ESSAYS ON MARKET IMPERFECTIONS AND FINANCING CONSTRAINT FOR SMEs

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ABSTRACT

Drawing on insights from the corporate finance and entrepreneurial finance literatures, this thesis combines different empirical strategies and econometric techniques to study the role of capital-market imperfections on the financial and operational activities of Small and Medium Enterprises (SMEs). The findings of the thesis can be summarized as follow: (1) credit-rationing effects are persistent and continue to impact the chances of failure later in the firm's history, but its effects are mitigated by greater profitability over time, human capital of the entrepreneur and lower financial risk, (2) the determinants of rationing are also investigated and the result shows those firms with more collateralisable assets, greater profitability, and more human (better projects) are less likely to be rationed, (3) collateral and human capital both have effect on demand and supply of bank debt, thus collateral and good human capital indicator may alleviate the problem caused by the asymmetric information problem, (4) by using switching regression biases, the result reaffirm that that financially constrained firms' investment is more sensitive to measures of internal financing, (5) by using data from 14 European countries, the result suggest that there is a positive and significant effect of cash flow on investment and a positive relationship between cash holding and cash flow, however the degree of financial development does not have any effect on cash-flow investment sensitivity, and lastly (6) the decreasing trend of the effect of cash flow on investment cannot be found then I may suggest that investment cash flow sensitivity still can be used as a measure of financial constraint.

The general contribution of the thesis is to provide distinctive complement to the existing literature by suggesting new ways to study the impact of market imperfections on SMEs by using different empirical strategies and econometric techniques. Previous empirical studies predominantly focus on large public companies and the application to small firms has not been exhaustive. The specific characteristics of small companies allow me to highlight a large number of interesting issues relating to how the financing constraint affects the SMEs and how human capital can lessen the constraints. Moreover, the thesis also investigate the investment cash-flow sensitivity across countries which, to the best of my knowledge, is still limited study assessing the effect of cash flow on investment using SMEs data from several countries. On the methodology issued, the thesis contributes by applying some econometric techniques that may reduce the problem when assessing the financial constraint by using indirect measurement.

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TABLE OF CONTENT

Page

LIST OF FIGURES

Figures Page

LIST OF TABLES

Table Page

CHAPTER 1 INTRODUCTION

1.1 Motivation

The financing problems of SMEs have been an interesting issue both for policy makers and researchers because of SMEs' role in economic growth and the perception that financial constraints at this level affect economic growth. Such constraints have been shown empirically to present one of the obstacles to growth (Ayyagari et al., 2007). Asymmetric information and adverse selection problems are considered to be factors contributing to the difficulties SMEs experience in obtaining external financing. This is due to their special characteristics, such as a lack of collateral and opaqueness of information about them.

How important are financing constraints empirically for SMEs? What are the the detailed factors to explain why some firms appear to be more constrained than others? Whilst attempts have been made in a number of countries over the last two decades to answer these questions, the availability of good data and the failure to use appropriate econometric techniques have made conclusions questionable. Therefore, financial constraints for SMEs remains one of the most interesting areas of research in corporate finance, particularly in emerging markets where imperfections are likely to be most marked (D'Espalier & Guariglia, 2012; Guariglia, 2008; Silva & Carreira, 2010). If data is available to provide definitive tests of the various theories proposed in the literature and the right methodology is applied in this process, I can expect to offer more reliable advice to governments around the world that are trying to stimulate economic growth.

Taking insights from corporate finance and human capital theories, this thesis attempts to present empirical studies in order to offer a greater understanding of how economists might measure the degree of financing constraints faced by SMEs. Moreover, it also explores the role of firm-specific and human capital factors that affect firm performance and how they may in turn alleviate the financing constraints for SMEs.

1.2 Background

Theoretical and empirical research both suggest that finance market imperfections and asymmetric information are the main causes of the financial constraints on firms, since borrowers allegedly hold more information about the firm than the lender (Stiglitz and Weiss, 1981). Information asymmetry theories identify two different issues to be contended with, namely adverse selection and moral hazard. Both of these would seem to have greater effects on SMEs than larger and older firms (Hyytinen & Väänänen, 2006). Adverse selection is based on the idea that and lender cannot distinguish between a good borrower (low chance of default) and a bad one (high chance of default). This enables the borrower either to conceal his type (good or bad) and exploit his superior knowledge over the bank to gain more favourable terms than are justified economically.

Moral hazard exists when the bank cannot observe the borrower's effort and he may choose after getting a loan to 'put his feet up'. These problems are likely to occur particularly at the start-up stage of the business, when information is least available to the bank. There will of course be a lender response to the borrower's behaviour. Since the lender does not know the type of the borrower, the lender will charge a higher interest rate to compensate for giving the loan to a bad borrower. Likewise, to deal with moral hazard, the bank may require collateral from the borrower so that he has something to lose from putting in minimal effort.

The potential borrower, then, knows the risk of his own project. Assuming, however, that the bank cannot judge whether a given applicant is more or less risky, it might charge all borrowers the same interest rate based on average risk. In the extreme case, this may mean that some businesses get no credit at all despite having viable projects. As a result, the market may not deliver the optimal amount of finance to firms and growth will suffer.

The moral hazard arguments can also lead to credit rationing because of the borrower's willingness to divert to more risky projects (Stiglitz and Weiss, 1981), engage in asset substitution and apply an inappropriate degree of effort on the project (Aghion and Bolton, 1997). Collateral may help alleviate this problem, but again, it has nothing to do with the viability of the project. In the extreme case, some firms with viable projects may have no collateral. Hence again, viable projects will be refused financing and lower economic growth will be the outcome.

If banks are able to build into their pricing mechanism, the need more monitoring to address the asymmetric information issue, and this will make external (i.e. bank) financing more expensive than internal (i.e. retained profits). If the effect of this pricing mechanism on interest rates is big enough, this may limit their investment to be based simply on internally generated funds. This is another indication of the existence of financial constraints (Myers and Majluf, 1984; Fazzari et al., 1988).

By definition, financing constraints consist of the inability of firms to finance economically appropriate levels of funding for a viable (positive NPV) project. Such a project would be offered funds in a perfect capital market. When I limit financing constraints to only bank

debt, I use the term **credit constraints (scaled down offer) and in particular credit rationing (loan refusal).**

Empirical research that has been conducted regarding the financing constraints can be classified into two different approaches based on how I measure the financing constraint. Firstly, I have direct measurement, when I classify the financing constrained firms based on directly asking firms about these constraints. By applying a priori classification of the firm to differentiate financially constrained firms and unconstrained firms, I focus on assessing how successful these priori classifications are in distinguishing between financially constrained firms and unconstrained firms. Moreover, I also try to investigate the determinants of financing obstacles of firms. The findings of this study showed that priori classifications are quite effective in classifying financially constrained firms and that financial and economic development helps alleviate the financing obstacles of the firms that report to be most constrained. Hashi and Toci (2010) investigate if the priori classification of firms in Southeastern Europe has any influence on the various dimensions of firms' perceived financing constraints. By using both the logic and ordered logit model, several dimensions of firm perception general financing obstacle, such as high interest rates or high collateral requirements, access to long-term and short-term loans are used to assess the determinants of the likelihood of firms applying for a loan and being denied credit (i.e., direct credit rationing).

The second approach is the indirect approach, when I use a link between cash flow and investment to measure the financing constraint. Fazzari, Hubbard and Peterson (1988) first adopted an empirical methodology to study the investment cash flow sensitivity (hereafter ICFS) by grouping the sample firms into financially constrained firms and unconstrained

firms. The methodology involves splitting the sample into sub-samples, according to suitable theoretical priors that characterize constrained and unconstrained firms (i.e., criteria that serve as proxies for capital market imperfections such as dividend policy, net worth and firm size), and then estimating reduced-form investment equations. Besides ICFS, there is another approach in measuring the financing constraints by using the cash-cash flow sensitivity (henceforth CCFS) (see Almeida, Campello & Weisbach, 2004).

When using ICFS and CCFS, I only have to carefully select the priori classification to classify firms as either constrained or unconstrained. Previous existing empirical studies have been used several priori classifications, such as the size of the firm, dividend pay-out ratio, coverage ratio, leverage and age of the firm. Cleary (1999) extended his classification scheme based on a firm's ability to raise funds externally and construct an index of a firm's financial strength using multiple discriminant analysis. Another work that uses an index to measure financing constraints is conducted by Whited and Wu (2006), with their WW Index and the SA index, proposed by Hadlock and Pierce (2010). While to address the potential problem using priori classification, Hu and Schiantarelli (1998) offers a switching regression model of investment to endogenously classify firms into constrained and unconstrained (see also Almeida & Campello, 2007).

In order to empirically test financial constraint and investment behavior, it is also very important to accurately measure a firm's investment opportunities so that the significance of cash flow in the investment equation does not reflect future profitability, but rather the effect of informational asymmetry. Most of the studies of investment cash flow sensitivity are based on panels of listed firms. A few studies focus on small and medium firms (Guariglia, 2008; Bechetti et al., 2009). SMEs have unique characteristics because they are subject to more

severe asymmetric information problems than large firms, particularly large quoted companies. This results in greater difficulties in getting external financing. Moreover, SMEs also have lower borrowing capacity because of poor track record system and (being more frequently in the service industries) also have lower collateral values. However, the focus on SMEs to assess the investment cash flow sensitivity could be challenging because I need to find a suitable control variable for a firm's investment opportunities. Since market information is not available, this makes it impossible to compute traditional proxies of investment opportunities, such as the market-to book value, fundamental Q or analyst's earning forecast for these unlisted firms. One of the first empirical models is the accelerator model, which explains investment using current and lag changes of sales growth. However, a convincing theoretical background is lacking. In this thesis, I use the sales to capital ratio to capture a firm's investment opportunity.

1.2.1 Research Framework

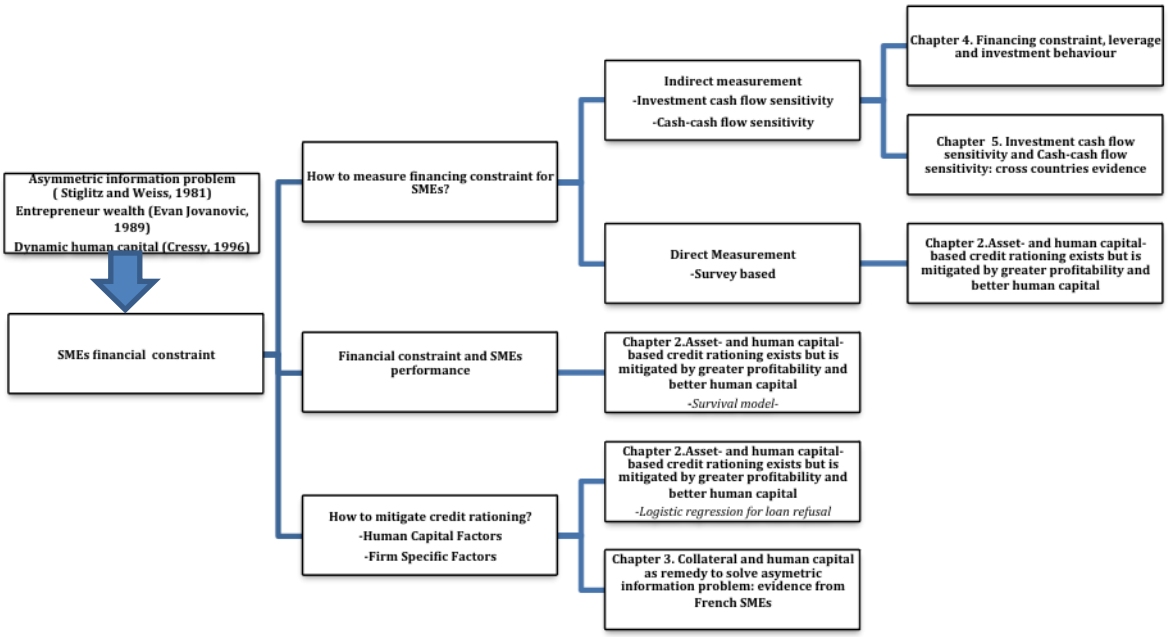

Figure 1.1 Research framework

The diagram above presents the research framework for analyzing financial constraint and market imperfections for SMEs financing. As can be seen from Figure 1.1, the asymmetric information problem (Stiglitz & Weiss, 1981), entrepreneur wealth model (Evan & Jovanovic, 1989) and dynamic human capital (Cressy, 1996) will be used in analysing the financing constrained SMEs that are the focus of this thesis.

