

Net working capital and tax liabilities as determinants of corporate credit risk

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Abstract

Liquidity and turnover indicators are usually found as relevant variables in corporate credit risk literature. However, these variables may reflect different firms' operational management and efficiency. This study intends to verify if the breakdown of net working capital and asset turnover into variables related with cash, activity indicators, investment and tax liabilities contains relevant information in determining firm's probability of bank credit default, controlling for other relevant variables. This study is based on a large dataset of Portuguese non-financial corporations. According to the results, these variables are relevant. In particular, we observe that firms that take longer to repay their suppliers, and firms whose purchases stay longer as inventories have associated higher probabilities of default. Moreover, we found a significant positive relation between firms' credit risk and the share of tax liabilities.

JEL classification: G21, G33, C25

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1 Introduction

The focus on corporate credit default has deserved a huge interest in the financial and banking literature. In the banking perspective, the asymmetric information in the credit market between entrepreneurs and lenders is critical. For credit risk management, it is crucial to analyse firm's financial position and identify its vulnerabilities in order to determine the price of a loan, and to decide about its approval (Stiglitz and Weiss (1981)). Afterwards a careful monitorization of firm's financial developments is also required, given its impact on banks' provision and impairment policies, as well as on capital requirements. Over the last years, there was a renewed interest about credit risk management and measurement supported by financial innovations, competition policies, and computational improvements. Additionally, under the Basel II Capital framework, banks were allowed to use internal credit risk models to determine their capital requirements. Thus, banks have developed several models to analyse firms' financial position, probability of default, and other credit risk parameters. More recently, the deterioration in the macroeconomic environment reinforced the relevance of a close monitorization of firm's financial position.

This study addresses corporate credit default, in the sense that it explores the relevance of some firm's characteristics in determining the probability of a bank loan default. In particular, this study intends to understand more deeply some aspects of financial position that were previously identified as relevant in determining firm's distress. Apart from the usual financial variables applied in the literature, related with profitability, leverage or firm's size, in this study we test the relevance of some variables underlying working capital and assets turnover, as these variables may reflect significant differences in firms' operational activity and efficiency. It also allows to analyse differences in firms' tax liabilities. Therefore, we investigate if working capital and assets turnover's components contain additional information regarding the probability of a bank loan default event. In this study we combine micro data for Portuguese firms from the Central Balance Sheet Data with information about credit status and banking relationships derived from the Central Credit Register, both databases available at Banco de Portugal. As these databases are quite exhaustive, this dataset allows a high coverage of banks' exposure to the corporate sector.

According to the results obtained, firm's working capital management and efficiency are relevant dimensions in determining the probability of default. The results obtained also highlight

the relevance of tax liabilities as an indicator of financial fragilities of a firm. Thus, these results suggest the relevance of a closer analysis of firm's operational activity as indicator of its financial strength. Moreover, they allow to identify tax liabilities as a relevant variable in the corporate credit risk analysis.

The study is organized as follows: section 2 briefly reviews related literature. A description of the data and variables, as well as some descriptive statistics are presented in section 3. Section 4 contains the econometric results, while section 5 presents some robustness specifications. Finally section 6 presents the main conclusions.

2 Related literature

Credit risk is related with the possibility of losses due to changes in the credit quality of counterparts. A relevant part of the literature on corporate credit risk has been related with modeling of default events, *i.e.* the failure of a firm to meet the commitments of credit contracts. Several alternative quantitative models have emerged.

For firms with public trade equity or debt, models can be classified as structural or reduced-form models (see Bielecki and Rutkowski (2002)), depending on the information available. Structural models focus on modeling and pricing credit risk of a firm, taking firms' asset value a critical role. One of the most popular structural model of firms' default was provided by Merton (1974). Accordingly to Merton's model, firm's equity is similar to a call option on the value of its assets, where the strike price is the value of liabilities. In this framework, default occurs when firm's asset value falls below the value of its liabilities.¹ In line with this model, the credit risk of a firm is essentially driven by the dynamics of its asset value and the respective volatility, taking the value of liabilities as given: the greater the value of the firm, and the smaller its volatility, the lower the probability of default. The number of standard deviations of assets' value is away from the default point is defined as distance-to-default.² Several studies have explored this model in determining the default probability of firms. One of the best known is Moody's - KMV model (Moody's (2004)). In turn, under reduced form models, firm's unobservable asset value process

¹In practice, default is distinct from bankruptcy which occurs when the firm is liquidated. Bankruptcy is based on a legal definition, and so it is a country-specific concept.

²Generally, distance-to-default (DD) is the distance between the firm's asset value in one year $E(V_1)$ and the default point (DTP) expressed in standard deviations of future assets returns:

$$DD = (E(V_1) - DTP)/\sigma_{V_1}$$

is not modeled and default events are specified in terms of some exogenous process.

Despite the attractiveness of these approaches, their implementation is limited by the availability of market information. This is an important issue for several European countries, as the fraction of listed firms or firms with access to debt markets is quite limited, and the fraction is even lower for companies that are traded regularly.³

Thus, a large part of empirical studies relies on more traditional approaches in order to identify the impact of idiosyncratic risk factors on the creditworthiness of firms. In particular, these studies intend to identify the contribution of some firms' financial indicators, mainly based on accounting data and other general firms' characteristics in determining a default event, even though they analyse the issue in different points of view, using different data and methodologies. Some studies, such as Demirovic and Thomas (2007), that combined simultaneously market and accounting data, found evidence that accounting variables were incrementally informative when added to a model with market measures.

The macroeconomic and financial environment has also been included in the empirical literature as a complement to firm-specific information on default modeling, given that average default frequency and individual default probabilities display comovement with macroeconomic and financial variables, which suggests that aggregate shocks can be a relevant driver of default. Duffie, Saita, and Wang (2007), Pesaran et al. (2006), and Bonfim (2009), for instance, confirmed that, besides idiosyncratic characteristics, macroeconomic environment variables improve the prediction of the probability of default.

The seminal empirical papers analysing the relevance of financial variables in identifying firms' default go back to the 60's with Beaver (1966) and Altman (1968). Beaver (1966) found that several ratios differed significantly between failed and viable firms, and observed that differences in common ratios between those groups of firms increased as the time to failure shortened. Using a set of some financial variables, Altman developed a weighed linear indicator to identify

³Given the constraints related with market data, some analysis go back to market information of comparable firms in order to estimate market assets value of non-listed firm. The market multiples approach allows to determine a firm's value based on the market's assessment of peers. This approach is based on public financial information of peers, on specialist analysis, and/or information disclosed to the market. Thus, this approach allows to estimate the market value of a non-listed firm based on market's assessment of other firms in the same business sector. However, multiples are influenced by the conditions observed in the market and by the characteristics of firms included in the set of analysed firms. Therefore, the criteria underlying the definition of this set of firms is crucial. It should be selected in order to minimize the difference between firms, taking into account operational activity, risk, economic and financial environment, as well as the legal and competition framework. The disadvantage of the market multiples is related to its dependence on the cyclical evolution of the capital markets, as well as the general environment of firms. Across several multiples approaches, the EBITDA multiple is often used, since it minimizes differences between firms. In particular, it avoids differences in the fiscal system, amortisation policies and capital structure.

distress and non-distress firms. The Altman's indicator, known as Z-score, has persisted in the literature as a benchmark.⁴

Over the last decades, empirical studies on corporate default were extensive. Despite no consensus in the literature regarding which variables should be considered as more relevant in modeling default events, a pattern among the variable selections suggest the importance of some main variables, even though not all used in each study. Regarding financial indicators, measures related with profitability, leverage, and liquidity are within those systematically found as relevant in determining firm's default. Other firms characteristics, such as size, age and business sectors were also highlighted in empirical researches (see for instance, Bunn and Redwood (2003), Benito, Delgado, and Pagés (2004), Lacerda and Moro (2008), and Bonfim (2009)). Some empirical literature also analysed the relevance of trade credit for firms' default, as well as firm-bank relationships.

Indeed, trade credit plays an important role in the external funding of firms across several countries. One of the main question in this subject is related with firm's choice between bank and trade credits, as trade credit is perceived as more expensive. The literature presents several arguments for their coexistence, related with financial and transaction factors, but also with the non-financial role of trade credit, such as price discrimination, warranty of product quality, or foster longer relationships with costumers, (e.g. Petersen and Rajan (1997)). On the financial literature, many studies emphasize that firms use trade credit because there are bank credit constraints (Petersen and Rajan (1994), Nilsen (2002), and Cuñat (2007)).⁵ These results are in line with the hypothesis of firms using other available forms of credit before trade credit as a source of financing, *i.e.* non-bank markets complement banks and public sources of borrowing by accommodating firms with the lower credit quality.⁶

According to the banking relationship literature, the relation firm-bank is crucial in mitigating asymmetric information, that is particularly important for smaller and younger firms, for which information is more scarce. A lending relationship may help to overcome this problem, as banks obtain firm's private information through repeated interaction (Diamond (1984)). Thus,

⁴The variables included in the Z-score index were: working capital/assets, retained earnings/assets, ebitda/assets, market-value-equity/assets and sales/assets.

⁵Cuñat (2007), for a panel of UK firms, found that trade credit is used at the margin, when other forms of credit have already been exhausted. Their results also suggest that the evolution of trade credit is related with the length of the commercial relationships, and that trade credit seems to be more prevalent when firms have lower levels of liquidity.

