LISBON
SCHOOL OF
ECONOMICS &
MANAGEMENT
UNIVERSIDADE DE LISBOA

# MASTERS IN
FINANCE

# MASTERS FINAL WORK
Dissertation

# DETERMINANTS OF CORPORATE CREDIT DEFAULTS IN A PORTUGUESE BANK

HUGO MIGUEL BIO SANTOS

OCTOBER – 2015

LISBON SCHOOL OF ECONOMICS & MANAGEMENT
UNIVERSIDADE DE LISBOA

# MASTERS IN
FINANCE

# MASTERS FINAL WORK
DISSERTATION

# DETERMINANTS OF CORPORATE CREDIT DEFAULTS IN A PORTUGUESE BANK

HUGO MIGUEL BIO SANTOS

**SUPERVISOR:**

Professor Doutor Joaquim José Miranda Sarmento

OCTOBER – 2015

**Acknowledgements**

I would like to express my gratitude to my supervisor Professor Joaquim Sarmento for all the support throughout this thesis.

Also, I am thankful to the person that provided the database I used in this work.

Finally, this thesis is dedicated to my parents, who never stop believing in me and have always supported me.

**Abstract**

Firms go through many difficulties and goals during their existence and, for that reason, many times they have to ask a bank for a loan. Credit Default happens when a certain firm cannot pay a scheduled obligation imposed by the bank at the loan contract celebration. This work intends to conduct a survey of probability of default by Portuguese firms. We test a sample of 1749 loans to Portuguese firms that have an account in a Portuguese bank. From this sample, 279 loans entered into default. We perform a probit model and a duration model and find that economic crisis increase the probability of default. There is also evidence that firms of the construction sector are more likely to enter in default. The loan's interest rate also plays an important role: higher interest rates tend to increase the probability of default. There is no evidence that the sales of the firm and the initial amount of the loan modify the probability of default. A firm entering in default lasts, on average, 839 days.

**Keywords:** Corporate, Credit, Default, Firms, Crisis

**Resumo**

As empresas passam por muitas dificuldades e objetivos durante a sua existência e, por essa razão, muitas vezes têm de recorrer a um empréstimo bancário. Incumprimento de crédito acontece quando uma empresa não consegue pagar uma obrigação imposta pelo banco, na celebração do contrato de empréstimo. Este trabalho levará a cabo um levantamento de probabilidade de incumprimento por parte das empresas portuguesas. Vamos testar uma amostra de 1749 empréstimos a empresas portuguesas concedidos por um banco português. Desta amostra, 279 empréstimos entraram em incumprimento. Conduzimos um modelo probit e um modelo de duração, descobrindo-se que uma crise financeira aumenta a probabilidade de incumprimento. Também existe evidência que as empresas pertencentes ao sector da construção têm mais probabilidade de entrar em incumprimento. A taxa de juro agregada ao empréstimo também tem um papel importante: maiores taxas de juro tendem a aumentar a probabilidade de incumprimento. Não existe evidência que as vendas da empresa e o montante inicial do empréstimo modifiquem a probabilidade de incumprimento. Uma empresa leva, em média, 839 dias para entrar em incumprimento.

**Palavras-chave**: Empresas, Crédito, Incumprimento, Crise

**Index**

Acknowledgements……I

Abstract……II

Resumo……III

Index……IV

1. Introduction……...1

2. Literature Review……..3

2.1. Definition of Default……...3

2.2. Probability of Default……3

2.3. Determinants of Loans……4

2.4. Recovery from Default……...7

3. Methodology and Data……..8

3.1. Methodology……...8

3.1.1. Probit Model……8

3.1.2. Duration Model……9

3.2. Data……9

4. Results……14

4.1. Probit Model……14

4.2. Duration Model…….16

5. Conclusion……...19

6. References……...21

7. Appendix…….25

7.1. Table 1 – Explanatory variables……...25

7.2. Table 2 – Descriptive statistics…….27

7.3. Table 3 – Annual Variation Rate of the amount loaned……...27

7.4. Table 4 – Total amount loaned…….27

7.5. Table 5 – Total amount loaned in default…….27

7.6. Table 6 – Firms in default…….28

7.7. Table 7 – Amount loaned in default by sector of activity (NACE)……..28

7.8. Table 8 – Interest Rates……28

7.9. Table 9 – Loans in default per Initial Amount……..28

7.10. Table 10 – Temporal Analysis of the sample…….29

7.11. Table 11 – Probit Model…….29

7.12. Table 12 – Duration Model (Panel A and B)……..30

7.13. Table 13 – Loan defaults per type of loan……..31

7.14. List of Kaplan-Meier Graphics……...32

## 1. Introduction

To understand the financial wealth of the Portuguese companies, it is important to study their capacity to pay off their debts.

By definition, the probability of default is the degree of likelihood that the borrower of a certain loan will not be able to pay the scheduled installments. When the borrower is unable to pay, they said to be in default and, then, the lenders have legal ways to try obtaining at least partial repayment.

The main purpose of commercial banks is to maximize their profits that come from their activity, so their managers should be concerned about the existence of certain risks in their assets' portfolio. An important part of these risks is credit risk. Therefore it is important to understand the determinants that take a firm to enter in default. In this work we analyze some of them: the interest rate, the type of loan, the activity sector (NACE), the economic cycle, the size of the firm (through sales) and the initial amount of the loan.

Throughout the years, we have been presenting a decrease of loans conceded to Portuguese firms but an increase in the ratio of defaults as results of the change on the financial and economic path in the last decade, as a consequence of world crisis (subprime and sovereign debt in Europe). A negative annual variation of 6.6% was registered, on November, 2014 concerning the amount loaned to firms (table 3). The total amount conceded to firms decreased: 86876 million euros were registered on the 4$^{th}$ quarter of 2014 and 92208 million euros on the same quarter of 2013; the amount registered on 2008 was 119188 million euros (table 4)! By constrast, the amount in default increased from 12356 million euros on the 4$^{th}$ quarter of 2013 to 13031 million

euros on the same quarter of 2014; referring again to 2008, the amount was only 2861 million euros (table 5). Plus, the number of firms in default increased too but the difference is not significant at least comparing just the two past years: from all the firms that asked for a loan, on the 4$^{th}$ quarter of 2014, 30.8% defaulted (30.3% on the same quarter of 2013); but if we return again to 2008, we see that only 17.2% of the firms entered in default (table 6). How about the interest rate that is being applied to these loans? 4.63% was being applied on November, 2014 and 5.30% on November 2013; going back to 2008, 6.70% was the interest rate registered (table 8). Besides interest rates are decreasing, the amount defaulted is higher. One may conclude that the interest rate is not the main determinant of the probability of default. Another determinant studied in this work is the sector of activity where a firm belongs. Table 7 lead us to tell that the construction sector is the one with higher rates of default: 28.7% on the 4$^{th}$ quarter of 2014 (24.5% for the same period of 2013) followed by the wholesale and retail, transports and repair with 16,5% (15.7%) and secondary sector (manufactured goods) with 11,7% (10.9%).