1.3 **Objectives and Research Questions**

This thesis, which takes the form of four empirical papers, presents an analysis of the financial market imperfections and financial constraints for SMEs. The objectives of the thesis are as follows:

1. To measure the degree financial constraints faced by SMEs using direct and indirect measurement.
2. To find out the effect of financial constraint, firm-specific and human capital factors on SMEs Performance
3. To identify the factors that may in turn alleviate the financing constraints for SMEs

1.4 Structure of the thesis

Apart from the introduction and conclusion chapter, the thesis is divided into four empirical chapters. Due to the aims and nature of the thesis, all the estimation, analysis and discussion are based on three different datasets that are extracted form three different data sources. The first dataset is a longitudinal dataset from some French start-ups, the second one is a panel dataset of UK SMEs that are extracted from FAME Database and the last one, is a panel dataset of 14 European Countries that are a extracted from Amadeus database. The summary of data used in each chapter can be found in section 1.6. Each chapter consists of several sections, namely introduction, literature review, methodology, data and descriptive statistics, empirical results and conclusion.

In chapter 2, I develop and estimate a model of SME survival under debt rationing by using panel data on some 9,000 French startups over the period 1994-2000. Our analysis of the determinants of rationing show those firms with more collateralisable assets, greater profitability, and more human (better projects) are less likely to be rationed. I also Consistent with Cressy (2006), I confirm that debt-rationing effects are persistent and continue to impact

the chances of failure later in the firm's history, but its effects are mitigated by greater profitability over time, human capital of the entrepreneur and lower financial risk, consistently with Cressy (2006).

In chapter 3, I estimate two different models to measure the disequilibrium loan market for short-term and long-term bank loans for panel data set consisting of 9417 French start-up SMEs. I recognize not only firm-specific variable but also human capital indicator into main disequilibrium model. The result suggests that collateral and human capital both have effect on demand and supply of bank debt, thus collateral and good human capital indicator may alleviate the problem caused by the asymmetric information problem. The results of this study also find that, over the entire period, over 45.84% of the samples are credit rationed for long-term bank credit, and 45.77% for short-term bank credit.

In chapter 4, by using unbalanced panel data that consisted of 7,185 SMEs in the UK over period 2003–2011, I use the method described in Hu and Schiantarelli (1998) and Almeida and Campello (2007) to estimate a model by using switching regression approach that incorporates the factors that reflect the severity of financial constraints in the main equation. I consider leverage to be the factor that reflects the severity of financial constraint. Iconsider firms with a high level of leverage to be constrained firms. The results show that financially constrained firms' investment is more sensitive to measures of internal financing. Meanwhile, leverage has a more significant effect for constrained firms. Our results also suggest a non-monotonic effect of leverage on cash flow sensitivity, as can be seen by the decreasing level of leverage for constrained firms and the increasing level for unconstrained firms.

In chapter 5, I present the investment cash flow sensitivity (ICFS) and the cash-cash flow sensitivity (CCFS) estimation for 14 European countries. The result suggests that there is a

positive and significant effect of cash flow on investment after controlling for the industry-year and country dummies which indicating that there is some friction in the financial market in EU area. I also find that that there is positive and significance relationship between cash holding and cash flow. The decreasing trend of the effect of cash flow on investment cannot be found then I may suggest that investment cash flow sensitivity still can be used as a measure of financial constraint

1.5 Summary of Data

Based on the aims and objectives of this thesis, the availability of good data is necessary in order to answer all the aims and objectives. Failures to get a good data have made the conclusion regarding the financial constraint and its impact on SMEs performance still questionable. If the good data is available to provide definitive tests of the various theories proposed in the literature and the right methodology is applied in this process, I can expect to offer more reliable result.

To the best of my knowledge, FAME is a database that is reliable enough to provide the data for UK and EU SMEs. While since this thesis also investigate the firm dynamic, in particular the determinant of survival rate of SMEs, a good longitudinal dataset with the same cohort is needed, therefore I use a survey of French start-up firms conducted by the French National Institute of Statistical and Economic Studies. The survey section used is the 1994 cohort. Since the focus of this particular thesis is the financial constraints for SMEs by using data of European SMEs, therefore SMEs are defined according to the definition shown as follows[1]:

[1] As can be found in EU law: EU recommendation 2003/361.
Source : http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/performance-review/files/supporting-documents/2013/annual-report-smes-2013_en.pdf

Table 1.1 EU Definition of SMEs

Category	Employees	Turnover	Balance Sheet
Micro	<10	< €2 million	< €2 million
Small	<50	< €10 million	< €10 million
Medium	<250	< €50 million	< €43 million

Table 1.2 Summary of data used

Chapter	Title	Data Used
2	Asset- and human capital-based credit rationing exists but is mitigated by greater profitability and better human capital: A panel study of a French start-up	A survey of French start-up onducted by the French National Institute of Statistical and Economic Studies. The survey section used is the 1994 cohort. It consists of 9,417 start-up firms.
3	Collateral and human capital as a remedy to solve credit rationing: Evidence from a French start-up	The same data as used in chapter 2
4	Financing constraints, leverage and firm investment : Switching regression approach	Balance sheets and income statements were extracted from the FAME dataset published for a large sample of UK small and medium firms (SMEs) over the period of 2003-2011[2]. The sampling strategy is as follows: 1. Select only UK active firms from 2003-2011 2. Select only firms that categorized into SMEs according to EU Definition 3. Exclude some firms from financial and services sector

[2] Note that this is *much* smaller than Guariglia (2008). I only include firms that are considered SMEs according to the OECD definition. (see : http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/sme-definition/index_en.htm)

		4. Outliers were removed from dataset by trimming the highest and lowest 1% distribution of key variables 5. The final dataset consists of 7185 firms over the years 2003-2011, consisting of 35136 observations of firms.
5	Investment cash flow sensitivity and Cash-cash flow sensitivity : Cross country evidence	Balance sheets and income statement were extracted from Amadeus dataset published for a large sample of EU Small Medium firms (SMEs) over the period 2004-2013. 1. Select only EU active firms from 2004-2013 2. Select only firms that categorized into SMEs according to EU Definition 3. Exclude some firms from financial and services sector 4. Outliers were removed from dataset by trimming the highest and lowest 1% distribution of key variables 5. Exclude a country with less than 100 observations 6. The final dataset consists of 8687 firms over the years 2004-2013, consisting of 48193 observations.

1.6 Contributions

Although a large number of studies have analyzed theoretically and empirically the investment cash flow sensitivity, the issue has still remain debatable. Previous empirical studies predominantly focus on large public companies and the application for small firms has not been exhaustive. The specific characteristics of the small companies allow me to highlight a large number of interesting issues relating to how the financing constraint affects the SMEs.

This thesis makes the first contribution by selecting a large panel of SMEs and a long period of time that I consider. I also use cross-country dataset to see the effect the magnitude of cash of investment. To the best of my knowledge, there is still limited study assessing the effect of cash flow on investment using SMEs data from several countries. Moreover, the thesis also contributes to the literature by presenting an empirical work that adding human capital indicator as determinant of loan refusal and firm survival. Hence, I may say that both firm-

specific financial indicators and human capital indicators may alleviate the problem caused by the asymmetric information problem.

The thesis also contributes to the new alternative methodology to classify firms based on non-priori classification by using switching regression model. Overall, our composition of different empirical strategies and econometric techniques provides a distinctive complement to the existing literature by suggesting new ways to study the impact of market imperfections on SMEs

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CHAPTER 2 ASSET AND HUMAN CAPITAL-BASED CREDIT RATIONING EXISTS BUT IS MITIGATED BY GREATER PROFITABILITY AND BETTER HUMAN CAPITAL: A PANEL STUDY OF FRENCH START-UP

2.1 Introduction

Small and medium enterprises (SMEs) play a significant role in both developed and developing countries. For example, SMEs contribute significantly to employment and gross domestic product (GDP) around the world (IFC, 2010), and SMEs in developed countries account for an average of 67 percent of formal employment in manufacturing. By comparison, in developing countries, this is around 45 % (Ayyagari et al., 2007). In terms of the share of GDP, SMEs constitute 49 % on average in developed countries and 29 % in developing countries (Ayyagari et al., 2007). Several empirical studies have found that SMEs create more jobs than large firms, which is especially the case for new companies (see Klapper and Richmond, 2009; Aterido, et al., 2011).

Despite important role of SMEs in the economy and in economic and social development, numerous studies suggest that they continue to face financial and non-financial constraints. Moreover, due to the nature of small firms, the effects appear to be more severe for SMEs than for large firms (Binks and Ennew, 1996; Fagiolo and Luzzi, 2006) for reasons that are well documented. New small businesses are often undercapitalised and considered to be particularly susceptible to failure in early life (Cressy, 2006). New firms tend to have a higher information asymmetry with respect to potential lenders than established firms. This may

result in a credit-rationing[3] problem faced by new firms (Stiglitz and Weiss, 1981; Cressy, 2002, 2006).

Related to new business survival, credit constraints and a lack of finances in general should limit the chance of business survival and the growth rate of start-up businesses (Xu, 1998; Beccheti and Trovato, 2002; Carpenter and Petersen, 2002). However, some of the recent empirical studies argue that credit rationing has been overemphasized, and the entrepreneur's strategy, prior knowledge and saving plans may be able to overcome the credit rationing problem (Cressy, 1996, 2000; Parker, 2000, 2002; Hurst and Lussardi, 2004).

Over the past two decades, theoretical and empirical research has concentrated on the post-entry performance of firms and it has investigated their survival, growth and credit rationing effects (Arrighetti and Vivarelli, 1999; Audretcsh and Mahmood, 1995; Mata and Portugal, 1994; Xu, 1998; Beccheti and Trovato, 2002; Carpenter and Petersen, 2002; Piabuo et al., 2015). Yet, there is still a shortage of work on the post-entry performance of new small business start-up, primarily due to the lack of suitable datasets to investigate the issues. To assess the post-entry performance of new businesses, a longitudinal database is needed to enable the researcher to track small firms subsequent to their entry (Mata, et al., 1995).

Relevant with the objectives of this thesis, this first empirical chapter measure the degree of financing constraints faced by SMEs using direct measurement based on the survey from new French start-up SMEs over the years of 1994-2000. The main reason why I use a longitudinal dataset from French SMEs is because I need a longitudinal dataset to find out the effect of financial constraint, firm-specific and human capital factors on SMEs Survival. The only free

[3] By definition, when a firm cannot borrow the optimal amount of money needed to finance the positive net present value projects.

and available data is from this particular survey. Specifically, by using this dataset, this chapter analyses the survival rate of new small firms and explores the impact of credit rationing and other firm-specific variables on small firm survival. This chapter substantially helps our understanding of the post-entry performance of start-up businesses and provides important consequences for government policy to promote the survival of new small businesses, in particular how to reduce the financial constraints that may have an effect to the survival rate of SMEs.

The chapter is organized as follows. Section 2.2 explains an overview of the empirical literature on post-entry performance of new small businesses and credit rationing; it also sets up the hypotheses to be tested. Section 2.3 presents the methodology used, and section 2.4 provides the data used and the data description. Section 2.5 provides the empirical findings. While, the last section concludes the chapter.