⁶Nevertheless, according to Biais and Gollier (1997) and Burkart and Ellingsen (2004), trade and bank credits can be either complements or substitutes, based on the fact that the suppliers may have a comparative advantage over banks in collecting information on firms, in assessing their creditworthiness, and in monitoring their actions.

the literature suggests that firms that borrow from a small number of banks or even concentrate the bulk of funding in a single relationship, and lasting it, tend to face lower financing constraints and get better credit conditions.^{7;8} However, a non-negligible fraction of firms present more than a single lending relationship. The stability and the efficiency of lending relationship is conditioned by several factors, such as firm's hold-up problems, market competition or banks' portfolio diversification (Carletti, Cerasi, and Daltung (2007)). The relation between the number of banking relationships and firm's credit quality has also been analysed, but the arguments are divergent. While some authors argue that the refusal of credit from a bank may send a negative signal to the market, thus making exclusive bank relationships undesirable, other authors found evidence that firms with lower quality tend to establish multiple relationships (e.g. Degryse and Ongena (2001), Farinha and Santos (2002), and Fok, Chang, and Lee (2004)).

Regarding Portuguese corporate credit risk, there are also some studies analysing firms' default. Antunes, Ribeiro, and Antão (2005) estimated the probability of default of non-financial corporations using data related with bank loans, firms' business sector and the macroeconomic environment. In Soares (2006) and Bonfim (2009), the analysis were based on micro data. Soares (2006) intended to estimate a syntectic indicator to identify potential distress situations. In this study, based on discriminant analysis, the financial ratios selected were related with leverage, funding structure of assets, liquidity and profitability. Accordingly to Bonfim (2009), profitability, solvency, liquidity, investment path and sales were relevant in determining the probability of default. Additionally, as mentioned previously, she also found that the inclusion of macroeconomic developments improved the econometric results. Lacerda and Moro (2008) analysed Portuguese firms's default exploring three alternative techniques, namely logistic regressions, discriminant analysis and support vector machines (SVM). They found that SVM was particularly relevant in capturing non-monotonic dependence of the probability of default from some variables. However, besides this finding, the three methods identified several common predictors of firm's default. Indicators related with cost structure, liquidity, activity, leverage, as well as interest over debt ratio, credit lines over debt ratio, accounts payable over sales and the size seem to be relevant for firms' default. Variables related with the number of banking relationships

⁷For instance, an increase of the number of lending relationships decreases the amount of credit (Petersen and Rajan (1994)), Cole (1998)) and Harhoff and Korting (1998)), while longer relationships increase the availability of credit (Petersen and Rajan (1994), Harhoff and Korting (1998)), and decrease collateral requirements (Harhoff and Korting (1998), and Berger and Udell (1995)). However, regarding interest rates the empirical evidence is mixed (e.g. Berger and Udell (1995), Petersen and Rajan (1994), Bonfim, Dai, and Franco (2008)).

⁸Boot (2000) and Ongena and Smith (1998) review the first wave of the literature on banking relationship, while Berger and Udell (2006) discuss the role of banking relationships in more recent financial framework, given the transformation observed in the financial industry over the last years.

and the median employment length also revealed to be important for firm's default. Bhimani, Gulamhussen, and Lopes (2010) also identified the relevance of some of above mentioned ratios, and also highlighted the relevance of non-financial variables.

3 Data and variables

3.1 Data sources

The empirical analysis performed in this study is based on the annual information of the Central Balance Sheet Database (CB), Central Credit Register (CRC), both available at Banco de Portugal, and Quadros de Pessoal (QP).

The CB contains financial information, based on balance sheet and profit and losses account, as well as some firms' characteristics, such as the economic activity sector, and the date of set up. Since 2006, instead of a voluntary survey, the annual CB is based on Simplified Corporate Information (Informação Empresarial Simplificada - IES), which is a joint project of Bank of Portugal, Ministry of Justice, Ministry of Finance and the Portuguese Institute of Statistics. IES also contains financial and non-financial information, as previously reported in the survey approach, but it covers the entire Portuguese corporate sector.⁹ In turn, the CRC contains information regarding the credit granted by a financial institution operating in Portugal above 50 euros. This database, which is mandatory and reported on a monthly basis to Banco de Portugal, contains the total outstanding amount of loans, unused credit lines, and information regarding credit overdue. Thus, the CRC contains nearly all the credit exposures of the banking system to Portuguese firms.¹⁰ Finally, the QP database was used to complement information regarding firm's employees.

In order to explore IES information, that allows a large coverage of the Portuguese corporate sector and simultaneously avoid eventual sample bias that voluntary surveys may induce (in particular for firms with better financial position), the period under analysis is limited from 2006 up to 2009.¹¹ Additionally, some selection criteria were imposed. Firstly, the financial

⁹IES is an electronic submission of information of accounting, fiscal and statistical nature that companies have usually to submit to the Ministry of Justice, the Ministry of Finance, Statistics of Portugal and the Banco de Portugal. Thus, instead of companies to report nearly the same information to the different public entities in different moments in time and in different formats, as it happened until 2006, they do it once to the mentioned system. As all firms have to submit the report, IES allows a high coverage of the Portuguese corporate sector by the CB of Banco de Portugal.

¹⁰For further details on the CRC and IES databases, see Banco de Portugal's Booklet No 5 and the Supplement of the Statistic Bulletin 1/2008, respectively.

¹¹As mentioned, IES started in 2006, but for the main element of financial statements, data regarding the

sector and public administrations were excluded, as well as observations with misreported data for total assets, business volume, number of employees, and age. Furthermore, firms with less than 5 employees were also ruled out. Then, observations with extreme values for some variables included in the analysis were excluded (1 per cent of the tails of the respective distributions), which allows to remove outliers and the most extremely misrecorded data. After these steps, the dataset comprises around 230 700 observations, which was used in the empirical analysis.

3.2 Determinants of firms' default

As mentioned previously, in this study we intend to analyse if some elements underlying working capital and assets turnover contain relevant information in determining the probability of default of a firm. Simultaneously, firm's business risk also plays a role in the analysis, according to structural models, where volatility is one of the key elements. Other relevant firms' characteristics and macroeconomic developments were also controlled for, given their relevance in determining a default event, as shown in empirical literature. Moreover, following the banking relationship literature, firm's relationship with the banking system is also included. In general, we have:

$$\begin{aligned}
 Prob(Defaul\textit{t}_{i,t}) = f(\textit{working capital and turnover components}_{i,t}; \\
 \textit{other characteristics}_{i,t}; \textit{banking relationships}_{i,t}; \\
 \textit{business risk}_i; \textit{macroeconomic environment}_t)
 \end{aligned}
 \tag{1}$$

In this study, a default event occurs when a firm has bank credit overdue at least longer than three consecutive months, evaluated at the end of the year, and higher than 500 euros.¹²

Working capital (WORKING CAPITAL), defined as the ratio of current assets net of current liabilities over total assets, is a relevant indicator in the financial analysis of a firm as it represents operating liquidity. Debt holders are usually concerned with firm's liquidity, as they are concerned with ongoing payments, besides the payment of the initial investment. Previous studies identified liquidity as a relevant variable in determining default events, with a negative coefficient (e.g. Altman (1968) and Bhimani, Gulamhussen, and Lopes (2010)). However, previous year was also required. Given this fact, for some variables, data for 2005 was also used.

¹²Note that a default event corresponds to a delay in the payment of the installment and/or the reimbursement of the principal at the debt maturity. It does not imply necessarily a bankruptcy event.

the working capital ratio requires a careful analysis. For instance, an increase of the working capital ratio may contribute to minimize stock-out events or even stimulate sales (by credit to customers). However, an increase of this indicator may also imply that money is tied up in inventory or money that customers still owe and so the firm cannot use it to pay off any of its commitments. So, an increase in working capital ratio may have underlying negative developments in firm's financial health. In turn, assets turnover (TURNOVER) indicates how the firm uses its assets in its business. A high volume of sales into total assets means that the firm takes advantage of its investments.

Therefore, in this study, working capital and assets turnover are decomposed in some variables related with cash, accounts receivable, accounts payable, inventory, and investment turnover in order to identify firm's operational fragilities that may induce firm's default. Additionally, we also include the share of tax liabilities in the analysis (TAX LIABILITIES). In this line, Bernhardsen and Larsen (2007) included trade accounts payable and unpaid taxes in the extended version of a model to analyse bank's credit risk exposures to the corporate sector, in addition to other financial ratios, age, size and industry classification.

Other firms' characteristics include accounting and non-accounting variables, in line with the empirical literature. Regarding the former, the analysis include measures related with leverage (LEVERAGE), sales growth (SALES GROWTH), interest coverage by earning before interest, depreciation and amortization (ebitda)(INTEREST COVERAGE), as well as the coverage of total liabilities (DEBT COVERAGE). The coverage variables allow to analyse firms' ability to repay capital and interests through the ongoing operational income.¹³ According to ebitda multiple approach, the coverage of firm's liabilities by ebitda can be seen as a proxy for the coverage of debt by firm's market value, for firms in the same business sector. Firm's dimension was also included, based on the natural logarithm of real total assets (SIZE). Taking into account non-accounting information, age (AGE) and changes in the number of total employees (CHANGE EMPLOYEES) were included. Furthermore, firm's economic business sector was also controlled for, given that financial ratios should be assessed in conjunction with the nature of the firm and the market in which it operates.

