credit divided by total credit. For firms with no credit present in the Portuguese Credit Register, we assign the value of zero to this variable.

In general, the regression results, reported in Table 3, suggest a negative role of short-term debt overhang in corporate investment decisions, measured as firm's investment in tangible and intangible assets scaled by total assets. The estimated coefficients of the short-term debt ratio is negative and statistically significant in the regressions of general investment (column (1))

and employment (column (3)). There is also evidence suggesting that short-term debt overhang is related to firm short-termism. A closer look at firm's asset and employment compositions shows an increasing investment of short-term assets and increased unpaid and part-time workers in firms with higher short-term debt overhang (see columns (2), (4), and (5)). Previous research indicates that myopic managers have an inclination to manipulate accruals and distort their firms' reported financial performance (e.g., Efendi *et al.* (2007), Burns and Kedia (2006), Fang *et al.* (2016)). We focus on the conflict of interest between firms and creditors by asking whether the pressure of paying down maturing debt at higher frequencies gives managers incentives to manage their earnings.

Following existing work such as Fang *et al.* (2016), we measure earnings management of firms using discretionary accruals and the performance-matched discretionary accruals in columns (6) and column (7). The results are again consistent with our expectation: the higher the short-term debt overhang, the higher the discretionary accruals, that is, the greater the likelihood that earnings quality is low.

Table 4 runs a similar exercise for firms in the default sample. But instead of including merely the short-term debt ratio, we interact the short-term debt overhang variable with the dummy variables for the default window ($W_{i,k}$), as shown in equation (4). The purpose is to examine the effect of short-term debt overhang for different default windows.

$$D_{i,t} = \varpi_k W_{i,k} \times ST_{i,t-1} + \alpha X_{i,t-1} + F_i + S_{(i)} + T_t + \varepsilon_{i,t} \tag{4}$$

The effect of short-term debt on investment and short-term asset investment is significant in all years, but the effect is more prominent in default year -3 and default year -2. To visualize, we plot the regression coefficients of the default window for discretionary accruals and the performance-matched discretionary accruals in Figure 14. As the pattern found in investment and earnings management are also highest at default year -2 and at default year -3, suggesting a more severe short-term debt overhang before default. The reversion in earnings managements at default year -1 and default year -2 is somehow expected as the delayed reporting of the unreported accruals need to be fulfilled eventually, which may have induced a closer scrutiny by firm's creditors and caused the firms to default earlier. These results, taken together, testify that business being too fixated on the short-term could be related with short-term debt overhang.

Concluding remarks

In addition to its conventional role in sorting firms, short-maturity debt can also arise from the maturity rat race among creditors, a form of coordination problem defined by Brunnermeier and Oehmke (2013). When facing financial

distress, a borrower has an incentive to use more short-term debt from an individual creditor because it dilutes the claims and payoffs of the remaining creditors. This eventually causes all the creditors to run into a shorter maturity structure. The presence of a large number of short maturity debt users can be dangerous for an economy, especially when the economy is in its downturn, accompanied with debt market liquidity deterioration (e.g., Almeida *et al.* (2012), Duchin *et al.* (2010), Gopalan *et al.* (2014), Chen *et al.* (2013)).

This paper examines the relevance of maturity race based on a group of financially distressed Portuguese firms which fail to comply with their credit obligations for the first time. Our results suggest important maturity shortening before firm default. This finding remains robust using various specifications. The study also sheds some light on how excessive short-term debt drives firm's myopic behaviors. In particular, we find that short-term debt overhang encourages firms to be overly short-term oriented in their investment and operation decisions. To meet short-term targets imposed by repaying short-term debt, they continue to invest in short-term assets and engage in earnings management. To mitigate the concern that myopic behaviors and excessive short term debt might be driven by common factors, we used an event-study approach in this paper. Our rational is that as the default events spreaded out across time, it is less likely that the results will be driven by a specific shock. However, firm default is also more likely to occur during the financial crisis period. Future research might consider a cleaner design to address this issue.