2.2 Literature Review and Hypothesis development

An analysis of firm failure must provide an exact definition of the term 'failure'. The closure of a firm may be either solvent or insolvent. Many small businesses close without owing debts because, apart from trade credits, they do not borrow. For example, Cressy (1996) found that only 1/3 of UK start-ups borrowed on overdraft at early stage of the business rising to 1/2 after three years. On a closure, the entrepreneur will generally move into an alternative activity, either employment in another company or another business start-up. However, not all closures are failed businesses. For example, an entrepreneur may decide to retire or may even die, resulting in the business ceasing to trade. Likewise, a successful business may close (lose its name) as a result of a trade sale. Most authors choose not to define a firm that is being sold or has a different owner as a failed firm.

2.2.1 Capital Structure Theory and Financial Search Theory

Firms' capital structure issues have been the subject of research since the late 1950s, starting with the work by Modigliani and Miller (1958), which gives basis to later research in the area of capital structure. Since debt has a prior claim on the firm's assets, a company may have an incentive to replace extensive equity with debt, but the agency problem of equity will probably arise.

The trade-off defines that the optimal capital structure is the proportion of debt to total assets that balances the tax benefit of using additional debt against financial distress/bankruptcy costs. The optimal debt ratio is firm dependent and also contingent on the business cycles. Besides the trade-off theory, the pecking order theory by Myers and Majluf (1984) and Myers (1984) also emphasizes information asymmetries between company insiders (managers and incumbent shareholders) and outside investors. The pecking order theory illustrates why firms usually rely more on debt financing and why leverage tends to increase with profitability. Information asymmetries have the strongest effect for equity issuances because equity holders have a residual claim on the firm's assets and earnings. Due to adverse selection processes, uninformed investors may worry that managers and current firm owners (i.e. equity holders) will wish to issue overvalued shares. Therefore, they are only willing to invest if the share price is sufficiently low or undervalued. Thus, in turn, issuing equity will be more costly for the firm and it will increase the attractiveness of issuing debt.

Regarding the role of search in finance, Cressy (2010) mentioned that the theoretical literature in the area of finance gaps in fact ignores the question of optimal search for finance. The empirical literature on the role of search in finance is equally scarce, some of th recent

studies have been conducted by Cosh, Cumming and Hughes (2009) and Cressy (2010) in reference to the UK biotech start-up.

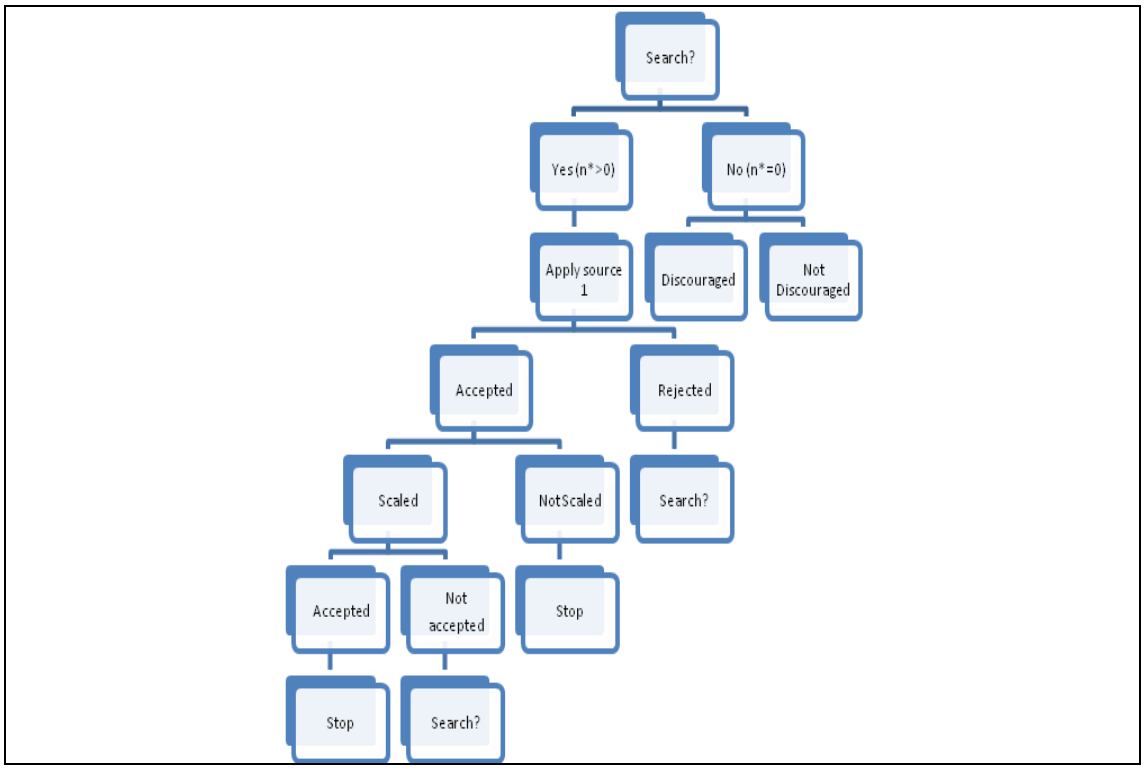


Figure 2.1 Finance search strategy
(source : Cressy, 2010)

Cressy (2010) presented the structure of finance, as seen in figure 2.1. Assuming there is asymmetric information in the market, entrepreneurs have no information advantages over other entrepreneurs in the market. The detailed explanations from Cressy (2010) are as follows:

> "There are N possible sources of funding for a project ($N \geq 1$). An entrepreneur can choose to search n such sources ($0 \leq n \leq N$). The benefits of search consist of the expected return to using any funds obtained in investment (the NPV of the investment project, say); the costs are the (known) time and effort involved in researching and approaching the various sources. Searching is assumed sequential. A firm may either initiate search or not search depending on whether

the marginal costs of the first search are less or greater than the benefits. If she searches (n*>0) she applies to source 1 (say) first. Her request is either accepted or rejected. If accepted, it may be scaled down (more generally, altered significantly) or not. If scaled down it may be acceptable or not. If acceptable she invests in the project; if unacceptable, or if the request is rejected, she has the option of searching another source ($N \geq 2$) for which another cost-benefit calculation is required. This goes on until the marginal benefit of further search is less than or equal to the marginal cost. On the other hand, the entrepreneur may decide not to search at all (n*=0) if the marginal benefits of search are initially less than the costs. This may be called the *discouraged borrower* effect, although often the term is used for a situation in which the borrower wrongly believes that search would not yield funds, or, would yield them only at unacceptable costs. The interesting thing about this structure is that although the firm may in the end get no funds, it is *never as a result of market failure*: the expected costs and benefits are optimally equated at the margin (or costs always exceed benefits)."

2.2.2 Financial Constraint, Wealth and Human Capital

2.2.2.1 Static Model

EJ Model

There are two points of view on an entrepreneur's function and a capitalist's function in modern economies, namely the views by Knight and Schumpeter. The first point of view mentioned that capital markets provide little capital to entrepreneurs and wealth is needed to

start up a business. Meanwhile, the second view stated that the role of entrepreneurs and capitalists are separate.

Evans and Jovanovic's (1989) model (subsequently EJ) describes the role of liquidity constraint in an individual's decision to become an entrepreneur. The main idea of the EJ model is estimating the model of entrepreneur choice decision, in which the tension of a liquidity constraint is a parameter and banks lend a proportion to the firm's assets rather than to its expected cash flow profits.

According to the EJ model, individuals can choose to work as wage employees or as entrepreneurs. Wage workers will get wages as their salaries, whereas the entrepreneur will only get y as his or her earnings, and it truly depends on the entrepreneur's skill Φ and y produced, according to the production function: $y = \Phi k^{\alpha}$, Where k is the initial wealth and $<\alpha<1$ is a technology parameter. The net income of an entrepreneur is given by:

$$I = y + r(z-k) \qquad (2.1)$$

where z is the initial wealth and r represents the interest rate. I suppose credit constraints on the entrepreneur, such that $k \leq \lambda z$, where $\lambda \geq 1$ is a financial constraint measurement. To analyse the choice to be an entrepreneur or wageworker, first consider the choice of k for the entrepreneur:

$$\text{Max } \Phi k^{\alpha} + y + r(z-k) \qquad (2.2)$$

$$\text{F.O.C} : \alpha\theta k^{\alpha-1} - r = 0 \qquad (2.3)$$

For the interior solution:

$$\left(\frac{\alpha\theta}{r}\right)^{\frac{1}{1-\alpha}} = b\theta^{\frac{1}{1-\alpha}} \qquad (2.4)$$

Where b is $\left(\frac{\alpha}{r}\right)^{\frac{1}{1-\alpha}}$. The entrepreneur will be unconstrained if the k< λz, i.e.:

$$\theta \leq \frac{r}{\alpha}(\lambda z)^{1-\alpha} \qquad (2.5)$$

Then the person has an option to become an entrepreneur, and when he chooses to become an entrepreneur, he will compare earning under self-employment to wage earnings (in both cases, the entrepreneur will receive an interest rate in his earning), i.e.:

$$I = \quad \text{Max} \left\{ \left(b^{\alpha} - rb\right)\theta^{\frac{1}{1-\alpha}}, w \right\} \text{ if } \theta \leq \frac{r}{\alpha}(\lambda z)^{1-\alpha} \qquad (2.6)$$

$$\text{Max } \{\theta(\lambda z)^{\alpha} - r\lambda z, w\} \quad \text{if } \theta > \frac{r}{\alpha}(\lambda z)^{1-\alpha}$$

What can be concluded from the EJ model is that in the unconstrained situation, whether or not the individual chooses to become entrepreneur depends solely on the value of θ, not the initial wealth. An individual will become an entrepreneur whenever θ exceeds a cut-off value. Figure 2.2 showed that if I draw this case diagrammatically in (Z ,θ).

Equation 2.6 describes the edge between constrained and unconstrained entrepreneurs, where individual below the boundary will be unconstrained and above the edge will be constrained. In an unconstrained region, there is some cut-off value of θ above, in which people become entrepreneurs, and this not dependent on the value of z. In this region, the capital invested is the same for all agents and so are the returns from being an entrepreneur.

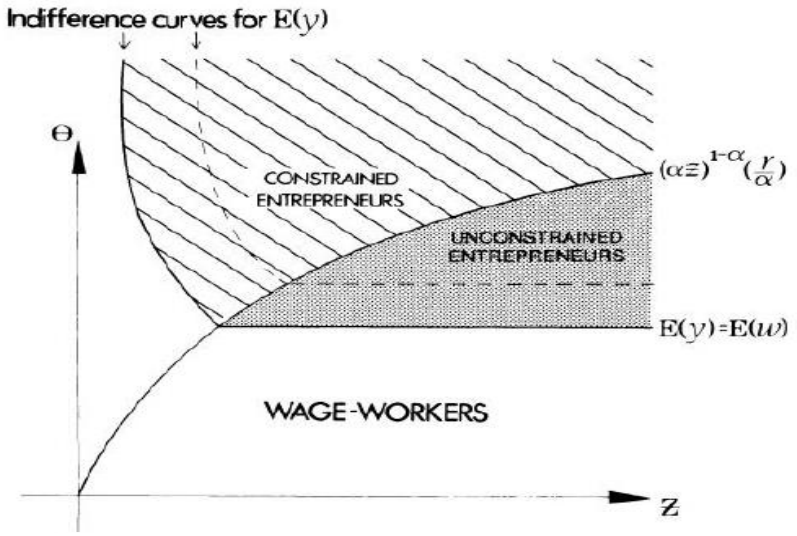


Figure 2.2 Credit rationing (EJ Model, 1989)

By assuming that $_z$ and θ are uncorrelated, a correlation between the probability of starting a business and assets will exist if there are liquidity constraints. Moreover, there will be a positive association between entrepreneurial earnings and initial assets, since wealthier people have started businesses at more efficient capital levels. Smaller firms will grow faster than larger firms that started at the same time, and this happens because smaller firms will be initially credit constrained and will have more incentives to invest profits back into the business then generate growth. Another possible policy recommendation that might increase the level of individual skill is by offering a policy to increase the level of skill that will increase entrepreneurship.

