

Investment Sensitivity to Inter-enterprises Payment Deadlines

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WP 2019 - Nr 38

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May 2019

Abstract

This paper investigates the determinants of firms investment financing constraints. Using an endogenous switching regression model on French Provence-Alpes Côte d'Azur region firms data collected between 2005-2014, we provide a novel evidence of the role of inter-enterprises payment deadlines which are days of sales outstanding and suppliers payment terms, as factors determining firms investment financing constraints. We also show that there is a non-negligible number of firms switching each year either from constrained regime to unconstrained regime or unconstrained regime to constrained one. By developing a model, we highlight the factors determining firms regime change.

Keywords: Firms Investment, Inter-enterprises Payment Deadlines, Endogenous Switching Regression Model.

JEL codes: G30, G32, C30, C33

*I deeply thank my PhD supervisors, Prof Mohamed Belhaj and Prof. Vêlayoudom Marimoutou for their guidance and support. I acknowledge the financial support of the Provence-Alpes Côte d'Azur regional council and Finances & Mediterranean Council.

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1 Introduction

Modigliani and Miller (1958) [23] launched the debate on the relationship between financing constraints and investment. Assuming perfect capital market, they defend the perfect substitutability between internal and external financing leading to the independence of firms investment from their financing decisions. The reality is however reflected by different markets frictions such as informational asymmetry on access to external funds, making capital markets imperfect. Consequently, some firms could face external financing constraints and their investment could be limited to their internal funds. As a result, internal and external financing are not perfect substitutes and the amount of internal funds could be an important determinant of investment. Since then, an abundant literature has studied the determinants of financing constraints on firms investment by investigating the sensitivity of investment to cash flow. Cash flow is defined in the literature as the sum between the net profit and the depreciation. This definition does not consider an important element: the business to business credits (B2B credits). B2B credits represent firms receivables from their customers and the debts to their suppliers, and could represent significant financing sources for firms.

This paper aims to contribute to the existing literature by considering B2B credits as a part of the cash flow and investigate their impact on firms investment. B2B credits generate inter-enterprises payment deadlines which are days of sales outstanding and suppliers payment terms. Therefore, we consider that it is more relevant to study directly the impact of inter-enterprises payment deadlines on firms investment. For a better interpretation of our results, we also controlled for the cash flow as defined in the literature.

Our second contribution is empirical. When investigating the sensitivity of investment to inter-enterprises payment deadlines, we follow the general strategy used by researchers. They consider that capital market imperfections must be studied by comparing its differential effect on the investment of firms classified in constrained and unconstrained groups. In this paper, we used the accelerator approach of the endogenous switching regression model providing estimates of separate investment regressions without a priori classification of firms in constrained or unconstrained regime. However, the firms can not be fixed in one regime over the period. Yet, the model does not specify to the researcher the proportions of firms that change regime each year during the period and the determinants of the firms regime change. We develop for the first time a model for this purpose.

In this paper, we consider a database containing accounting informations on French Provence-Alpes Côte d'Azur region firms between 2005-2014. In this region, 99% of firms are Small and Medium Enterprises (SMEs). Our third contribution is

that this study is conducted on SMEs. It allows to provide a new index of financing constraints for the latter. Indeed, a large majority of papers related to financing constraints in the existing literature concerns large firms. These categories of firms are often less concerned by the information asymmetries than SMEs.

Our findings on the determinants of firms investment are the following. First, our results on the investment cash-flow sensitivity are consistent with the result of Fazzari et al.(1988) [12] where the cash flow impact on investment is significant and increasing with the constraint status of the firms. Second, our results provide the evidence that inter-enterprises payment deadlines impact significantly firms investment. The investment is positively sensitive to suppliers payment terms whereas it is negatively sensitive to the days of sales outstanding. The constrained firms investment is more sensitive to the days of sales outstanding and suppliers payment terms than the unconstrained firms investment. These results confirm the regional entrepreneurs statements. Indeed, when meeting them and discussing with them about the challenges they encounter, they mostly talk about days of sales outstanding and suppliers payment terms. Furthermore, we also exploit the selection equation to analyse the proportions of unconstrained and constrained firms per year during the period of study. These proportions are not constant over time. There is a non-negligible number of firms changing regime each year from unconstrained to constrained or constrained to unconstrained regime. Through the model we develop in order to learn more about the factors determining firms regime change, we found that tangibility, leverage, financial autonomy, and the soft budget constraint are the factors influencing significantly unconstrained firms movement to the constrained regime. In parallel, tangibility, leverage, financial autonomy, long-term debt, size, and soft budget constraint are the factors impacting significantly constrained firms movement to the unconstrained regime.

The rest of the paper is organized as follows: Section 2 provides a brief review of the past literature on the determinants of firms investment financing constraints, particularly the cash-flow which was widely studied. Section 3 explains the methodology of the endogenous switching regression model. Section 4 presents and describes in detail the data used in order to give a representative view of Provence-Alpes Côte d’Azur firms. Section 5 gives the empirical results and also outlines a key description of the constrained and the unconstrained groups per year as well as the factors making a firm to change regime. Finally, section 5 concludes.

2 Related Literature

The body of research devoted to the effect of financing constraints on firms investment is mainly focused on the investment-cash flow sensitivity. It is composed of

two kind of research ideas: empirical and theoretical evidences. Theoretical research began with Modigliani and Miller (1958) [23] defending the irrelevance of firm's capital structure on its investment decisions under perfect capital markets. However, in reality, there are several markets frictions making capital markets imperfect, such as informational asymmetry or agency problems. Consequently, certain firms faced difficulties to access to external financing. As a result, the cost of external financing could become higher than the cost of internal financing and the level of internal financing could be an important determinant of investment empirically speaking. Since then, Fazzari et al.(1988) [12] study the impact of financial constraints on firms investment decisions by assessing the effect of cash-flow on firms investment. Using dividend payout, they split their sample into constrained and unconstrained firms¹ and found that constrained firms investment are more sensitive to cash flow than unconstrained firms investment. Fazzari et al.(1988) [12] find support in a number of subsequent papers (Hoshi et al.(1991) [16], Whited(1992) [33], Bond and Meghir(1994) [6], and Carpenter et al.(1994)). In 1997, Kaplan and Zingales [22] questioned Fazzari et al.(1988) [12] results and demonstrated that the investment sensitivity to cash flow is higher for unconstrained firms than for constrained firms. These findings were further supported in 1999 by Cleary [9]. Some contributions try to explain these inconsistent findings in the literature. Using two different classification criteria, Moyen (2004) [24] showed that the unconstrained firms investment-cash flow sensitivity could be higher or lower than the constrained firms investment cash flow sensitivity depending on the classification criteria used. Gianni La Cava (2005) [13] distinguishes financially distressed firms from financially constrained firms. He demonstrated that the presence of financially distressed firms appears to bias downwards the constrained firms investment-cash flow sensitivity and showed that the estimated sensitivity degree appears to be the same for both groups.

Nevertheless, in the literature, the cash flow, is calculated as the sum of the net profit and depreciation. A such definition does not consider the B2B credits. They are significant alternative sources of financing between firms. In this paper, our approach consists of considering the B2B credits payment terms, the days of sales outstanding and suppliers payment delays, in addition to the cash flow and evaluate their impacts on firms investment.

To address the investment-cash flow sensitivity theoretical debate, recent research stressed on empirical evidence. The discussed strand concerns the firms classification into constrained and unconstrained groups. Since the first papers in these areas, research are conducted by splitting firms into subgroups according to their constraint status. Fazzari et al. (1988) [12], Kaplan and Zingales (1997) [22] and other papers used a prior firms classification method to split their sample into constrained and

¹Constrained firms are firms that have no dividend payout.

unconstrained groups. The problem of this technique is the static misclassification it can cause but also the selection criteria can be correlated to the endogenous variable. It may also cause a dynamic misclassification, the firm position or situation may evolve over the sample especially when the study period is long. Schiantarelli (1998) [19] was the first to attempt to address the misspecification effect by using an endogenous switching regression model. With this model the firms groups are determined endogenously by a selection equation.

Nonetheless, within the existing literatures using the endogenous switching regression model, none exploits the selection equation. The model defines two groups of firms that differ according to their investment behavior but does not automatically specify to the researcher the firms changing regime across the period as well as the factors determining the firms status change. Our paper is the first to extend the selection equation by developing a theoretical model for this purpose.