All these data take us to ask ourselves some questions that we will try to answer in this thesis: How much is the probability of default of a certain Portuguese firm and how much time goes by from the loan contract celebration to the default date.

This thesis proceeds as follows. In section 2 is presented a brief literature review on loans, defaults and recoveries. The methodology we used to approach this matter is explained in section 3, where all variables and models are examined in detail. In section 4, our main results are explained. In section 5 we summarize our main findings.

## 2. Literature Review

### 2.1. Definition of Default

Firstly we should begin by defining default: a firm enters in default when it can't pay the amount in debt after 3 consecutive months, says Antunes, A., Ribeiro, N. & Antão, P. (2005). Although this period (3 months) is not considered by some authors. Faria, A. (2013) states that default happens when a firm does not carry out with its scheduled payments or violates any loan contract requirement implying that just one failure results in default.

Hazak, A. & Mannasoo, K. (2007) come with a more precise definition comparing default, bankruptcy – the legal definition of default referring to the situation where a firm is legally declared unable to pay its creditors – and negative equity – the accounting view of default, yet is not a *de facto* definition of default but instead a strong sign of distress. Furthermore, various other definitions for corporate credit default appear in many works, such as loan default (Ward & Foster, 1997; Campbell et al. 2005) and cash insolvency (Laitinen, 1994).

### 2.2. Probability of Default

It is very important to know that one may think that bigger firms should be less exposed to bankruptcy but that is false. Jim Collins (2009) in his study "How the mighty fall" shows that all institutions are vulnerable and their size and quality does not matter. But is this really true? Many authors studied the importance of the dimension of a firm in the probability of default. In one hand we have the authors that stated that smaller firms tend to display higher probability of default, like Bhattacharjee et al (2002), Bunn & Redwood (2003), Eklund et al (2001) and Jiménez & Saurina (2004). On the other hand,

we have the ones (Pain & Vesala (2004) and Bernhardsen (2001)) that argue that the size of the firm does not play an important role in the probability of default, mainly if the financial situation of the firm is controlled. Benito et al (2004) using data from Spanish firms, reached the same results as Bonfim, D. (2006), concluding that there is a positive relation between the dimension of a firm and the probability of default in a way that there is a higher number of defaults but these defaults have, generally, a very low magnitude.

Relatively to countries' legislation, firms of countries that facilitate the procedures to open new businesses and have less regulated labor markets have more probability of bankruptcy, states Claessens, S. & L. F. Klapper (2005).

For some authors, the amount of credit plays an important role in the probability of default. Antunes, A., Ribeiro, N. & Antão, P. (2005), in their study, alerts that in general, there is a lower probability of default attached to firms with higher credit amounts.

Faria, A. (2013) admits, in her master thesis, that in fact, there was a great change on the financial and economic path in the last decade, as a consequence of world crisis (subprime and sovereign debt in Europe). These changes led, on one hand, to the deterioration of financial conditions of many Portuguese economic agents, which saw their payment of loan conditions get worse and, on the other hand, to the reduction of the allowed credit level resulting in the reduction of new loans conceded by the banks.

### 2.3. Determinants of Loans

When any firm goes to a certain bank to ask for a loan, there are characteristics of that firm that may influence some variables of the loan.

One of those characteristics is the rating of the firm and the relation it has with the bank. One of the main determinants of the costs of credit is the firm's rating, this is the classification that is assigned to a firm which gives information about the probability of payment, defends Dittrich (2007). Da Silva, A. & Braga, S. (2014) studied the determinants that influence the conditions of a loan to a certain firm and concluded that the relationship that a firm has with a bank has a decisive role in the conditions of the loan, such as the interest rate charged and the amount. Besides these, firms with positive results and high sales may benefit, such that implies a certain safety to the bank for the payment of the debt. There is more literature analyzing the relationship between firms and banks but it is easy to find many inconsistencies. In the work "Relações bancárias e custos de financiamento", Bonfim, D., Dai, Q. & Franco, F. (2010) studied the impact of these relations in the costs of credit. They concluded that Portuguese firms gather loans from different banks even if they are small firms. Additionally, the bigger the firm is, the higher the number of banking relations it has and this leads to a significant decrease of the costs of credit. On the other hand, Diamond (1984) defends that firms may benefit from an unique banking relationship. This finding comes from the idea of an unique banking relation provides less monitoring costs which may lead to less costs of credit. This theory was tested afterwards by Petersen & Rajan (1994) which concluded that the existence of many creditors may increase the spread charged and it decreases the credit supply. But many works found that, rarely, firms have just one banking relation, just like the Portuguese study mentioned above. D'Auria, Foglia & Reedtz (1999) found the same for Italian firms. From 1079 firms, Ongena & Smith (2000) found that only 15% ask loans from just one bank. In this study is also said that firms, generally, maintain more banking relations in countries with inefficient judicial

systems and with weak creditors' rights. It is important to refer some explanations about why firms prefer loans from different banks simultaneously. According to Sharpe (1990) & Rajan (1992), from an unique banking relation, the bank has access to information of privilege nature, which allows it to explore the power of the firm and also extract the information of all loans. So, smaller firms that ask for a loan to only one bank should experience higher credit costs.

In the side of the variables we may highlight the spread charged and there is many authors discussing it. Fortunato, C. (2013) studied the changes in the spread charged and concluded that it increases where they are required guarantees to shareholders and/or managers and it decreases in case of loans with longer and higher amounts due to the reduction of the costs of credit. So, it is expected that banks charge higher interest rates on loans to riskier borrowers and require, at the same time, a guarantee. Pozzolo, A. (2002) concludes then that banks charge higher interest rates on loans with collaterals (secured loans) than on unsecured loans. As we can see, collaterals or guarantees are important to calculate the spread charged on a certain loan and Steijvers, T. & Voordeckers, W. (2009) indicated exactly that collateral was playing, by that time, a very important role in obtaining bank finance. They also predicted that collateral would become even more important in the future. In their work they also talked about the collateral as a mechanism to mitigate informational asymmetries and thus solving the credit-rationing problem, that happens when, in equilibrium, the demand for loans exceeds the supply at the current interest rate. This was also discussed by Stiglitz, J. & Weiss, A. (1981).

### 2.4. Recovery from Default

After bankruptcy some firms may recover from the difficulties but we have to be aware that when a firm enters in default, the firm is not the only impaired.

Some signs shown by firms with financial difficulties were studied by Bonfim, D. (2006): Levels of profitability, sales and investment are quite low; dependence on borrowed funds is significantly high.

Branch, B. (2002) studied the magnitude of the costs of bankruptcy. The process imposes costs on different parties like the owners and creditors of the firm but also on those who have any kind of contact with that firm (landlords, suppliers, customers, employees, etc.) or potential claims against (e.g., product liability claims).

