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Borrowing Patterns, Bankruptcy and Voluntary Liquidation *

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Abstract

We study the impact of financial variables upon bankruptcy and voluntary exit. Controlling for efficiency, which we find to decrease the odds of both bankruptcy and voluntary exit, characteristics of firms which correlate with the firms' access to funds, exert very different impacts upon the two modes of exit.

Our findings support the idea that information asymmetries create cash constraints and that financial decisions are used to signal firms' quality and reduce the degree of information asymmetries between borrowers and lenders.

Key words: bankruptcy, exit, leverage, debt maturity, credit lines, bank relationships

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1 Introduction

Firms may exit in different ways. Different ways of exiting are triggered by different forces and may have remarkably different implications. Voluntary liquidations and bankruptcies are quite different in what concerns the magnitude of the losses incurred and the identity of those that bear them. Although exit is commonly associated with failure, this needs not to be so, as the owners of exiting firms may have made a profit. Whether or not there were losses, in liquidations debtors are paid in full. In contrast, bankruptcies involve losses, at least for those creditors whose credits are left unpaid.

However, most empirical studies that have looked to the exit decision have treated all exits alike. In one of the few exceptions to this rule, Schary (1991) distinguished between bankruptcies, mergers, and voluntary exits, and developed empirical models to analyze these different means of exit. Having observed 61 firms of which 43 have exited, she was unable to estimate significant parameters to explain the different exit modes. In another study, Harhoff, Stahl, and Woywode (1998) analyzed the competing risks of voluntary exit versus bankruptcy with a large sample of over 10,000 German firms. The major strength of their sample is that it contained data on the legal form of the firms, which enabled them to highlight the effect of limitation of liability upon the two different forms of exit. Apart from the legal form, their sample also had data on the entrepreneurs for a subsample of firms; they found that when entrepreneurs approach the retirement age, the likelihood of voluntary exit increases while, this had no effect upon the probability of bankruptcy.

While most economic theories assume that, in a reasonably competitive environment, only efficient firms survive while inefficient firms exit, firms may also exit not because they are inefficient, but because the owners lack the funds to keep them going. If financial markets were perfect, this would not

happen, as firms would be able to borrow the cash they need. As potential creditors do not have complete information on the firm's prospects, they may deny funding to projects which are good (Stiglitz and Weiss, 1981), and good firms may be forced to exit.

A number of empirical studies have discussed the impact of cash constraints on of firms' investment decisions (see Hubbard, 1998, for a survey). A few studies analyzed the effect of financial constraints on the decision to become an entrepreneur (Holtz-Eakin, Joulfaian, and Rosen, 1994), on the amount of capital available to the new firm (Evans and Jovanovic, 1989) and on its role as shaping the size of new firms over time (Cabral and Mata, 2003), but little research has focused on its impact upon survival (but see Cressy, 1996).

Indeed, there are only a few studies that have analyzed the effect of indebtedness on the chances of survival. High levels of debt have been found to be negatively related to survival by Zingales (1998), Baggs (2005) and Heiss and Koke (2004). Huyghebaert and Van de Gucht (2004) also studied this issue, but found no independent effect of leverage upon survival. Many of the arguments about the relationship between leverage and survival that permeate these studies suggest that the authors have bankruptcy in mind. Empirically, however, they typically did not distinguish between voluntarily and involuntarily exit. A plausible reason why authors did not discriminate between exit modes is lack of appropriate data. The absence of such discrimination would be innocuous if all exits (or the vast majority of them) would be of the same type, or if they shared common determinants. None of these assumptions is warranted, however.

In this paper, we distinguish between bankruptcies and voluntary exits and analyze the effect that credit decisions exert upon these two different modes of exit. We combine two unique datasets to create an even more unique one. One of the datasets includes information on all firms employing

paid labor in Portugal, while another one records all credit relationships between financial intermediaries and non-financial firms. This allows us to identify firms that cease to operate and to discriminate between those that exit with losses for creditors from those that do not. Furthermore, because we have data on all the lending relationships between firms and banks, we are able to construct a very unique dataset, containing very detailed information on the magnitudes and types of lending relationships on a comprehensive set of firms. Our lending relationships are restricted to banks; we will not discuss direct lending between the public and firms. We do not see this as a disadvantage; on the one hand, Portugal – like most continental European countries – is a bank based economy, in which stock and bond markets have a rather limited scope. On the other hand, banks are more the kind of monitoring lender which is portrayed in models than the general public.

The paper is organized as follows. In the next section, we review the implications of the theories regarding capital structure and lending relationships for the two types of exit considered in this paper. Many of the existing models have opposite implications for bankruptcy and voluntary exit which have not been previously contrasted. In section 3 we discuss our data sources and measurement. Section 4 presents our basic results. Finally section 5 summarizes our findings and concludes the paper.

2 Credit and the exit of firms

2.1 Debt

2.1.1 Debt as a means of alleviating problems of asymmetric information

One argument on how debt may alleviate information asymmetries between firms and lenders is due to Ross (1977). The problem is that firms differ in type (some are good, and some are bad), and while managers know which

type is the firm, outsiders cannot tell which firms are good and which are bad.

Managers can credibly communicate their firm's type to outsiders, by choosing a compensation scheme in which managers make more money if the firm is successful, but lose money if the firm goes bankrupt.