In turn, the proxy for business risk was the volatility of cashflow over total assets (SD CASHFLOW). Banking relationships variables include the number of total relationships, defined

¹³In order to avoid potential collinearity between the regressors, a direct measure of profitability was not included in the specifications. Indeed, in the correlation matrix included in the Annex section, we can observe that DEBT COVERAGE and INTEREST COVERAGE were highly correlated with profitability, measured by operational returns over total assets (ebitda/total assets).

at the banking group level and taking into account the weight of each banking group in firm's total bank debt (BANKING RELATIONSHIPS). Under this scope, the analysis also included the absolute change in the total number of independent banking relationships over the year (CHANGE BANK RELATIONSHIP), as well as the availability of unused credit lines (CREDIT LINE). Finally, regarding the economic environment, time dummies variables were included, or alternatively GDP year-on-year growth rate (GDP) and average interest rate applied on loans to non-financial corporations (INT RATE). Table I in the Annex section briefly describes each variable.

3.3 Descriptive statistics

This section presents some summary statistics of the dataset used in this study, including a breakdown by default and non-default firms and by firms' dimension (based on the recommendation of European Commission).¹⁴ In Table 1, we observe that the fraction of micro and small firms corresponds to a high share of the dataset used in this study, around 90 per cent. In turn, the fraction of default events is small in the total sample, as well as in each dimension class. In general, there is a gradual increase of this percentage over the sample period, which is in line with macroeconomic and financial developments, and supports the cyclicity of default events.

Table 1: Sample summary

Year	Total		Micro		Small		Medium		Big	
	# Obs.	% default	# Obs.	% default	# Obs.	% default	# Obs.	% default	# Obs.	% default
2006	58 540	1.9	27 700	1.9	25 782	1.8	4 357	2.2	701	2.0
2007	59 627	2.1	27 923	2.0	26 472	2.1	4 489	2.3	743	3.9
2008	58 209	2.5	27 382	2.6	25 793	2.5	4 327	2.1	707	1.4
2009	54 354	3.0	25 629	2.9	24 068	3.0	4 014	3.1	643	3.0
Average	57 683	2.4	27 159	2.3	25 529	2.4	4 297	2.4	699	2.6
Total	230 730		108 634		102 115		17 187		2 794	

The differences between default and non-default firms are illustrated in Table 2, which presents some descriptive statistics for the two groups of firms. It is noteworthy that the sample mean of the two groups for the analysed variables are statistically different, according to the

¹⁴According to the European Commission Recommendation of 6 May 2003 (2003/361/EC), micro firms are defined as those with fewer than 10 employees and less than 2 million euro of business volume or total assets; small firms are those with fewer than 50 employees and less than 10 million euro of business volume or total assets; medium firms are those with fewer than 250 employees and a business volume below 50 million euros or whose total assets is lower than 43 million euros. All remaining firms are considered large firms.

Welch test.¹⁵ Thus, firms that do not fulfill their credit commitments seem to present some particular characteristics.

Default firms present lower levels for working capital and assets turnover in comparison to non-default firms. They also present lower coverage of liabilities and interest by ebitda, sales growth and employees changes. Moreover, they show lower levels of cashflows and higher volatility. In turn, default firms present significantly higher leverage ratios. Note that the leverage ratio for the percentile 25 of default firms is close to the percentile 50 of non-default firms. Regarding bank lending relationships, default firms present a lower concentration of total debt, which means that these firms tend to establish more banking relationships than non-default firms.

Regarding the main components of working capital and assets turnover variables, default firms present higher levels for accounts payable, accounts receivable and inventories indicators. In turn, default firms show lower investment turnover and cash ratio. Finally, default firms present a significantly higher proportion of tax liabilities over total assets.

Given the potential difference of some of these variables by firm's size, Table 3 presents the mean and median values of some variables for each dimension group. A positive relation is generally observed for working capital, while there is some stability regarding assets turnover. Concerning activity indicators, there is a negative relation for inventories and accounts payable, while for accounts receivable the relation is not monotonic. In turn, investment turnover seems to present a U-shape relation with firms' dimension. The same path applies for the coverage of interest by ebitda. A negative relation is found between firms' size and leverage, tax liabilities, cashflow volatility as well as weighted bank relationships. In turn, debt coverage and sales growth show a positive relation with firms' size.

¹⁵The Welch test estimation takes into account eventual differences in variance between the two groups.

Table 2: Descriptive statistics: Non-default vs default firms

Panel A - Non-default firms							
	mean	sd	p10	p25	p50	p75	p90
WORKING CAPITAL	0.19	0.42	-0.32	-0.04	0.19	0.45	0.71
TURNOVER	1.42	0.99	0.50	0.78	1.18	1.77	2.59
ACCOUNT PAYABLES	0.29	0.27	0.03	0.10	0.22	0.38	0.60
ACCOUNT RECEIVABLES	0.23	0.23	0.00	0.03	0.18	0.34	0.51
INVENTORIES	0.36	0.65	0.00	0.03	0.14	0.38	0.88
CASH & EQUIVALENTS	0.28	0.60	0.01	0.02	0.08	0.26	0.69
INVESTMENT TURNOVER	16.46	42.28	1.19	2.44	5.46	13.31	32.99
TAX LIABILITIES	0.05	0.07	0.01	0.01	0.03	0.06	0.11
SOCIAL SEC. LIABILITIES	0.00	0.02	0.00	0.00	0.00	0.00	0.00
DEBT COVERAGE	0.20	0.32	-0.03	0.06	0.13	0.26	0.50
INTEREST COVERAGE	145.26	15625	-0.84	1.62	3.93	10.17	27.47
LEVERAGE	0.74	0.27	0.40	0.58	0.75	0.88	0.98
SALES GROWTH	0.01	0.27	-0.28	-0.12	0.00	0.12	0.30
CASHFLOW RATIO	0.07	0.12	-0.03	0.02	0.06	0.12	0.19
SD. CASHFLOW	0.06	0.07	0.01	0.02	0.04	0.08	0.14
CHANGE-EMPLOYEES	0.03	0.19	-0.17	-0.08	0.00	0.10	0.23
BANKING RELATIONSHIPS	0.71	0.27	0.34	0.49	0.72	1.00	1.00
CHANGE_BANK_RELATIONSHIP	0.21	0.84	-1.00	0.00	0.00	1.00	1.00
CREDIT LINE	0.67	0.47	0.00	0.00	1.00	1.00	1.00
SIZE	13.32	1.42	11.64	12.34	13.19	14.14	15.17
AGE	2.48	0.84	1.39	1.95	2.56	3.09	3.47
Panel B - Default firms							
	mean	sd	p10	p25	p50	p75	p90
WORKING CAPITAL	0.03	0.45	-0.55	-0.23	0.04	0.30	0.61
TURNOVER	0.86	0.71	0.28	0.44	0.68	1.05	1.59
ACCOUNT PAYABLES	0.58	0.45	0.08	0.25	0.49	0.80	1.22
ACCOUNT RECEIVABLES	0.33	0.31	0.00	0.06	0.26	0.49	0.78
INVENTORIES	0.51	0.91	0.00	0.02	0.17	0.56	1.41
CASH & EQUIVALENTS	0.12	0.29	0.00	0.01	0.02	0.09	0.33
INVESTMENT TURNOVER	11.93	37.94	0.63	1.25	2.86	7.64	21.50
TAX LIABILITIES	0.13	0.14	0.01	0.03	0.07	0.18	0.33
SOCIAL SEC. LIABILITIES	0.03	0.06	0.00	0.00	0.00	0.03	0.12
DEBT COVERAGE	0.07	0.20	-0.12	-0.02	0.06	0.13	0.23
INTEREST COVERAGE	23.83	795	-3.87	-0.45	1.45	3.39	8.26
LEVERAGE	0.92	0.28	0.62	0.76	0.88	1.00	1.25
SALES GROWTH	-0.13	0.35	-0.57	-0.33	-0.12	0.05	0.26
CASHFLOW RATIO	0.00	0.14	-0.16	-0.05	0.02	0.06	0.13
SD. CASHFLOW	0.08	0.09	0.01	0.03	0.05	0.10	0.18
CHANGE-EMPLOYEES	-0.05	0.21	-0.29	-0.17	-0.06	0.00	0.20
BANKING RELATIONSHIPS	0.58	0.25	0.28	0.38	0.52	0.80	1.00
CHANGE_BANK_RELATIONSHIP	0.02	0.99	-1.00	0.00	0.00	0.00	1.00
CREDIT LINE	0.60	0.49	0.00	0.00	1.00	1.00	1.00
SIZE	13.60	1.37	12.05	12.68	13.42	14.37	15.43
AGE	2.45	0.78	1.39	1.95	2.48	3.00	3.43

Note: "sd" stands for standard deviation; while p10, p25, p50, p75, p90 stand for, respectively, the percentile 10, 25, 50, 75 and 90 of the distribution of each variable.