It is common that during industry distresses, the number of recoveries decrease, not only due to a downward revision in the economic worth of firm's assets, but also because of the financial constraints that industry peers of the defaulted firms face, as proposed by Shleifer & Vishny (1992).

Another finding about firm recovery was defended by Antunes, A. (2005) and is more logical and common sense known. He found that the severity of the default has a very important role in the probability of extinction. In other words, the more critical is the default, more probability exists of the firm being extinct.

## 3. Methodology and Data

### 3.1. Methodology

What's the probability of default of a certain Portuguese firm? In case of default, how many time goes from the agreement date to default date?

We collected data composed by 1749 observations randomly chosen from the database of firm loans of a Portuguese bank. The loans examined in this work were negotiated over the period January, 1996 to April, 2015.

Table 10 shows a temporal analysis of the sample. The majority of our sample are loans that were celebrated between 2011 to April, 2015 (35.3+38.2=73.5%) and it is rare that any loan celebrated between 2014 and April, 2015 had already defaulted (4.7%) but many defaulted between 2011 and April, 2015 (46.3+32.6=78.9%).

To understand the main determinants that affected probability of default, we apply the following estimation methods:

#### 3.1.1. Probit Model

This model is used very often on works about credit risk so it should be considered as methodology on any work about default (Bonfim, Diana; 2006).

In this thesis is assumed that the model, in which the error term has the normal distribution, takes the form: $\Pr(Y = 1|X) = F(BX)$, where Pr denotes the probability that an event occurs (i.e. default) given the values of the X variables and where F is the cumulative distribution function of the standard normal distribution. The parameters B can be estimated by maximum likelihood.

In this model, the loans that entered in default take the value of 1. The ones that did not enter in default take value of 0.

### 3.1.2. Duration Model

It is important to know that is not relevant for a study just to know if certain firm will enter in default or not, but also in which moment that default will happen. Duration models are appropriate for modeling data that have an end-of-duration occurrence, given that the duration has lasted to some specified time (Kiefer 1988; Hensher & Mannering 1994). The inclusion of a variable of time is significant to assess a complete analysis of the credit risk, as well as interest rates. Duration models are being used, nowadays, to model the time of survival of a loan, assuming time to default as dependent variable. So, t determines the time from the loan agreement to the default date.

Since we have a baseline hazard (function of duration time: $h_0(t)$), a function of explanatory variables (X) and the associated parameters B, we apply the Cox Proportional hazard model: $h(t|Xi) = h0(t)e^{BXi}$.

## 3.2. Data

The probability of default can be affected by characteristics of the macroeconomic environment, the loan and the firm:

- Moments of crisis/Economic cycle, interest rate, initial amount
- Type of loan
- CAE, sales

Do crisis affect probability of default? As clearly stated on the literature review, both recent crisis turned out to be a setback to the firms and a road to default. We created two different dummies (one for each crisis). If the firm entered in default after September, 2008 (subprime crisis) dummy "*Lehman Brothers*" takes value 1 and takes value 0 if not. The same way if the firm entered in default after April, 2011 (troika Portuguese agreement), dummy "*Troika*" takes value 1 and 0 if not. We expect, according to a probit model, the sign of these two variables should be positive.

Defining *interest rate,* it is the amount charged, expressed as a percentage of principal, by a lender (in this case the bank) to a borrower (in this case a certain firm) for the use of assets. Interest rate applied to loans has a positive coefficient when applying a probit model to determine the probability of default, like expected by Bonfim, D. (2006) in her work "Determinantes do risco de crédito: o contributo de características das empresas e da envolvente macroeconómica".

Analyzing the data of Banco de Portugal (table 9) regarding the defaulted loans per *initial amount* (in % of the total amount loaned), we can see that, generally, as the initial amount increases, the percentage of loans in default decreases so, we may expect a negative signal for this variable, when applying a probit model. The study of Antunes, A., Ribeiro, N. & Antão, P. (2005) is consistent with this expectation.

The type of loan is divided in 7 groups of dummies:

- *Commercial Discount*: this type of loan works with "Letras". The owner of the "Letra" asks for money in advance to the bank in exchange of the endorsement of that "Letra" to the bank. By this way, the bank turns to be the owner of the "Letra" and on the maturity date will charge it to the debtor. This commercial

discount behaves like a normal way of financing but the interest is paid in advance discounted to the amount borrowed. For example, if the amount of a certain "Letra" is 1000€ with the maturity date in the next 3 months, with interest rate of 5%, the amount that the bank borrows in advance is 1000-12.5=987.5€.

- "*Bullet*": Like the name tells, this type of loan has only one payment of capital and interest at the maturity date.
- *Not regulated*: These loans are frequently asked by firms of the agricultural sector, especially when revenues are temporarily unpredictable. In this type of loan there is only a maturity date but the firm may pay partial reimbursement whenever it has capacity to do it without obeying to a plan of payments agreed previously.
- *Capital at maturity*: There is a periodic payment of interest (monthly, quarterly, semi-annual) and the capital is only paid at the maturity date.
- *Pledged Current Account*: The bank gives the firm the opportunity to have a credit limit with a fixed maturity date but with no periodic payments. The main objective is to prevent scarcity of money in the short run.
- *Grace period* on principal: The bank allows the firm to pay only interest (no capital) till a certain date. Then it will pay interest plus capital in periodic payments.
- Loan with *constant payments*: Like the name says itself, the firm pays interest plus capital in periodic payments from the beginning of the contract till the maturity date.

Taking into account the problem of collinearity, we removed the dummy of pledged current account from the estimation models. In the other cases, the dummy assumes value 1 if the firm asked for a certain type of loan and assumes 0 if not.

Table 13 gives us the percentage of loan defaults per type of loan. As we can see, from our sample, the higher percentages of defaulted loans are from types "Bullet", "Capital at maturity" and "Grace Period". Curiously, all these types of loans give the firm the opportunity to an initial stage of low financial pressure, which increases in the final stage of the contract. We may conclude that, on average, firms that prefer to pay the majority of the loan in the final stage of a loan contract are more likely to enter in default. So, we expect these 3 types of loan to be positive and the others negative on the probit model.

From the aggregation of the Nomenclature of Economic Activities, we divided the codes in 5 groups of dummies:

- Dummy *AB*: codes from the primary sector (agriculture, forestry, fishing…) – goes from 01111 to 09900.
- Dummy *C*: secondary sector (manufactured goods) – from 10110 to 33200
- Dummy *F*: construction – from 41100 to 43992
- Dummy *GH*: wholesale and retail, transports and repair – from 45110 to 53200
- Dummy *I*: Accommodation and restaurants – from 55111 to 56305
- Dummy *O*: Other codes – all the codes that are not in the intervals above

To avoid collinearity, we now remove "dummy O". For the other variables, the dummy assumes value 1 if the nomenclature of the firm belongs to the interval and assumes 0 if not.