Firms whose managers choose high levels of debt confront increased probabilities of going bankrupt. If its firm goes bankrupt the manager incurs big losses, which is why only managers of high quality firms choose high debt levels. These firms will confront high probabilities of going bankrupt but, as they are good, they confront lower chances of exiting.

2.1.2 Incentive conflicts between shareholders and debtholders

Debt can also create incentives on equity-owners to act differently from the interest of debt-holders. These incentive conflicts have consequences for the probability of exit and of bankruptcy.

Firstly, owners of highly indebted firms may pursue riskier strategies than they would if the firms were less indebted. This is because when firms rely largely on debt, stockholders get most of the earnings if projects are successful, but debtholders bear the losses in case the firm goes bankrupt (Jensen and Meckling, 1976). The consequence is that, if a firm is highly indebted, it will take chances: it will either survive or go bankrupt. It will not exit without imposing losses on creditors. A second possibility is that stockholders are paid out cash from the raised debt, thereby increasing the probability that the firm is unable to meet its commitments (Myers, 2001).

The mere presence of debt may impair efficiency within the firm, by reducing the incentives for making efficiency enhancing investments. Equity-holders may refrain from contributing additional equity to the firm, as they will bear the entire cost of this additional equity but not the benefits if the firm goes bankrupt in the meantime (Jensen and Meckling, 1976; Myers,

1977; Jensen, 1986). This increases the chances that firms forgo profitable investments and put them in a less favorable position for surviving. This should, in principle, apply both to bankruptcy and voluntary exit. However, even if firms decided to leave voluntarily, their debts would not let them avoid bankruptcy, and we should not expect a positive effect of debt of debt on voluntary exit. Furthermore, the fact that the equityholders of highly indebted firms are doing business with the money of others creates an incentive to try to postpone exit as much as they can and "play for time" in the words of Myers (2001). They may not be able to control the decision of going into bankruptcy but, to the extent that they have discretion on the decision to voluntary exit, they will not exit.

2.1.3 Deep pockets and resisting competition

Indebted firms may also be more likely to go bankrupt, because debt invites predation by rivals (Bolton and Scharfstein, 1990). In order to reduce agency problems, debtholders should call bankruptcy whenever the firm is unable to meet its commitments. This makes highly leveraged firms less able to resist adverse circumstances arising either from nature or from strategic behavior by competitors (predation). However, while this does not affect the states of nature, this makes indebted firms an easy prey for competitors and increases the likelihood of predation.

2.1.4 The predictions of information and agency models of debt

By and large, the predictions of agency theory for the conflicts between equity holders and debtholders are consistent and are not different from those from Ross (1977): debt increases bankruptcy and decreases voluntary exit. This is fortunate, as we expect results to be clear, but will not allow us to discriminate between competing explanations.

2.2 Debt maturity

Granting short term rather than long term credit may attenuate the asset substitution problem, as it enables banks to monitor much more closely the payment performance of firms (Barnea, Haugen, and Senbet, 1980; Ho and Singer, 1982). With short term credit, the bank will be aware of financial problems as soon as they emerge and will have the option of claiming payment of the principal before the situation deteriorates and greater losses become inevitable.

If they are to grant long term credit, banks will take additional risks, and will thus require a compensation in the form of higher interest rates. Firms which have good private information about themselves will more likely choose to get short term credit and run the risk of having to roll it over; those with bad information will prefer to establish long term contracts and save on the transaction costs required to rolling over the debt (Flannery, 1986). Thus, Flannery (1986) predicts a positive relationship between debt maturity and the quality of firms.

The same prediction emerges in a model by Diamond (1991). In this model, however, the cost that firms incur in trying to roll over their short-term debt, is that banks may not be willing to do it, and firms may go bankrupt. As in Flannery's model, only firms which have good information choose short-term debt. Unlike in Flannery's model, however, firms with very high risk may not be given the option of getting long-term debt. Firms with which end up with short-term debt, therefore, will be the best and the worst firms, while long-term debt will be granted to intermediate firms.

Most empirical studies seem to support Diamond's prediction (Guedes and Opler, 1996; Stohs and Mauer, 1996; Barclay and Smith Jr, 1995), but Berger, Espinosa-Vega, Frame, and Miller (2005) present contrary evidence. Both Barclay and Smith Jr (1995) and Berger, Espinosa-Vega, Frame, and

Miller (2005) give support to the idea that firms with larger information asymmetries issue more short-term debt.

Therefore, short-term debt should be positively associated with bankruptcy. In what voluntary exit is concerned, the predictions of Flannery's model is that short-term credit should be negatively related to exit, while in Diamond's model the result will depend on the balance between good and bad firms; if bad firms dominate, short-term credit should be positively associated with increased exit; if good firms dominate, short-term credit should be negatively associated with exit.

2.3 Credit lines

Firms maintain credit lines as a backup for liquidity needs. By establishing a credit line, the bank commits itself to lend at a predetermined interest rate, in exchange for a fee paid by the firm on the commitment. Although an escape clause, which is normal in this type of contracts, allows banks to renege on their commitments, they will normally choose to honor the commitments due to reputation considerations (Boot, Greenbaum, and Thakor, 1993)

Liquidity needs may emerge from adverse events, but also from profit opportunities that need to be exploited on the spot. Credit lines may alleviate the problem of excessive liquidation created by adverse events when firms are financed with short-term debt. Short-term debt leads to too frequent bankruptcy because the firm may not be able to roll over its debt or will be able to do it only at high interest rates. Insurance against this possibility provided by short-term debt with a loan commitment for future funding alleviates the problem (Houston and Venkataraman, 1996).