3 Empirical strategy

This paper studies the effect of the inter-enterprises payment deadlines on firms investment. Conducting an empirical study, we follow Schiantarelli (1998) [19] and use an endogenous switching regression model for our estimation. Considering a firm i at time t , the model is constituted by the following three equations:

$$I_{1it} = \beta_1 X_{it} + \epsilon_{1it} \quad (1)$$

$$I_{2it} = \beta_2 X_{it} + \epsilon_{2it} \quad (2)$$

$$y_{it}^* = \alpha Z_{it} + \nu_{it} \quad (3)$$

Equations 1 and 2 are the structural equations that describes the firms investment behavior in the regimes. I_{1it} and I_{2it} are the investment spending of two firms i at time t respectively in regime 1 and 2. X_{it} represents the determinants of firms investment. β_1 , β_2 are vectors of parameters, ϵ_1 , ϵ_2 the vectors of error terms.

Equation 3 is the selection equation. The dependent variable, y_{it}^* , determines for each firm i at time t , its likelihood of being in regime 1 or regime 2. In this paper, the two regimes considered are the unconstrained and constrained regimes. Therefore, the firms likelihood to be in regime 1 or 2 will be determined according to the severity of informational asymmetry it faces. The selection process is the following. Consider I_{1it} and I_{2it} respectively the investment spending of unconstrained and constrained firms. $I_{1it} - I_{2it}$ is the difference between unconstrained and constrained firms investment spending. This difference is the consequence of the severity of

informational asymmetry. Thus, when there is no informational asymmetry, there will be no financial constraints and all the firms will have the same investment spending. Then, $I_{1it} - I_{2it} = y_{0it}^* = 0$. When a firm i faces informational asymmetry at time t causing its financial constraint, its investment I_{it} is lower than an unconstrained firm investment : $I_{it} \leq I_{1it} \implies I_{it} - I_{2it} \leq I_{1it} - I_{2it}$. Yet, I_{it} corresponds to the investment of a constrained firm. So, $I_{it} - I_{2it} = 0$, and $I_{1it} - I_{2it} = y_{it}^* \geq y_{0it}^* = 0$. Inversely, a firm i is unconstrained at time t if its investment I_{it} is larger than a constrained firm investment, meaning $I_{it} > I_{2it} \implies I_{it} - I_{1it} > I_{2it} - I_{1it}$. I_{it} corresponds to the investment of an unconstrained firm. So $I_{it} = I_{1it}$ and $0 > I_{2it} - I_{1it} \implies I_{1it} - I_{2it} = y_{it}^* < y_{0it}^* = 0$. Thus, the firm i will be in the unconstrained regime at time t if $y_{it}^* < 0$ with an investment behavior such as $I_{it} = I_{1it}$. Inversely, the firm i will be in the constrained regime at time t if $y_{it}^* \geq 0$ with an investment behavior such as $I_{it} = I_{2it}$.

The set of the selection equation independent variables, Z_{it} , is expressed as a vector of firms characteristics that is associated with its constraint status.

The parameters in the three equations are estimated via maximum likelihood. For the estimation of those parameters, it is assumed that ϵ_{1it} , ϵ_{2it} and ν_{it} are jointly normally distributed with mean 0 and covariance matrix Σ that allows for non zero correlation between the shocks to investment and the shocks to firms characteristics:

$$\Sigma = \begin{bmatrix} \sigma_1^2 & \sigma_{12} & \sigma_{1\nu} \\ \sigma_{21} & \sigma_2^2 & \sigma_{2\nu} \\ \sigma_{\nu 1} & \sigma_{\nu 2} & \sigma_\nu^2 \end{bmatrix} \quad (4)$$

The main advantage of this model is its ability to control for multiple indicators that jointly determine the group in which a firm is likely to belong without the need to split the sample into many smaller parts. In addition, the model simultaneously estimates the equation that predicts (or selects) the constraint status of the firms and the investment behavior of constrained and unconstrained firms.

3.1 Empirical specifications

This section specifies the model we estimated. We use Hobdari et al.(2009) [15] approach of the endogenous switching regression model for our model specifications.

3.1.1 Investment equations

The investment equations in the two regimes are the following.

For the unconstrained regime:

$$\begin{aligned}
(I/K)_{it}^U &= a_1(Sales_{it-1}/K_{it-1}) + b_1CashFlow_{it-1} + c_1DSO_{it-1} \\
&+ d_1SPT_{it-1} + e_1Tangibility_{it-1} + f_1D_{1it-1} \\
&+ g_1D_{2it-1} + h_1D_{3it-1} + \varphi_i + \tau_t + \epsilon_{1it}
\end{aligned}$$

For the constrained regime:

$$\begin{aligned}
(I/K)_{it}^C &= a_2(Sales_{it-1}/K_{it-1}) + b_2CashFlow_{it-1} + c_2DSO_{it-1} \\
&+ d_2SPT_{it-1} + e_2Tangibility_{it-1} + f_2D_{1it-1} \\
&+ g_2D_{2it-1} + h_2D_{3it-1} + \varphi_i + \tau_t + \epsilon_{2it}
\end{aligned}$$

Except the parameters, the two investment equations have the same components. The dependent variables correspond to firms investment in fixed capital (reconstruction, expansion and acquisition of buildings, constructions of new buildings and other business related projects). It is calculated as the ratio of the new amount of fixed capital between the beginning and the end of a year and the lagged capital stock. The set of independent variables includes the cash flow, sales, days of sales outstanding and suppliers payment terms, the tangibility and three dummy variables. We calculated the *cash flow* in line with the existing literature, as the sum of the net profit after taxes and the depreciation expenses. The sales revenue corresponds to the firm total sales revenue per year. This variable is controlled because we expressed the relationship between the investment and the cash flow, days of sales outstanding and suppliers payment terms by using the accelerator–sales approach. This approach supposes that sales could summarize investment opportunities. The investment is supposed to be an increasing function of sales. We expect a positive sign for the latter. The *tangibility ratio* is calculated as the ratio between tangible assets and total assets. Tangible assets decrease the firms default risks. The higher the firms tangibility ratio, the higher its luck to get external funding for investment. We expected that the assets tangibility will have a positive impact on firms investment. The use of this variable derives from its use in the selection equation as initial guess (see section 3.1.2). The *days of sales outstanding (DSO)* correspond to the ratio between the firm receivables and its annual sales revenue, multiplied by 360 days. They correspond to the number of days between the delivery of goods or performance of a service and the collection of the related payments. The *suppliers payment terms (SPT)* are the ratio between the firm payables and purchases, multiplied by 360 days. They are the average payment terms to the suppliers. We expect firms investment to be decreasing with days of sales outstanding and increasing with suppliers pay-

ment terms. The investment sensitivity to the inter-enterprises payment deadlines are expected to be larger in the constrained regime than in the unconstrained regime in absolute value. $D1$, $D2$, $D3$ correspond to dummies calculated respectively as the product between the initial guess (see section 3.1.2) and respectively the cash flow, days of sales outstanding, and suppliers payment terms. They are included to control for the tangibility effect on the investment-cash flow, investment-days of sales outstanding, investment-suppliers payment terms sensitivities. Finally, φ_i and τ_t represent respectively sector and year fixed effects.

3.1.2 Selection equation

The selection equation determines endogenously the firms likelihood of being in the constrained or unconstrained regime. The selection equation we estimated is the following.

$$y^*_{it} = \kappa Size_{it} + \rho Age_{it} + \beta Tangibility_{it} + \gamma leverage_{it} + \vartheta SBC_{it} + \omega RatioFinAutonomy_{it} + \alpha Longtermdebt + \nu_{it} \quad (5)$$

The dependent variable, y^*_{it} , proxy the severity of informational asymetry for each firm i at time t . Although the severity of informational asymetry is unknown by the researcher. Only firms characteristics are observed. To overcome this, y^*_{it} is expressed as a latent variable measuring the firms **likelihood** to be in the constrained or unconstrained regimes. For the estimation we must give an initial guess for this variable also called the classification variable. In this paper, we follow the approach of Almeida et al.(2007) [?] and use assets tangibility as initial guess. They assume that tangible firms are less exposed to informational asymetry because tangible assets can be set as collateral and this decreases the firms default risks and increases its ability to get external funds. In this paper, we take the median as threshold and assume that a firm having a tangibility ratio more than the median tangibility ratio is more *likely* to be financially unconstrained and a firm having a tangibility ratio larger than the median tangibility ratio is more likely to be unconstrained. The observation will be coded 1 if the firm tangibility ratio is larger than the median tangibility ratio and 0 if not. To address potential biases in the results, we made robustness check of the initial guess (see section 4.4).