Table 3: General statistics description by firm's dimension

	Micro		Small		Medium		Large	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
WORKING CAPITAL	0.16	0.17	0.21	0.20	0.22	0.20	0.20	0.18
TURNOVER	1.42	1.16	1.41	1.18	1.39	1.17	1.38	1.19
ACCOUNT PAYABLES	0.30	0.21	0.30	0.24	0.27	0.23	0.23	0.20
ACCOUNT RECEIVABLES	0.21	0.15	0.25	0.21	0.24	0.22	0.21	0.19
INVENTORIES	0.42	0.16	0.32	0.13	0.25	0.14	0.21	0.12
CASH & EQUIVALENTS	0.30	0.09	0.26	0.08	0.21	0.05	0.23	0.04
INVESTMENT TURNOVER	18.51	5.68	14.49	5.27	13.48	4.64	18.22	5.03
TAX LIABILITIES	0.06	0.03	0.05	0.03	0.04	0.02	0.03	0.02
LEVERAGE	0.77	0.78	0.72	0.74	0.69	0.71	0.67	0.69
DEBT COVERAGE	0.19	0.12	0.21	0.13	0.23	0.14	0.28	0.16
INTEREST COVERAGE	106.4	5.7	94.9	5.6	122.9	5.2	223.3	6.2
SALES GROWTH	-0.01	-0.01	0.01	0.00	0.02	0.01	0.03	0.02
CASHFLOW RATIO	0.06	0.06	0.07	0.06	0.07	0.06	0.08	0.07
SD CASHFLOW	0.07	0.04	0.06	0.04	0.05	0.03	0.04	0.03
CHANGE-EMPLOYEES	0.00	0.00	0.05	0.00	0.04	0.00	0.04	0.01
BANKING RELATIONSHIPS	0.78	0.89	0.67	0.63	0.52	0.46	0.50	0.42

4 Econometric analysis

4.1 Econometric approach

The econometric approach in this study relies on a binomial logit model. The dependent variable, $d_{i,t}$, is a dummy variable that takes the value one if firm i , in period t , presents a credit default event, and zero otherwise. To the extent that this variable is related to another latent unobserved random variable, $d_{i,t}^*$, which can be defined as:

$$d_{i,t}^* = \alpha + x'_{i,t}\beta + z'_t\delta + \varepsilon_{it}$$

where ε_{it} conditional on $(x_{i,t}; z_t)$ follows a logistic distribution, and if we have that $d_{i,t} = 1$ if $d_{i,t}^* > 0$, and zero otherwise, we get:

$$\begin{aligned}
\text{Prob}(d_{i,t} = 1 | x_{i,t}; z_t) &= \text{Prob}(d_{i,t}^* > 0 | x_{i,t}; z_t) \\
&= \text{Prob}(\varepsilon_{it} > -(\alpha + x'_{i,t}\beta + z'_t\delta)) \\
&= 1 - F(-(\alpha + x'_{i,t}\beta + z'_t\delta)) \\
&= F(\alpha + x'_{i,t}\beta + z'_t\delta)
\end{aligned}$$

where, $Prob(d_{i,t} = 1|x_{i,t}; z_t)$ is the probability of default of the firm i , and $F(\cdot)$ is the cumulative probability function of ε .

The variable $d_{i,t}^*$ can be interpreted as a function of the firm's losses, such that if this function is greater than zero (or if the losses exceed a given threshold) the company defaults. As shown above, the probability of default is considered to be a function of firm's characteristics ($x_{i,t}$), and some common factors to all firms (z_t).

The logit model uses the maximum likelihood methodology and the characteristics of firms that have survived and failed to efficiently determine the optimal weight of each explanatory variable in an index of likelihood of failure, which is then mapped into a probability between 0 and 1. The model estimated was based on unbalanced panel data, with random effects.

4.2 Do activity indicators and tax liabilities contain relevant information?

The analysis of data carried out previously shows a significant difference in the operational management and efficiency between default and non-default firms. In this section, we intend to corroborate some of these findings throughout some econometric regressions. For this purpose, we focus on new episodes of default, *i.e.* we exclude from the dataset firms that recorded default events in two consecutive years.¹⁶

We begin by presenting the results for a baseline specification with working capital and assets turnover as explanatory variables. The results are shown in models 1 and 2 of Table 4. We observe that working capital is statistically significant with a negative coefficient, meaning that firms with higher liquidity tend to present lower default probabilities. Assets turnover also presents a negative and statistically significant coefficient. Thus, firms that present higher operational efficiency have associated lower default probabilities.

Regarding the other firm's characteristics, leverage shows a positive coefficient, in line with the results observed in the literature (e.g. Bonfim (2009), Bhimani, Gulamhussen, and Lopes (2010), Bunn and Redwood (2003), and Benito, Delgado, and Pagés (2004)), which suggests that firms whose assets are highly financed by external funding present a higher probability of default. Coverage of debt by ebitda shows a negative and statistically significant impact on default probability. In turn, interest coverage is not statistically significant. A negative coefficient was found for sales growth, which seeks to capture corporate potential growth.¹⁷ Employees

¹⁶This hypothesis implied the exclusion of around of 1 500 observations.

¹⁷As mentioned, sales growth is related with firm's growth opportunities. However, high growth rates may

changes, which may be more deeply related with firm's growth, shows a similar relation. These results suggest that firms with higher growth opportunities tend to show lower probability of default.¹⁸ Corporate size, measured by real total assets, shows a positive and statistically significant coefficient. As larger firms are typically less risky, this result is somewhat counterintuitive. However, some studies also found a positive relation between default and firm's size (e.g. Bonfim (2009), Bhimani, Gulamhussen, and Lopes (2010), and Benito, Delgado, and Pagés (2004)). In turn, age shows a negative and statistically significant coefficient, which means that younger firms present higher probability of default. As far as bank relationships are concerned, firms that have available unused credit lines tend to present lower default probabilities. In turn, the weighted number of banking relationships presents a negative coefficient, which indicates that firms with higher concentration of bank debt also present lower default probability (in line with Lacerda and Moro (2008)). However, regarding the dynamics of the total number of lending relationships in each year, we found that firms that increase the number of these relationships show a lower probability of default. The business risk, measured by the volatility of cashflow over total assets, shows a positive and statistical significant coefficient, *i.e.* firms whose cash flows are more volatile have associated higher probabilities of default.

In turn, in line with the literature that shows the relevance of controlling for global developments discussed above, time dummies were also included. These variables are all statistically significant and jointly relevant to the model, supporting the contribution of systemic factors in determining default events. According to these variables, the progressive deterioration in the macroeconomic and financial environment observed in the sample period had a negative impact on default probability. Therefore, common factors related to macroeconomic conditions have impact on the probability of company default in addition to firm-level characteristics. If we try to disentangle the time variables in some relevant economic drivers, despite the short period under analysis, we observe that the probability of default decreased with the GDP growth but increases with the average interest rate applied on bank credit granted to non-financial corporations (model 2).¹⁹

Finally, as mentioned previously, all the specifications included business sector dummies, reflect an excessive risk taking. This argument suggests that strong sales growth rates can be positively related with firms distress. However, the analysis of the impact of different percentiles of the sales growth distribution does not suggest this situation, *i.e.* there is a monotonic impact of sales growth on default probability.

¹⁸It should be noted that, even though sales growth and employees changes may be both related with firms' growth opportunities, the correlation between these variables is not high, as can be seen in the correlation matrix presented in the Annex section.

¹⁹The hypothesis of equality of GDP growth and average interest rate's coefficients was rejected by statistical tests.

given the structural difference between sectors. The coefficients of these variables are not presented in tables for simplicity. Even though they were not all individually significant, the relevance of their inclusion in the regressions was confirmed by statistic tests.²⁰

The remaining models of Table 4 present the results for the specifications where working capital and assets turnover are replaced by variables related with cash ratio, accounts receivable, accounts payable, inventories, investment turnover and tax liabilities.

We observe that accounts payable, accounts receivable, and inventories are all statistical significant and present positive coefficients. Therefore, these results suggest that firms that take longer to repay their suppliers, firms that wait longer to receive from their customers, and firms whose purchases stay longer as inventories, have associated higher default probabilities. In turn, firms with higher proportions of cash present lower probability of default. This result is in line with the empirical literature of determinants of credit default (such as Benito, Delgado, and Pagés (2004), Lacerda and Moro (2008)).²¹ Investment turnover also presents a negative and statistically significant coefficient. Finally, the share of tax liabilities presents a positive and statistically significant coefficient. Hence, taxes liabilities seem to be a relevant indicator in the analysis of the probability of default. The remaining variables included as regressors preserve the results discussed previously.

Comparing the specifications, those including the breakdown of working capital and assets turnover seem to improve the general performance of the baseline model. In particular, the coefficient related with taxes liabilities is strongly significant. These results suggest that this variable is closely related with firm's financial fragility and its probability of default.

²⁰Note that the objective of the current analysis was to identify the relevance of some variables of firm's financial positions in determining the probability of default. The objective was not to estimate the probability of default firm-by-firm. If this was the case, and given the mentioned relevance of business activity in determining firm's specific features, it would be relevant to perform the analysis sector-by-sector in order to get specific coefficients for each variable in each business sector.

²¹Nevertheless, it should be noted that Acharya, Davydenko, and Strebulaev (2012) argue that an increase in cash holdings may induce higher risk in medium/long run. The authors claim that riskier firms may choose to hold higher cash reserves as a buffer against possible cashflow shortfalls.