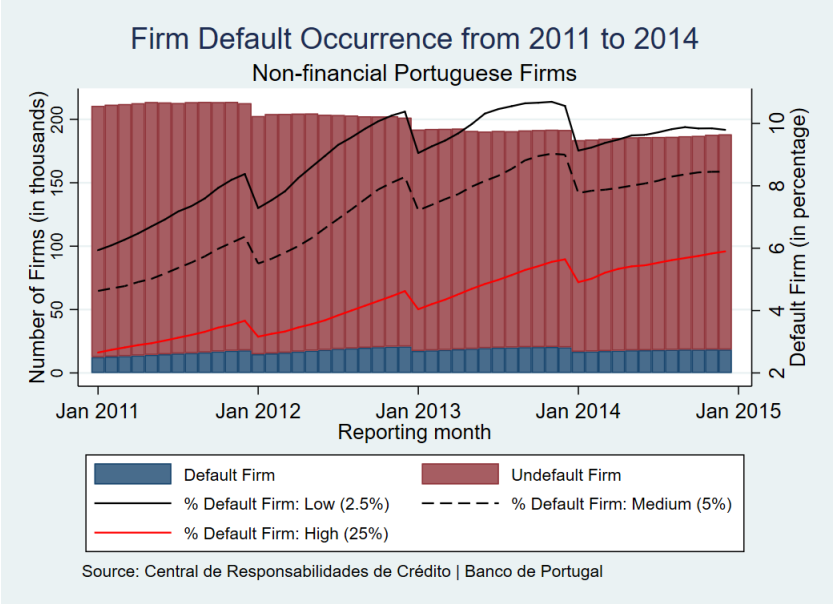

FIGURE 1: The occurrence of firm default from 2011 to 2014.

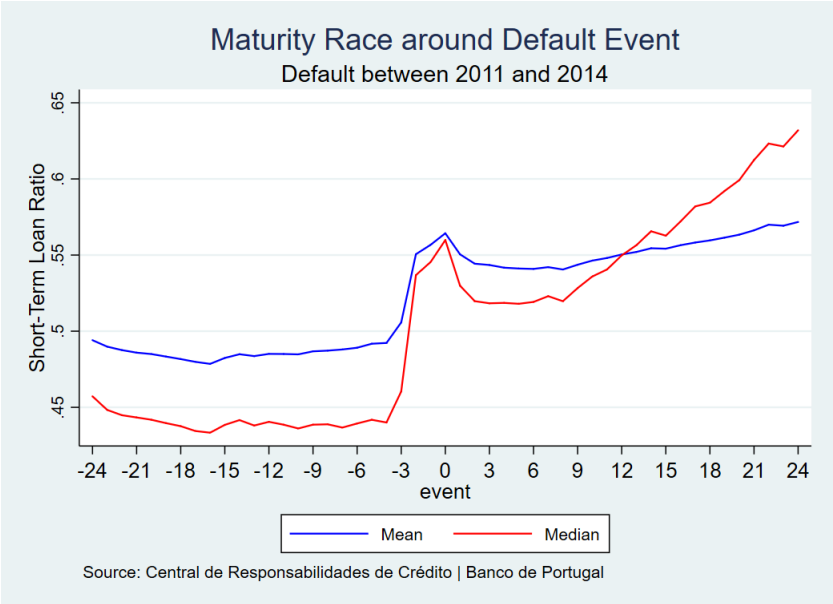

FIGURE 2: The evolution of short-term debt ratio around default.

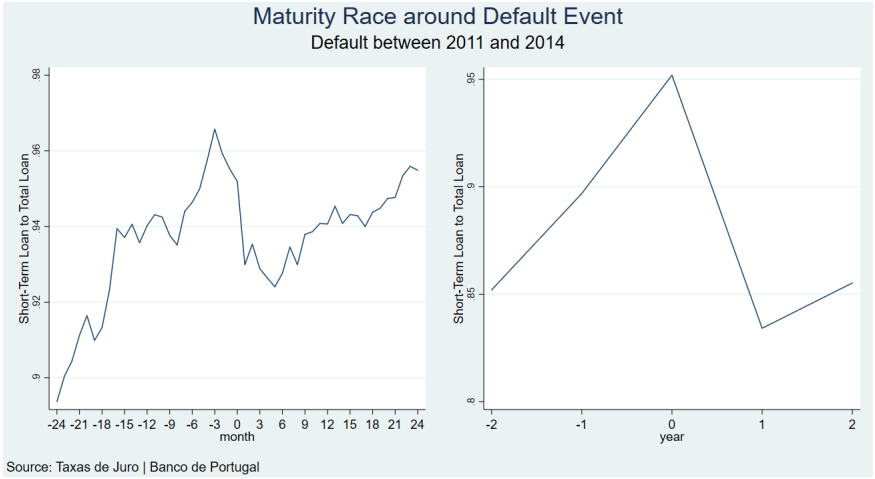

FIGURE 3: The evolution of short-term debt ratio for new loans around default.