2.2.2.2 Dynamic Model (Human Capital and Entrepreneur Ability)

Cressy (1996) used large random samples of UK start-up businesses to outline a human capital model of survival. Cressy (1996b) defined human capital as the entrepreneur age, industry specific work experience, managerial human capital and whether the start-up

business was a business purchase or not. He mentioned that the reasonable assumptions why human capital determines the survival of businesses are as follows:

1. Assuming that positive utility is associated with the exercise of work and a business skill means better-skilled individuals have more satisfaction both from wages and / or entrepreneurship.
2. Human capital is a function of age (concave function).
3. The expected utility return for an individual as an entrepreneur is higher than that of the wage worker.
4. Entrepreneurship is a learning experiment.
5. The utility of human capital in wage employment is assumed certain; an older entrepreneur has a lower reservation utility than a younger entrepreneur, and therefore, the older entrepreneur will stay in business longer.

Later, empirical research discussed issues of endogeneity of capital constraints, such as the study from Astebro and Bernhardt (2003) and Parker and Van Praag (2003). Astebro and Bernhardt (2003) employed two-stage estimation procedures. At the first stage, they estimated the relationship between human capital, entrepreneur ability and financial wealth. At the second stage, they analysed the relationship between a firm's start-up capital, entrepreneur ability, human capital and financial wealth (the predicted values obtained from the first stage). The general finding of the study is that a wealth and capital requirement is found to increase with human capital and entrepreneur ability. The marginal effect of wealth on capital demand decreases when adding a human capital variable. Whereas, adding the entrepreneur's ability may increase the marginal effect of wealth.

A different approach was used by Parker and Van Praag (2003) by defining capital constraint as loan-down scaling rather than loan denial. They found that credit constraints are endogenous and being reduced by human capital. In other words, more educated people will be less constrained. In relation to the firm performance, they also found that credit constraints will slow down the firm performance, and human capital influences the business performance directly (via entrepreneur ability) and indirectly (via relaxation of capital constraint).

2.2.3 Hypothesis Development of Loan Refusal

Following the seminal paper of Stiglitz and Weiss (1981) (henceforth, SW), new and small firms are likely facing difficulties in raising loans from external sources, principally banks. Loan downscaling is a less extreme version in which the loan is not refused but a smaller amount is offered. In addition to these two constraints, there is the so-called discouraged borrower effect, in which the potential borrower with a viable project does not apply for a loan for fear of refusal. I focus on start-up variables in order to get the biased parameters of start-up loan refusal.

From the lender's side, they must define and observe borrower characteristics in order to decide which borrowers will be granted loans (Diamond, 1991). Lenders may base the lending decision on the price and the non-price elements. However, sometimes price is not an effective credit allocation mechanism. Therefore, lenders have to focus on some observed non-price elements, such as experiences, collateral, level of education of the owner and any forms of borrower self-insurance. Evans and Jovanovic (1989) argued that banks ration credit by applying a lending rule. For a commercially viable project, the bank will lend a proportion of the firm's assets. This constitutes credit rationing if the bank, on this basis, offers less than the viable project requires.

One of the most important aspects that may be affecting the likelihood of loan refusal, hence credit rationing, is the availability of collateral. Collateral pledged by a borrower may help to reduce the adverse selection problem[4] faced by the lender (Stiglitz and Weiss, 1981; Besanko and Thakor, 1987). Lower risk borrowers may offer more collateral in order to differentiate themselves from their higher risk counterparts. Therefore, collateral acts as a signal to alleviate informational asymmetries and thus solve the credit-rationing problem.

In most studies, it can be concluded that collateral has an important role in this regard, and it also appears to play a corrective or motivational role for the borrower (See Cressy and Toivanen, 2001 Steijver and Voordecker (2009) provide an extensive literature survey of collateral as a remedy for the informational asymmetries problem).

Another variable that is considered the most important factor affecting loan refusal is the firm size. Small firms are thought to have disadvantages in getting loans, because of the higher probability of failure, higher monitoring costs associated with them, and because they can provide lower collateral compared to the larger firms[5]. On the other hand, empirical research also find that a unit of bankruptcy costs is likely to decrease with size (Audretsch and Elston, 2002).

Other financial indicators that may be important determinants of loan refusal are as follows: (1) firm profitability, measured as the return on an asset. This might be thought of as a proxy for the firm's investment opportunity set and future prospect of the firm. A higher

[4] Adverse selection occurs when the borrower knows his risk better than the lender. It occurs because of information asymmetries between the lender and borrower.

[5] This is partly a function of the fact that smaller firms tend to be located in service industries where collateral in the form of fixed assets is less available.

profitability level of the firm can indicate the firm as a good future prospect and conveys information of having a high quality project; (2) the capital structure of the firm, a proxy for financial risk, and measured by the debt ratio. Debt ratio is computed as the ratio of debt to total assets (total asset is measured as the sum of debt and equity). The leverage has ambiguous effect on the probability of loan refusal because by it can increase the probability of default. However, it also reveals that in general, prior lenders have found that the borrowers are reliable enough and this prior access to debt conveys positive information to a new potential lender. I assume this effect would be neutralized for excessive use of debt.

Moving to owner-specific variables, the human capital of the entrepreneur may be relevant to the issue of the presence and severity of financial constraints (Cressy, 1996). For example, characteristics such as education and experience may be indicative of the quality of a firm's project. The founder's education level and experiences may be good signals for a high-quality project because having a skilled and experienced owner can be a guarantee that the owner will select the profitable project and manage the project better, compared to an unskilled owner. Experiences can be placed into different categories, namely previous job experiences and prior experiences in the same or different field of business.

Finally, from the review of the literature above, the hypotheses were propounded in alternative hypotheses forms and I expect not to reject this alternative hypothesis. The hypothesis statements are as follows:

Hypothesis 1a : Firms that provide more collateral during the start-up year are likely to have a lower likelihood of loan refusal.

Hypothesis 1b : Larger firms during the start-up year are likely to have a a lower likelihood of loan refusal.

Hypothesis 1c : Firms with higher opportunities of investment during the start-up year are likely to have a lower likelihood of loan refusal.

Hypothesis 1d: Firms with higher leverage during the start-up year are likely to have a higher likelihood of loan refusal.

Hypothesis 1e: The higher the education level of the entrepreneur is, the lower the probability of loan refusal.

Hypothesis 1f: Having experience in the same or different entrepreneurial business will decrease the probability of loan refusal.

Hypothesis 1g: Having previous job experiences will decrease the probability of loan refusal.

2.2.3.1 Firm Financial Factors

Some of the studies analysing the effect of size on firm survival found that larger firms are expected to have higher probabilities of survival rather than their smaller counterparts (Audretsch and Mahmood, 1995; Mata et al., 1995; Mata & Portugal, 2002; Liu & Li, 2015). The convincing argument that supports these general findings is that smaller entrants may not have a minimum efficient scale required to operate efficiently in the market and will face cost disadvantages compared to the larger firms. Asymmetric information in credit markets also provides an explanation on why larger firms survive longer, because an entrepreneur starting larger ventures that can signal his or her ability by committing more capital to the business may increase the probability of success. Another explanation for the low survival rate of small start-ups is because new small firms have liquidity constraints or initial underinvestment that would negatively impact the probability of survival.

Jovanovic (1982) argued that current firm size is an important factor in predicting the probability of firm survival. As all firms start without any prior knowledge about their efficiency, they will gradually learn about their efficiency, which may increase the probability of surviving and growing. However inefficient firms will fail. The current size of the firm is also already incorporated in all firm histories, which means nothing more is required to predict firm survival (Geroski, et.al., 2010), or it means that a firm that has grown in the past give a signal that those firms has been performing well and therefore the probability of failure is low. However, using the current size of the firm as a predictor of firm survival may lead to an endogeneity problem because firms that are about to exit tend to shrink and vice versa.

Existing research uses the log of the number of employees, log of total assets and log of the firm's revenue as measures of the firm's size (See Geroski et al., 1997 and Mata & Portugal, 1994). Geroski et al. (2007) found that firms with larger sizes during the birth year will survive longer and that any subsequent increases of firm size will also improve the probability of survival. Audrestch et al. (1999) found that the start-up size was positively related to survival. However, it is barely significant, since the study only found that the initial size was significant in three out of 13 sectors.

Some of the empirical studies on a firm's survival also consider the financial condition of the firms as a critical part in determining firm survival. Profitability and leverage have been extensively researched as two main financial factors that may have an effect on firm survival. The growing firm may indicate that this particular firm has a positive prospect in the future.

The profitability ratio is seldom used as a measure of a firm's performance. Having a higher level of profit may result in a higher probability of survival.

Regarding the effect of financial structure on firm survival, (Huynh et al., 2010) find that survival rate has a negative relationship with leverage. However, Astebro and Bernhardt (2003) argued that the probability of survival is increasing with external debt if the firm is not too indebted.

Since small firms also claimed that they face greater credit rationed conditions compare to larger firms, it can be inferred that this credit rationing problem can also be a problem to a number of many small business that have a higher probability of failure. New firms start the business with limited funds and less capital than needed (Evans and Jovanovic, 1989). The credit and financial constraints may reduce the likelihood of survival and firm's growth (Xu, 1998; Beccheti and Trovato, 2002; Carpenter and Petersen, 2002). Musso and Schiavo (2008) found that for the French firms over the period 1996-2004, there was a higher probability of failure for firms having difficulty in getting finances. Finally, it may be reasonable to argue that loan refusal also has a negative impact on firm survival.

Finally, from the review of the literature regarding the firm-specific factors impact on firm survival, the hypotheses were propounded in alternative hypothesis forms as follows:

Hypothesis 2a : Firms with a larger initial size have a lower probability of failure.

Hypothesis 2b: Firms that have higher profitability ratios have lower probabilities of failure

Hypothesis 2c : Firms that have higher leverage ratios increase the probability of failure.

Hypothesis 2d : Firms that are refused loans have a higher probability of failure.

2.2.3.2 Human Capital Factors

Related to the entrepreneur specific determinant of survival, the literature of entrepreneurship has long emphasized the importance of human capital as one of the important determinants of firm survival. Some existing empirical research found that human capital could be a good predictor for a firm's survival (Preisendörfer and Voss, 1990; Cooper et al., 1994; Gimeno et al., 1997; Mata and Portugal, 2002;).

Human capital can be defined as a possession of valuable knowledge and skills by the owner, which is very valuable in improving the survival chances of firms. Becker (1993) created a distinction between general and specific human capital; general human capital is defined in the context of years of education and work experience. Whereas, specific human capital is described with factors associated with the specific domain, such as the managerial and industry specific experience (Bosma et al., 2004).

Human capital may influence a firm's survival in several ways. Firstly, human capital may increase the entrepreneur's ability to select the most profitable opportunities for the business. which may result in higher profits, thus increasing business survival chances (Cressy, 1996). Secondly, greater human capital can also increase the productivity of the entrepreneur, which means the business owner is more efficient in consolidating and dealing with operations or is able to attract more customers and raise more capital from investor (Brüderl et al., 1992). It

can then be argued that entrepreneurial human capital may increase efficiency and plays an important role in the market selection process (See, Evan and Jovanovic, 1982).

The entrepreneurs with greater human capital will be able to learn faster about market conditions but still uncertain with their efficiency level. However they will adjust the capacity level and therefore reduce the probability of failure. People with human capital resources are rarely forced into self–employment by the desperate need for income; they start the business by finding a promising business opportunity (Vinogradov & Isaksen, 2008). On the contrary, people who start their business as a "refuge" from unemployment start a new business in order achieve conditions for subsistence or because of necessity-based entrepreneurial activity.

In this chapter, I consider both generic and specific human capital. Generic human capital is measured by level of education attained by the business owner. I try to capture the effect of education on firm's survival by adding dummy variables that that represent business owners who do and do not have a diploma. Additionally, I also take into account general start-up experience by including the entrepreneur's prior work experience. I distinguish the entrepreneur's prior work experience as a manager, worker or executive.