Credit lines also allow firms to take advantage of some investment opportunities that may require firms to dispose of funds faster than they can get from financial markets (Huberman, 1984). Firms possessing credit lines should, therefore, be in better position to avoid bankruptcy and to take ad-

vantage of profitable opportunities and prosper.

The fact that firms have an unused credit line indicates that banks found the firm to be trustable, as they committed themselves to grant credit. Firms may, thus, choose to get credit lines also in order to signal to others their quality and get better terms in other credit deals (Kanas, 1987). On the other hand, it also indicates that the firm is not credit constrained, as funds are available and the firm decided not to use them. They should, therefore, be less likely to exit.

2.4 Number of creditors

In order to reduce information asymmetries, banks invest in obtaining information about the firms they lend money to. The more information they get about firms they do business with, the better positioned they are to lend money. Investments in information gathering are costly, and doing business with several banks duplicates them. As banks pass these costs to firms in the form of credit costs and availability (Petersen and Rajan, 1994) firms may benefit from developing close banking relationships with a single bank.

However, doing business with only one bank creates a potential hold-up problem. If the firm has no alternative source of funds, banks may take advantage of their monopoly position and charge higher interest rates. Firms might, therefore, prefer to do business with several banks, as this reduces the bargaining position of each one of them.

The choice of the number of banks to borrow from involves a trade-off between duplicating the fixed costs of providing information to lenders and the benefits from lower bargaining power from the part of banks. Firms normally start doing business with a single bank and, as they grow older and larger switch to multiple relationships (Farinha and Santos, 2002)

However, developing multiple relationships also has costs (other than the fixed cost of providing information), as approaching a new bank creates an

adverse selection problem. Without previous private knowledge about the firm, the new bank will not be able to tell whether the firm is approaching it to escape from a rent extraction attempt, or because the original bank is not willing to lend the extra funds due to his knowledge that the firm is of a poor quality (Sharpe 1990, Rajan 1992). A good firm may therefore be pooled with low quality firms and be offered inferior credit terms. This should hold, at least for some time, before the new bank has the time to develop firm specific knowledge.

If the hold-up argument holds true, firms with more than one bank relationship should have lower interest rates, thus lower costs. Increases in the number of banks after a certain point should, however, increase costs. After a certain point, the duplication of the fixed costs of getting information offsets the benefits of increased competition among lenders. *Ceteris paribus*, we expect that, when the number of banks is small, increases in the number of banks decrease the probability of exit. After a certain number of banks, increases in this number should increase exit.

Distress exacerbates this problem and creates an additional one. Whenever a firm goes into distress and asks for an extension of credit, banks will be unsure whether this request has been previously rejected by another bank with better information. Furthermore, multiple creditors make coordination about potential recovery plans more difficult, and firms are more likely to go bankrupt. Thus, the higher the number of banks the more likely it is that a firm goes bankrupt.

2.5 Age of the firm

Over time, information is produced which is relevant to both the firm and others. As time goes by and firms age, firms learn about their abilities, and others (including banks) learn about them. Time may also bring changes in behavior, either because of learning effects or because firms develop reputa-

tional assets that they need to protect. All of these reasons have an impact upon the likelihood of either voluntary exit or bankruptcy.

2.5.1 Learning about own efficiency

Experience in the marketplace gradually reveals information to firms which make them learn about their true level of efficiency. Firms which find out to be efficient survive and grow, while those which are inefficient exit (Jovanovic, 1982). The most inefficient firms will have exited in the first periods. Firms that will have survived will be the most efficient firms, which will, therefore, be less likely to exit in the future (Jovanovic, 1982). Because the sample will have fewer and fewer bad firms, the average probability of exit will be decreasing over time, even if the individual chances of exit of each firm will not vary over time, something which is known as spurious duration dependence.

2.5.2 Learning by doing

While the above argument rests on the idea that efficiency of each firm is a given, and time only reveals this level to firms, time – through the accumulation of production – also brings specific experience which may be relevant to reduce costs.

2.5.3 Conveying information to others

Time also reduces the asymmetry of information between the firms and potential creditors. Banks observe the payment record of firms over time and will be more likely to be willing to lend money to firms that have a proven track record.

On the one hand, even if banks do not observe anything substantive about firms, only from observing that firms have survived, banks can infer that "quality" of the firms; if the spurious duration dependence effect applies,

they know that firms survived up to that moment are less likely to exit in the future.

2.5.4 Shifting from risky to safer strategies

Finally, firms may shift to safer projects over time, in order to protect the reputation they have developed in the meantime. Young firms, not having a reputation to protect, will choose riskier projects which will only permit payment of debts in case they are successful. After a number of periods paying its debts, a firm develops a reputation of being a good payer, and starts enjoying more favorable credit terms. Old firms will choose safe projects in order not to damage its reputation (Diamond, 1989).

3 The data

The data used in this paper come from two sources. The first is the *Quadros de Pessoal* survey, conducted by the Portuguese Ministry of Employment on firms employing paid labor. The second is the *Central de Responsabilidades de Crédito*, which is managed by the Bank of Portugal, and which records credit information for all non-financial firms or individuals with a credit relationship vis-à-vis the Portuguese financial system. Both databases are described below.