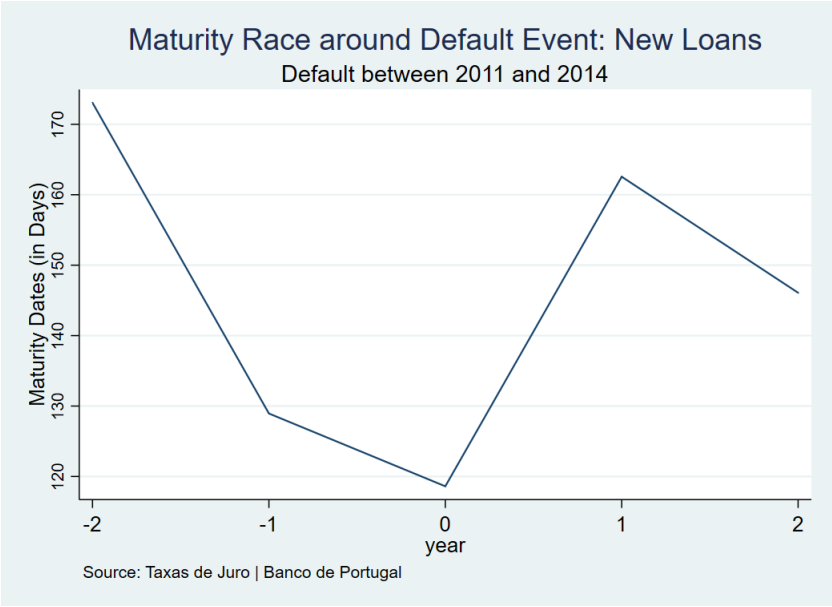

FIGURE 4: The evolution of time-to-maturity for new loans around default.

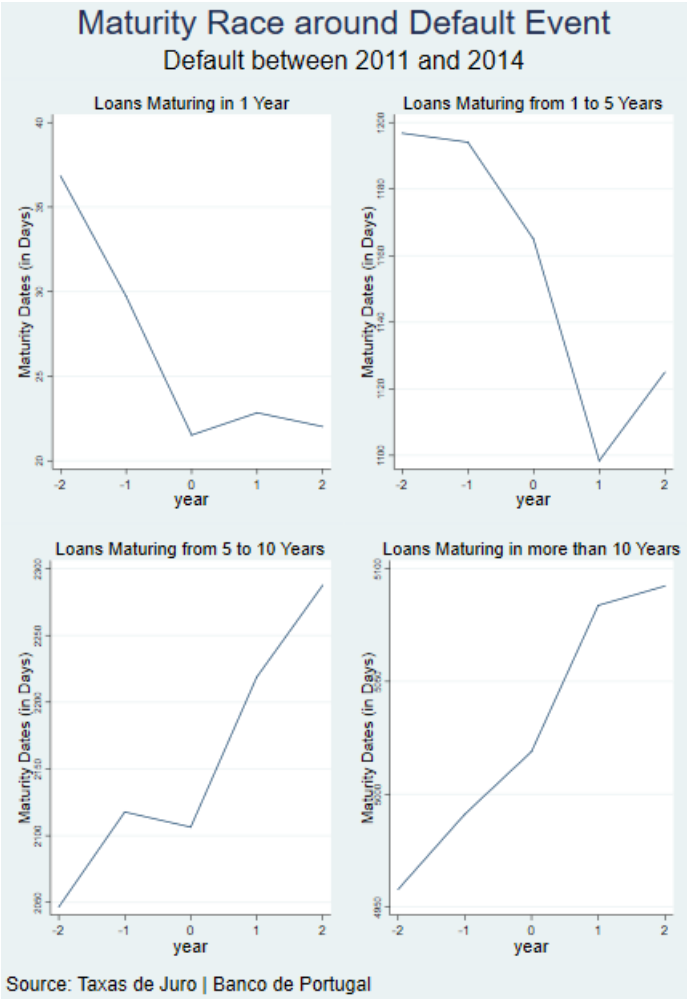

FIGURE 5: The evolution of time-to-maturity for new debt around default: subsample analyses by maturity class.

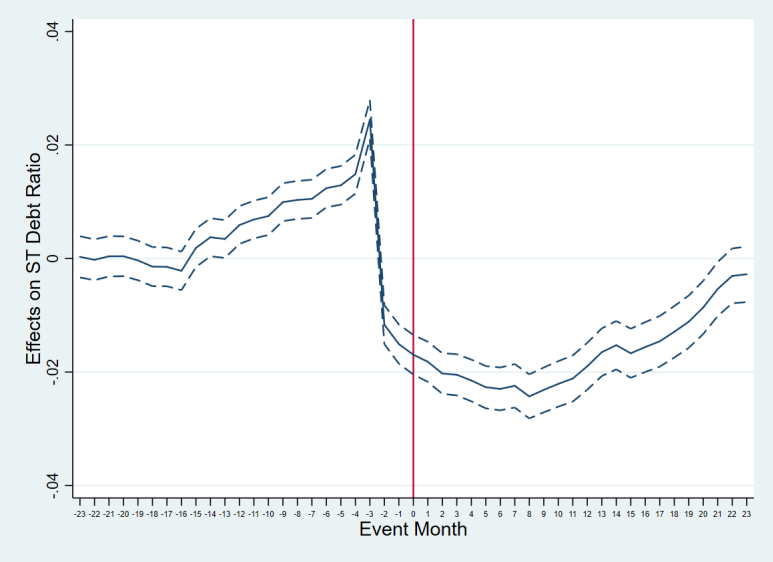

FIGURE 6: Estimated coefficients of ϖ_k, with the short-term debt ratio as the dependent variable.