Firms classification in the constrained or the unconstrained group is influenced by the set of selection equation independent variables ², Z_{it} , named the selection vector. In this work, some variables of the selection vector come from the existing

²It's composed by a set of firms multiple characteristics.

literature but we add some variables that we think are important. The selection vector includes first the firms size. The *size* is proxy by the employees number per year. It has the advantage of being insensitive to inflation. Second, we use firms age which is a non-negligible firm characteristic. The *tangibility* is controlled in the three equations of the model because of its role as initial guess. It's calculated as the ratio between the tangible assets and the total assets. The *leverage* is measured as the ratio between the total debt and the debt plus equity. The *Soft Budget Constraint (SBC)* is a dummy variable taking 1 if the firm has a negative EBITDA but receives positive financial debt. The *ratio of financial autonomy* is calculated as the ratio between the equity and financial debt. The *Long term debt* refers to the gross financial debt.

We expect positive signs for the *size*, *age*, *tangibility*, *SBC*, *ratio of financial autonomy* and a negative sign for the *long term debt*. At the moment, we can not predict the *leverage* sign because there is not a main consensus in the literature about it. When a firm has a high or low leverage, it can sometimes be interpreted differently according to whether or not it is the firm choice to renounce to debt or to use more debt (Hovakimian (2009) [18]).

4 Data

Our sample is collected from Diane³ database constructed by Bureau Van Dijk. It includes annual informations on French PACA Region non-financial firms over 2005-2014. They are the only data we can access. The data base is such that firms have at least one employee. We adjusted the data base to get our final sample because an estimation with the raw data gives non-significant results. Potential outliers and unexpected data were dropped out of 1 % and 99 % percentiles of all variables. In addition, observations having days of sales outstanding and suppliers payment terms higher than 360 days were deleted as well as firms with tangibility ratio larger than 1. Finally, we get an unbalanced panel of 122746 observations over the whole period. The firms are from eighty different sectors according to the second level subdivision of the French Classification of Activities (NAF rev.2) by INSEE. Table 1 reports the descriptive statistics of the variables used.

4.1 Descriptive statistics

Table 1 gives a general description of the key variables by giving their mean and their standard deviations. PACA Region firms are on average 13 years old. An average firm has 8 employees and invests around 17 % of its capital stock each year.

³This database covers the majority of French companies (more than 1,3 Millions firms) required to file their annual financial accounts.

Firms investment was not stable accross the period. It was increasing between 2009-2010 and decreasing between 2006-2008 and 2011-2014. The tangible assets of an average firm represent around 34% of its total assets. Table 1 shows also that inter-enterprises payment deadlines have decreased during the period of study, especially after the 2008 financial crisis. An average firm collected payments from its customers in 39 days in 2006 compared to 35 days in 2014. In parallel, the suppliers were paiyed in 71 days in 2006 compared to 51 days in 2014.

Table 1: Descriptive statistics

Variables	2006	2007	2008	2009	2010	2011	2012	2013	2014	Obs
Investment	Mean	0.179	0.177	0.168	0.173	0.189	0.174	0.162	0.158	122746
	Std	0.57	0.56	0.54	0.56	0.6	0.54	0.53	0.54	0.53
Sales	Mean	14.3	14.6	14.6	13.8	13.4	13.4	13.4	13.1	122746
	Std	24	25	27	26	24	22	24	25	20
Cash Flow	Mean	0.6	0.65	0.59	0.56	0.56	0.54	0.46	0.45	122746
	Std	1.5	1.5	1.6	1.4	1.4	1.4	1.3	1.36	1.13
Days of sales outstanding	Mean	39.4	37.7	36.	35.8	36.2	36.2	36.3	37.6	122746
	Std	44	42	42	42	43	43	43	45	44
Suppliers payment terms	Min	0	0	0	0	0	0	0	0	0
	Max	356	353	356	352	348	357	352	354	348
Tangibility	Mean	71	65	63	60.5	60.7	62.5	61.3	61.4	122746
	Std	78	76	72	72	72	72	71	72	70
Size	Min	0	0	0	0	0	0	0	0	0
	Max	360	360	360	360	360	360	360	360	360
Age	Mean	0.33	0.33	0.33	0.34	0.34	0.34	0.34	0.34	122746
	Std	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Leverage	Mean	8	7.6	7.4	7	7	7.14	7.2	7.2	122746
	Std	13.5	13.2	12.8	12.1	12.2	12.4	12.6	12.6	12.6
Fin.Autonomy	Mean	12.5	12.3	12.5	12.4	16.2	13	13.2	13.4	122746
	Std	10.5	10.5	10.5	10.5	10.5	10.7	10.5	10.5	10.3
Long term debt	Mean	0.3	0.3	0.31	0.32	0.32	0.32	0.33	0.32	122746
	Std	0.37	0.33	0.34	0.34	0.34	0.34	0.34	0.34	0.34
Soft budget const.	Mean	0.36	0.36	0.37	0.37	0.37	0.37	0.38	0.38	122746
	Std	0.23	0.23	0.23	0.24	0.24	0.24	0.24	0.24	0.25
Investment	Mean	0.95	1.04	1042	1.09	1.13	1.11	1.13	1.09	122746
	Std	2.5	2.9	2.7	2.9	3.6	3	2.9	2.7	2.6
Soft budget const.	Mean	0.083	0.078	0.08	0.1	0.09	0.094	0.11	0.1	122746
	Std	0.28	0.27	0.28	0.31	0.29	0.29	0.32	0.31	0.31

Note: The first year, 2005, does not appear because of the investment lagged denominator. Sales revenue and cash flow are divided by the lagged capital. Days of sales outstanding and suppliers payment terms are expressed in days.

Figure 1 details the distributional characteristics of the inter-enterprises payment deadlines by year over the period. We remark that except in 2006, the 25th percentile of the days of sales outstanding and suppliers payment terms is approximately equal to zero. It means that from 2007 to 2014, at least 25% of firms cashed their customers and paid their suppliers immediately.

In 2006, the median of the days of sales outstanding and suppliers payment terms are respectively 26 and 52 days compared to 20 and 31 days in 2014. The third quartile of the days of sales outstanding and suppliers payment terms are respectively 63 and 110 days in 2006 against 55 and 79 days in 2014 meaning that at least 25% of the firms cashed their customers in more than 55 days and 25% paid their suppliers in more than 79 days in 2014.

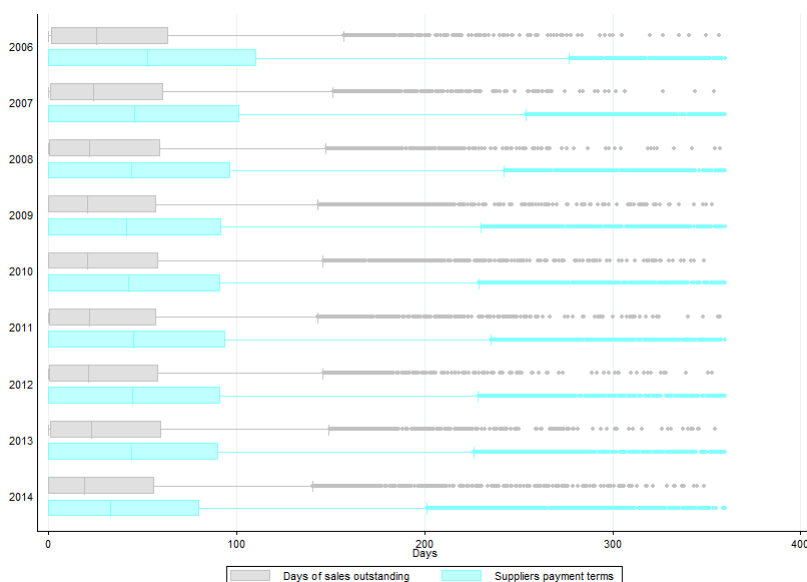


Figure 1: Box plots of inter-enterprises payment deadlines for each year

Even though we have described inter-enterprises payment deadlines over the eighty sectors of our sample (see appendix 2), to better contrast the sectoral distributional characteristics of inter-enterprises payment deadlines, we have gathered the observations according to the four broad sectors of the economy⁴. Figures 2 provides the distributional characteristics of inter-enterprises payment deadlines according to the four broad sectors of economics activities. The quaternary sector has the lowest inter-enterprises payment deadlines. At least 50% of firms in this sector cashed their customers and paid their suppliers immediately. In contrast, the high-

⁴We follow the 20th century suggestion of economists considering that there are four main economic sectors. The primary sector produces raw material. The secondary sector provides finished goods through the raw material. The tertiary sector provides services to the other agents of the economy. The quaternary sector incorporates all activities related to technology, information gathering, media, culture, research and development, and intellectual activities

est inter-enterprises payment deadlines are in the primary and tertiary sectors. The secondary sector has the intermediate inter-enterprises payment deadlines.