Table 4: Logit regression - Dependent variable: default

	Model 1		Model 2		Model 3		Model 4	
	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.
WORKING CAPITAL	-0.3298*** (-5.68)	-0.0030*** (-5.43)	-0.2999*** (-5.21)	-0.0028*** (-5.00)				
TURNOVER	-1.2003*** (-26.62)	-0.0111*** (-15.14)	-1.1995*** (-26.70)	-0.0113*** (-15.29)				
CASH & EQUIVALENTS					-0.3139*** (-3.08)	-0.0026*** (-3.04)	-0.3107*** (-3.06)	-0.0026*** (-3.02)
ACCOUNT PAYABLES					1.7279*** (28.23)	0.0141*** (18.14)	1.7189*** (28.36)	0.0143*** (18.34)
ACCOUNT RECEIVABLES					0.3068*** (3.63)	0.0025*** (3.58)	0.3023*** (3.59)	0.0025*** (3.55)
INVENTORIES					0.0995*** (4.00)	0.0008*** (3.94)	0.0985*** (3.99)	0.0008*** (3.93)
TAX LIABILITIES					6.5032*** (32.61)	0.0530*** (19.80)	6.4309*** (32.75)	0.0536*** (20.00)
INVESTMENT TURNOVER					-0.0034*** (-4.61)	-0.0000*** (-4.48)	-0.0034*** (-4.59)	-0.0000*** (-4.46)
LEVERAGE	1.6575*** (18.13)	0.0153*** (14.48)	1.6717*** (18.39)	0.0157*** (14.75)	0.8964*** (9.68)	0.0073*** (9.09)	0.8963*** (9.75)	0.0075*** (9.16)
DEBT COVERAGE	-0.5434*** (-4.04)	-0.0050*** (-3.90)	-0.5478*** (-4.08)	-0.0051*** (-3.94)	-1.2083*** (-8.37)	-0.0098*** (-7.62)	-1.2077*** (-8.40)	-0.0101*** (-7.65)
INTEREST COVERAGE	0.0000 (0.38)	0.0000 (0.38)	0.0000 (0.39)	0.0000 (0.39)	0.0000 (0.18)	0.0000 (0.18)	0.0000 (0.21)	0.0000 (0.21)
SD CASHFLOW	2.1177*** (8.55)	0.0195*** (7.93)	2.1026*** (8.54)	0.0198*** (7.94)	0.5320* (1.94)	0.0043* (1.93)	0.5186* (1.90)	0.0043* (1.90)
SALES GROWTH	-0.8297*** (-12.35)	-0.0076*** (-10.43)	-0.8203*** (-12.25)	-0.0077*** (-10.40)	-0.8976*** (-12.26)	-0.0073*** (-10.56)	-0.8884*** (-12.18)	-0.0074*** (-10.54)
SIZE	0.0744*** (4.17)	0.0007*** (4.14)	0.0730*** (4.11)	0.0007*** (4.09)	0.2998*** (16.02)	0.0024*** (13.47)	0.2968*** (15.99)	0.0025*** (13.50)
AGE	-0.3929*** (-12.67)	-0.0036*** (-10.32)	-0.3961*** (-12.81)	-0.0037*** (-10.46)	-0.4034*** (-12.35)	-0.0033*** (-10.44)	-0.4052*** (-12.47)	-0.0034*** (-10.55)
CHANGE-EMPLOYEES	-1.2849*** (-11.63)	-0.0118*** (-9.75)	-1.2848*** (-11.65)	-0.0121*** (-9.81)	-1.1728*** (-10.22)	-0.0096*** (-9.06)	-1.1725*** (-10.25)	-0.0098*** (-9.10)
CREDIT LINES	-0.6156*** (-13.23)	-0.0057*** (-12.69)	-0.6092*** (-13.16)	-0.0057*** (-12.69)	-0.5330*** (-10.74)	-0.0043*** (-10.88)	-0.5272*** (-10.70)	-0.0044*** (-10.86)
BANKING RELATIONSHIPS	-2.6191*** (-28.46)	-0.0241*** (-16.39)	-2.6129*** (-28.57)	-0.0245*** (-16.55)	-2.5193*** (-25.71)	-0.0205*** (-16.96)	-2.5119*** (-25.83)	-0.0209*** (-17.12)
CHANGE_BANK_REL	-0.2494*** (-11.89)	-0.0023*** (-9.93)	-0.2477*** (-11.81)	-0.0023*** (-9.92)	-0.1934*** (-8.96)	-0.0016*** (-8.16)	-0.1913*** (-8.88)	-0.0016*** (-8.11)
2007	0.2812*** (4.70)	0.0026*** (4.61)			0.3825*** (6.06)	0.0031*** (5.92)		
2008	0.5593*** (9.61)	0.0052*** (8.93)			0.7216*** (11.72)	0.0059*** (10.62)		
2009	0.6945*** (11.25)	0.0064*** (10.42)			0.7567*** (12.10)	0.0062*** (11.18)		
GDP			-0.1467*** (-11.60)	-0.0014*** (-10.60)			-0.1679*** (-12.86)	-0.0014*** (-11.59)
INT_RATE			0.1799*** (6.34)	0.0017*** (6.10)			0.2590*** (8.80)	0.0022*** (8.22)
# Observations	195329		195329		195329		195329	
# Firms	72649		72649		72649		72649	
Log-likelihood	-14043.2		-14054.6		-13353.2		-13367.7	
Log-likelihood constant	-16682.8		-16682.8		-16682.8		-16682.8	
Pseudo-R2	0.158		0.158		0.200		0.199	
Wald Chi2	2960.2		3004.9		2981.6		3053.8	
Prob > Chi2	0.00		0.00		0.00		0.00	
sigma_u	1.02		0.99		1.23		1.20	
rho	0.24		0.23		0.31		0.30	
Chi2_c	55.95		51.87		117.45		110.73	
BIC	28452		28463		27121		27137	
AIC	28146		28167		26774		26801	

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. All models estimated using a random-effects logit estimator, where the dependent variable is a binary variable default related with credit overdue. Z-scores in parenthesis. The marginal effects correspond

to the average, assuming as baseline firms with credit lines and changes in the number of bank lending relationships. In all regressions, a constant and business sector dummies were included. The pseudo-R2 is a measure of goodness of the fit, being computed as function of the model's log-likelihood and of the log-likelihood of the constant-only model, for the sub-sample used in each estimation. The Wald test evaluates the overall statistical significance of the estimated coefficients. Rho measures the proportion of the total variance resulting from the panel-level variance component. If rho is zero, the panel-level variance is not relevant and the panel estimator is not different from the pooled estimator.

4.3 Are there significant differences by firm's size?

Firm's dimension is usually related with activity diversification, which may affect firm's reaction to idiosyncratic and external shocks. The uniqueness of the dataset used in this study allows for more desegregated analysis of corporate sector. Therefore, Table 5 presents the same specifications ran previously, but partitioning the sample by firm's dimension.²²

In general, the results described for the full sample apply for micro and small firms, but with some exceptions. Regarding the decomposition of working capital and asset turnover, the activity indicators and tax liabilities are relevant in determining the probability of a default event. However, for micro firms, account receivables and the cash ratio are not statistical significant. Comparing the models, the inclusion of these variables in the analysis improves the performance of the specifications.

For firms classified in the medium and large classes, some variables lose statistical significance, in particular in the case of larger firms. For medium firms, and as far as decomposition of working capital and assets turnover is concerned, accounts payable and tax liabilities are statistically significant, with positive coefficients. However, for these firms, account receivables show a negative and statistically significant coefficient, which is in contrasts with the results of the other regressions. For large firms, a smaller set of variables is statistically significant. However, given the specificities of those firms, the specifications for larger firms do not fulfill statistics properties and tests. These results may suggest that large firms have less informative accounting.

The results obtained by firm's dimension class allow to verify that the relevance of some variables changes across firm's groups, given the heterogeneity between firms. The information underlying the operational cycle of firms, as well as the share of tax liabilities seem to be particularly relevant in determining default probabilities for smaller firms.

²²In this analysis, only regressions with the time dummies are presented, as the coefficients of the variables under analysis were very similar to those obtained in specification with macroeconomic variables (due to short-time dimension of the dataset), and the global performance of two approaches did not present sizeable differences.