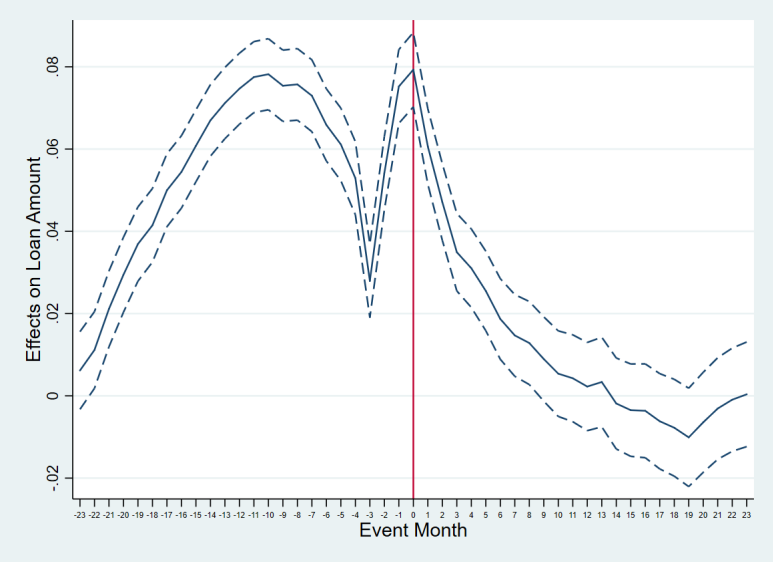

FIGURE 7: Estimated coefficients of ϖ_k, with the log amount of total credit as the dependent variable.

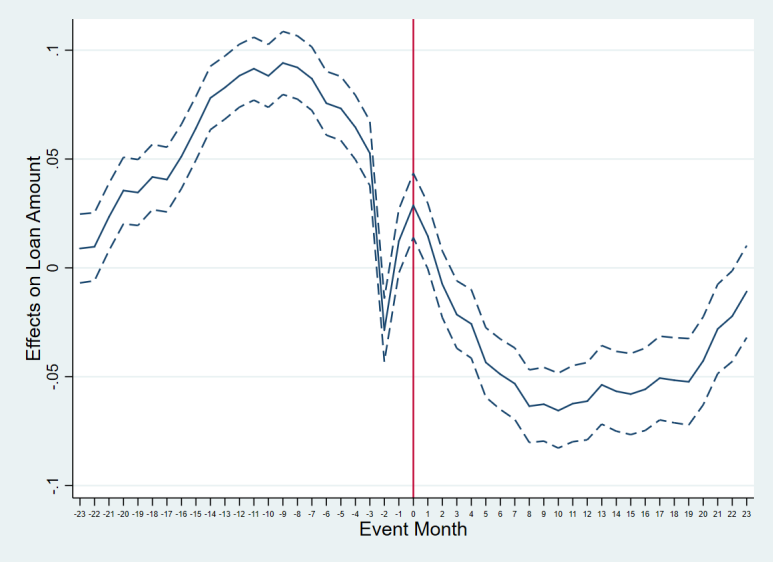

FIGURE 8: Estimated coefficients of ϖ_k, with the log amount of total short-term credit as the dependent variable.

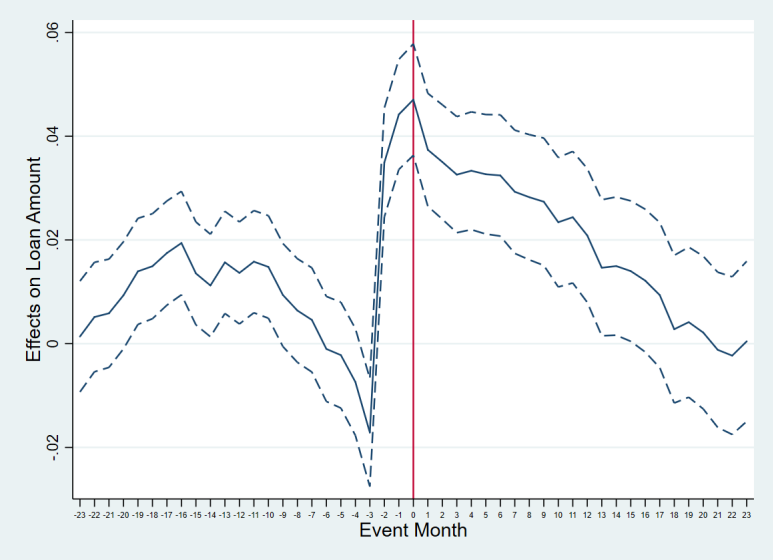

FIGURE 9: Estimated coefficients of ϖ_k, with the log amount of total long-term credit as the dependent variable.