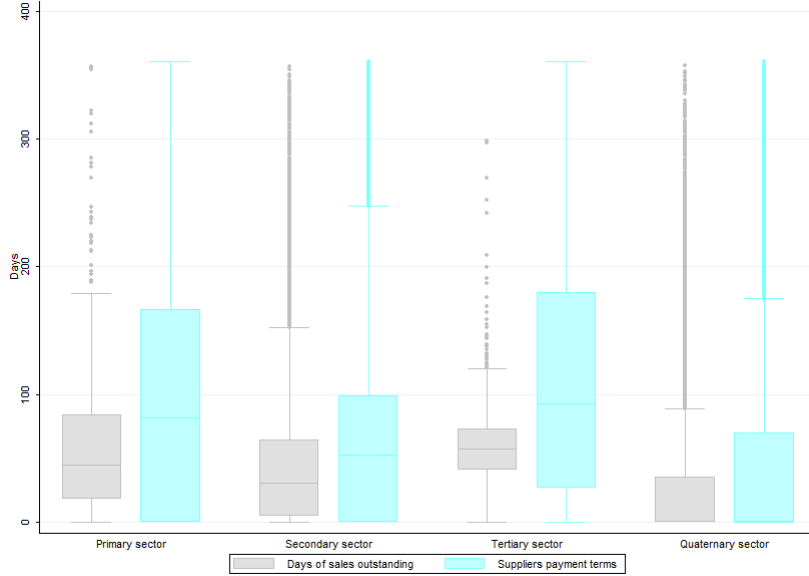


Figure 2: Box plots of inter-enterprises payment deadlines for each broad sector of the economy

In France the inter-enterprises payment deadlines are regulated. In general when two firms conclude a contract, the settlement deadline is set to 60 days. This limit is purely theoretical. In reality, despite the penalties established in case of late payments, many firms exceed 2 months. The non-respect of the regulatory payment terms by some firms leads to gaps between their payment terms. We describe the inter-enterprises payment deadlines by splitting them into 4 categories: those having delays of less than 30 days, between 30 and 60, between 60 and 90 days and more than 90 days. Figure 2 shows firms proportions per days slice. Since 2005, there are more and more firms collecting payments from their customers in 30 days. In 2014, approximately 45% of firms cashed their customers in less than 30 days compared to 22%, 18%, 15% respectively between 30-60, 60-90 and more than 90 days. In parallel, in 2014, only 15% of firms paid their suppliers in 30 days. The large majority of firms pay their suppliers between 30-90 days.

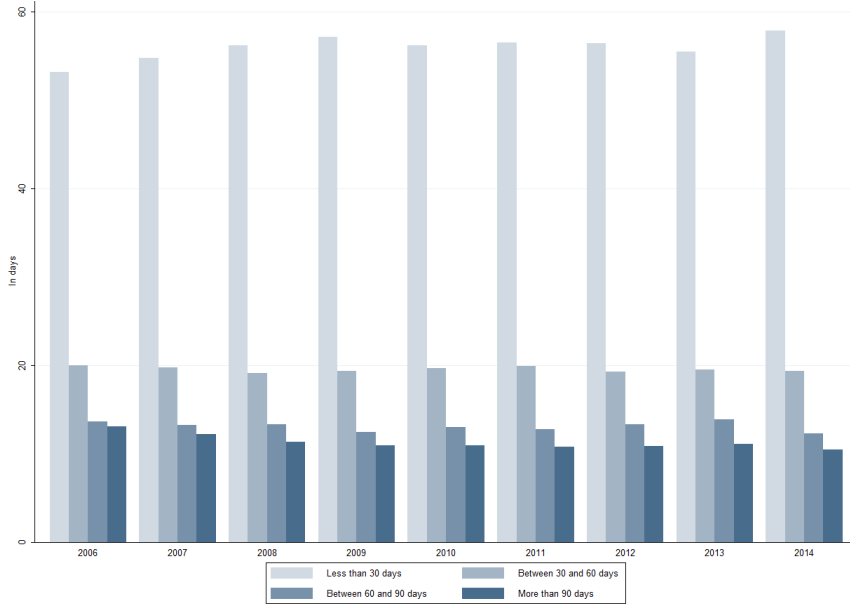


Figure 3: Firms proportion per days of sales outstanding slice

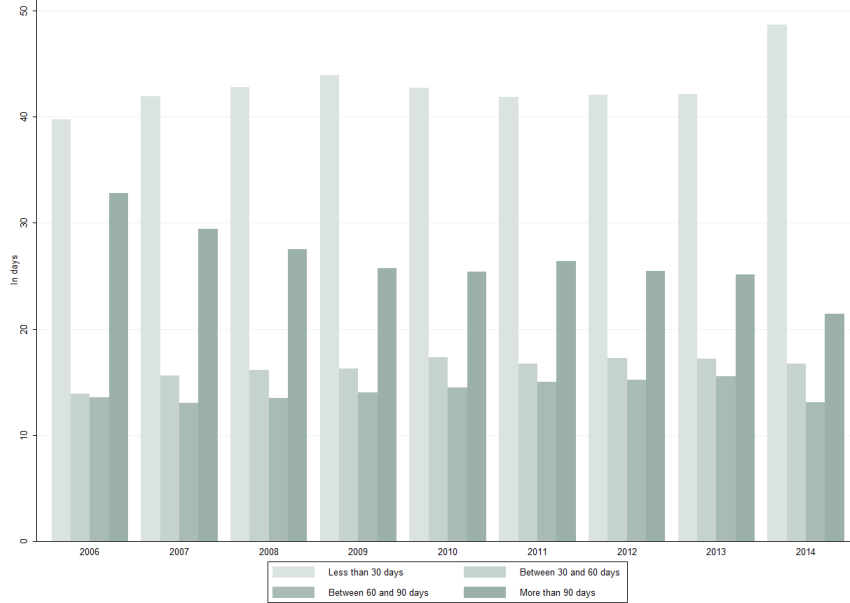


Figure 4: Firms proportion per supplier payment terms slice

This paper uses assets tangibility as initial guess and its median as threshold to conduct the endogenous switching regression model (see section 3.1). Table 5 presents the kernel density and the median of the tangibility ratio by year. We remark that the tangibility ratio is slightly right skewed. The median is not constant but it does not hardly change over time. It is approximatively equal to 0.23.

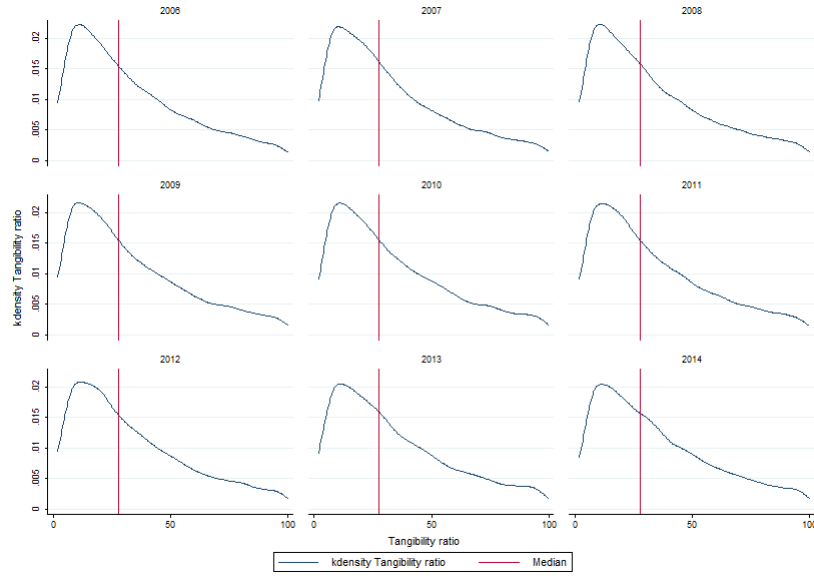


Figure 5: Tangibility ratio density

Upstream the estimation, it is interesting to evaluate approximatively the dependence between our key variables. Table 2 provides a preliminary view on the relationship between the main variables through their correlation matrix. Investment is significantly and positively correlated to the cash flow and the suppliers payment terms. It is negatively correlated to the days of sales outstanding. Cash flow displays a significant and positive correlation to the days of sales outstanding and suppliers payment terms.