Table 5: Logit regression by firm's dimension - Dependent variable: default

	Micro				Small			
	Model 1		Model 2		Model 1		Model 2	
	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.
WORKING CAPITAL	-0.2815*** (-3.38)	-0.0026*** (-3.23)			-0.4038*** (-4.64)	-0.0040*** (-4.39)		
TURNOVER	-0.9336*** (-13.64)	-0.0085*** (-8.24)			-1.3256*** (-18.33)	-0.0130*** (-10.44)		
CASH & EQUIVALENTS			-0.1281 (-1.05)	-0.0010 (-1.05)			-0.9161*** (-4.60)	-0.0077*** (-4.38)
ACCOUNT PAYABLES			1.2460*** (14.17)	0.0094*** (9.89)			1.9002*** (20.24)	0.0159*** (12.94)
ACCOUNT RECEIVABLES			0.0801 (0.65)	0.0006 (0.65)			0.2598** (2.08)	0.0022** (2.05)
INVENTORIES			0.0671* (1.91)	0.0005* (1.90)			0.1102*** (2.98)	0.0009*** (2.95)
TAX LIABILITIES			7.2637*** (22.49)	0.0550*** (12.34)			6.6968*** (21.82)	0.0562*** (13.83)
INVESTMENT TURNOVER			-0.0030*** (-3.08)	-0.0000*** (-2.98)			-0.0040*** (-3.28)	-0.0000*** (-3.17)
LEVERAGE	1.3297*** (10.29)	0.0121*** (8.14)	0.8424*** (6.36)	0.0064*** (5.85)	2.1218*** (14.41)	0.0208*** (11.02)	1.1471*** (7.59)	0.0096*** (7.06)
DEBT COVERAGE	-0.1038 (-0.57)	-0.0009 (-0.57)	-0.6175*** (-2.99)	-0.0047*** (-2.87)	-0.4764** (-2.30)	-0.0047** (-2.24)	-1.0620*** (-4.67)	-0.0089*** (-4.37)
INTEREST COVERAGE	0.0001 (1.35)	0.0000 (1.34)	0.0001 (1.04)	0.0000 (1.04)	-0.0001 (-0.92)	-0.0000 (-0.92)	-0.0001 (-0.93)	-0.0000 (-0.93)
SD CASHFLOW	2.5959*** (7.40)	0.0236*** (6.29)	1.4896*** (3.79)	0.0113*** (3.65)	1.7038*** (4.54)	0.0167*** (4.33)	0.5380 (1.29)	0.0045 (1.29)
SALES GROWTH	-0.8992*** (-9.29)	-0.0082*** (-7.20)	-0.9243*** (-8.85)	-0.0070*** (-7.32)	-0.7293*** (-7.41)	-0.0071*** (-6.51)	-0.7909*** (-7.45)	-0.0066*** (-6.63)
SIZE	0.2581*** (5.84)	0.0023*** (5.36)	0.7114*** (15.23)	0.0054*** (10.23)	0.0934*** (2.66)	0.0009*** (2.64)	0.5104*** (13.61)	0.0043*** (10.52)
AGE	-0.3062*** (-6.55)	-0.0028*** (-5.53)	-0.3609*** (-7.13)	-0.0027*** (-6.10)	-0.4455*** (-9.80)	-0.0044*** (-7.66)	-0.4323*** (-8.90)	-0.0036*** (-7.41)
CHANGE-EMPLOYEES	-1.2362*** (-7.35)	-0.0112*** (-5.88)	-0.9620*** (-5.54)	-0.0073*** (-4.91)	-1.3624*** (-8.76)	-0.0133*** (-7.21)	-1.0189*** (-6.27)	-0.0085*** (-5.77)
CREDIT LINES	-0.6258*** (-9.75)	-0.0057*** (-8.71)	-0.5637*** (-8.18)	-0.0043*** (-8.00)	-0.6359*** (-9.14)	-0.0062*** (-8.63)	-0.5577*** (-7.41)	-0.0047*** (-7.42)
BANKING RELATIONSHIPS	-3.0289*** (-21.88)	-0.0275*** (-10.15)	-3.0214*** (-19.91)	-0.0229*** (-11.06)	-2.3605*** (-17.58)	-0.0231*** (-10.89)	-2.2961*** (-15.90)	-0.0193*** (-11.17)
CHANGE_BANK_REL	-0.3704*** (-10.26)	-0.0034*** (-7.40)	-0.3038*** (-8.05)	-0.0023*** (-6.71)	-0.1976*** (-6.66)	-0.0019*** (-5.84)	-0.1453*** (-4.73)	-0.0012*** (-4.44)
2007	0.2451*** (2.65)	0.0022*** (2.60)	0.3230*** (3.28)	0.0024*** (3.20)	0.3269*** (3.76)	0.0032*** (3.67)	0.4357*** (4.72)	0.0037*** (4.58)
2008	0.5812*** (6.59)	0.0053*** (5.80)	0.7614*** (8.04)	0.0058*** (6.90)	0.6173*** (7.28)	0.0060*** (6.66)	0.7926*** (8.74)	0.0066*** (7.84)
2009	0.6071*** (6.55)	0.0055*** (5.89)	0.7232*** (7.52)	0.0055*** (6.67)	0.8148*** (8.91)	0.0080*** (8.01)	0.8867*** (9.56)	0.0074*** (8.62)
# Observations	83562		83562		92953		92953	
# Firms	38969		38969		35995		35995	
Log-likelihood	-6063.7		-5700.8		-6624.8		-6262.2	
Log-likelihood constant	-7179.5		-7179.5		-7987.2		-7987.2	
Pseudo-R2	0.155		0.206		0.171		0.216	
Wald Chi2	1248.6		1161.7		1374.7		1330.0	
Prob > Chi2	0.00		0.00		0.00		0.00	
sigma_u	0.95		1.26		0.98		1.23	
rho	0.22		0.32		0.23		0.32	
Chi2_c	13.99		43.41		21.23		53.08	
BIC	12467		11787		13593		12913	
AIC	12187		11470		13310		12592	

	Medium				Large			
	Model 1		Model 2		Model 1		Model 2	
	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.
WORKING CAPITAL	-1.1330*** (-4.41)	-0.0116*** (-3.92)			0.7042 (1.07)	0.0072 (0.97)		
TURNOVER	-1.9127*** (-8.78)	-0.0196*** (-5.66)			-1.0691** (-2.53)	-0.0109* (-1.87)		
CASH & EQUIVALENTS			-0.7762 (-0.99)	-0.0073 (-0.98)			0.5171 (1.51)	0.0049 (1.25)
ACCOUNT PAYABLES			3.2408*** (10.06)	0.0307*** (7.07)			2.3131*** (2.69)	0.0219*** (2.67)
ACCOUNT RECEIVABLES			-0.7111* (-1.82)	-0.0067* (-1.76)			2.4170** (2.17)	0.0229 (1.60)
INVENTORIES			-0.1671 (-0.99)	-0.0016 (-0.99)			0.2420 (0.48)	0.0023 (0.48)
TAX LIABILITIES			6.5764*** (8.16)	0.0622*** (6.23)			1.7118 (0.35)	0.0162 (0.35)
INVESTMENT TURNOVER			-0.0034 (-0.88)	-0.0000 (-0.86)			-0.0032 (-0.54)	-0.0000 (-0.53)
LEVERAGE	3.0376*** (7.62)	0.0312*** (6.01)	2.0214*** (5.31)	0.0191*** (4.70)	1.6623** (2.23)	0.0169* (1.88)	0.8887 (0.93)	0.0084 (0.90)
DEBT COVERAGE	-2.1594*** (-3.42)	-0.0222*** (-3.12)	-3.4483*** (-5.30)	-0.0326*** (-4.32)	-2.8603** (-2.32)	-0.0291* (-1.72)	-3.0081** (-2.29)	-0.0285* (-1.66)
INTEREST COVERAGE	-0.0016** (-2.09)	-0.0000** (-2.03)	-0.0009 (-0.97)	-0.0000 (-0.96)	0.0001 (0.81)	0.0000 (0.77)	0.0001 (0.35)	0.0000 (0.34)
SD CASHFLOW	2.1967** (2.08)	0.0226** (2.02)	1.3678 (1.17)	0.0129 (1.17)	-1.0587 (-0.24)	-0.0108 (-0.24)	-1.6972 (-0.36)	-0.0161 (-0.36)
SALES GROWTH	-0.5541* (-1.87)	-0.0057* (-1.82)	-0.8586*** (-2.70)	-0.0081** (-2.52)	-1.5966* (-1.72)	-0.0162 (-1.42)	-1.0226 (-1.01)	-0.0097 (-0.96)
SIZE	-0.2011** (-2.28)	-0.0021** (-2.17)	0.3653*** (4.07)	0.0035*** (3.68)	0.0030 (0.01)	0.0000 (0.01)	0.0930 (0.42)	0.0009 (0.42)
AGE	-0.1024 (-0.88)	-0.0011 (-0.87)	-0.0334 (-0.28)	-0.0003 (-0.28)	-0.2242 (-0.86)	-0.0023 (-0.76)	-0.1894 (-0.68)	-0.0018 (-0.62)
CHANGE-EMPLOYEES	-1.6962*** (-3.35)	-0.0174*** (-3.07)	-1.2318** (-2.40)	-0.0117** (-2.28)	0.7051 (0.65)	0.0072 (0.65)	0.1911 (0.17)	0.0018 (0.17)
CREDIT LINES	-0.4765* (-1.69)	-0.0049* (-1.71)	0.0411 (0.13)	0.0004 (0.13)	-1.5594** (-2.01)	-0.0159** (-2.11)	-0.8517 (-1.01)	-0.0081 (-1.05)
BANKING RELATIONSHIPS	-2.0131*** (-5.47)	-0.0207*** (-4.42)	-2.2131*** (-5.54)	-0.0209*** (-4.58)	-0.2355 (-0.30)	-0.0024 (-0.29)	-0.4260 (-0.51)	-0.0040 (-0.48)
CHANGE_BANK_REL	-0.1241** (-1.99)	-0.0013* (-1.94)	-0.0829 (-1.29)	-0.0008 (-1.29)	-0.1292 (-0.92)	-0.0013 (-0.86)	-0.1587 (-1.07)	-0.0015 (-0.98)
2007	0.1697 (0.82)	0.0017 (0.82)	0.2648 (1.21)	0.0025 (1.21)	1.4191** (2.41)	0.0144** (1.97)	1.4988** (2.41)	0.0142** (1.99)
2008	0.0935 (0.44)	0.0010 (0.44)	0.2194 (0.98)	0.0021 (0.99)	-0.4756 (-0.65)	-0.0048 (-0.62)	-0.2268 (-0.29)	-0.0021 (-0.29)
2009	0.8110*** (3.60)	0.0083*** (3.65)	0.5588** (2.54)	0.0053*** (2.60)	0.5690 (0.92)	0.0058 (0.94)	0.9925 (1.58)	0.0094 (1.46)
# Observations	16204		16204		2610		2610	
# Firms	5951		5951		906		906	
Log-likelihood	-986.0		-946.4		-139.6		-132.5	
Log-likelihood constant	-1328.7		-1328.7		-196.3		-196.3	
Pseudo-R2	0.258		0.288		0.289		0.325	
Wald Chi2	287.1		270.3		67.4		67.3	
Prob > Chi2	0.00		0.00		0.00		0.00	
sigma_u	0.93		1.05		0.43		0.59	
rho	0.21		0.25		0.05		0.10	
Chi2_c	4.40		5.77		0.04		0.17	
BIC	2263		2222		515		533	
AIC	2032		1961		339		333	

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. All models estimated using a random-effects logit estimator, where the dependent variable is a binary variable default related with credit overdue. Z-scores in parenthesis. The marginal effects correspond to the average, assuming as baseline firms with credit lines and changes in the number of bank lending relationships. In all regressions, a constant and business sector dummies were included. The pseudo-R2

is a measure of goodness of the fit, being computed as function of the model's log-likelihood and of the log-likelihood of the constant-only model, for the sub-sample used in each estimation. The Wald test evaluates the overall statistical significance of the estimated coefficients. Rho measures the proportion of the total variance resulting from the panel-level variance component. If rho is zero, the panel-level variance is not relevant and the panel estimator is not different from the pooled estimator.