Quadros de Pessoal (QP) covers all firms employing paid labor in Portugal and records data at the firm level, namely employment, sales, ownership structure and industry codes, plus detailed information on every person working at the firm, namely their employment status (whether they are wage earners or owners of the firm, their wages (for wage earners), levels of education, date of birth, date of the first employment in the firm. The survey has a longitudinal dimension, i.e., firms are identified by a unique number, which allows individual firms to be followed over time.

Table 1: Credit types, Bank of Portugal.

Credit type	Description
1	Commercial liabilities
2	Financing liabilities at discount
3	Other short-term financing liabilities
4	Medium- and long-term financing liabilities
5	Other liabilities
6	Credit lines and other off-sheet liabilities
7	Overdue credit liabilities
8	Credit liabilities under litigation
9	Credit write-offs (off-sheet)
10	Renegotiated credits

Central de Responsabilidades de Crédito (CRC) includes data collected by the Bank of Portugal from all financial intermediaries legally operating in Portugal. Its data includes information to the monthly credit balances of all customers of each one of these institutions, discriminating credit balances according to maturity and its repayment status (see table 1). The available data includes the complete credit history of each non-financial firm between 1995 and 2000. The two data sets could be matched using a unique legal identifier for firms, and thus we were able to track credit information for all firms in the QP database.

We identified voluntary exits and bankruptcies using a two step procedure, which combines the two data sources. In the first step, we used QP to identify exits. This was done by locating in QP the year when a particular firm ceases to report to the survey. For the period we are analyzing, QP includes over 190,000 firms per year, and with such a large database, there are inevitably some coding errors in the files. In identifying exits, we required that a firm be absent from the survey for at least two years. Thus, for an exit to be recorded in t , a firm has to be absent from QP in $t + 1$ and $t + 2$. For this reason, in our subsequent analysis we use data only until 1998 (the last year for which we can identify an exit), although our data files go until

Table 2: Exits

Year	Voluntary exit		Bankruptcy		Continuation		Total sample	
	Number	(%)	Number	(%)	Number	(%)	Number	(%)
1996	9,984	(7.5)	1,536	(1.2)	121,290	(91.3)	132,774	(100.0)
1997	10,384	(7.5)	1,744	(1.3)	126,149	(91.2)	138,244	(100.0)
1998	13,124	(9.2)	2,066	(1.4)	127,309	(89.3)	142,466	(100.0)
Total	33,492	(8.1)	5,346	(1.3)	374,748	(90.6)	413,586	(100.0)

2000. Since a temporary exit may occur for a number of reasons other than cessation of activity (for instance, due to late delivery of the questionnaire by firms), we edited the status of firms that were absent from QP for one year. That is, firms that were in QP in years $t - 1$ and $t + 1$ were considered to be active in year t even if they were not actually in the file. The firm's record was amended for that year, with all variables being imputed as simple averages. For a few firms, the data on sales was missing, and the same procedure was followed to impute sales when a firm was present in QP in years $t - 1$, t and $t + 1$ but sales was recorded as zero in year t .

Bankruptcies were identified as those exits for which firms defaulted on their debt obligations during the two years after exit was identified. CRC includes two specific categories for defaults, namely "Overdue Credit Liabilities", and "Credit Liabilities Under Litigation". Any exit occurring in year t is considered "voluntary" if no default is recorded in $t + 1$ and $t + 2$. Likewise, any exit in t for which defaulted amounts are recorded in $t + 1$ or $t + 2$ is deemed "bankruptcy". Based on these definitions, we calculated the number of exiting firms as displayed in table 2. Almost ten percent of firms exit, of which roughly one fifth are bankruptcies. These ratios are fairly constant in the three years for which data is available.

CRC was also the source for the measures of the amounts and type of credit, along with information about the lenders that concern us the most in this study. From QP we computed measures of firm size, firm age, ownership

structure and measures of the wages paid and the human capital at the firm, that are used in the analysis to control for other differences in firms characteristics and that will be described later in this section. The data from CRC is the following.

Total Debt Total debt is calculated by adding all on-balance sheet credit types, which are types 1 through 10 except 6 and 9. The logarithm of one plus the on-balance sheet amount (in euros) was used.

Short- and long-term debt We also computed the amount of short- and long-term debt. Types 1 through 3 are explicitly short-term items, while types 4 and 5 correspond to long-term debt. Impaired credit types 7 and 8 were imputed to short- and long-term debt proportionally. Credit type 10 was ignored. In order to include in our regressions firms without any short- or long-term debt (or both), we used the logarithm of one plus the relevant amount (in euros).

Credit lines The main component of off-balance items (type 6) are credit lines. The logarithm of one plus the amount (in euros) was used.

Number of bank relationships The literature of banking relationships has emphasized that cursory contact with a bank does not make a relationship. In this context, it has been emphasized that the scope and in particular the length of the contacts between firms and banks is important in providing the bank with the information that makes relationships valuable. We are limited to counts of the number of banks with which firms have contacts, as we do not have information on the length of the relationships. Although we do not have information on the length of the relationship, we limited the count of the number of banks firms borrow from to those they borrow

Table 3: Credit variables

Variable	Mean	Std. Dev.
Log of 1 + total debt	5.482	5.268
Log of 1 + short-run debt	4.926	5.149
Log of 1 + credit lines	1.981	4.088
Bank relationships	0.275	0.616

Note: sample size is 413,586 observations

long-term, to avoid counting as a borrowing relationship banks with which firms may have only commercial paper operations. We used the information on long-term debt to each lender to count the number of long-term bank relationships. Multiple long-term loans with the same lender are counted as a single bank relationship.