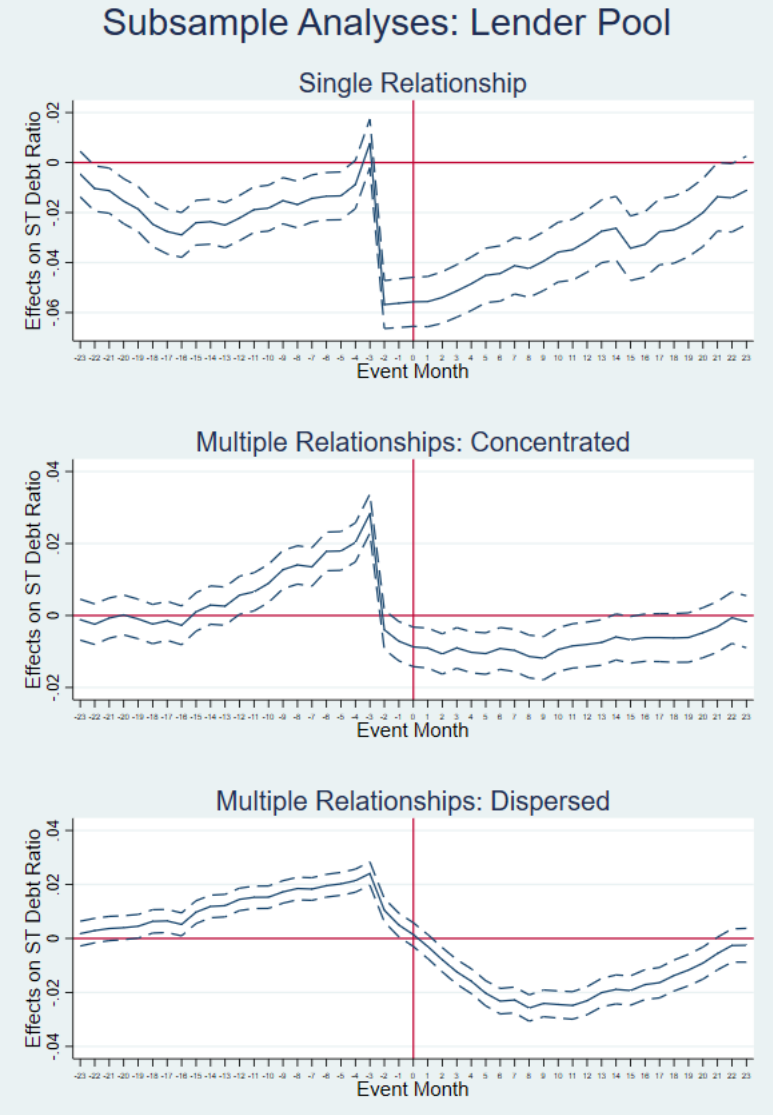

FIGURE 10: Subsample analyses of the estimates for ϖ_k by lender pool type, with the short-term debt ratio as the dependent variable.

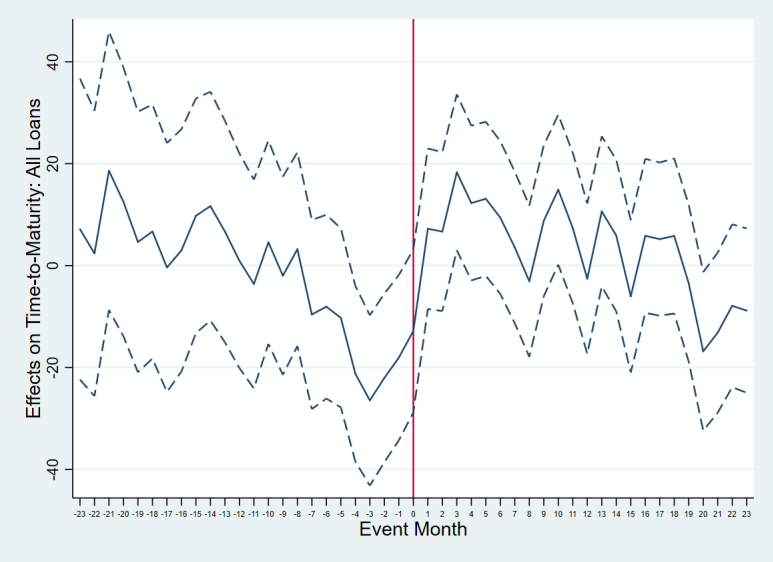

FIGURE 11: Estimated coefficients of ϖ_k for all loans, with time-to-maturity as the dependent variable.