To assess specific human capital owned by the business, I consider the entrepreneur's prior start-up experience in the same industry as the focal business or in the different industry. The variable is binary and it takes '1' if the entrepreneur has experience in the same industry or different industry and '0' otherwise. Since prior entrepreneur experience both in the same of different industry will provide them with the absorptive capacity to make business planning, I

hypothesize that the overall effect of prior entrepreneurial experience will be negative to the probability of failure.

Finally, from the review of the literature above, the hypotheses were propounded in alternative hypotheses forms and I expect not to reject this alternative hypothesis. The hypothesis statements are as follows:

Hypothesis 2e : Higher educational levels of the entrepreneur will be connected with a lower likelihood of failure

Hypothesis 2f : Prior job experience will be negatively related to the likelihood of failure

Hypothesis 2g : prior entrepreneurial experiences will be negatively related to the likelihood of failure

2.3 Methodology

2.3.1 Logistic Regression

In this methodology section, I present the methods used in the analysis for determinants of loan refusal at the birth year followed by the analysis of firm survival. The causes of start-up loan refusal are identified and related to rationing via bank lending practices (collateral, profitability and risk) and project quality (human capital of the entrepreneur); this enables us to separate loan refusal for economic reasons (poor project quality) from refusal due to credit market imperfections (bank lending practices based on collateral and firm financial condition). Since The credit rationing condition here is defined as a respondent statement or answer that applies for a bank loan and did not get the desirable loan (loan refusal). A dummy variable is used to describe loan refusal as follows: Refuse = 1 if on application the firm is refused a loan at startup; = 0 otherwise. Since the dependent variable is dummy

variable, I may choose to use logistic regression or probit regression. However, since the data has slightly flatter tails (the skewness), then logit has better interpretation than probit regression. The logit also has better interpretation than probit and it can be interpered as modeling log odds.

$$\Pr(Y_{it} = 1) = F(X'_{it}\,\beta) \qquad (2.7)$$

Where Y_{it} is the dummy variable for loan refusal, 1 if a firm asks for a loan and did not get it, 0 otherwise. X'_{it} is the vector for explanatory variables, which can be classified into two factors, firm-specific and human capital factors. Firm-specific variables are *Size, Collateral, ROA and Lev.* Human-specific factors that are also included in the estimation are *Diploma, Exp* and *Prev.* Since I focus on analysing the determinant of loan refusal, hence credit rationing, the observation will be equal to the number of samples surveyed in the year 1994.

Logistic regression uses a maximum likelihood estimation where the initial values of the estimated parameters are used and those values of the estimated parameters are adjusted until the maximum likelihood value of the estimated parameters is obtained. By implementing the logistic regression, one of the main outputs is the odds ratio, which can be interpreted as the effect of one unit of change in independent variables in the predicted odds ratio by assuming the other explanatory variables in the model are constant.

2.3.2 Survival Analysis

2.3.1.1 Non-Parametric Methods

In general, a survivor function shows the cumulative survival probabilities throughout the observation time or measurement window. It may be stated as describing how long the subjects of observation are "alive" than how quickly they "die" (Hosmer & Lemeshow, 1999). The survival function is then defined as:

$$S(t) = 1 - F(t) = prob(T > t) \tag{2.8}$$

Where $S(t)$ is the proportion of surviving the firm beyond time *t*, and *F(t)* represents the cumulative distribution function of the variable time T. Therefore, the survivorship function is defined as the unconditional probability that an event of failure has not yet occurred at time t. The survival function is a monotone non-increasing function where at time *t*=0 then *S(t)* =1, and at $t = \infty$, *S(t)* =0. The most widely used non-parametric estimation of survival is by using a method from Kaplan and Meier (1958), which is defined as

$$\widehat{S}(t) = \prod_{t_i > t} (1 - \frac{d_i}{n_i}) \tag{2.9}$$

where n_i is the number of firms under the risk at time t_i, meanwhile d_i denotes the number of failures at t_i. The product is overall observed failure ages that are less than or equal to *t.* The hazard rate function measures the rate in which the risk is being accumulated, or in other words, it gives the rate of failure conditional upon the subject of observation having survived until time t, which is expressed as:

$$h(t) = \underset{\Delta t \to 0}{Lim} \frac{\Pr ob(t + \Delta t > T > t) / T > t}{\Delta t} = \frac{f(t)}{S(t)} \tag{2.10}$$

The cumulative hazard function can then be expressed as:

$$H(t) = \int_0^t h(u)du = \int_0^t \frac{f(u)}{S(u)} du = \int_0^t \frac{f'(u)}{S(u)} du = -\ln S(t) \qquad (2.11)$$

To show the differences in the duration of survival between firms, I divide the full sample into subsamples and examine whether the survival functions differ according to firm-specific characteristics. I also test the equality of survival functions between subsamples by using the log-rank test and Wilcoxon test.

I describe the duration of survival t as the period from the year of the firm's establishment to the year 2000, the last year of observation. To investigate factors affecting the firm survival, it is very crucial to look at the data in terms of duration of life. In this paper, censored data refers to those firms who still exist in the year 2000.

2.3.1.2 Semi Parametric Methods

Using a proportional hazards model proposed by Cox (1972), I try to identify whether the covariates affect the hazards of the firms. The proportional hazards model is famous as a parametric approach for survival data, and it is very useful to explain the effects of covariates on the hazards of individuals. Geroski et al. (2007) stated that the Cox-proportional hazard model allows one to define the failure more rigorously than is possible with conventional approaches such as probit and logit models. The hazard function for the Cox proportional hazards model is represented by:

$$h_j(t) = h_0(t)\phi(X, \beta) \qquad (2.12)$$

which can be read as the hazard subject j faces is part of some function of the hazard everybody faces (the baseline hazard h_0) that is modified by some function of the explanatory variables. In this case, the shape of the baseline hazard function (a function of time) is the same for all firms, and some variations in the explanatory variables will translate into parallel movement of this function. This means that it will only affect the hazard function's shape. The hazard function is written in equation (7) in order to have a positive hazard function. Given the fact that the hazard function is a conditional probability:

$$h_j(t) = h_0(t)e^{X'\beta} \qquad (2.14)$$

β is estimated by using maximum likelihood, while $h_0(t)$ denotes the baseline hazard function. In this model, the baseline function involves the time dimension, but not the X variables. $h_0(t)$ represents how the hazard rates change as a function of survival time, while $X'\beta$ represents how the hazard changes a function of covariates (Hosmer & Lemeshow, 1999).

2.4 Data and Descriptive Statistics

The database used for this paper is a single cohort from the French SINE database. This data is taken from a survey of French start-ups conducted by the French National Institute of Statistical and Economic Studies. The survey section used is the 1994 cohort. It consists of 9417 start-ups that had been set up or taken over during the first half of 1994 and had survived for at least one month. New firms that were surveyed are classified based on of their registration in the *"Systèmed'Informationset de Répertoire des Entreprises et des Etablissements"* (SIRENE repertory). A range of human and financial capital variables are

recorded at start up, along with failure information in the years following. The data is thus an unbalanced panel with number of observation for each individual firms varies between 1 and 6 years, depending on if and when the firm fails. Since this chapter also investigates the effect of financial constraint on SMEs Survival, therefore I use a longitudinal dataset and the only longitudinal dataset that can be used is coming from the SIRENE repertory.

In France, since the eighties, SMEs can be considered as important sector in regards to job creation. The growth in the number of start-up in France results not only from the greater possibilities to start-up up, but also a greater supply of entrepreneurship. Regardless the importance of the France SMEs, as can be inferred from the survey, major obstacle faced by the SMEs is about the difficulties to get banking financing. Since the sample are start-up businesses, so that they are very much rely on band/debt financing instead of going to the capital market to get external financing. However, nowadays, the opportunity of getting fund from capital market is getting larger especially for the Growth-stage SMEs.

Table 2.1. Survival and failure of the 1994 cohort

Year	Number of Firms	Fail	% of Survived /Active SMEs	% Closed Operations
1995	8,174	824	91.25%	8.75%
1996	7,177	804	82.72%	17.28%
1997	7,132	466	77.78%	22.22%
1998	6,539	657	70.80%	29.20%
1999	5,993	607	64.36%	35.64%
2000	5,508	551	58.50%	41.50%

In 1994, I had 9417 firms[6], and this number slowly decreases as firms close solvently or bankruptcy. On average, there are 7.82% failures in a single failure per subject data, and 25% of 9417 firms at year 1994 survived up to 4 years. The average period of survival was 5.3 years. Table 2.1 shows cohort survival and failure rates over time.

Referring back to our discussion of the term 'failure', in the empirical analysis I examine only the determinants of the closure of firms and leave open the issues of whether this is failure in the sense of bankruptcy. I define a binary variable, *close*, for firm closure as follows:

Close=1: if the firm permanently stops trading activity in any year from 1995-2000

Close=0: if the firm remains actively trading in year 2

The credit rationing condition here is defined as a respondent statement or answer that applies for a bank loan and did not get the desirable loan (loan refusal). A dummy variable is used to describe loan refusal as follows:

Refuse = 1 if on application the firm is refused a loan at startup; = 0 otherwise

However, some of the respondents who claim they do not apply for a loan for various reasons, those respondents could be categorized as discouraged borrower when they claim they do not have problem of obtaining finance or when they did not enter the application process due to fear of rejection. Those respondents should be excluded from the sample to avoid self-selection bias.

[6]From the 9,422 sample firms in 1994, 5 firms were dropped from the sample because these firms are seen as reappearing after failing in a certain year.

I also used several variables that may be good predictors for the firm's survival. I decided to limit the variables into two different categories, firm-specific variables and human capital specific variables. For firm-specific variables, I computed a measure of size, a profitability ratio and a leverage ratio. Firm size (*Size*) is measured here by the logarithm of total assets. As a proxy for profitability, I computed the return on asset (ROA), which is derived from profit over a firm's gross assets. Meanwhile, I use the debt to total equity ratio as a measure of a firm's leverage (*Leverage).* I drop some observation with the leverage ratio is larger than 1, then the final number of firms are 8,485, with 42,157 observation during the period of 1994-2000.

The human capital proxies are coming from the survey and all of them are dummy variables. I recognize the proxies of level of education (*Diploma*), prior entrepreneurial experience in the same and different fields of business (*Exp*) and prior job experiences either as a manager, as an executive or as a worker *(Prev)*. I also use some control variables that define the demographic criteria of sample, age of the entrepreneur (*Age*), gender *(Gender*) and nationality (*Nationality*), legal form of business (*Form*); seven industrial dummies are also used.

Table 2.3 provides general descriptive statistics and correlation for the variables used in the analysis. As predicted, the loan refusal variable has a negative correlation with a majority of firm specific and human capital factors. It can be seen that loan refusal has a negative correlation with firm size, leverage, investment opportunity, and collateral, the level of education and previous jobs of the owner. Meanwhile, having prior experiences in the same or different business has a positive correlation with the loan refusal variables. Collateral and leverage has a positive relationship with the size of the firm, 0.405 and 0.73 respectively.

Table 2.2 Variable definition

Variable Name	Variable Definition
Credit Rationing (Loan Refusal)	Loan refusal condition, hence it will be used as a proxy for credit rationing; 1 for having a loan refusal and 0 otherwise
Size	Log of gross total asset [7]
Collateral (Col)	Total fixed asset/Assets
Return on Asset (Npm)	Profit after tax/ Total gross assets
Leverage (Lev)	Total debt/ total gross assets
Diploma (Dip)	1 if having diploma, 0 otherwise
Experiences (Exp)	1 if having prior experiences in the same or different business, 0 otherwise
Previous Jobs (Prev)	1 if having previous job, 0 otherwise
Business form (BusForm)	1 for limited liability firms, 0 otherwise
Age of owner less than 40 (Age)	1 if age less than 40, 0 otherwise
Gender	1 for male, 0 for female
Nationality	1 if French citizen, 0 otherwise

[7] Reasons to use logged variables fall into two categories: Statistical and substantive. Statistically, if your variables are right skew. Then, the regression can be influenced a lot by one or a few cases at the high end on one or both variables. Taking the log can help this by reducing or eliminating skew. Substantively, some variable are better thought of in terms of ratios than differences.