3.1 Controlling for Efficiency

In order to control for efficiency, a number of variables were computed from QP.

Size and productivity Measure of size were included on different grounds. First, if there are economies of scale, larger firms will have smaller average costs. Second, scale should also be related to exit as larger units tend to use technologies which are more capital intensive, and have small variable costs. Conceptually, if there were not economies of scale total average costs were identical, but firms' costs composition were different, those firms which higher variable average costs would exit first. Finally, size may be a consequence of different managerial abilities. Firms are run by individuals, which compare the income they can get from wage work with the rewards that can be obtained from entrepreneurship. Individuals for which entrepreneurship provides greater benefits run firms, while the others work as wage earners (Lucas, 1978). Those with greater abilities will be able to run larger firms.

Two measures of size were included: sales and employment. They both

come from QP, and they may be regarded as alternative measures of size. Simultaneous inclusion of both (in logarithms) will control for differences in productivity. The observed productivity is a direct measure of efficiency. Ceteris paribus, firms which are able to generate more value per employee, will be more efficient and will be less likely to exit.

Wages and human capital Wages can also be seen as a proxy for productivity. QP includes information on each worker at the firm. Wages and a number of human capital variables were calculated from that part of the files. Wages were calculated as the average monthly wage (in thousand euros) paid to wage earners in each firm. Schooling was defined as the minimum number of years required to obtain the highest degree reported to QP. Elementary school corresponds to 6 years of schooling, secondary school to 12 years, and an university degree to 17 years. The average wage earners was calculated based on date of birth of each person and then averaged across individuals. The same procedure as the one described for age was used to compute the tenure of persons working at the firm, based on the date of admission at the firm.

3.2 Age of firms

Firm age The age of firms was calculated from QP, by subtracting the year of the firms' founding from current year. For those cases for which information of date of creation was missing in QP, we used an auxiliary data set (*Tabelas Gerais* database) available at Banco de Portugal, which contains legal information on all existing and extinct firms in Portugal, including the date of creation. The information of both datasets is highly consistent for those firms which are present in both.

3.3 Ownership and ease of access to funds

One implication of the information asymmetry argument is that, as financial markets are unable to provide funding, firms which have better access to internal funding will be in a better position to survive, in particular to avoid bankruptcy. Two ownership indicators were included to control for differences in access to funds.

3.3.1 Number of active owners

More partners bring more money to the firm, and this should make firms with a larger number of partners less likely to go bankrupt. More partners may also have complementarities, which increase the chances of success of firms. After a certain point, however, an increase in the number of active partners creates coordination and free-rider problems, which may decrease efficiency.

As QP includes an indicator for the employment status of each person that works at the firm (owner, wage-earner, and a residual class of unpaid family member) a proxy for the number of partners in the firm can be calculated as a count of the number of persons which has the owners status in QP.

3.3.2 Foreign Ownership

Foreign firms have access to a number of assets not available to domestic firms; these include both capital, and intangible assets such as technology and marketing knowledge. This should make them to be less cash constrained and also more productive. Fewer liquidity constraints should make foreign firms less likely to go bankrupt. Greater productivity should make them less likely to exit. Controlling for productivity, however, they should be more footloose and exit with greater probability than their domestic counterparts.

Foreign ownership was measured by a dummy variable which takes the value 1 if the firm's equity is partially or fully owned by foreigners, and 0

Table 4: Other summary statistics (Sample: 413,586 observations)

Variable	Mean	Std. Dev.
Log of workers	1.476	1.103
Log of sales	13.481	1.551
Number of owners	0.612	0.862
Foreign ownership	0.011	0.106
Firm age	14.754	11.673

otherwise.

4 Results

We estimated a multinomial logit model for the risks of bankruptcy and voluntary exit with continuing firms as the reference category. All independent variables are measured previously to the exit decision, so endogeneity problems are less of a concern. Many independent variables are in logs, therefore, interactions between them are implicitly taken into account. The dependent variables are positive if exit (voluntary or bankruptcy) occurs and zero if the firms continues. Consequently, a positive coefficient means that increases the the corresponding variables increases the chances of exiting.

Table 5 displays the results of three estimations. Our basic specification in columns (1) and (2) includes firms' debt plus second order polynomials in the number of banks, the number of owners and firm age. It also includes two measures of the size of firms (employment and sales), plus the dummy variable that indicates whether the firm is owned by foreigners along with industry and year dummies (not reported in the table). In addition to these variables, the second specification also includes the magnitude of short-term debts and the third the magnitude of the credit lines.