Analyzing table 7, we can see that the activity sector that has the highest percentage of amount in default is the construction sector, so we should expect that in our probit model, "dummy F" has a positive impact on the probability of default. The work of Martinho, R. & Antunes, A. (2012) is consistence with the previous finding once they conclude that the evolution of the ratios of amount defaulted firms that belong to construction ("dummy F") and real estate activities (in our study takes part of "dummy O" – other codes) are clearly the worst, no matter the size of the firm.

The variable "*sales*" is problematic once we couldn't collect all the data about the sales of all firms. This variable would be important to represent the size of firm. By the way, from the literature review, one may conclude that there are many contradictory opinions about the role that the size of the firm plays in the probability of default.

Table 1 summarizes the description of all independent variables that were explained above.

## 4. Results

### 4.1. Probit Model

To answer our first research question about the probability of default, we performed a probit model that is shown in table 11. In this table we have 4 models: 1 and 2 considering two different economic cycles (after subprime crisis and after the first IMF agreement with the Portuguese government), 3 taking into account the different types of loan and 4 regarding the characteristics of the firm. The regression coefficients are used to predict the probability of default. However, the interpretation of probit models coefficients is not so direct as in linear regression models. The increase in probability attributed to an one-unit increase in a given variable depends both on the values of the other variables and the starting value of the given variables. At least we know a positive coefficient means that an increase in that variable leads to an increase in the probability of default. On the other way, a negative coefficient means that an increase in that variable leads to a decrease in the probability of default.

So, how the effect of economic crisis complicates firm's ability to pay their loans? The results show us that both crisis turn out to be real enemies to the Portuguese firms. Both coefficients confirms that the probability of a certain firm defaults during an economic crisis is very high. With this scenario, firms are exposed to higher financial pressure so it would be important that firms take special attention to their expenditure in times of economic difficulties, to avoid the need of a banking loan. The results show us that many other variables increase the probability of default by a Portuguese firm. As expected, the higher the interest rate of a loan, the higher the probability of default. The explanation is simple: as interest rate increases, the financial burden is higher so it

becomes more difficult to pay the loan. From model 3, we conclude that all types of loan increases the probability of default. In the case of the sectors of activity it is patent that the only sector that increases the probability of default is the construction sector once the only positive coefficient is F.

| | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| **Lehman Brothers** | 0.9817*** | | | |
| | (0.0041) | | | |
| **Troika** | | 0.9497*** | | |
| | | (0.0063) | | |
| **Interest Rate** | 0.0036** | 0.0058** | | |
| | (0.0017) | (0.0022) | | |
| **Initial Amount** | 0.0000* | 0.0000 | | |
| | (0.0000) | (0.0000) | | |
| | **Type of loan** | | | |
| **Commercial** | | | 0.1129*** | |
| **Discount** | | | (0.0333) | |
| **Bullet** | | | 0.2098*** | |
| | | | (0.0545) | |
| **Not Regulated** | | | 0.1085*** | |
| | | | (0.0332) | |
| **Capital at maturity** | | | 0.2111*** | |
| | | | (0.0683) | |
| **Grace Period** | | | 0.1613*** | |
| | | | (0.0344) | |
| **Constant Payments** | | | 0.1168*** | |
| | | | (0.0344) | |
| | **Characteristics of the firm** | | | |
| **AB** | | | | -0.0914** |
| | | | | (0.0416) |
| **C** | | | | -0.0415 |
| | | | | (0.0426) |
| **F** | | | | 0.1299*** |
| | | | | (0.0496) |
| **GH** | | | | -0.0358 |
| | | | | (0.0381) |
| **I** | | | | -0.0745 |
| | | | | (0.0522) |
| **Sales** | | | | 0.0000 |
| | | | | (0.0000) |
| **Constant** | -0.0119 | 0.0030 | 0.0616*** | 0.2011*** |
| | (0.0109) | (0.0152) | (0.0117) | (0.0341) |
| **Observations** | 1749 | 1749 | 1749 | 1279 |
| **R-squared** | 0.9086 | 0.7214 | 0.0276 | 0.0276 |

### 4.2. Duration Model

Regarding the other research question that contemplates time, we estimate a duration model (Cox-hazard model) and results are shown in table 12. This model allows us to consider not only that a firm entered in default but also in which moment it turns out to be more likely to happen. The average duration of a firm (of our sample) entering in default is 839 days. Table 12 is composed by 5 models: 1 and 2 considering two different economic cycles, 3 taking into account the different types of loan, 4 regarding the characteristics of the firm and 5 assuming all variables.

Comparing the two crisis in analysis, coefficients of table 12A reveal us that firms defaulted faster after IMF agreement. One possible reason is that the Portuguese firms resented more from the difficulties caused by the IMF agreement than by the subprime crisis. The only variable more that induces a decrease in the time to default is the dummy C. All other variables indicate a higher amount of time of, eventually, entering in default.

Table 12B is composed by the hazard ratios. The coefficient of 1.122 for the loans that defaulted after subprime crisis suggests that the hazard of default is higher for these loans by 22.2% as compared to others. Yet, model 2 presents a coefficient of 0.994 for Troika and this result tells that the hazard of default is lower for loans that defaulted after IMF agreement by 0.6% as compared to others. By analyzing all the other coefficients in a similar fashion, we see that the hazard of default of the Commercial Discount and Bullet are too high comparing to others. Besides Troika, the only variable that registers a lower hazard of default when compared to others of the same group is dummy C.

A non-parametric measure was applied: the Kaplan-Meier estimator. This statistic is used to examine the isolated impact of specific variables. The graphics are shown in figures 1-8. The cumulative probability is seen on the Y-axis and the time on the X-axis. We can see clearly that the K-M estimator for dummy C shows that the firms of secondary sector (manufactured goods) have more probability of default, during all their lifetime, than compared to others. Dummy O also shows this result. Furthermore, we can see, on the Troika graphic that in the beginning of the analysis time, the probability was higher for firms that entered in default after the IMF agreement when compared to others.

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| **Lehman Brothers** | 0.1152* | | | | 0.1073 |
| | (0.0687) | | | | (0.0795) |
| **Troika** | | -0.0061 | | | |
| | | (0.0748) | | | |
| **Interest Rate** | 0.0687*** | 0.0697*** | | | 0.0902*** |
| | (0.0082) | (0.0082) | | | (0.0094) |
| **Initial Amount** | -0.0000* | -0.0000 | | | -0.0000 |
| | (0.0000) | (0.0000) | | | (0.0000) |
| | **Type of loan** | | | | |
| **Commercial** | | | 1.9310*** | | 2.2390*** |
| | | | (0.1138) | | (0.1339) |
| **Discount Bullet** | | | 2.1386*** | | 2.5330*** |
| | | | (0.1532) | | (0.2035) |
| **Not Regulated** | | | 0.8590*** | | 1.3039*** |
| | | | (0.1019) | | (0.1263) |
| **Capital at maturity** | | | 0.7465*** | | 1.2956*** |
| | | | (0.1602) | | (0.1875) |
| **Grace Period** | | | 0.3862*** | | 0.7169*** |
| | | | (0.0936) | | (0.1274) |
| **Constant Payments** | | | 0.4101*** | | 0.6513*** |
| | | | (0.0634) | | (0.0782) |
| | **Characteristics of the firm** | | | | |
| **AB** | | | | 0.2834** | 0.3114*** |
| | | | | (0.1170) | (0.1175) |
| **C** | | | | -0.0595 | 0.0188 |
| | | | | (0.1112) | (0.1122) |
| **F** | | | | 0.2789** | 0.1253 |
| | | | | (0.1166) | (0.1217) |
| **GH** | | | | 0.2012** | 0.1208 |
| | | | | (0.0972) | (0.1004) |
| **I** | | | | 0.1728 | 0.0867 |
| | | | | (0.1493) | (0.1507) |
| **Sales** | | | | 0.0000* | |
| | | | | (0.0000) | |