Table 2.3 Descriptive statistics and correlation matrix

No	Variables	Obs	Mean	Std.Dev	Correlation Matrix												
					1	2	3	4	5	6	7	8	9	10	11	12	13
1	Loan Refusal	42,157	0.0320	0.1760	1.000												
2	Size at Birth Year	7,771	5.6000	1.2240	-0.065	1.000											
3	Size	42,157	6.0070	1.2080	-0.065	1.000	1.000										
4	Collateral	40,180	5.1890	1.4380	-0.032	0.405	0.405	1.000									
5	Leverage	42,157	0.5380	0.2490	-0.070	0.737	0.737	0.286	1.000								
6	Return on Assets	42,157	0.2590	1.4030	0.002	-0.297	-0.297	-0.232	-0.236	1.000							
7	Diploma	42,157	0.8020	0.3980	-0.021	0.046	0.046	0.069	0.031	-0.051	1.000						
8	Experiences	42,157	0.9600	0.1950	0.016	-0.048	-0.048	-0.061	-0.036	0.062	-0.013	1.000					
9	Previous Jobs	42,157	0.9660	0.1820	-0.029	0.071	0.071	0.036	0.034	0.011	0.018	0.042	1.000				
10	Legal Form	42,157	0.3320	0.4710	-0.006	0.327	0.327	0.336	0.045	-0.271	0.062	-0.122	0.048	1.000			
11	Age	42,157	0.6490	0.4770	0.032	-0.144	-0.144	-0.001	-0.060	0.076	0.153	-0.004	-0.074	-0.142	1.000		
12	Gender	42,157	0.7610	0.4270	0.039	0.014	0.014	0.021	-0.064	0.124	0.039	0.093	0.078	0.082	0.060	1.000	
13	Nationality	42,157	1.0820	0.3610	0.020	-0.082	-0.082	-0.066	-0.062	0.053	-0.181	-0.001	-0.015	-0.008	0.015	0.083	1.000

2.5 Empirical Results

2.5.1 Logistic Regression of Loan Refusal

The result of estimating equation (1) is presented in Table 2.4. The probability of loan refusal is assumed depending on firm-specific factors and entrepreneur/human-specific factors. In model (1), I present the probability of loan refusal during the start-up year as a function of *Size, Leverage, Collateral, and ROA* in the start-up year. In model (2), I also add some human-specific factor into the model as a function of probability of loan refusal: namely dummy for diploma, experiences and previous jobs. In the last column (model 3), some industrial dummies are added for a robustness check of the model.

As can be seen from model 1-3 at columns 1,3 and 5, the results suggest that *Size* and *Collateral* have a significant and negative impact on the probability of loan refusal (Hypotheses 1a & 1b are supported). This is consistent with the idea that small firms have higher information costs and that size of the firm could be a signal for a firm's ability to repay the loan. As can be seen from column 6 in Table 2.4, the odd ratio of start-up size is 0.851, which means that for one – a unit increase in the firm's start-up size, and the expected change is 0.851. Firms with more collateral experience the sizeable decline in the probability of loan refusal. The finding is consistent with the idea that collateral pledged by the borrower may help to reduce the asymmetric information problem and collateral can act as a signal to mitigate this problem.

The collateral can convey information when lenders/banks consider the creditworthiness of the firm. Pledging collateral also can be a solution to the moral hazard problem because after obtaining and pledging the collateral, the borrower will repay the loan in a timely basis in order to avoid losing collateral. The collateral then can be a solution to the moral hazard

problem by reducing the possibility to switch to a more risky project or do less effort to realize the proposed project (Hypothesis 1a). As expected, the collateral also has a positive significance odd ratio that indicates that a one-unit increase of the collateral value will decrease the probability of loan refusal by 0.851.

I also find that the likelihood of loan refusal is lower for a firm with higher investment opportunity; however, the result is not significant (Hypothesis 1c is not supported). The profitability level may also be used as a screening tool by lenders, and therefore firms who have higher profitability levels will provide a signal as good borrowers with the ability to repay the loan through operating outcome. When a firm has profit, it also can be seen that the firm has the ability to finance its positive NPV investment by using internal financing before going to the market to obtain more funds.

Interestingly, I find the insignificant and negative effect of leverage on loan refusal (hypothesis 1d is not supported). The results suggest that a firm with higher leverage at start-up will be less likely to get rationed. Firms with higher leverage level mean that the firms undertake the profitable project by issuing new debt rather than equity. The investor may have seen this debt issuance a strong signal that those firms are undertaking the profitable projects and have a good prospect in the future. It can also be said that in general, prior lenders may have found that the borrowers are reliable enough, and this prior access to debt conveys positive information to a new potential lender.

In reference to human capital as a predictor of probability of loan refusal, which can be seen from column 3 in Table 2.4, I found that education (*Dip*) has a significant and negative effect on the probability of loan refusal (hypothesis 1e is supported). However, when industrial

dummies are added into model, the result becomes insignificant but still has a negative sign. The positive odd ratio of this variable indicates that if an individual switches from someone who does not have a diploma to someone who does (by assuming other explanatory variables are constant), then the odd ratio of not experiencing loan refusal will be 77.9% of what it was before.

The human capital variables can be considered as a signal for project quality: firms with good project quality are more likely to receive loans and firms with bad quality projects are more likely to have loans refused (hypothesis 1e is supported). Interestingly, I find that having experiences in the same or different entrepreneurial field (*Exp*) has a positive but insignificant effect on loan refusal. This finding is in contrast with the idea that by having the previous entrepreneurial experience, either in the same field or in different firms, entrepreneurs will have accumulated learning and knowledge to survive in the business (hypothesis 1g is not supported).

Regarding the size and gender effect on probability of getting loan. The result suggests that man will have higher probability of loan refusal, therefore more male entrepreneurs are rejected when they apply for a loan. While for age variable, the older the entrepreneur the lower probability of getting loan refusal. I may suggest that the age and maturity of the owner indeed has an impact to the loan-acceptance .

Table 2.4 Logistic Regression for start-up loan refusal (pr(refusal=1))

Variables	Expected Sign	Model 1		Model 2		Model 3	
		1	2	3	4	5	6
		logitcoeff	odds ratio	logitcoeff	odds ratio	logitcoeff	odds ratio
Constant		-1.633***	0.195***	-1.510***	0.221***	-1.808***	0.164***
		-0.318	-0.0622	-0.547	-0.121	-0.638	-0.105
Size at start-up	-	-0.149*	0.862*	-0.139*	0.870*	-0.161*	0.876*
		-0.0818	-0.0705	-0.0821	-0.0715	-0.0906	-0.0720
Collateral (Col)	-	-0.168***	0.845***	-0.169***	0.844***	-0.161***	0.851***
		-0.0559	-0.0472	-0.0557	-0.0471	-0.0609	-0.0519
Return on Asset (Roa)	-	-0.124	0.884	-0.134	0.875	-0.134	0.875
		-0.0816	-0.0722	-0.0838	-0.0733	-0.0915	-0.08
Leverage (Lev)	+/-	-0.162	0.851	-0.131	0.877	-0.152	0.859
		-0.252	-0.214	-0.251	-0.221	-0.261	-0.225
Diploma (Dip)	-			-0.233	0.792	-0.25	0.779
				-0.146	-0.116	-0.153	-0.119
Experience (Exp)	-			0.49	0.619	0.454	0.610
				-0.391	-0.638	-0.395	-0.621
Previous jobs (Prev)	-			-0.507**	0.602**	-0.480*	0.619*
				-0.255	-0.153	-0.259	-0.16
Business form (BusForm)	+/-					0.112	0.526
						-0.165	-0.184
Age less than 40 (Age)	+/-					0.346**	0.585**
						-0.148	-0.209
Gender						0.532***	0.592***
						-0.184	-0.314
Nationality						0.0479	0.509
						-0.142	-0.148
Industry dummy		No	No	No	No	Yes	Yes
Number of firm		7,232	7,232	7,232	7,232	7,232	7,232
Log likelihood		-1,099	-1,099	-1,095	-1,095	-5,896	-5,896
DF		4	4	7	7	11	11

This table gives the logistic regression result of the logistic investment model (See Equation 2.7). The logistic regression equation determines the probability of loan refusal. The dependent variable in the model is coded as 1 if a firm asked for a loan and did not get the loan, 0 otherwise. In model 1, I only include all firm-specific risk and in model 2, I also add some human factors. In the last model, 7 industry dummies and individual demographic variables are also added into equation. ***, **, and * indicates significance at the 1%, 5% and 10 % levels respectively. Standard errors in parentheses.

Hence, I can say that credit rationing exists due to market imperfection conditions and project quality conditions since lenders still used some specific financial indicator to reduce the asymmetric information problem between the borrower and lender. The borrower should signal that they are reliable by pledging collateral and having more assets. Moreover, the result also suggests that lenders may see the observed characteristic of the borrower as a signal of a good quality project and the ability to provide internal funds. An owner with a diploma and previous job experience is more likely to have lower probability of loan

2.5.2 Survival Analysis

2.5.2.1 Kaplan - Meier Estimates

In this section, I provide the estimation results using the nonparametric and semi-parametric methods. First, I estimate the survival function by using Kaplan Meier (KM) Methods for the entire sample. The Kaplan-Meier survival estimation for the full sample is shown in figure 2.3. As seen in figure 2.3, around 50% of firms that began in 1994 did not survive to year 7.

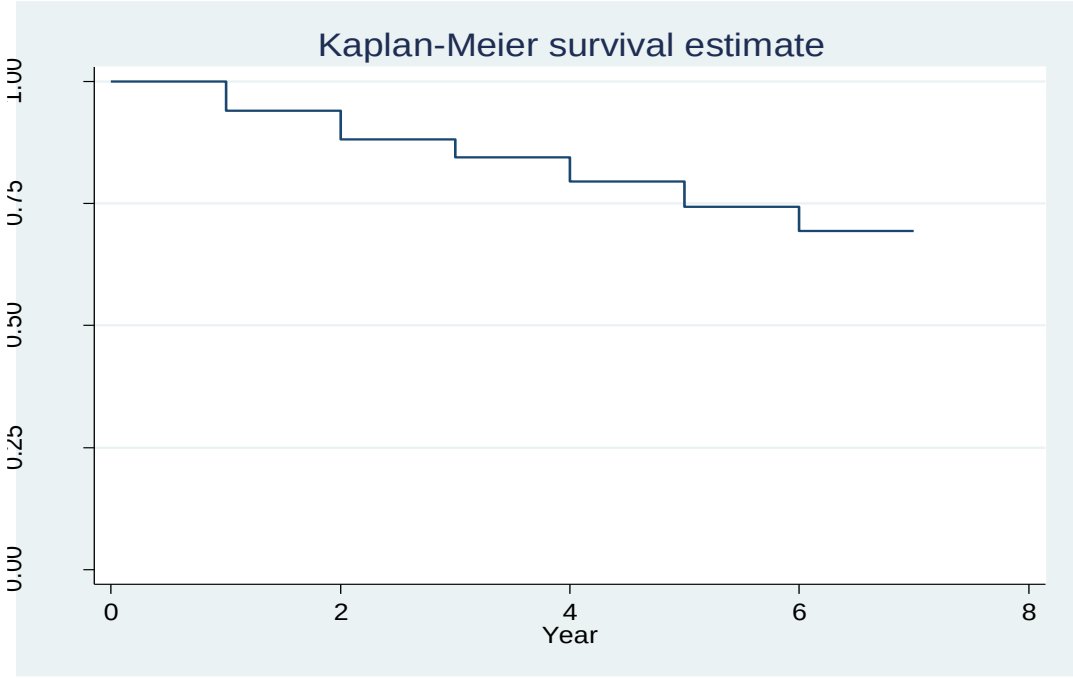
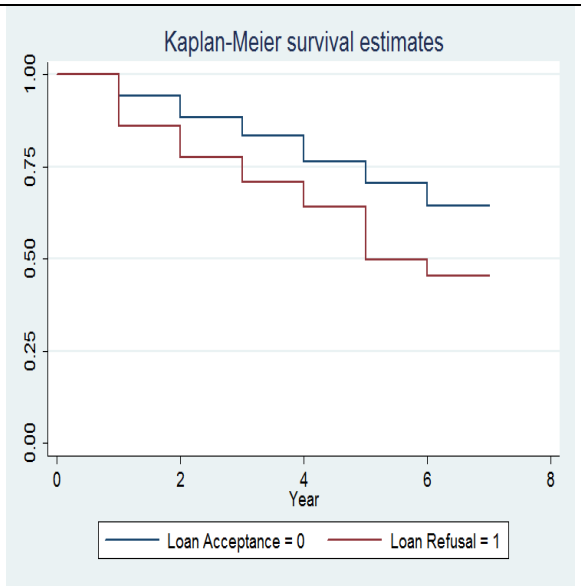