Before starting commenting on the results, it is worth spending a couple of lines reminding our readers that, as we estimated the effects of many of our independent variables in the form $\alpha \log X + \beta \log Z$, we can retrieve the

Table 5: Regression results: determinants of exit

	(1)	(2)	(3)	(4)	(5)	(6)
	Volunt.	Bankr.	Volunt.	Bankr.	Volunt.	Bankr.
Log(employment)	-0.608a (0.000)	-0.549a (0.000)	-0.609a (0.000)	-0.565a (0.000)	-0.606a (0.000)	-0.542a (0.000)
Log(sales)	-0.132a (0.000)	-0.176a (0.000)	-0.133a (0.000)	-0.198a (0.000)	-0.128a (0.000)	-0.168a (0.000)
Log(1 + total debt)	-0.009a (0.000)	0.256a (0.000)	-0.011b (0.011)	0.160a (0.000)	-0.011a (0.010)	0.162a (0.000)
Log(1 + sh.-run debt)			0.002 (0.649)	0.098a (0.000)	0.003 (0.463)	0.102a (0.000)
Log(1 + credit lines)					-0.009a (0.000)	-0.038a (0.000)
Bank relationships	-0.239a (0.000)	0.368a (0.000)	-0.236a (0.000)	0.572a (0.000)	-0.231a (0.000)	0.587a (0.000)
Bank relationships ²	0.030b (0.018)	-0.012 (0.088)	0.030b (0.022)	-0.050a (0.000)	0.031b (0.018)	-0.049a (0.000)
Owners	-0.220a (0.000)	-0.038 (0.452)	-0.221a (0.000)	-0.042 (0.407)	-0.222a (0.000)	-0.054 (0.287)
Owners ²	0.001 (0.959)	-0.060a (0.009)	0.001 (0.958)	-0.058b (0.012)	0.001 (0.934)	-0.054b (0.018)
Foreign ownership	0.677a (0.000)	-0.288 (0.115)	0.678a (0.000)	-0.260 (0.155)	0.690a (0.000)	-0.214 (0.242)
Firm age	-0.032a (0.000)	-0.055a (0.000)	-0.032a (0.000)	-0.056a (0.000)	-0.032a (0.000)	-0.056a (0.000)
Firm age ²	0.000a (0.000)	0.001a (0.000)	0.000a (0.000)	0.001a (0.000)	0.000a (0.000)	0.001a (0.000)
N	413586		413586		413586	

Note: estimation also includes industry and year dummies.

effect of the ratio of X/Z from our estimates, by noting that the previous expression can be written as $\alpha \log(X/Z) + (\beta - \alpha) \log Z$. For example, if X stands for sales and Z for employment, α measures the effect of productivity, conditional on the independent effect of employment, which is estimated as the difference between the estimated coefficient for employment β and the one for sales α . The sign of the difference $\beta - \alpha$ will give us the sign of the effect of employment, given the effect of productivity.

Therefore, taking into account the estimated coefficients in Table 5, we estimate that larger firms have lower probabilities both of exiting voluntarily and of going bankrupt. This result holds for both our size measures (employment and sales), and it also holds when each one of this variables is omitted (not reported in the table). Simultaneous inclusion of both variables allows us to interpret the results as evidence of the effect of productivity (sales per worker). The effect of sales per worker is given by the coefficient of sales in table 5, thus indicating that more productive firms have lower probability of exiting and going bankrupt. As the coefficient of employment is of a larger magnitude than that of sales, our results indicate that, controlling for productivity, firms which employ a larger number of persons have a lower probability of exit. Overall, these results indicate that efficiency matters for survival and that it affects voluntary exit and bankruptcy very much in the same manner. We move now to the effects of the credit variables.

The effect of debt is to increase bankruptcy and to decrease the probability of voluntary exit, as expected. We do not have measures of equity or assets in our data, so we cannot compute the usual debt to equity or to assets ratios. However, our data on firm sales, allow us to control for the firm size and interpret our results as reflecting the impact of debt over sales (the inverse of the liquidity ratio), conditional on sales. The independent effect of sales remains negative when we take into account the effect of debt over sales (which is also negative).

Our results also indicate that the larger the proportion of short-term debt a firm holds, the more likely it is that it goes bankrupt. Note that the independent effect of debt still holds as the coefficient of debt is larger than that of short-term debt. We were, however, unable to uncover a statistically significant effect of this variable upon voluntary exit.

Credit lines have a clear and similar effect upon bankruptcies and exit. The larger the magnitude of unused credit lines, the less probable it is that a firm exits (either voluntarily or by bankruptcy).

The number of bank relationships shows the expected effects. More banks decrease the probability of voluntary exit but only while firms borrow from a small number of banks. Indeed, according to our estimates, firms that deal with four or more banks see their probability of exit increased. More banks, on the other hand increase the likelihood of going bankrupt. Although the rate at which this probability is decreasing, the maximum is achieved when the number of banks is around 6 (the estimates in column 1 produce a maximum with 15 banks).

The results for the age of firms are also consistent with our predictions. Young firms exhibit a significantly higher probability of exit than their more mature counterparts, while this probability decreases at decreasing rates. In non-reported regressions, the effect of firm age was measured by a set of age dummies. Interestingly, in both equations the effect of age is very similar. The coefficients of the age dummies are monotonically decreasing until the age of ten and statistically different from the omitted class (firms with 50 years and more) up to the fifth or sixth year, depending on the specification.