| | | | | | |
|---|---|---|---|---|---|
| **Observations** | 1654 | 1654 | 1654 | 1208 | 1208 |

| | **Model 1** | **Model 2** | **Model 3** | **Model 4** | **Model 5** |
|---|---|---|---|---|---|
| **Lehman Brothers** | 1.1221 | | | | 1.1132 |
| | (0.0771) | | | | (0.0885) |
| **Troika** | | 0.9939 | | | |
| | | (0.0743) | | | |
| **Interest Rate** | 1.0712 | 1.0722 | | | 1.0944 |
| | (0.0088) | (0.0088) | | | (0.01032) |
| **Initial Amount** | 1 | 1 | | | 1 |
| | (0.0000) | (0.0000) | | | (0.0000) |
| | | | **Type of loan** | | |
| **Commercial Discount** | | | 6.8966 | | 9.3836 |
| | | | (0.7848) | | (1.2566) |
| **Bullet** | | | 8.4878 | | 12.5913 |
| | | | (1.3007) | | (2.5621) |
| **Not Regulated** | | | 2.3608 | | 3.6838 |
| | | | (0.2405) | | (0.4651) |
| **Capital at maturity** | | | 2.1096 | | 3.6532 |
| | | | (0.3380) | | (0.6850) |
| **Grace Period** | | | 1.4713 | | 2.0481 |
| | | | (0.1378) | | (0.2610) |
| **Constant Payments** | | | 1.5070 | | 1.9180 |
| | | | (0.0955) | | (0.1499) |
| | | | **Characteristics of the firm** | | |
| **AB** | | | 1.3276 | | 1.3654 |
| | | | (0.1553) | | (0.1604) |
| **C** | | | 0.9422 | | 1.0190 |
| | | | (0.1047) | | (0.1143) |
| **F** | | | 1.3217 | | 1.1335 |
| | | | (0.1541) | | (0.1379) |
| **GH** | | | 1.2229 | | 1.1284 |
| | | | (0.1188) | | (0.1133) |
| **I** | | | 1.1887 | | 1.0906 |
| | | | (0.1774) | | (0.1644) |
| **Sales** | | | | 1 | 1 |
| | | | | (0.0000) | (0.0000) |
| **Observations** | 1654 | 1654 | 1654 | 1208 | 1208 |

## 5. Conclusion

This work examines why so many firms enter in default. Over the study we tried to answer to two main questions: How much is the probability of default of a certain Portuguese firm and how many time goes by from the loan contract celebration to the default date.

Of the 1749 loans, 279 entered in default. Most of these events occurred on moments of crisis, mainly in the construction sector. Many findings of this work are consistent with what was expected. The coefficients of both crisis come out to be positive, according to probit model. As expected, both economic crisis revealed as being disadvantageous to the firms. Although we expected some types of loan might decrease the probability of default, all coefficients indicate that any type of loan increase the probability of default. Curiously, the lower coefficients of the types of loans were the ones that we expected to be negative but this might say nothing clearly. Regarding the activity sector, the result of higher probability of default in the case of the construction sector confirms the initial expectation. Afterwards, both initial amount and sales reveal to not modify the probability of default. The expected sign of initial amount was wrong but maybe the justification is in the fact that, as we can see from table 9, recently, the numbers are not so different. Only when we reach amounts higher than 5 million euros, we have a much lower number of loans in default. Once the sample had very few loans with that amount, we assume the different result come from that reason. Regarding sales, we had already said that the literature was very inconclusive in this matter.

Firms last, on average, 839 days to enter in default. Troika agreement and firms of the secondary sector (manufactured goods) tend to decrease the time a firm is faced with a situation of default.

## 6. References

Antunes, A., Ribeiro, N. & Antão, P. (2005), Estimativas de probabilidades de incumprimento em contexto macroeconómico, *Relatório de Estabilidade Financeira, Banco de Portugal*, pp. 125-136.

Antunes, A. (2005), Analysis of delinquent firms using multi-state transitions, *Banco de Portugal Working Paper*, 5-05.

Benito, A., Javier Delgado, F. & Martínez, Pagés, J. (2004), A synthetic indicator of financial pressure for Spanish firms, *Banco de España Working Paper No. 411*.

Bernhardsen, E. (2001), A model of bankruptcy prediction, *Norges Bank Working Paper 2001/10*.

Bhattacharjee, A., Higson, C. Holly, S. & Kattuman, P. (2002), Macro economic instability and business exit: determinants of failures and acquisitions of large UK firms, *Cambridge Working Papers in Economics 0206*.

Bonfim, D., Dias, D., Richmond, C. (2010), Access to Bank Credit after Corporate Default, *Financial Stability Report, Banco de Portugal*.

Bonfim, D. (2006), Factores determinantes do risco de crédito: o contributo de características das empresas e da envolvente macroeconómica, *Relatório de Estabilidade Financeira, Banco de Portugal, Lisboa*, 161-177.

Bonfim, D, Dai, Q., & Franco, F. (2010), Relações bancárias e custos de financiamento. *Relatório de estabilidade financeira, Banco de Portugal*, 163-180.

Branch, B. (2002), The cost of bankruptcy: A review. *International Review of Financial Analysis 11*, 39–57.

Bunn, P. & Redwood, V. (2003), Company accounts based modelling of business failures and the implications for financial stability, *Bank of England Working Paper No.210*.

Campbell, J.Y., Hilscher, J., Szilagyi, J. (2005), In search of distress risk. *Deutsche Bundesbank, Discussion Paper, No. 27*.

Claessens, S. & L. F. Klapper (2005), Bankruptcy around the world: explanations of its relative use, *American Law and Economics Review, 7,* 253-283.

Collins, J. (2009), How the mighty fall. *BusinessWeek. May 25*

D'Auria, C., Foglia, A. & Reedtz, P. M. (1999), Bank interest rates and credit relationships in Italy, *Journal of Banking and Finance*, *23*, 1067-1093.

Diamond, D. (1984), Financial intermediation and delegated monitoring, *Review of Economic Studies*, 51, 393-414.