Table 2: Pairwise correlation coefficients among the key variables

Variables	Investment	Cash Flow	DSO	SPT
Investment	1			
Cash Flow	0.04**	1		
Days of Sales Outstanding (DSO)	-0.006*	0.08**	1	
Suppliers payment terms (SPT)	0.025**	0.016**	0.31**	1

Note that *, ** indicate statistical significance at 1% and 5%.

5 Results

Tables 3 (3.a and 3.b) reports the maximum likelihood estimation results of the basic endogenous switching regression model specified in section 3.1. All the selection variables have significant coefficients at 5% level. They play an important role in determining the likelihood of a firm to belong to a particular regime. The estimates indicate that larger, older, highly tangible, leveraged and financially autonomous, less indebted firms are more likely to be unconstrained.

Table 3.b reports the estimation results of the two component equations. We first confirm the previous finding in the existing literature. The investment is positively related to cash flow in both regimes with the estimated coefficient larger in the constrained regime than in the unconstrained one. When an unconstrained firm cash flow increases by one unit, its investment increases by 0.012 unit compared to 0.16 unit for a constrained firm. Inversely, a one unit decrease of an unconstrained firm cash flow implies a decrease of its investment spending by 0.012 unit compared to 0.16 unit when the cash flow decrease concerns a constrained firm.

Secondly, the investment sensitivity to the inter-enterprises payment deadlines is in line with our expectations. The investment is significantly related to inter-enterprises payment deadlines at 1% level in both regimes. The investment-days of sales outstanding sensitivity is negative whereas the investment-suppliers payment terms sensitivity is positive. A one day increase in firms days of sales outstanding implies a decrease in unconstrained firms investment spending by 0.003% compared to 0.012% in the constrained regime. Inversely, a one day decrease in firms days of sales outstanding implies an increase of unconstrained firms investment spending by 0.003% compared to 0.012% in the constrained regime. In parallel, a one day increase in suppliers' payment terms increases unconstrained firms investment by 0.007% compared to 0.020% for constrained firms. Inversely, a one day decrease in suppliers' payment terms decreases unconstrained firms investment by 0.007% compared to 0.020% for firms in the constrained regime. Thus, a shock on customers or suppliers' payment terms will have on constrained firms investment respectively five times and thrice the effect on unconstrained firms investment. Overall, when customers and suppliers' payment terms increase simultaneously by one day, the unconstrained firms investment increases by 0.004% compared to 0.008% for constrained firms.

The gap between the two regimes investment-inter-enterprises payment deadlines sensitivities is caused by unconstrained firms capacity to easily get external funds such as loans or securities issuance to finance their investment whereas the constrained firms can not have access to external funds as they need. So, unconstrained firms do not need a large flexibility from their suppliers to pay their debts and will not be highly limited by a late payment from their customers contrary to constrained

firms. As long as the maturity of the suppliers debt has not expired, the constrained firms have a period of time during which they will be able to benefit from these cash. In contrast, a late payment represents less liquidity for them.

The initial guess effect on the investment sensitivity to the cash flow and the inter-enterprises payment deadlines were controlled through dummies D_1 , D_2 , D_3 representing respectively tangibility effect on investment-cash flow, investment-days of sales outstanding and investment-suppliers payment terms sensitivities. D_1 is significant at 1% level in both the regimes with positive coefficient in the unconstrained regime and negative in the constrained regime. For constrained firms, the higher their tangibility is, the lower the agency conflicts between their stakeholders or informational asymmetry will be. Tangible assets decrease their default risks. Then once constrained firms tangibility reaches a certain level, they become unconstrained. These unconstrained firms will invest highly by borrowing in addition to their cash flow. A higher borrowing will increase their default risks and their investment will be highly sensitive to their cash flow as tangibility increases. D_2 is only significant in constrained group. Indeed, when the constrained firms tangibility ratio increases, their investment sensitivity to the days of sales outstanding increases. Yet, the investment-days of sales outstanding sensitivity is negative. This implies that as well as the tangibility ratio increases, the constrained firms investment is less and less sensitive to the days of sales outstanding. At a certain level of the constrained firms tangibility ratio, they become unconstrained and their investment sensitivity to the days of sales outstanding becomes more lower than when they were constrained. D_3 is non-significant for both groups. Firms investment sensitivity to suppliers payment terms is not related to the tangibility.

5.1 Policy implications

Our findings demonstrate that an increase in inter-enterprises payment deadlines increases firms investment capacity. Some economists propose to reduce inter-enterprises payment deadlines from 60 days to 30 days while some other find that long payment terms are efficient especially in crisis period. We think that inter-enterprises payment deadlines should be regulated to avoid scandalous cases. However an intermediate solution, allowing to control for scandalous payment deadlines on the one hand and giving firms the possibility to benefit from long days of sales outstanding or suppliers payment terms on the other hand, could be found. One solution could be the development and simplification of the factoring. The factoring can be used by both seller and buyer firms, regardless their healthiness or riskiness, to transmit their customers or suppliers invoices to a bank or a factor in order to obtain or allow an immediate payment.

Table 3: Baseline endogenous switching regression model (see section 3.1)

This table reports the maximum likelihood estimates of the endogenous switching regression model. The reported p-values test the null hypothesis that a single investment regime is sufficient to describe the data as opposed to two regimes. The selection equation estimates are reported in Table 2a. In table 2b are reported the two investment equations estimates of the two regimes. These equations are clustering with firms ID and estimated with sector and year dummies. The exogeneity of all our explanatory variables were verified. Note that **, * indicate respectively the statistical significance at 1% and 5%.

(a) Selection equation		
LogAge $_{it-1}$	0.37**	0.002
Size $_{it-1}$	0.006**	0.0001
Tangibility $_{it-1}$	0.75**	0.008
Leverage $_{it-1}$	0.37**	0.007
SBC $_{it-1}$	0.03**	0.006
Fin. Aut $_{it-1}$	0.26**	0.01
Long term debt $_{it-1}$	-0.16**	0.06
Constant	-1.37**	0.008

(b) Investment equations		
Unconstrained		
Variables	Coef	Std
Sales $_{it-1}/K_{it-1}$	0.001**	0.0001
Cash Flow $_{it-1}/K_{it-1}$	0.012**	0.001
LogDays of Sales Outstanding $_{it-1}$	-0.003*	0.001
LogSuppliers Payment Terms $_{it-1}$	0.007**	0.001
Tangibility $_{it-1}$	-0.002	0.009
D*Cash Flow $_{it-1}/K_{it-1}$	0.06**	0.008
D*logDays of Sales Outstanding $_{it-1}$	0.002	0.001
D*logSuppliers Payment Terms $_{it-1}$	-0.002	0.001
Constant	0.05	0.03

Constrained		
Variables	Coef	Std
Sales $_{it-1}/K_{it-1}$	0.026**	0.001
Cash Flow $_{it-1}/K_{it-1}$	0.16**	0.005
LogDays of Sales Outstanding $_{it-1}$	-0.012*	0.005
LogSuppliers Payment Terms $_{it-1}$	0.020**	0.006
Tangibility $_{it-1}$	0.13**	0.02
D*Cash Flow $_{it-1}/K_{it-1}$	-0.09**	0.01
D*logDays of Sales Outstanding $_{it-1}$	0.03**	0.005

D*logSuppliers Payment Terms _{it-1}	-0.006	0.004
Constant	-0.25**	0.04
Model P.Value -Likelihood Ratio test-	0.000	

5.2 Constrained and unconstrained firms proportions

The number of firms in the constrained and unconstrained regime are not constant across the period. Nonetheless the proportions of firms moving from constrained to unconstrained or unconstrained to constrained regimes are not given by the estimation. One solution is to use the estimated selection equation in order to extract the percentage of constrained and unconstrained firms per year.