Easy access to internal funds seems to improve the chances of avoiding bankruptcy. Firms with larger number of active owners and firms with foreign owners are less likely to go bankrupt, although for foreign ownership the effect is really not significant. In the voluntary exit equation, foreign ownership displays a positive coefficient, consistent with a view that foreign firms are

Table 6: Wages and human capital characteristics (Sample: 338,707 observations)

Variable	Mean	Std. Dev.
Average wage	0.394	0.231
Schooling	7.987	2.542
Age	34.692	9.07
Tenure	4.678	4.683

less attached to a country than their domestic counterparts. The results for the number of owners indicate that more owners increase the probability of survival. However, the quadratic term is never significant in the voluntary exit equation, thus giving little support to the congestion hypothesis.

4.1 Further controls for efficiency

In Table 5 our controls for efficiency include two measures of firm size, which together can be taken as a measure of labor productivity. We do not have information on earnings or profits but, except for very small firms in our sample, we have data on the wages paid. Wages can be regarded as a proxy for efficiency if wages are, to some extent, the product of bargaining between firms and workers. More productive or highly profitable firms should be able to pay higher wages. If workers are indeed able to get part of this profit, high wages should be an indication of efficiency.

In the estimations reported in Table 7 we included in our regressions measure for the wages paid by firms. In columns (1) and (2), only the level of wages paid is included in addition to the same variables that were already included in table 5. The coefficients associated to wages are always and significant on both equations, indicating that the most productive firms confront lower chances of exiting, no matter the mode of exit considered. In addition, the effect of other variables remains pretty stable.

Wages may differ between firms due to different compositions of the la-

Table 7: Wages as measures of efficiency

	(1)	(2)	(3)	(4)
	Volunt.	Bankr.	Volunt.	Bankr.
Log(employment)	-0.560a (0.000)	-0.482a (0.000)	-0.558a (0.000)	-0.477a (0.000)
Log(sales)	-0.116a (0.000)	-0.157a (0.000)	-0.120a (0.000)	-0.158a (0.000)
Wage	-0.146a (0.000)	-0.606a (0.000)	-0.172a (0.000)	-0.681a (0.000)
Schooling			0.017a (0.000)	0.005 (0.494)
Age			0.006a (0.000)	0.008a (0.000)
Tenure			-0.012a (0.000)	-0.001 (0.784)
Log(1 + total debt)	-0.011b (0.031)	0.156a (0.000)	-0.009 (0.064)	0.157a (0.000)
Log(1 + short-run debt)	0.002 (0.623)	0.102a (0.000)	0.001 (0.813)	0.102a (0.000)
Log(1 + credit lines)	-0.012a (0.000)	-0.037a (0.000)	-0.013a (0.000)	-0.039a (0.000)
Bank relationships	-0.215a (0.000)	0.550a (0.000)	-0.216a (0.000)	0.550a (0.000)
Bank relationships ²	0.023 (0.096)	-0.041a (0.000)	0.021 (0.138)	-0.042a (0.000)
Owners	-0.331a (0.000)	-0.128b (0.017)	-0.329a (0.000)	-0.130b (0.016)
Owners ²	0.017a (0.000)	-0.036 (0.123)	0.017a (0.000)	-0.036 (0.132)
Foreign ownership	0.724a (0.000)	-0.255 (0.228)	0.707a (0.000)	-0.287 (0.182)
Firm age	-0.033a (0.000)	-0.056a (0.000)	-0.029a (0.000)	-0.057a (0.000)
Firm age ²	0.000a (0.000)	0.001a (0.000)	0.000a (0.000)	0.001a (0.000)
N	344108		338707	

Note: estimation also includes industry and year dummies.

bor force, namely due to different stocks of human capital. Accordingly, in columns (3) and (4) wages are supplemented by three variables measuring the stock of human capital at the firm: education, age and tenure, of these variables being averages at the firm. These variables are included to control for determinants of wages and we are not really interested in their effects. Yet, we note that the estimated coefficients have the same signs in both equations. More importantly, neither the effect of wages nor the effect of other variables are much affected by its inclusion. Moreover, the magnitude of the Owners squared term is now quite larger (and statistically significant). Yet, the effect of owners in the voluntary exit equation is maximum when the number of owners is 10, which still does not present evidence of congestion effects.

4.2 More on bank relationships

In Table 5 we reported that firms that borrow from four or more banks have their probability of exiting voluntarily increased, while the likelihood of going bankrupt increases for increases in the number of banks (up to 6 banks).

These results are particularly interesting, given that they are obtained for an European country. Many American studies concentrate on the dichotomy between single and multiple relationships, on the assumption that as a second supplier would be enough to reduce the hold-up problem (Petersen and Rajan (1994)). In particular outside the U.S., (Ongena and Smith, 2000) suggested that many firms may maintain more than two relationships and (Detragiache, Garella, and Guiso, 2000) suggested that this pattern may be due to firms seeking to avoid, not hold-up but refusal to lend due to banks' internal problems. Our results suggest that, for more than four banks, this may come at the expense of survival.