4.4 Determinants vs predictors of default

In the previous sections, we found empirical evidence of the relevance of activity indicators, investment turnover, as well as tax liabilities as determinants of firm's probability of default. In this section we re-estimate the previous specifications including as regressors one-lag period of the firm-specific variables instead of the contemporaneous ones (with exception of AGE). This approach allows to verify if these variables play a role as predictors of default events, which may also be useful as accounting data is obtained with a significant delay. Even though a close banking relationship may minimize the lack of updated information about the firm's financial performance, some data is not available. Moreover, this approach allows to minimize potential endogeneity problems in previous specifications, related with firm's creditworthiness and its financial position. The results of this approach are presented in Table 6.

According to the results, the general conclusions remain valid, in terms of statistical significance and the direction of the impact of each variable on firm's default probability. Nevertheless, there are some exceptions. In particular, in these specifications, changes in the number of banking relationships shows a positive and statistically significant coefficient. This result suggests that firms that changed the number of banking relationships have associated higher probabilities of default in the following year. Regarding the decomposition of working capital and asset turnover, accounts receivable are not significant. In turn, accounts payable and inventories variables, those activity indicators that are more dependent on firm's performance, show positive and significant coefficients. Therefore, firms with higher level for these variables have associated higher probability of default in the following year. In turn, tax liabilities preserves the positive and statistically significant coefficient. Thus, this variable seems to be a relevant indicator of firm's financial vulnerabilities and failure in bank credit commitments.

Table 6: Logit regression - Dependent variable: default - with lag regressors

	Model 1		Model 2		Model 3	
	Coef.	Marg. Eff.	Coef.	Marg. Eff.	Coef.	Marg. Eff.
WORKING CAPITAL _{t-1}	-0.3255*** (-3.84)	-0.0046*** (-3.69)				
TURNOVERT-1	-1.0266*** (-19.96)	-0.0144*** (-11.01)				
CASH & EQUIVALENTSt-1			-0.5727*** (-3.91)	-0.0070*** (-3.74)	-0.5219*** (-3.60)	-0.0064*** (-3.47)
ACCOUNT PAYABLESt-1			1.4550*** (17.89)	0.0177*** (11.76)	1.4223*** (17.46)	0.0174*** (11.72)
ACCOUNT RECEIVABLESt-1			-0.1537 (-1.32)	-0.0019 (-1.32)	-0.1546 (-1.33)	-0.0019 (-1.32)
STOCKSt-1			0.1239*** (3.69)	0.0015*** (3.61)	0.1247*** (3.71)	0.0015*** (3.63)
TAX LIABILITIESSt-1			5.5371*** (20.40)	0.0673*** (13.19)		
INVESTMENT TURNOVERT-1			-0.0045*** (-3.65)	-0.0001*** (-3.50)	-0.0045*** (-3.66)	-0.0001*** (-3.52)
SOCIAL SEC. LIABILITIESSt-1					9.6421*** (16.17)	0.1178*** (11.94)
OTHER TAXESSt-1					4.5341*** (14.71)	0.0554*** (11.34)
LEVERAGET-1	1.3440*** (10.47)	0.0189*** (9.18)	0.7078*** (5.61)	0.0086*** (5.38)	0.7064*** (5.58)	0.0086*** (5.35)
DEBT COVERAGET-1	-1.0915*** (-6.05)	-0.0153*** (-5.45)	-1.8201*** (-9.97)	-0.0221*** (-8.06)	-1.7671*** (-9.64)	-0.0216*** (-7.91)
INTEREST COVERAGET-1	-0.0004** (-2.08)	-0.0000** (-2.05)	-0.0005** (-2.30)	-0.0000** (-2.27)	-0.0005** (-2.28)	-0.0000** (-2.25)
SD CASHFLOWt-1	3.6358*** (12.10)	0.0511*** (9.57)	2.5948*** (8.14)	0.0315*** (7.23)	2.6409*** (8.27)	0.0323*** (7.34)
SALES GROWTHt-1	-0.2315*** (-2.61)	-0.0033** (-2.56)	-0.3534*** (-3.74)	-0.0043*** (-3.60)	-0.3571*** (-3.78)	-0.0044*** (-3.64)
SIZEt-1	0.0599*** (2.86)	0.0008*** (2.84)	0.2329*** (10.97)	0.0028*** (9.20)	0.2286*** (10.76)	0.0028*** (9.10)
AGE	-0.3823*** (-9.20)	-0.0054*** (-7.52)	-0.4116*** (-9.68)	-0.0050*** (-7.86)	-0.4130*** (-9.71)	-0.0050*** (-7.90)
CHANGE-EMPLOYEESt-1	-0.5788*** (-4.46)	-0.0081*** (-4.23)	-0.5653*** (-4.23)	-0.0069*** (-4.03)	-0.5587*** (-4.18)	-0.0068*** (-3.99)
CREDIT LINESt-1	-0.1533*** (-2.63)	-0.0022*** (-2.69)	-0.1402** (-2.32)	-0.0017** (-2.38)	-0.1384** (-2.29)	-0.0017** (-2.34)
BANKING RELATIONSHIPSt-1	-2.4250*** (-21.59)	-0.0341*** (-11.82)	-2.3297*** (-20.02)	-0.0283*** (-11.92)	-2.3152*** (-19.92)	-0.0283*** (-11.99)
CHANGE_BANK_RELt-1	0.0710*** (2.81)	0.0010*** (2.72)	0.0940*** (3.70)	0.0011*** (3.54)	0.0943*** (3.70)	0.0012*** (3.55)
2007	-0.5294*** (-8.67)	-0.0074*** (-7.77)	-0.6506*** (-10.27)	-0.0079*** (-8.91)	-0.6510*** (-10.27)	-0.0080*** (-8.93)
2008	-0.1477*** (-2.72)	-0.0021*** (-2.72)	-0.1799*** (-3.26)	-0.0022*** (-3.23)	-0.1757*** (-3.18)	-0.0021*** (-3.16)
# Observations	119553		119553		119553	
# Firms	54003		54003		54003	
Log-likelihood	-8731.5		-8615.9		-8587	
Log-likelihood constant	-10024.5		-10024.5		-10024	
Pseudo-R2	0.129		0.141		0.143	
Wald Chi2	1666.5		1645.6		1675.9	
Prob > Chi2	0.00		0.00		0.00	
sigma_u	0.42		0.73		0.72	
rho	0.05		0.14		0.14	
Chi2_c	0.83		8.17		7.7542	
BIC	17802		17618		17572	
AIC	17521		17298		17243	

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

All models estimated using a random-effects logit estimator, where the dependent variable is a binary variable default related with credit overdue. Z-scores in parenthesis. The marginal effects correspond to the average, assuming as baseline firms with credit lines and changes in the number of bank lending relationships. In all regressions, a constant and business sector dummies were included. The pseudo-R² is a measure of goodness of the fit, being computed as function of the model's log-likelihood and of the log-likelihood of the constant-only model, for the sub-sample used in each estimation. The Wald test evaluates the overall statistical significance of the estimated coefficients. Rho measures the proportion of the total variance resulting from the panel-level variance component. If rho is zero, the panel-level variance is not relevant and the panel estimator is not different from the pooled estimator.

Tax liabilities

Tax liabilities over total assets showed to be a relevant variable in previous specifications. Against this background, we decompose those liabilities between taxes related with Social Security (overdue) and others taxes (TLSS, and TLOTHER, respectively), having in mind that the failure of commitments regarding Social Security taxes may reflect significant financial difficulties for a firm (in particular if employees' contributions are involved). The last model of Table 6 presents the results under this conjecture.²³ In this specification, while the remaining variables preserve the results described previously, the new variables are statistically significant and both show positive coefficients, in particular the variable related with Social Security taxes. Thus, firms with higher levels of Social Security taxes over total assets have associated higher probabilities of default in the following year.

5 Robustness tests

In order to verify how the previous results were conditioned by some of the adopted hypothesis, some robustness checks were performed.

Firstly, we re-estimate the specifications including the cash conversion cycle (defined as days in receivables + stock days - days of accounts payable) instead of the three activity indicators individually. However, this variable was not statistically significant. We also ran alternative specifications that included general government components in net terms, *i.e.* assets and liabilities. The results remained globally unchanged.

Then, we also tested the non-monotonicity of some variables included in the analysis. Thus, the first set of regressions was re-estimated, replacing interest coverage by dummy variables

²³In this specification, we used total liabilities instead of short-term, given that the breakdown by debt maturity is not available for these taxes. However, this approach does not have relevant impact on the analysis, as a very high share of tax liabilities is short-term.

identifying the quartiles of the respective distribution. According to this approach, we found a monotonic impact of interest coverage on the probability of default, *i.e.* the probability of default decreases as interest coverage increases. An alternative approach was related with the empirical distribution of this variable in this sample, namely the high levels of this variable in the right tail. Therefore, we redefined the interest coverage variable, assuming that observations above the percentile 90 took that value. The magnitude of the coefficient increased significantly under this approach, but it remained statistically non-significant.