Dittrich, F. (2007), The Credit Rating Industry: Competition and Regulation. *Inauguraldissertation Zur Erlangung des Doktorgrades der Wirtschafts-und Sozialwissenschaflichen Fakultat der Universitat Zu Koln*.

Eklund, T., Larsen, K. & Bernhardsen, E. (2001), Model for analysing credit risk in the enterprise sector, *Norges Bank Economic Bulletin Q3 01*.

Faria, A. (2013), Modelização da Taxa de Incumprimento das Empresas Portuguesas com base na Evolução de Variáveis Macroeconómicas, *Dissertação de Mestrado.*

Fortunato, C. (2013), A Importância do Spread e das Garantias na Concessão de Crédito às Pequenas e Médias Empresas, *Dissertação de Mestrado – Universidade da Beira Interior*.

Gujarati, D. N. (2011), Econometrics by example. Hampshire, UK: Palgrave Macmillan

Hazak, A. & Mannasoo, K. (2007), Indicators of Corporate Default - An EU Based Empirical Study, Eesti Pank, *Bank of Estonia*.

Hensher, D.A. & F.L. Mannering (1994), Hazard-based duration models and their application to transport analysis, *Transport Reviews, 14, 1*, 63-82

Jiménez, G. & Saurina, J. (2004), Collateral, type of lender and relationship banking as determinants of credit risk, *Journal of Banking and Finance, No.28*, 2191-2212.

Kiefer, N.M. (1988). Economic duration data and hazard functions, *Journal of Economic Literature, 27, June*, 646-679.

Laitinen, E.K., 1994. Traditional versus operating cash flow in failure prediction. *Journal of Business Finance and Accounting, Vol. 21, No. 2*:195–217.

Martinho, R. & Antunes, A. (2012). Um modelo de scoring para as empresas portuguesas. *Relatório de Estabilidade Financeira, Banco de Portugal*.

Ongena, S. & Smith, D. (2000), What determines the number of bank relationships? Cross-country evidence, *Journal of Financial Intermediation, 9*, 26-56.

Pain, D. & Vesala, J. (2004), Driving factors of credit risk in Europe, *mi meo*.

Petersen, M. A. & Rajan, R.G. (1994), The benefits of lending relationships: Evidence from small business data, *The Journal of Finance, 49*, 3-37.

Pozzolo, A. (2002). Secured Lending and Borrowers' Riskiness. *Working Paper, Bank of Italy, Research Department.*

Rajan, R. (1992), Insiders and outsiders: The choice between informed and arm's-length debt, *The Journal of Finance, 47,* 1367-1400.

Sharpe, S. (1990), Asymmetric information, bank lending and implicit contracts: A stylized model of customer relationships, *The Journal of Finance, 45,* 1069-1087.

Shleifer, Andrei & Robert Vishny, 1992, Liquidation values and debt capacity: A market equilibrium approach, *Journal of Finance, Vol. 47,* 1343-1366.

Silva, A., Graça Braga, Silvia Maria (2014). A importância do relacionamento bancário no financiamento das PME: estudo numa agência bancária portuguesa. *Revista Brasileira de Finanças [online] 2014, 12.*

Steijvers, T. & Voordeckers, W. (2009). Collateral and credit rationing: a review of recent empirical studies as a guide for future research. Journal *of Economic Surveys, 23 (5)*. 924- 946.

Steijvers, T. (2008). Existence of Credit Rationing for SMEs in the Belgian Corporate Bank Loan Market. *SSRN Working Paper Series, Belgium*.

Stiglitz, J. & Weiss, A. (1981). Credit rationing in markets with imperfect information. *The American Economic Review, 71, nº3*.393–410.

Ward, T.J., Foster, B.P., 1997. A note on selecting a response measure for financial distress. *Journal of Business Finance and Accounting, Vol. 24, No. 6*:869–879.

# 7. Appendix

## 7.1. Table 1 – Explanatory variables: independent variables used with their expected sign and theoretical reason; Source: own table

| Variable | Type | Definition | Source | Expected Sign | Reason |
|---|---|---|---|---|---|
| **Lehman Brothers** | Dummy | 0 – didn't default or defaulted before subprime crisis<br>1 – Defaulted after subprime crisis | Bank Database | + | In periods of crisis, there is higher probability of default |
| **Troika** | Dummy | 0 – didn't default or defaulted before IMF agreement<br>1 – Defaulted after IMF agreement | Bank Database | + | In periods of crisis, there is higher probability of default |
| **Interest Rate** | Discrete | Percentage | Bank Database | + | Higher interest rates put more pressure to firms and then a higher probability of default |
| **Initial Amount** | Discrete | Number | Bank Database | - | There is a lower probability of default attached to firms with higher credit amounts |
| | **Type of loan** | | | | |
| **Commercial Discount** | Dummy | 0 – if it isn't a comercial discount loan<br>1 – if it is | Bank Database | - | Own data (table 13) |
| **Bullet** | Dummy | 0 – if it isn't a bullet loan<br>1 – if it is | Bank Database | + | Own data (table 13) |
| **Not Regulated** | Dummy | 0 – if it isn't a not regulated loan<br>1 – if it is | Bank Database | - | Own data (table 13) |
| **Capital at maturity** | Dummy | 0 – if it isn't a capital at maturity loan<br>1 – if it is | Bank Database | + | Own data (table 13) |
| **Pledged Current Acc.** | Dummy | 0 – if it isn't a PCA loan<br>1 – if it is | Bank Database | - | Own data (table 13) |
| **Grace Period** | Dummy | 0 – if it isn't a | Bank | + | Own data |

| | | | | | |
|---|---|---|---|---|---|
| | | grace period loan<br>1 – if it is | Database | | (table 13) |
| **Constant Payments** | Dummy | 0 – if it isn't a constant payments loan<br>1 – if it is | Bank Database | - | Own data (table 13) |
| | **Characteristics of the firm** | | | | |
| **AB** | Dummy | 0 – if it doesn't belong to primary sector<br>1 – if it belongs | Bank Database | - | From the sectors analyzed, construction is the only said to increase prob. of default |
| **C** | Dummy | 0 – if it doesn't belong to secondary sector (manufacture)<br>1 – if it belongs | Bank Database | - | From the sectors analyzed, construction is the only said to increase prob. of default |
| **F** | Dummy | 0 – if it doesn't belong to construction<br>1 – if it belongs | Bank Database | + | From the sectors analyzed, construction is the only said to increase prob. of default |
| **GH** | Dummy | 0 – if it doesn't belong to wholesale and retail, transports and repair<br>1 – if it belongs | Bank Database | - | From the sectors analyzed, construction is the only said to increase prob. of default |
| **I** | Dummy | 0 – if it doesn't belong to Accommodation and restaurants<br>1 – if it belongs | Bank Database | - | From the sectors analyzed, construction is the only said to increase prob. of default |
| **O** | Dummy | 0 – if it doesn't belong to any other sector<br>1 – if it belongs | Bank Database | - | From the sectors analyzed, construction is the only said to increase prob. of default |
| **Sales** | Discrete | Number | Bank Database | Nd | Cannot conclude from literature |