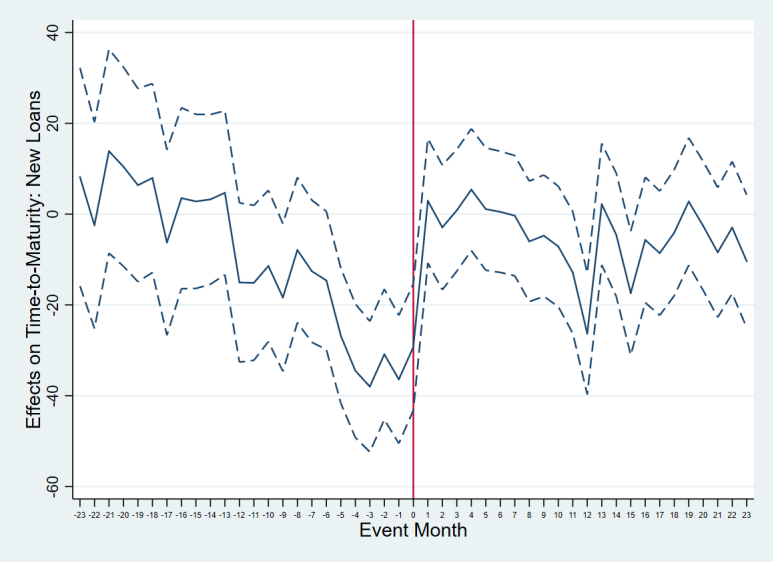

FIGURE 12: Estimated coefficients of ϖ_k for new loans, with time-to-maturity as the dependent variable.

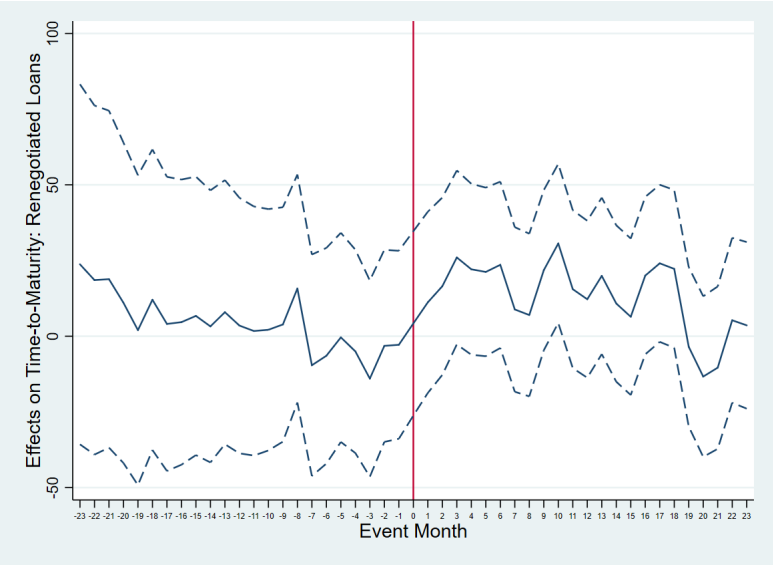

FIGURE 13: Estimated coefficients of ϖ_k for renegotiated loans, with time-to-maturity as the dependent variable.

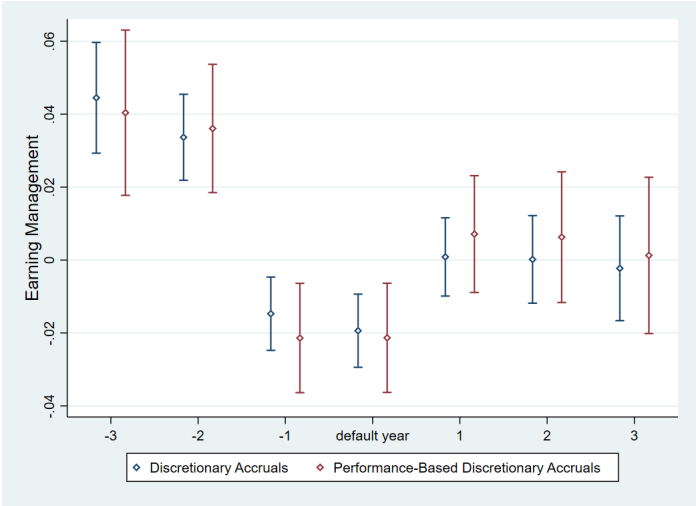

FIGURE 14: Estimated coefficients of ϖ_k , with the discretionary accruals and the performance-based discretionary accruals as the dependent variable.