Figure 2.3 Kaplan meier estimation –Full sample

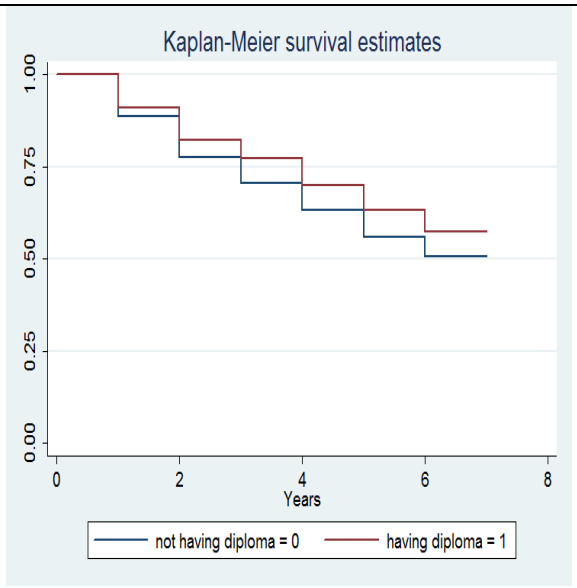
In survival analysis, it is also highly recommended to look at the Kaplan-Meier curves for all the categorical predictors before going through more detail and advanced models. It will provide a pattern of survival function and/or failure function for each group. It also gives insight of whether the groups are proportional and whether I need to include this categorical variable in the final model. The Kaplan-Meier (KM) graphs from different subsamples can be found in Figure 2.4



(a)

Log-rank test for equality of survivor functions

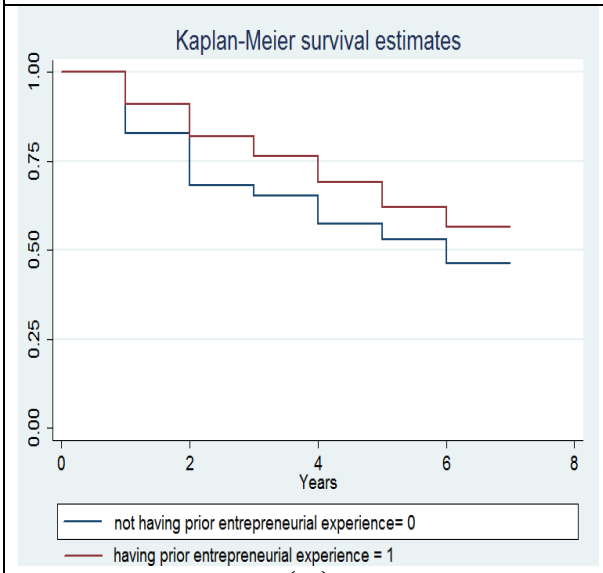
Wald chi2(1) = 34.30
Pr>chi2 = 0.0000



(b)

Log-rank test for equality of survivor functions

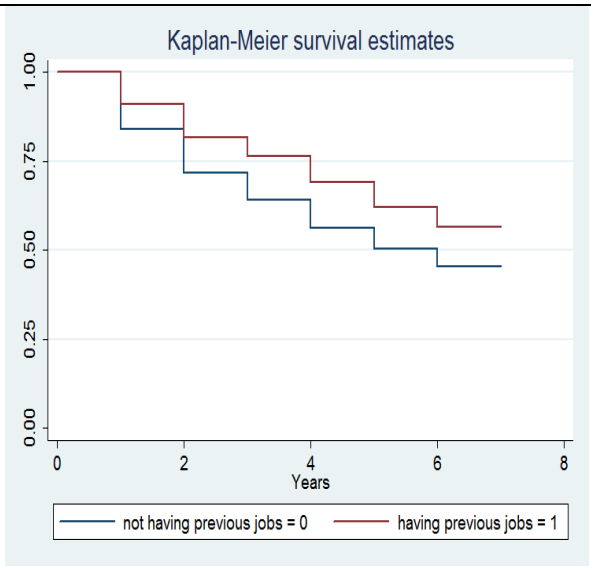
Wald chi2(1) = 17.75
Pr>chi2 = 0.0000



(c)

Log-rank test for equality of survivor functions

Wald chi2(1) = 10.29
Pr>chi2 = 0.0013



(d)

Log-rank test for equality of survivor functions

Wald chi2(1) = 12.09
Pr>chi2 = 0.0005

Figure 2.4 Kaplan meier estimation –Different sub-sample

I provide four different sub-samples based on categorical variables that may be used as predictors for a firm's survival. In Figure 2.4a, I provide a KM graph based on the loan refusal variable. As can be seen from the estimation, unrationed firms or firms who do not get

loan refusal have higher probabilities of survival and have a p-value of 0.0000. From the graph I see that the survival function for each group of rationed are not perfectly parallel but are separate, except at the very beginning. From figure 2.4b-2.4d, I also can observe that the firm whose owner has a diploma, experiences and prior jobs also has a lower probability of failure (see figure 2.4b-2.4d). The p-value of log rank test of KM estimates in Figures 2.4b-2.4d is also less than 5%, thus these three categorical variables can be included in the final model.

2.5.2.2 Cox Proportional Hazard Estimates

The Cox proportional hazards (CPH) model is estimated to see the effects of covariates on business survival. Because the sample is stratified, longitudinal weights, which are the final weight provided by the dataset, are used to eliminate sample selection bias from this source[8]. Table 4 shows the main results obtained from estimating the cox proportional hazard model.

As already mentioned in previous literature, using the current size of firms as a predictor of business survival may lead to endogeneity issues. In order to check the endogeneity issue, I do the Hausman test[9]. The result suggests that the current size may be considered an endogenous variable since I found that the difference in the coefficient is systematic. From this result, I then include not only the size on the start-up year, but also the current size as the covariates in the CPH model.

[8]The longitudinal weight is provided in the database. These strata are classified according to the origin of the business (start-up or takeover: 2 modalities), the branch of the business (8 modalities) and the localization (22 French regions plus 4 overseas departments). The databases must then be used with the correction of a weight variable (the reverse of the draw rate per branch, per region and per origin).

[9] The procedures are as follows: (1) first,I do the first estimation with all covariates and (2) redo the work by including the lagged value of non-categorical variables and (3) test whether there is no systematic difference of coefficients under both model. If there is a systematic difference of coefficients,I may conclude that current size is an exogenous variable and it may not lead to unbiased estimation.

Table 2.5 Cox proportional hazard estimates

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Loan refusal	0.651***	0.626***	0.564***	0.281***	0.263***	0.218**
	(0.176)	(0.176)	(0.177)	(0.0997)	(0.0997)	(0.100)
Size at start-up	-0.447***	-0.446***	-0.466***			
	(0.0380)	(0.0384)	(0.0399)			
Size				-0.510***	-0.509***	-0.546***
				(0.0167)	(0.0168)	(0.0172)
Leverage	0.371**	0.350**	0.326*	0.299***	0.298***	0.291***
	(0.173)	(0.173)	(0.175)	(0.0837)	(0.0836)	(0.0840)
Return on Assets (Roa)	-0.0282	-0.0294	-0.0197	-0.0146***	-0.0151***	-0.0134**
	(0.0240)	(0.0250)	(0.0227)	(0.00498)	(0.00510)	(0.00535)
Diploma (Dip)		-0.334***	-0.248**		-0.224***	-0.152***
		(0.104)	(0.109)		(0.0496)	(0.0518)
Experience (Exp)		-0.693***	-0.562***		-0.486***	-0.325***
		(0.174)	(0.179)		(0.0932)	(0.0951)
Previous jobs (Prev)		-0.433**	-0.370**		-0.354***	-0.234***
		(0.177)	(0.178)		(0.0894)	(0.0905)
Business form (BusForm)			0.162			0.171***
			(0.118)			(0.0539)
Age less than 40 (Age)			0.0390			-0.0416
			(0.104)			(0.0464)
Gender			-0.172			-0.245***
			(0.111)			(0.0510)
Nationality			0.344***			0.236***
			(0.0844)			(0.0452)
Observations	7,771	7,771	7,771	42,157	42,157	42,157
Log likelihood	-4093	-4079	-4058	-18809	-18779	-18669
DF	4	7	17	4	7	17
Chi2	145.5	174	214.7	863.4	922.4	1143

This table provides the cox proportional hazard estimates (See Equation 2.13). Loan refusal is coded as 1 if a firm asked for a loan and did not get the loans, 0 otherwise. In models 1-3, start-up size is considered as the determinant of firm survival; however, in models 4-6, I use current size as the predictor of firm survival. I only include all firm-specific risk, and in model 2, I also add some human-specific factors. The explanation will be based on model 3 and model 6. ***, **, and * indicate significance at the 1%, 5% and 10 % levels respectively. Standard errors in parentheses.

As seen from models 1- 3 in Table 2.5, *rationed* firms or firms who experienced loan refusal in the first year have a positive and significant effect on the probability of failure (hypothesis 2d is supported). Since firms had experienced loan refusal at early stage of the business, it may affect the growth of the firms in the future, hence decreasing the chance of survival. In respect to the firm size, I find that it does have an important effect on firm survival (hypothesis 2a is supported). The larger the start-up size is in terms of assets, the lower chance of failure. The result is consistent with previous empirical research (See Geroski et al., 1997, 2007 and Mata & Portugal, 1994).

The firm profitability also has a negative but not significant effect on a chance of failure (hypothesis 2c is not supported). Firm's profitability can be seen as an ability to grow, therefore by having internal sources of retained earnings, then firms will be able to invest and run a positive project that are expected to have a good return. The level of a firm's leverage indeed has a positive but also not significant effect on a firm's failure (hypothesis 2d is not supported). This finding strengthens the idea that firms should be aware that the excessive use of debt may increase the probability of not being able to repay the debt, hence it will increase the probability of failure. The leverage used also conveys the risk that has been taken by the firm by its financing structure decision.

From the human capital variables, having previous entrepreneurial experience and having a prior job have negative and significant effects on the chance of firm failure (hypothesis 2f-2g are supported). However, the result found the insignificant but negative effect of having a diploma on business survival (hypothesis 2e is not supported). The result suggests that various types of prior entrepreneur experience and better levels of human capital are important in determining the firm's survival. New entrants with a high level of human capital and higher quality information on business opportunities may significantly increase the new firm survival rates.