The selection equation (see equation 3 in section 3) is a linear function expressed as:

$$y_{it}^* = \alpha Z_{it} + \nu_{it} \quad (6)$$

Thus the estimated selection equation is the following: $\overline{y_{it}^*} = \overline{\alpha Z_{it}^*}$

The selection rule was expressed as follows: the firm is financially constrained if $y_{it}^* \geq 0$ and financially unconstrained if $y_{it}^* < 0$. Using the estimated results, a firm belongs to the unconstrained regime if $\overline{\alpha Z_{it}^*} < 0$ and to the constrained regime if $\overline{\alpha Z_{it}^*} \geq 0$.

Table 4 gives the per year estimated firms proportion in the constrained and unconstrained regimes.

Table 4: Constrained and unconstrained firms proportion per year

Variables	2007	2008	2009	2010	2011	2012	2013	2014
Constrained firms(in %)	60.6	60.2	63.3	62.4	65.1	69.8	76.04	76.8
Unconstrained firms(in %)	39.2	39.7	36.6	37.5	34.8	30.1	23.9	23.1

We observe an increase in constrained firms proportion since after the financial crisis of 2008. The increase in constrained firms proportion is parallel to the decrease in investment described in section 4.

Some firms change regime during the period. Figure 2 represents the number of unconstrained firms moving to the constrained regime and vice versa each year. Between 2008-2010, there were about 16% of firms changing regime each year, against

approximately 14% by 2012. Because of the 2008 crisis, the number of unconstrained firms becoming constrained was increasing. The peak of 3.8% was reached in 2009. Since 2010, there are less and less unconstrained firms changing regime.

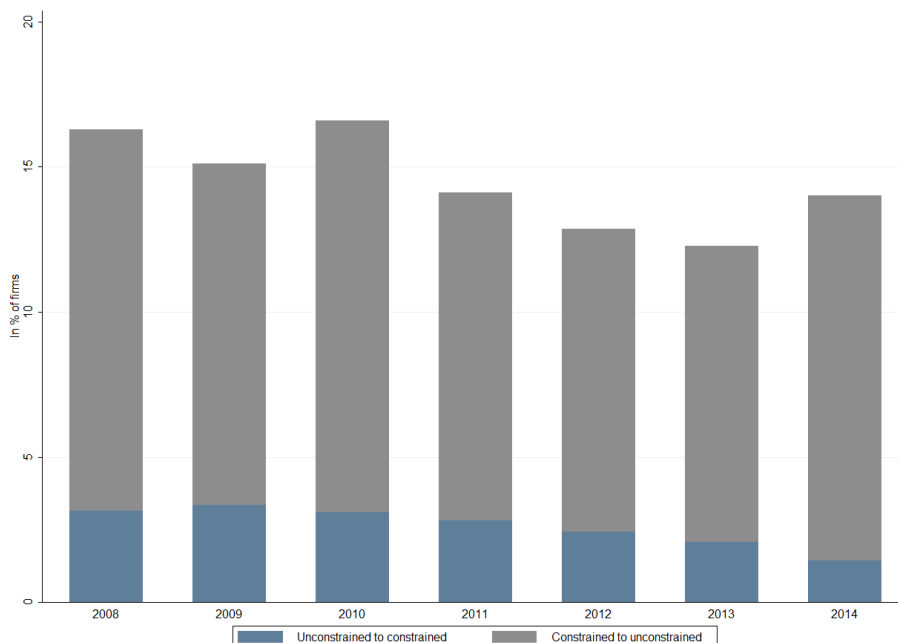


Figure 6: Evolution of firms movement between regimes

5.3 The determinants of firms status change.

Through the selection equation the variables determining the firms likelihood to belong to a regime were identified. However, the variables causing the firms regime change from constrained to unconstrained and vice versa remain unknown. In this sub-section, we develop a model for this purpose.

Consider the following equations:

$$W_{it}^U = \gamma_1 \Delta D_{it} + \nu_{1it} \quad (7)$$

$$W_{it}^C = \gamma_2 \Delta D_{it} + \nu_{2it} \quad (8)$$

Equations 7 and 8 estimate respectively the determinants of firms regime change from constrained to unconstrained and inversely. The dependent variable W^U and W^C are dummies that proxy respectively for the firms regime change from constrained to unconstrained and unconstrained to constrained regimes. W^C takes 0 if the firm has not changed regime and 1 if it moves from unconstrained regime at time t to

constrained regime at $t+1$. W^U takes 0 if the firm has not changed regime and 1 if it moves from constrained regime at time t to unconstrained regime at $t+1$. ΔD is the set of explanatory variables. It is composed by the variation of each variable used in the switching regression model except investment because of its endogeneity. We add also the interest coverage ratio that we have not used in the switching regression estimation but was used in past literature. The overall considered explanatory variables are sales, cash flow, days of sales outstanding, suppliers payment terms, tangibility, size, soft budget constraint, leverage, long-term debt, ratio of financial autonomy and the interest coverage ratio. We performed a logit regression to estimate this equation.

Tables 6 reports the estimated results. They reveal that size, tangibility, leverage, long-term debt, soft budget constraint, and financial autonomy are the factors influencing constrained firms status change to the unconstrained regime. More constrained firms size, tangibility, leverage, long-term debt, soft budget constraint, or financial autonomy increases more their financial constraints decrease, and more they become unconstrained. In contrast, more constrained firms size, tangibility, leverage, long-term debt, soft budget constraint, or financial autonomy decreases, more their constrained status does not change.

On the other hand, tangibility, leverage, soft budget constraint, and financial autonomy are the factors influencing unconstrained firms regime change to the constrained regime. More unconstrained firms tangibility, leverage, soft budget constraint, or financial autonomy decreases, more they face financial constraints, and more they become constrained. In contrast, more unconstrained firms tangibility, leverage, soft budget constraint, or financial autonomy increases, more their unconstrained status does not change.

Long-term debt does not influence unconstrained firms regime change to the constrained regime while it influences constrained firms regime change to the unconstrained regime. One possible reason is that a decrease of an unconstrained firm's long-term debt does not necessary mean that the firm faces financial constraints. Most of the times, it is simply unconstrained firms choice to reduce their long-term debt. However, an increase of constrained firms long-term debt indicates mostly that they do not face credit rationing any more.

Size influences constrained firms regime change to the unconstrained regime while it does not influence unconstrained firms regime change to the constrained regime. The reason is that a decrease of unconstrained firms size is not an indicator of their riskiness or healthiness. Some employee may leave their jobs because they reached the end of their contract. Although, when constrained firms hiring rate increases, it mostly means that their constrained status has decreased or vanished.

Cash flow, days of sales outstanding, suppliers payment terms, and interest cov-

erage rate do not influence neither constrained firms regime change to the unconstrained regime nor unconstrained firms regime change to the constrained regime. We found in section 4.2 that cash flow, days of sales outstanding, and suppliers payment terms are factors determining firms investment financing constraints. This could be the reason why they are not determinants of firms status change.

Table 5: Determinants of firms status change

	Const. to Unconst.		Unconst. to Const.	
	Coef	Std	Coef	Std
$\Delta Sales_{it}$	-0.00005	0.00003	-0.00003	0.00004
$\Delta Cashflow_{it}$	0.0002	0.0003	0.00008	0.0003
$\Delta Days\ of\ sales\ outstanding_{it}$	0.0005	0.001	0.00008	0.0003
$\Delta Suppliers\ payment\ terms_{it}$	0.0007	0.0005	0.001	0.001
$\Delta Size_{it}$	0.03**	0.01	-0.01	0.01
$\Delta Tangibility_{it}$	1.66**	0.4	-1.93*	0.43
$\Delta Leverage_{it}$	0.80**	0.19	-1.34**	0.27
$\Delta Long - term\ debt_{it}$	0.0002*	0.0001	-0.00006	0.0001
$\Delta Soft\ Budget\ Constraint_{it}$	0.25*	0.1	-0.50**	0.08
$\Delta Fin.\ Autonomy_{it}$	1.17**	0.36	-2.01**	0.47
$\Delta Int.\ Cov.\ Ratio_{it}$	-2.65	3.75	-0.76	4.8

Note: The interest coverage ratio is the ratio between the interest expenses and the EBITDA. Note that **, * indicate respectively the statistical significance at 1% and 5%.