### 7.2. Table 2 – Descriptive statistics; Source: own table

| Variable | Observations | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Default | 1749 | 0.16 | 0.37 | 0 | 1 |
| Lehman Brothers | 1749 | 0.15 | 0.35 | 0 | 1 |
| Troika | 1749 | 0.12 | 0.33 | 0 | 1 |
| Interest Rate | 1749 | 6.93 | 3.19 | 0 | 25 |
| Initial Amount | 1749 | 133979.79 | 410935.12 | 126 | 8000000 |
| | Type of loan | | | | |
| Commercial Discount | 1749 | 0.09 | 0.28 | 0 | 1 |
| Bullet | 1749 | 0.04 | 0.20 | 0 | 1 |
| Not Regulated | 1749 | 0.08 | 0.28 | 0 | 1 |
| Capital at maturity | 1749 | 0.03 | 0.16 | 0 | 1 |
| Pledged Current Account | 1749 | 0.24 | 0.43 | 0 | 1 |
| Grace Period | 1749 | 0.09 | 0.29 | 0 | 1 |
| Constant Payments | 1749 | 0.43 | 0.50 | 0 | 1 |
| | Characteristics of the firm | | | | |
| AB | 1749 | 0.14 | 0.35 | 0 | 1 |
| C | 1749 | 0.16 | 0.37 | 0 | 1 |
| F | 1749 | 0.12 | 0.33 | 0 | 1 |
| GH | 1749 | 0.38 | 0.48 | 0 | 1 |
| I | 1749 | 0.06 | 0.23 | 0 | 1 |
| O | 1749 | 0.14 | 0.34 | 0 | 1 |
| Sales | 1279 | 1259348.54 | 3608745.67 | 0 | 89640246 |

### 7.3. Table 3 – Annual Variation Rate of the amount loaned (in %); Source: Banco de Portugal

| Nov 13 | Dec 13 | Jan 14 | Feb14 | Mar 14 | April 14 | May 14 | Jun 14 | Jul 14 | Aug 14 | Sept 14 | Oct 14 | Nov 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| -5.6 | -4.7 | -5.5 | -5.2 | -5.4 | -6.6 | -7.0 | -7.2 | -7.9 | -7.6 | -6.3 | -6.4 | -6.6 |

### 7.4. Table 4 – Total amount loaned (in million euros); Source: Banco de Portugal

| 2008 | 4th quarter 2013 | 1st quarter 2014 | 2nd quarter 2014 | 3rd quarter 2014 | 4th quarter 2014 |
|---|---|---|---|---|---|
| 119188 | 92208 | 91554 | 89600 | 88209 | 86876 |

### 7.5. Table 5 – Total amount loaned in default (in million euros); Source: Banco de Portugal

| 2008 | 4th quarter 2013 | 1st quarter 2014 | 2nd quarter 2014 | 3rd quarter 2014 | 4th quarter 2014 |
|---|---|---|---|---|---|
| 2861 | 12356 | 12818 | 12902 | 13143 | 13031 |

### 7.6. Table 6 – Firms in default (in % of all firms that asked for a loan); Source: Banco de Portugal

| 2008 | 4th quarter 2013 | 1st quarter 2014 | 2nd quarter 2014 | 3rd quarter 2014 | 4th quarter 2014 |
|---|---|---|---|---|---|
| 17.2 | 30.3 | 31.3 | 31.3 | 31.3 | 30.8 |

### 7.7. Table 7 – Amount loaned in default by sector of activity – NACE (in % of the total amount loaned); Source: Banco de Portugal

| | 2008 | 4th quarter 2013 | 1st quarter 2014 | 2nd quarter 2014 | 3rd quarter 2014 | 4th quarter 2014 |
|---|---|---|---|---|---|---|
| **Primary sector** | 1.8 | 6.0 | 6.2 | 6.3 | 6.5 | 6.8 |
| **Secondary sector** | 3.6 | 10.9 | 11.1 | 11.4 | 11.6 | 11.7 |
| **Construction** | 3.3 | 24.5 | 26.1 | 25.9 | 27.4 | 28.7 |
| **wholesale and retail, transports and repair** | 3.3 | 15.7 | 15.8 | 16.2 | 16.4 | 16.5 |
| **Accommodation and restaurants** | 1.7 | 12.1 | 12.4 | 12.8 | 13.7 | 13.2 |

### 7.8. Table 8 – Interest Rates (in%); Source: Banco de Portugal

| 08 | Nov13 | Dec13 | Jan14 | Feb14 | Mar14 | April14 | May14 | Jun14 | Jul14 | Aug14 | Sept14 | Oct14 | Nov14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6.7 | 5.30 | 5.10 | 5.34 | 5.01 | 5.46 | 5.38 | 5.42 | 4.49 | 4.52 | 4.76 | 4.59 | 4.76 | 4.63 |

### 7.9. Table 9 – Loans in default per Initial Amount (in % of the total amount of loans); Source: Banco de Portugal

| | 2008 | 4th quarter 2013 | 1st quarter 2014 | 2nd quarter 2014 | 3rd quarter 2014 | 4th quarter 2014 |
|---|---|---|---|---|---|---|
| **< 20.000€** | 11.1 | 22.7 | 23.3 | 23.6 | 24.1 | 24.2 |
| **20.000€ - 50.000€** | 8.0 | 20.2 | 20.3 | 20.7 | 21.5 | 21.4 |
| **50.000€ - 100.000€** | 6.9 | 19.5 | 19.8 | 19.9 | 20.4 | 20.6 |
| **100.000€ - 200.000€** | 6.0 | 18.1 | 18.7 | 18.8 | 19.1 | 19.0 |
| **200.000€ - 400.000€** | 4.7 | 16.9 | 17.6 | 18.3 | 18.8 | 18.9 |
| **400000€ - 1.000.000€** | 4.6 | 17.6 | 18.1 | 18.8 | 19.3 | 19.2 |
| **1.000.000€ - 5.000.000€** | 3.5 | 18.4 | 19.3 | 20.0 | 20.5 | 20.7 |
| **> 5.000.000€** | 1.0 | 10.4 | 10.9 | 11.0 | 11.4 | 11.6 |

### 7.10. Table 10 – Temporal analysis of the sample; Source: own table

| | % of loans | % of loans defaulted (date of agreement) | % of loans defaulted (date of default) |
|---|---|---|---|
| **[1996-2009[** | 15.3 | 33.3 | 9.3 |
| **[2009-2011[** | 11.2 | 19.4 | 11.8 |
| **[2011-2014[** | 35.3 | 42.6 | 46.3 |
| **[2014-2015]** | 38.2 | 4.7 | 32.6 |