Additionally, we ran an alternative set of regressions where direct firm-bank variables were not included, *i.e.* variables related with credit lines, number of banking relationships and its dynamics, due to potential endogeneity issues between banks' decisions and firm's financial position. The results regarding the core variables analysed in this study remained valid under this framework.

Finally, and as far as econometric method is concerned, all the regressions presented in previous sections were re-estimated with the logit, with standard errors adjusted for heteroscedasticity and clustered at the firm level, instead of the panel data approach. The conclusions discussed above remained valid, *i.e.* the effect of the core variables under analysis preserved the sign and statistical significance on the probability of default.

6 Final Remarks

In this study we analysed the impact of several firm's characteristics on the respective credit risk. In particular, we tried to identify the potential impact of firms' operational management and efficiency on its probability of default, controlling for other relevant variables. We performed this analysis on a large dataset for Portuguese non-financial corporations, mainly based on Central Balance Sheet Data and Central Credit Register, that allows for a high coverage of the exposures of the Portuguese banking system to the corporate sector, for the period 2006-2009.

Liquidity indicators and assets turnover are usually identified as relevant variables in empirical literature. However, they can reflect different firms' operational management and efficiency. According to the results of the study, the decomposition of these variables into variables related with cash, activity indicators, inventories, investment turnover and tax liabilities contains relevant information regarding firms' financial fragilities. In particular, firms that take longer to repay their suppliers, firms that wait longer to receive from their customers, and firms whose

purchase stay longer as inventories, have associated higher probabilities of default. Moreover, we also found a positive relation between firm's credit risk and the share of tax liabilities. Therefore, based on these results, the operational cycle of a firm and, in particular, tax liabilities seem to be relevant variables in the analysis of the probability of bank credit default. This seems to be more relevant for smaller firms.

In line with previous studies on corporate credit risk, the analysis performed in this study confirmed broadly the relevance of other financial and non-financial characteristics of a firm as determinants of default probability.

The main analysis presented in this study was based on *ex post* credit risk, *i.e.* situations where firms have defaulted or not, which allows to characterize the financial vulnerabilities and other characteristics of firms that default. Nevertheless, the specifications that include as explanatory variables firms' characteristics with a lag confirm the relevance of some variables under analysis as predictors of firms' probability of default, in particular variables related with account payables and tax liabilities. Furthermore, under this framework, the decomposition of tax liabilities variable allowed to verify that Social Securities taxes also seems to be a relevant indicator as predictor of default probability.

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Annexes

Table I: Variables definition

Variable	Definition
Dependent variable	
DEFAULT	Dummy variable which takes the value 1 if the firm has delay in payments at least longer than 90 days in bank credit
Regressors	
Firm's characteristics	
WORKING CAPITAL	Current assets net of short term liabilities over total assets.
TURNOVER	Sales over total assets
DEBT COVERAGE	Earning before interest, depreciation and amortisation over total debt
INTEREST COVERAGE	Earning before interests, depreciation and amortisation over interest paid
LEVERAGE	Total debt over total assets
SD CASHFLOW	Standard deviation of cashflow over total assets
SALES GROWTH	Sales growth defined as the difference of the natural logarithm of real sales
SIZE	Natural logarithm of real total assets
AGE	Natural logarithm of (1+ age in years)
CHANGE_EMPLOYEES	Percentual change of the number of employees in the year
CASH AND EQUIVALENTS	Cash and equivalents over total debt
ACCOUNT PAYABLES	Total trade credit over (purchases of goods for resale, raw materials, secondary and consumable + supplies and external services)
ACCOUNT RECEIVABLES	Total trade credits to customers over sales
INVENTORIES	Inventories over Cost of goods sold
INVESTMENT TURNOVER	Sales over investment
TAX LIABILITIES	Short term tax liabilities over total assets
SOCIAL SECURITY TAXES	Social security liabilities (overdue) over total assets
Banking relationships	
BANKING RELATIONSHIPS	Number of banking relationships defined at the banking group level, based on the relevance of each group in firm's total banking debt
CHANGE_BANK_REL	Changes in the number of independent banking relationships in the year
CREDIT LINE	Dummy variable which takes the value 1 if the firm has unused credit lines
Macroeconomic variables	
GDP	Annual growth rate of GDP
INT_RATE	Average interest rate applied on loans granted to the non-financial corporations
Control variables	
SECTOR	Dummy variables of business sector (13 sectors)

Table II: Correlation matrix

	DEFAULT	WORKING CAP	TURNOVER	CASH & EQ	A PAY	A REC	INVENTORIES	TAX LIAB	SOCIAL SEC	OTHER TAXES	INVTURNOVER	DEBT COV	LEVERAGE	INTEREST COV	SD CASHF	SGROWTH	SIZE	AGE	Δ EMPL	CLINE	BANK REL	PROFIT	Δ BANK REL
DEFAULT	1.000																						
WORKING CAP	-0.057	1.000																					
TURNOVER	-0.085	0.000	1.000																				
CASH & EQ	-0.041	0.276	0.133	1.000																			
A PAY	0.157	-0.088	-0.366	-0.185	1.000																		
INVENTORIES	0.036	0.020	-0.259	-0.110	0.209	1.000																	
TAX LIAB	0.151	-0.098	0.169	0.055	-0.006	-0.033	-0.046	1.000															
SOCIAL SEC	0.165	-0.075	-0.034	-0.034	0.092	0.032	0.412	0.412	1.000														
OTHER TAXES	0.117	-0.068	0.192	0.070	-0.043	-0.048	-0.053	0.920	0.111	1.000													
INVTURNOVER	-0.116	0.186	0.184	0.067	-0.223	0.005	-0.018	0.054	0.004	0.058	1.000												
DEBT COV	-0.064	0.259	0.196	0.513	-0.243	-0.094	-0.149	0.052	-0.065	0.077	-0.009	1.000											
LEVERAGE	0.099	-0.555	0.004	-0.409	0.226	-0.037	0.065	0.169	0.136	0.140	0.018	-0.501	1.000										
INTEREST COV	-0.015	0.056	0.048	0.143	-0.041	-0.028	-0.019	0.007	-0.019	0.014	0.025	0.162	-0.096	1.000									
SD CASHF	0.032	-0.178	0.181	0.040	-0.058	-0.117	-0.046	0.253	0.088	0.245	0.010	-0.023	0.253	0.000	1.000								
SGROWTH	-0.078	-0.078	0.145	-0.008	-0.097	-0.105	-0.112	0.008	-0.035	0.019	0.020	0.133	0.030	0.019	-0.011	1.000							
SIZE	0.030	0.122	-0.289	-0.121	0.109	0.220	0.011	-0.297	-0.058	-0.301	-0.023	-0.037	-0.157	-0.009	-0.309	-0.002	1.000						
AGE	-0.006	0.225	-0.123	0.076	-0.005	0.118	0.054	-0.137	-0.032	-0.135	0.016	0.032	-0.297	0.003	-0.161	-0.167	0.361	1.000					
Δ EMPL	-0.058	-0.042	0.066	-0.010	-0.052	-0.038	-0.062	-0.008	-0.037	0.002	-0.021	0.057	0.014	0.004	0.004	0.302	0.006	-0.142	1.000				
CLINE	-0.024	0.099	-0.050	-0.063	0.012	0.100	-0.012	-0.138	-0.046	-0.134	-0.004	-0.021	-0.058	0.000	-0.113	-0.018	0.341	0.175	0.003	1.000			
BANK REL	-0.071	-0.049	0.106	0.161	-0.080	-0.161	-0.006	0.094	-0.006	0.105	0.069	0.087	-0.033	0.085	0.123	0.019	-0.379	-0.150	-0.015	-0.323	1.000		
PROFIT	-0.069	0.180	0.219	0.181	-0.188	-0.069	-0.165	0.056	-0.066	0.083	-0.027	0.727	-0.373	0.091	-0.122	0.242	-0.026	-0.047	0.113	-0.005	-0.005	1.000	
Δ BANK REL	-0.035	0.045	-0.012	-0.028	-0.010	0.012	-0.007	-0.045	-0.030	-0.041	-0.022	-0.030	0.024	-0.008	-0.017	0.054	0.029	-0.051	0.074	0.084	-0.290	0.004	1.000

Note: DEFAULT-Dummy variable which takes the value 1 if the firm has delay in payments at least longer than 90 days in its bank credit; WORKING CAP-Current assets net of short term liabilities over total assets; LEVCOV-Earning before interest, depreciation and amortisation over total debt; LEVERAGE-Total debt over total assets; INTEREST COV-Earning before interests, depreciation and amortisation over interest paid; TURNOVER-Sales over total assets; SGROWTH-Sales growth is defined as the difference of the natural logarithm of real sales; SD CASHF-Standard deviation of cashflow over total assets; SIZE-Natural logarithm of real sales; Δ EMPL-Percentage change of the number of employees in the year; CASH & EQ-Cash and equivalents over total debt; APAY- Account payable - (Total trade credits /purchases of goods for resale, raw materials, secondary and consumable + supplies and external services); AREC- Account receivables - (Total trade credits to customers/turnover); INVENTORIES - (Inventories/ Cost of goods sold); INVTURNOVER-Sales over investment; TAX LIAB-Short term liabilities to General Government over total assets; AGE-Natural logarithm of age in years (plus one); BANK REL-Number of banking relationships defined at the banking group level, based on the weight of each group in firm's total banking debt; Δ BANK REL - Changes in the number of independent banking relationships in the year; CLINE-Dummy variable which takes the value 1 if the firm has unused credit lines; RGOP-Operational income over total assets.