TABLE 1. Variable definitions

Variables	Measurement
	Firm-Specific Variables
Age	The number of years elapsed since a firm's foundation year.
Size	The log value of a firm's total assets.
Profitability	The ratio of a firm's earnings before interest and tax to total turnover.
Leverage	The ratio of a firm's total liabilities to total assets.
Growth	The relative change in a firm's total number of employees.
Cash	The ratio of a firm's cash and bank deposits to total assets.
Current asset ratio	The ratio of a firm's total current assets to total assets.
Loss	A dummy variable which takes a value of 1 if a firm's net operating income is negative and 0 otherwise.
ST debt ratio	The ratio of a firm's total short-term credit to total credit outstanding. Short-term credit is defined as bank credit with a residual maturity of less than one year.
Overdue intensity	The ratio of a firm's total overdue credit to total credit.
Investment	The ratio of a firm's fixed tangible and intangible assets to total assets.
Investment: ST assets	The ratio of a firm's total current assets to the firm's fixed tangible and intangible assets.
Employment	The log value of a firm's number of employees.
Employment: unpaid	The ratio of a firm's unpaid employees to the firm's total number of employees.
Employment: part-time	The ratio of a firm's part-time employees to the firm's total number of employees.
Discretionary accruals	The difference between a firm's total accruals and the fitted normal accruals derived from a modified Jones model as in Fang et al. (2016).
Performance based discretionary accruals	A firm's discretionary accruals minus the corresponding discretionary accruals of a matched firm from the same fiscal year and CAE3 industry with the closest profitability (measured as a firm's earnings before interest and tax divided by the firm's total turnover).

Table 1 – continued

Variables	Measurement
	Bank-Firm Relationship Variables
Lender pool	The number of active bank relationships in a specific year.
Lender concentration	The concentration of bank relationships, calculated as the sum of the squares of the bank lending share in the spirit of the Herfindahl–Hirschman Index.
Relation duration	The number of months elapsed since the establishment of a bank-firm relationship.
New client	A dummy variable which takes a value of 1 if a loan is extended by a bank who just establishes the relationship with the borrower in the current year and 0 otherwise.
	Bank-Specific Variables
Bank size	The log value of a bank's total assets.
Market power	The share of a bank's credit extension to the credit extension by all the financial institutions.
Loan-to-deposit	The ratio of a bank's credit to deposits.
Credit growth	The annual change in a bank's total credit extension.
Bank current ratio	The ratio of a bank's current assets to current liabilities.
Domestic bank	A dummy variable which takes a value of 1 if the credit extension institution is located in Portugal and 0 otherwise.
Sovereign debt	The ratio of a bank's Sovereign credit to the bank's total assets.
Non-performing debt	The ratio of a bank's non-performing credit to total credit.
	Loan-Specific Variables
Renegotiation	A dummy variable which takes a value of 1 if a reported loan in the *New Credit Operations Database* corresponds to a renegotiated loan and 0 otherwise.
Collateral	A dummy variable which takes a value of 1 if a loan is secured by a collateral and 0 otherwise.
Past default	A dummy variable which takes a value of 1 if a loan is extended to a firm who has defaulted on the lending bank in the past three years and 0 otherwise.

	# Firms		Age		Size		Profitability		Leverage		Cash	
Default	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
2011	156 107	26 919	15.11	13.20	12.32	12.44	-0.11	-0.29	0.96	1.29	0.15	0.11
2012	152 346	22 294	15.52	13.86	12.28	12.35	-0.13	-0.44	1.00	1.51	0.15	0.11
2013	148 067	17 146	15.88	14.97	12.31	12.37	-0.10	-0.43	1.01	1.63	0.16	0.11
2014	148 124	13 289	15.92	16.34	12.30	12.44	-0.08	-0.42	1.05	1.72	0.16	0.11
	# Firms		Growth		Current ratio		ST debt ratio		Lender pool		Lender concentration	
Default	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
2011	156 107	26 919	0.04	0.00	0.70	0.70	0.58	0.52	2.47	3.73	0.73	0.60
2012	152 346	22 294	0.00	-0.08	0.70	0.69	0.57	0.50	2.34	3.47	0.75	0.63
2013	148 067	17 146	0.03	-0.06	0.71	0.69	0.57	0.52	2.32	3.35	0.76	0.65
2014	148 124	13 289	0.07	-0.01	0.70	0.68	0.55	0.52	2.35	3.23	0.75	0.67