6 Conclusion

The existing literature studying the determinants of firms investment financing constraints widely investigates the investment sensitivity to the cash flow. Yet, the cash flow as defined in the literature does not include the receivables from the customers and trade payables which are important firms financing sources. This paper provides a relevant complement to the existing literature by considering the business to business credits as part of the cash flow. The B2B credits generate days of sales outstanding and suppliers payment terms. In this paper, we assume that they could impact firms investment.

Between 2005 and 2014, our sample of firms from Provence-Alpes Côte d’Azur region (PACA) provides evidence that as cash flow, the inter-enterprises payment deadlines are significant determinants of firms investment. Firms investment is negatively sensitive to days of sales outstanding whereas it is positively sensitive to suppliers payment terms. The study being conducted on firms classified in constrained and unconstrained regimes, we found that the constrained firms investment is more sensitive to inter-enterprises payment deadlines than that of unconstrained firms.

By conducting this study on PACA region firms, we provide a novel index of financing constraints for SMEs. Indeed, in this region 99% of firms are SMEs. Yet, most of the studies on firms investment financing constraints are conducted on large firms. The SMEs are more concerned by financing constraints than large firms. Furthermore, this empirical study is conducted using an endogenous switching regression model. If this model allows a non-priori classification of firms in constrained and unconstrained regimes, it does not give to the researcher information on the constrained and unconstrained firms behavior. In this paper, we exploit the selection equation to determine the proportions of firms in each regime. Remarking that, these proportions are not constant over year, we develop a model allowing to extract the number of firms changing regime each year and the reason why they change regime.

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Appendix 1: Robustness check

Because of the initial guess, we made a robustness check in verifying and addressing potential biases in our results. We repeated the estimation by changing the initial guess. We replaced it by the Return on Capital Employed (ROCE). It measures a firm's profitability and the efficiency with which its capital is employed. In this case, we choose a threshold by sector to create the initial guess. We assumed that firms with a ROCE less than the median ROCE by sector are more "likely" to be financially constrained and inversely. The estimated results (see Table 7) of the key variables are found to be robust.

Table 6: Endogenous switching regression model with ROCE

Note that **, * indicates respectively the statistical significance at 1% and 5% level

(a) Selection equation		
Variables	Coef	Std
LogAge $_{it-1}$	0.38**	0.001
Size $_{it-1}$	0.0006**	0.0001
ROCE $_{it-1}$	-0.11**	0.0009
Leverage $_{it-1}$	0.3**	0.005
Long term debt $_{it}$	-0.31**	0.05
SBC $_{it-1}$	0.07**	0.004
Fin.Aut $_{it-1}$	0.001**	3.26e-06
Constant	-1.05**	0.005
(b) Investment equations		
Unconstrained		
Variables	Coef	Std
Sales $_{it-1}/K_{it-1}$	0.001**	0.0001
Cash Flow $_{it-1}/K_{it-1}$	0.009**	0.002
LogDays of Sales Outstanding $_{it-1}$	-0.003*	0.0009
LogSuppliers Payment Terms $_{it-1}$	0.006**	0.001
ROCE $_{it-1}$	0.003	0.002
D*Cash Flow $_{it-1}/K_{it-1}$	0.0008	0.003
D*logDays of Sales Outstanding $_{it-1}$	0.001	0.001
D*logSuppliers Payment Terms $_{it-1}$	0.001	0.001
Constant	0.02*	0.013
Constrained		
Variables	Coef	Std

Sales _{<i>it-1</i>} / <i>K</i> _{<i>it-1</i>}	0.02**	0.001
Cash Flow _{<i>it-1</i>} / <i>K</i> _{<i>it-1</i>}	0.16**	0.016
LogDays of Sales Outstanding _{<i>it-1</i>}	-0.015**	0.003
LogSuppliers Payment Terms _{<i>it-1</i>}	0.027**	0.005
ROCE _{<i>it-1</i>}	-0.01**	0.004
D*Cash Flow _{<i>it-1</i>} / <i>K</i> _{<i>it-1</i>}	-0.03	0.02
D*logDays of Sales Outstanding _{<i>it-1</i>}	0.01**	0.006
D*logSuppliers Payment Terms _{<i>it-1</i>}	-0.14	0.004
Constant	-0.06	0.04
Model P.Value -Likelihood Ratio test-	0.000	

Appendix 2: Descriptive statistics by sector

Table 7: Number of observations by sector according to the French Classification of Activities (NAF rev.2)

Code	Observations	Code	Observations	Code	Observations
01	628	37	67	77	527
02	56	38	243	78	4
03	5	39	3	79	65
08	53	41	926	80	176
09	4	42	383	81	3345
10	3706	43	24608	82	483
11	162	45	8741	85	543
13	220	46	12017	86	1308
14	141	47	25518	87	217
15	84	49	851	88	45
16	375	50	25	90	242
17	90	51	11	91	26
18	796	52	133	92	6
19	7	53	5	93	331
20	693	55	2436	94	9
21	19	56	12875	95	855
22	353	58	313	96	4960
23	612	59	71	99	2
24	44	60	4		
25	1569	61	161		
26	392	62	975		
27	243	63	85		
28	476	64	460		
29	201	65	1		
30	65	66	39		
31	394	68	1055		
32	1129	72	71		
33	2241	73	484		
35	28	74	524		
36	43	75	181		

¹ Note: The column code gives the code assigned by INSEE to each activity in the French Classification of Activities level 2 (NAF rev.2).

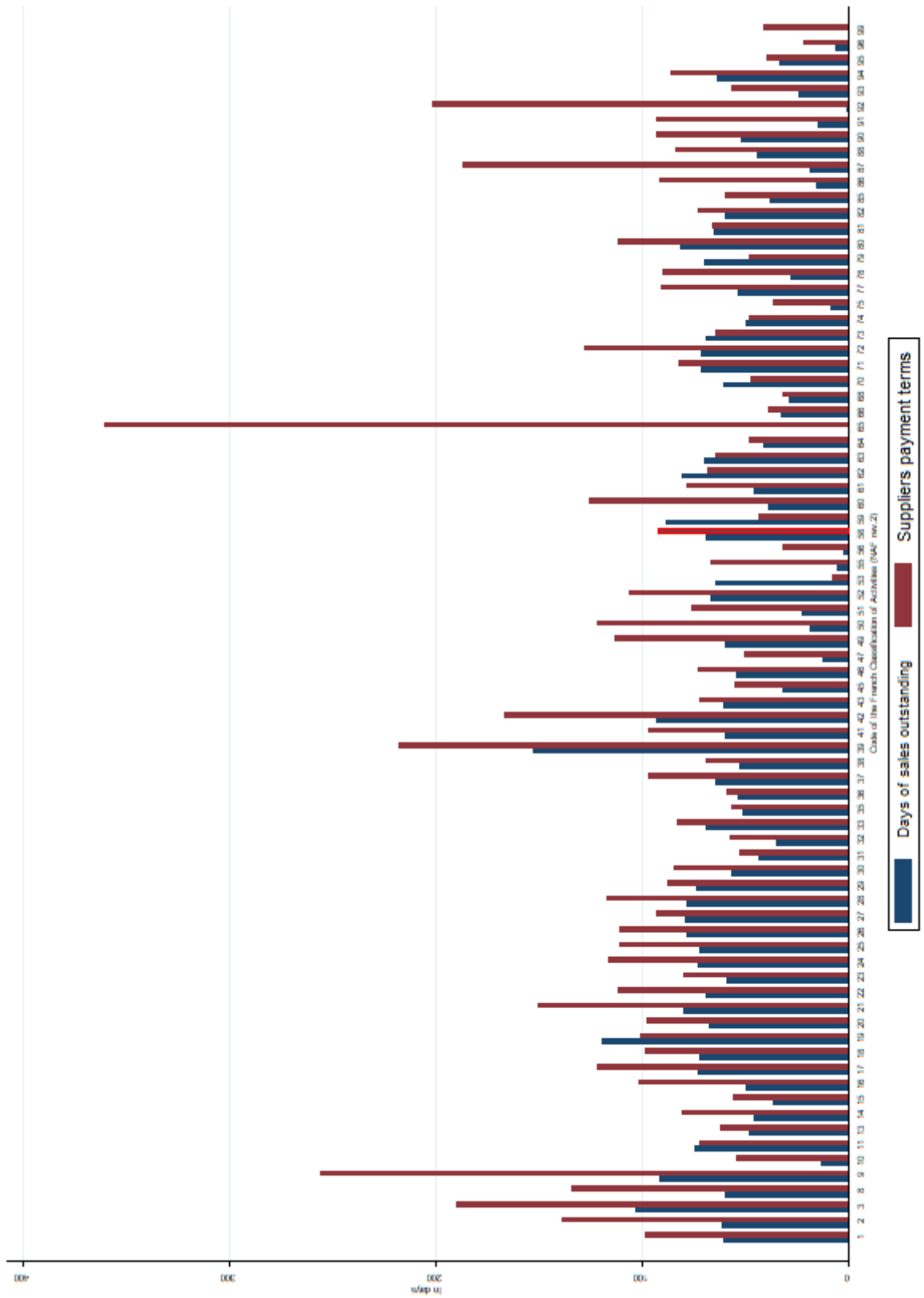


Figure 7: Inter-enterprises payment deadlines per sector according to the French Classification of Activities (NAF rev.2)