The measure of the number of bank relationships that we have been using throughout the paper is a direct count of the number of banks with which

Table 8: Bank relationships

	(1)	(2)	(3)	(4)
	Volunt.	Bankr.	Volunt.	Bankr.
Log(employment)	-0.606a (0.000)	-0.534a (0.000)	-0.606a (0.000)	-0.544a (0.000)
Log(sales)	-0.128a (0.000)	-0.161a (0.000)	-0.128a (0.000)	-0.167a (0.000)
Log(1 + total debt)	-0.011b (0.014)	0.159a (0.000)	-0.011b (0.011)	0.163a (0.000)
Log(1 + short-run debt)	0.003 (0.549)	0.108a (0.000)	0.003 (0.483)	0.102a (0.000)
Log(1 + credit lines)	-0.010a (0.000)	-0.035a (0.000)	-0.009a (0.000)	-0.038a (0.000)
Bank relationships	-0.270a (0.000)	0.726a (0.000)	-0.192a (0.000)	0.670a (0.000)
Bank relationships ²	0.053 (0.146)	-0.069a (0.000)	0.024 (0.077)	-0.061a (0.000)
Increased bank relationships			-0.072b (0.031)	-0.178a (0.000)
Owners	-0.221a (0.000)	-0.059 (0.241)	-0.222a (0.000)	-0.052 (0.299)
Owners ²	0.001 (0.942)	-0.053b (0.021)	0.001 (0.936)	-0.055b (0.017)
Foreign ownership	0.691a (0.000)	-0.230 (0.208)	0.690a (0.000)	-0.215 (0.239)
Firm age	-0.032a (0.000)	-0.056a (0.000)	-0.032a (0.000)	-0.056a (0.000)
Firm age ²	0.000a (0.000)	0.001a (0.000)	0.000a (0.000)	0.001a (0.000)
N	413596		413596	

Note: estimation also includes industry and year dummies.

In columns (1) and (2) bank relationships are measured by the number equivalent of banks implied by the Herfindahl index of debt concentration.

firms have a borrowing long term operation. Given that firms borrow from a large number of banks, it is unlikely that all banks are have the same importance to firms. It might be argued that the number of banks firm borrow from is not the best measure for the number of bank relationships, as some banks may be more important than others, in particular in contexts in which firms borrow from many banks simultaneously.

In the first two columns of Table 8, the number of bank relationships is not a simple count, but takes into account the share of total debt borrowed from each bank. In these columns the number of bank relationships is replaced by the number equivalent of the Herfindahl index of debt concentration. The Herfindahl index of concentration (H) is the sum of the squared shares of the debt held by each bank, and $1/H$ corresponds to the number of banks that would be required to produce the observed H , if the firm would borrow equally from all banks. The results do not show major changes. Perhaps the most noticeable change is that the increases in the number of banks are now detrimental for survival for a number of banks greater than 2.5 rather than 3.7 as before.

In columns (3) and (4) the number of bank relationships is again the number of banks with which firms have long-term borrowing operations. In these columns, we also include the a dummy indicating whether or not a new relationship was just initiated. The literature on banking relationships has emphasized that relationships with banks are developed over time, and many studies include the duration of the relationship as a proxy for its strength (e.g. Berger and Udell, 1995). Farinha and Santos (2002) analyzed the decision of Portuguese firms to switch from single bank to multiple bank relationships and found that firms with poorer performance are more likely to make the transition from single to multiple banks. They further found, that after switching to multiple banks, firms are more likely to perform poorly and to default on their obligations. In contrast to these findings, our results suggest

that an increase in the number of relationships decreases the probability of exiting both voluntarily and by bankruptcy.

These results certainly deserve further investigation, but some tentative explanations may be advanced: firms are subject to close scrutiny by banks before the first long-term loan, these first loans are relatively unimportant in magnitude and one year is insufficient to observe firms defaulting on these new long-term loans.

5 Conclusion

We analyzed the impact of financial variables upon two modes of exit that differ on who bears losses: in voluntary exit losses are beard by the equity-holders only, while in bankruptcy debtholders share part of this burden.

Our results support the idea that efficiency is a key driver of the survival of firms. Larger firms and those that are more productive have lower probabilities of exiting voluntarily and of going bankrupt.

We also find that the remaining determinants of exit, namely those related to the access of funds, different very widely between voluntarily exit and bankruptcy. These findings give very strong support to the idea that firms are cash constrained, largely due to information asymmetries between borrowers and lenders. Our findings also support the idea that financial decisions are used to signal firms' quality and reduce the degree of information asymmetries between borrowers and lenders. Highly leveraged firms experience significantly higher probabilities of going bankrupt, but are significantly less likely to exit voluntarily, a finding which is consistent with both information and agency explanations. Intensive reliance on short-term debt also increases bankruptcy, but we did not find any significant relationship between short-term debt and voluntary exit. Credit lines are statistically related to the two types of exit, a finding which is consistent with information

arguments.

We also found that borrowing from more banks lowers the likelihood of voluntary exit, if the number of banks is small. However, for firms that borrow from four banks or more, increases in the number of banks makes voluntary exit more likely. Choosing the right number of banks involves a trade-off between benefiting from a lower monopoly power from the part of lenders and having to pay for the extra costs of making a larger number of lenders knowledgeable about the firm. On the other hand, the likelihood of going bankrupt increases if firms borrow from more banks, which is consistent with more banks representing increased coordination costs in case of distress.

The finding that younger firms exhibit lower chances of exiting voluntarily and of going bankrupt is consistent with information asymmetries and with learning effects. Finally, we find that firms that have more owners and those that have foreign owners have significantly lower probabilities of going bankrupt, while the contrary is true for voluntary exit. Again, this supports that notion that firms are cash constrained, as access to more abundant sources of funds improves the chances of avoiding bankruptcy.

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