### 7.11. Table 11 – The probability of default – Probit with all the variables except dummy O and dummy Current Pledged Account which could induce collinearity - Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1; Source: own table

| | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| **Lehman Brothers** | 0.9817*** | | | |
| | (0.0041) | | | |
| **Troika** | | 0.9497*** | | |
| | | (0.0063) | | |
| **Interest Rate** | 0.0036** | 0.0058** | | |
| | (0.0017) | (0.0022) | | |
| **Initial Amount** | 0.0000* | 0.0000 | | |
| | (0.0000) | (0.0000) | | |
| | **Type of loan** | | | |
| **Commercial** | | | 0.1129*** | |
| | | | (0.0333) | |
| **Discount** | | | 0.2098*** | |
| | | | (0.0545) | |
| **Bullet** | | | 0.1085*** | |
| | | | (0.0332) | |
| **Not Regulated** | | | 0.2111*** | |
| | | | (0.0683) | |
| **Capital at maturity** | | | 0.1613*** | |
| | | | (0.0344) | |
| **Grace Period** | | | 0.1168*** | |
| | | | (0.0344) | |
| **Constant Payments** | | | | |
| | **Characteristics of the firm** | | | |
| **AB** | | | | -0.0914** |
| | | | | (0.0416) |
| **C** | | | | -0.0415 |
| | | | | (0.0426) |
| **F** | | | | 0.1299*** |
| | | | | (0.0496) |
| **GH** | | | | -0.0358 |
| | | | | (0.0381) |
| **I** | | | | -0.0745 |
| | | | | (0.0522) |
| **Sales** | | | | 0.0000 |
| | | | | (0.0000) |
| **Constant** | -0.0119 | 0.0030 | 0.0616*** | 0.2011*** |
| | (0.0109) | (0.0152) | (0.0117) | (0.0341) |
| **Observations** | 1749 | 1749 | 1749 | 1279 |
| **R-squared** | 0.9086 | 0.7214 | 0.0276 | 0.0276 |

**7.12. Table 12 – Duration Model – Cox-hazard test with all the variables except dummy O and dummy Current Pledged Account which could induce collinearity and, in model 5 we excluded dummy Troika too - Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1; Source: own table**

**Panel A**

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| Lehman Brothers | 0.1152* | | | | 0.1073 |
| | (0.0687) | | | | (0.0795) |
| Troika | | -0.0061 | | | |
| | | (0.0748) | | | |
| Interest Rate | 0.0687*** | 0.0697*** | | | 0.0902*** |
| | (0.0082) | (0.0082) | | | (0.0094) |
| Initial Amount | -0.0000* | -0.0000 | | | -0.0000 |
| | (0.0000) | (0.0000) | | | (0.0000) |
| | | | Type of loan | | |
| Commercial | | | 1.9310*** | | 2.2390*** |
| | | | (0.1138) | | (0.1339) |
| Discount | | | 2.1386*** | | 2.5330*** |
| Bullet | | | (0.1532) | | (0.2035) |
| Not Regulated | | | 0.8590*** | | 1.3039*** |
| | | | (0.1019) | | (0.1263) |
| Capital at | | | 0.7465*** | | 1.2956*** |
| maturity | | | (0.1602) | | (0.1875) |
| Grace Period | | | 0.3862*** | | 0.7169*** |
| | | | (0.0936) | | (0.1274) |
| Constant | | | 0.4101*** | | 0.6513*** |
| Payments | | | (0.0634) | | (0.0782) |
| | | | Characteristics of the firm | | |
| AB | | | | 0.2834** | 0.3114*** |
| | | | | (0.1170) | (0.1175) |
| C | | | | -0.0595 | 0.0188 |
| | | | | (0.1112) | (0.1122) |
| F | | | | 0.2789** | 0.1253 |
| | | | | (0.1166) | (0.1217) |
| GH | | | | 0.2012** | 0.1208 |
| | | | | (0.0972) | (0.1004) |
| I | | | | 0.1728 | 0.0867 |
| | | | | (0.1493) | (0.1507) |
| Sales | | | | 0.0000* | |
| | | | | (0.0000) | |
| Observations | 1654 | 1654 | 1654 | 1208 | 1208 |

**Panel B – Hazard Ratios**

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| Lehman Brothers | 1.1221 | | | | 1.1132 |
| | (0.0771) | | | | (0.0885) |
| Troika | | 0.9939 | | | |
| | | (0.0743) | | | |
| Interest Rate | 1.0712 | 1.0722 | | | 1.0944 |
| | (0.0088) | (0.0088) | | | (0.01032) |
| Initial Amount | 1 | 1 | | | 1 |

| | | | | | |
|---|---|---|---|---|---|
| | (0.0000) | (0.0000) | | | (0.0000) |
| | | | **Type of loan** | | |
| **Commercial Discount** | | | 6.8966 | | 9.3836 |
| | | | (0.7848) | | (1.2566) |
| **Bullet** | | | 8.4878 | | 12.5913 |
| | | | (1.3007) | | (2.5621) |
| **Not Regulated** | | | 2.3608 | | 3.6838 |
| | | | (0.2405) | | (0.4651) |
| **Capital at maturity** | | | 2.1096 | | 3.6532 |
| | | | (0.3380) | | (0.6850) |
| **Grace Period** | | | 1.4713 | | 2.0481 |
| | | | (0.1378) | | (0.2610) |
| **Constant Payments** | | | 1.5070 | | 1.9180 |
| | | | (0.0955) | | (0.1499) |
| | | | **Characteristics of the firm** | | |
| **AB** | | | 1.3276 | | 1.3654 |
| | | | (0.1553) | | (0.1604) |
| **C** | | | 0.9422 | | 1.0190 |
| | | | (0.1047) | | (0.1143) |
| **F** | | | 1.3217 | | 1.1335 |
| | | | (0.1541) | | (0.1379) |
| **GH** | | | 1.2229 | | 1.1284 |
| | | | (0.1188) | | (0.1133) |
| **I** | | | 1.1887 | | 1.0906 |
| | | | (0.1774) | | (0.1644) |
| **Sales** | | | | 1 | 1 |
| | | | | (0.0000) | (0.0000) |
| **Observations** | 1654 | 1654 | 1654 | 1208 | 1208 |

## 7.13. Table 13 – Loan defaults per type of loan; source: own data

| Type of loan | Quantity | Defaults | % |
|---|---|---|---|
| **Pledged Cur. Acc.** | 422 | 26 | 6% |
| **Commercial Disc.** | 149 | 26 | 17% |
| **Bullet** | 70 | 19 | 27% |
| **Not regulated** | 147 | 25 | 17% |
| **Capital at Maturity** | 44 | 12 | 27% |
| **Grace Period** | 166 | 37 | 22% |
| **Constant Payments** | 751 | 134 | 18% |

**7.14. Figures 1 – 8: Graphics of Kaplan-Meier estimator (blue lines are dummy=1; red lines are dummy=0; variables are written in the graph, in blue); Source: own figures**