TABLE 2. Characteristics of defaulted firms and non-defaulted firms

	Investment	Investment: ST asset	Employment	Employment: unpaid	Employment: part-time	Discretionary Accruals	Performance Based Discretionary Accruals
ST debt ratio	-0.036***	0.034***	-0.032***	0.003***	-0.033	0.005***	0.005***
	(-76.20)	(67.31)	(-31.90)	(9.66)	(-0.58)	(5.06)	(3.79)
Size	0.016***	-0.019***	0.222***	-0.015***	0.385***	-0.042***	-0.049***
	(37.06)	(-43.78)	(255.36)	(-57.06)	(7.70)	(-46.72)	(-35.51)
Profitability	-0.000	-0.000	0.040***	-0.006***	-0.030	0.001	-0.012***
	(-0.94)	(-0.52)	(77.01)	(-34.97)	(-0.97)	(1.38)	(-15.33)
Leverage	-0.005***	0.004***	0.003***	0.001***	0.034*	0.020***	0.022***
	(-30.88)	(27.12)	(9.88)	(13.60)	(1.87)	(31.19)	(22.13)
Growth	0.005***	-0.004***	0.177***	-0.006***	0.269***	0.000	0.001
	(14.14)	(-10.30)	(225.26)	(-25.54)	(5.97)	(0.33)	(0.96)
Cash	0.015***	-0.014***	-0.003	0.006***	-0.075	0.173***	0.145***
	(11.67)	(-10.37)	(-1.20)	(8.02)	(-0.49)	(59.31)	(32.49)
Loss	0.007***	-0.006***	-0.037***	-0.003***	-0.097*	-0.007***	0.049***
	(15.17)	(-13.47)	(-40.28)	(-10.55)	(-1.86)	(-9.06)	(38.45)
Current Ratio	-0.355***	0.411***	-0.012***	0.002**	0.255*	-0.051***	-0.059***
	(-283.38)	(311.82)	(-4.50)	(2.10)	(1.71)	(-19.97)	(-15.01)
Observations	1 301 308	1 315 541	1 318 938	1 269 878	952 602	416 163	416 163
Adjusted R^2	0.754	0.742	0.907	0.658	0.859	0.268	0.093

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE 3. The effect of short-term debt overhang: full sample

	Investment	Investment: short-term asset	Employment	Employment: unpaid	Employment: part-time	Discretionary Accruals	Performance Based Discretionary Accruals
ST debt ratio x [default year - 3]	-0.037***	0.037***	0.015*	0.003	-0.001	0.042***	0.038***
	(-6.05)	(6.03)	(1.69)	(1.07)	(-0.14)	(5.44)	(3.26)
ST debt ratio x [default year - 2]	-0.033***	0.033***	0.059***	-0.002	0.002	0.034***	0.036***
	(-6.47)	(6.40)	(8.25)	(-0.78)	(0.64)	(5.61)	(4.05)
ST debt ratio x [default year - 1]	-0.022***	0.020***	0.028***	-0.002	0.002	-0.013**	-0.019**
	(-4.81)	(4.51)	(4.45)	(-1.01)	(0.83)	(-2.48)	(-2.45)
ST debt ratio x default year	-0.017***	0.013***	-0.103***	0.009***	0.006**	-0.017***	-0.018***
	(-4.00)	(2.94)	(-16.96)	(5.25)	(2.40)	(-3.73)	(-2.60)
ST debt ratio x [default year + 1]	-0.026***	0.022***	-0.192***	0.018***	0.009***	0.004	0.012*
	(-5.72)	(4.68)	(-29.54)	(9.57)	(3.30)	(0.93)	(1.75)
ST debt ratio x [default year + 2]	-0.026***	0.019***	-0.165***	0.018***	0.016***	0.005	0.014*
	(-4.97)	(3.62)	(-22.31)	(8.45)	(5.12)	(1.00)	(1.70)
ST debt ratio x [default year + 3]	-0.019***	0.010	-0.147***	0.020***	0.017***	0.005	0.011
	(-3.07)	(1.59)	(-16.35)	(7.68)	(4.41)	(0.73)	(1.12)
Size	0.015***	-0.018***	0.208***	-0.018***	-0.017***	-0.042***	-0.042***
	(5.48)	(-6.91)	(56.20)	(-16.14)	(-10.54)	(-12.47)	(-8.30)
Profitability	-0.001	-0.000	0.047***	-0.007***	-0.007***	-0.004***	-0.011***
	(-0.74)	(-0.08)	(31.62)	(-14.82)	(-8.64)	(-3.59)	(-6.70)
Leverage	-0.008***	0.008***	0.008***	0.001***	0.001**	0.010***	0.013***
	(-11.46)	(10.89)	(7.84)	(3.68)	(1.97)	(6.19)	(5.40)
Growth	0.006***	-0.004**	0.200***	-0.008***	-0.002	0.003	-0.001
	(2.71)	(-2.04)	(68.02)	(-8.87)	(-1.53)	(1.21)	(-0.20)
Cash	-0.008	0.012	-0.098***	0.012***	0.016***	0.167***	0.143***
	(-0.89)	(1.37)	(-8.21)	(3.39)	(3.09)	(13.58)	(7.82)
Loss	0.012***	-0.012***	-0.063***	-0.003***	-0.002	-0.003	0.059***
	(5.02)	(-4.93)	(-18.67)	(-3.02)	(-1.06)	(-1.25)	(15.88)
Current ratio	-0.297***	0.345***	-0.003	0.016***	0.002	-0.055***	-0.076***
	(-39.44)	(45.55)	(-0.24)	(4.93)	(0.32)	(-6.29)	(-5.77)
Observations	130 752	132 548	132 830	123 458	88 200	39 906	39 906
Adjusted R^2	0.500	0.505	0.853	0.504	0.509	0.248	0.095

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE 4. The effect of short-term debt overhang: default sample

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