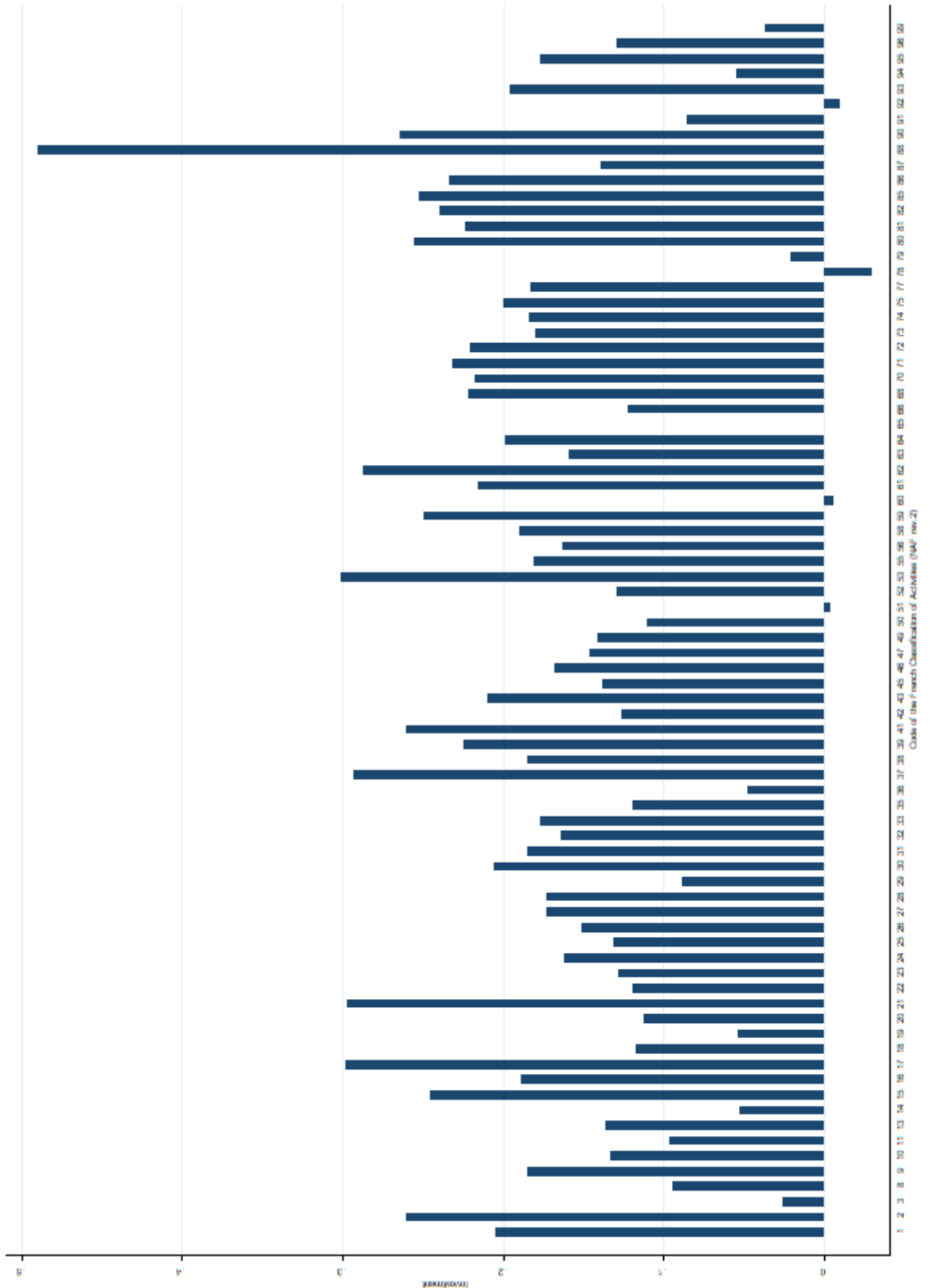


Figure 8: Investment per sector according to the French Classification of Activities (NAF rev.2)

Table 8: Labels of the French Classification of Activities codes (NAF rev.2)

Code	Label	Code	Label
01	Crop and animal production, hunting and related services	56	Food
02	Forestry and logging	58	Edition
03	Fishing and aquaculture	59	Production of motion pictures, video and television programs; sound recording and music publishing
05	Extraction of coal and lignite	60	Programming and dissemination
06	Extraction of hydrocarbons	61	Telecommunications
07	Extraction of metal ores	62	Programming, consulting and other IT activities
08	Other mining and quarrying	63	Information Services
09	Extractive Industries Support Services	64	Financial services activities, except insurance and pension funds
10	Food industries	65	Insurance
11	Beverage manufacturing	66	Auxiliary activities in financial services and insurance
12	Manufacture of tobacco products	68	Real estate activities
13	Textile manufacturing	69	Legal and accounting activities
14	Clothing industry	70	Activities of head offices; management consultancy
15	Leather and footwear industry	71	Architectural and engineering activities; control activities and technical analysis
16	Woodworking and manufacture of articles of wood and cork, except furniture; manufacture of articles of straw and plaiting	72	Scientific research and development
17	Paper and paperboard industry	73	Advertising and market research
18	Printing and reproduction of recordings	74	Other specialized, scientific and technical activities
19	Coking and refining	75	Veterinary activities
20	Chemical industry	77	Rental and leasing activities
21	Pharmaceutical industry	78	Employment-related activities
22	Rubber and plastic products manufacturing	79	Activities of travel agencies, tour operators, reservation services and related activities
23	Other non-metallic mineral product manufacturing	80	Investigations and security
24	Metallurgy	81	Services related to buildings and landscaping
82	Administrative activities and other business support activities		
25	Manufacture of metal products, except machinery and equipment	84	Public administration and defense; compulsory social security
26	Computer, electronic and optical product manufacturing	85	Education
27	Manufacture of electrical equipment	86	Activities for human health
28	Manufacture of machinery and equipment n.e.c.	87	Medico-social and social housing
29	Automotive Industry	88	Social action without accommodation
30	Manufacture of other transport equipment	90	Creative, arts and entertainment activities
31	Manufacture of furniture	91	Libraries, Archives, Museums and Other Cultural Activities
32	Other manufacturing industries	92	Organization of games of chance and money
33	Repair and installation of machinery and equipment	93	Sports, recreation and leisure activities

35	Production and distribution of electricity, gas, steam and air conditioning	94	Activities of community organizations
36	Collection, treatment and distribution of water	95	Repair of computers and personal and household goods
37	Collection and treatment of wastewater	96	Other personal services
38	Collection, treatment and disposal of waste; recovery	97	Household activities as employers of domestic staff
39	Remediation and other waste management services	98	Undifferentiated activities of households as producers of goods and services for their own use
41	Construction of buildings	99	Activities of extraterritorial organizations and bodies
42	Civil Engineering		
43	Specialized construction work		
45	Trade and repair of motor vehicles and motorcycles		
46	Wholesale trade, except of motor vehicles and motorcycles		
47	Retail trade, except of motor vehicles and motorcycles		
49	Land transport and pipeline transport		
50	Water transport		
51	Air transport		
52	Warehousing and auxiliary transport services		
53	Post and courier activities		
55	Accommodation		