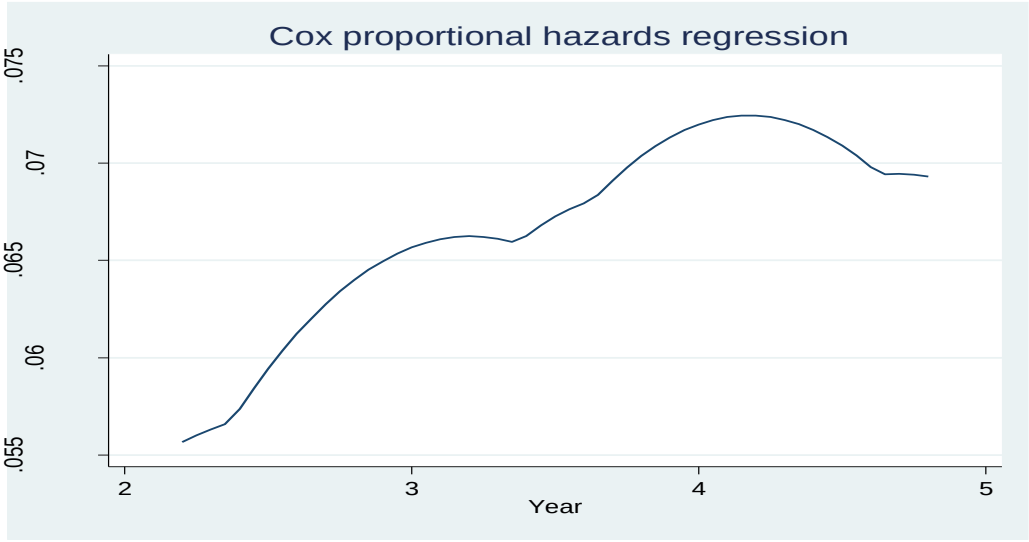


Figure 2.5 Estimated cox failure hazard function

If the current size is used as a covariate in the cox proportional hazard model, the result is not much different from the estimation result that uses the start-up size as the covariate of the cox proportional hazard model. Experiencing a loan refusal and having a higher level of leverage positively affect the chance of firm failure. On the other hand, as a firm becomes larger and has a good investment opportunity, the chance of failure will decrease significantly. From the human-specific factors, having a diploma, having experience and having a previous job before starting the business will decrease the chance of failure.

Turning to the hazard rate graph model, it can be shown from Figure 2.5 that the failure hazard clearly has two peaks, one at 3.2 years into the firm's life, and another at about 4.2 years. After this local maximum, the curve appears to decline significantly. This is consistent with the hypothesis that 'most firms die young' but suggests a somewhat longer time span for the failure curve to peak and afterwards decline to a low long-run value.

2.5.2.3 Testing the PH Assumption

The cox proportional hazards model assumes that the hazard ratio is that the ratio is the same for the whole sample period or at any point on the time scale provided. As can be seen in figure 2.6, the plotted lines are reasonably parallel, and it indicates that the Cox proportional hazard assumption has not been violated, and this would be suitable as a foundation to estimate the variable on one baseline survivor function.

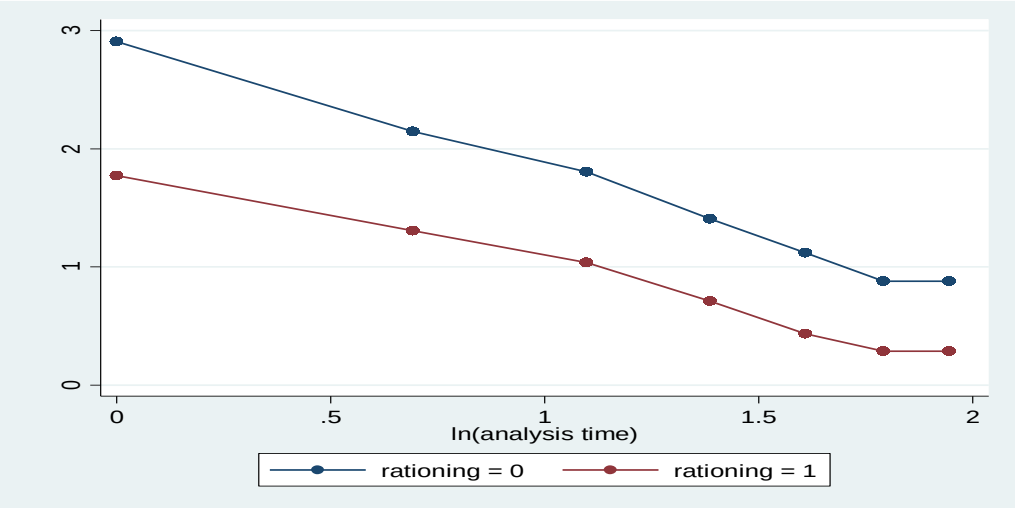


Figure 2.6 Testing the PH assumption: Graphical methods (1)

Another graphical method of evaluating the Cox proportional hazard assumption is to compare the plotted lines between the Kaplan-Meier observed survival curves and the Cox predicted curves for the same variable. When the predicted and observed plotted lines are close together, it indicates that the assumption has not been violated (See figure 2.7).

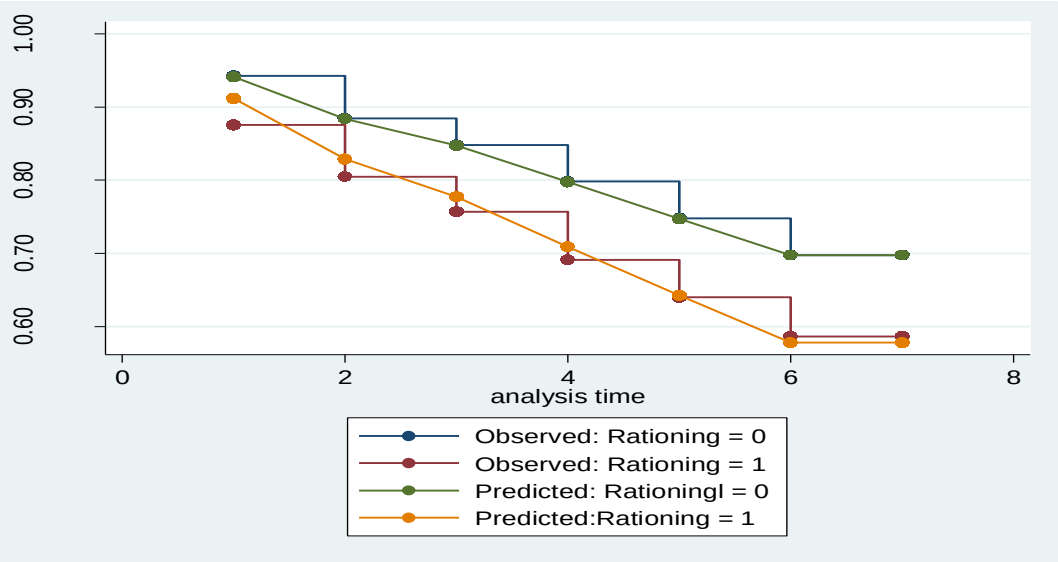


Figure 2.7 Testing the PH Assumption: Graphical Methods (2)

2.6 Conclusion

The post entry performance of a new firm has been extensively discussed in many empirical studies. By using 9, 417 small to medium firms born in year 1994, I try to investigate the effect of firm-specific factors and human specific factors on firm survival. Before investigating the survival rate of the new firm, I implement the logistic regression to find out the determinant of loan refusal. I have the dummy variable of *rationed*, which is defined as 1 if the firm asked for a loan and did not receive the loan and 0 otherwise.

The result suggests that the probability of being rationed indeed is influenced by the firm-specific factors and human capital factors. Larger firms are more likely to have the higher probability of loan acceptance rather than the small firms. A firm with more pledging collateral also has a decreasing probability of loan refusal. The result strengthens the idea that loan refusal is determined by market imperfections conditions; therefore the borrower should provide some observed financial indicator in order to reduce the asymmetric

information between the lender and borrower. Regarding human capital, I find that prior entrepreneurial experience and the level of education will increase the probability of getting a loan. The project quality and management indeed affects the probability of loan refusal..

From the sample, almost 50 percent of firms are closed at year 2000, with an average of 4.3 years, which is quite consistent with the previous empirical findings. The chance of firm survival is also influenced by both firm-specific factors and human specific factors. The initial size, levels of profitability, leverage and accessibility in getting a loan have significant and positive effects of the firm's survival. The education level of the owner and prior entrepreneurial experiences both and jobs also have positive impacts on a firm's survival. Various entrepreneur experiences may be seen as the accumulated learning ability that can be useful in running the business.

SMEs often fail to grow due to a lack of the supporting environment that is needed to expand the business. Improving management skill can be done through human development and increase access to finance, whereas Improving the business environment can be done by improving the investment climate, for example, by ensuring that the policy makers find ways to support not only large firms but also SMEs.

In relation to the human capital of the entrepreneur, a lack of management is often seen as the primary cause of the firm failure. The management team, which consists of more than one individual, may offer a wider range set of skills instead of a single individual. An increase in human capital quality will also be associated with the increase in a firm's output and performance. Moreover, the development of human capital may lead to endogenous growth by providing the positive externalities, for example the smarter the human may lead to more

efficient use of resources, from the development of accumulation of human capital, and it also leads to greater innovation through the process of research and development. Enhancing human capital capacity can be achieved through training, linkage, knowledge transfer and networks.

There is no doubt that defining the credit rationing existence and its determinant is very complex. However, as this result finds, I can say that asset and human capital based credit-rationing does exists, but the probability of loan refusal will mitigate by having greater assets, having more pledged collateral and better human capital, consistently with Evan and Jovanovic (1989) and Cressy (1996, 2006). Moreover, credit rationing has indeed an impact to the chances of failure, but its effects are reduced by greater profitability, better human capital and lower financial risk (2006).

CHAPTER 3 COLLATERAL AND HUMAN CAPITAL AS A REMEDY TO SOLVE CREDIT RATIONING: EVIDENCE FROM FRENCH START-UP

3.1 Introduction

The neoclassical theory of investment provided a foundation for the imperfect substitution between internal and external finance (Modigliani and Miller, 1958). Since then, a number of studies have been done to justify the effect of financial factors on a firm's investment decisions. When internal finances are insufficient to finance a positive NPV project, firms need to obtain funds in order to ensure the life of the business.

The SMEs have been recognized as a key element in the economy, so it needs a way to obtain the necessary financial sources. However, due to special characteristic of SMEs, their opaque information and the fact that most of them are unquoted businesses, SMEs still have a severe problem of financial constraints. Most of them still rely on bank loans, since getting funds from the capital market is often difficult and costly (Bhattacharya and Thakor, 1993: Berger and Udel, 2002). The problem is more severe when banks are reluctant to lend to small firms because of the tendency of banks to make SMEs lending more profitable and the consolidation of banks regulation including the application of Basel II Capital Accord; therefore, banks tend to reduce the credit supply to the SMEs (Berger, 2006).

There is a well-established literature focused on the imperfections in the capital market related to the information asymmetries, transaction costs and agency issues. Such market imperfections may give rise to the existence of credit rationing, where credit rationing can be defined as the situation in which the demand for commercial loans exceeds the supply of

these loans at the commercial loan rate quoted by the bank (Jaffee and Modigliani, 1969). Information asymmetries may result in credit rationing where bankers cannot differentiate among borrowers. Therefore, the banks will deny lending to some borrowers who are observationally identical from those who receive loans. The moral hazard arguments can also lead to credit rationing because the borrower's willingness to divert the project to more risky projects (Stiglitz and Weiss, 1981), engage in asset substitution and apply an inappropriate degree of effort on the project (Aghion and Bolton, 1997).

Although there are many theoretical and empirical studies concerning credit rationing, this study is an attempt to empirically investigate the existence of credit rationing for SMEs in the French corporate bank loan market, by estimating the demand-supply disequilibrium model for bank credit and predicting the proportion of credit -rationed firms during the sample period. The model is estimated on the basis of a panel data set of small and medium-sized French firms for the period of 1994-2000. All samples were start-up businesses that were born at year 1994. The database used for this paper is a single cohort from the French SINE database. This data is taken from a survey of French start-ups conducted by the French National Institute of Statistical and Economic Studies.

Relevant with the objectives of this thesis, this second empirical chapter tries to investigate some factors that may have an effect to alleviate financing constraints faced by SMEs. By applying the disequilibrium model, this chapter has main contribution in a way providing alternative way to measure the financial constraint measurement. I estimate two different models to measure the disequilibrium loan market for short-term and long-term bank loans. Short-term bank loans are defined as bank loans with a maturity of less than two (2) years, whereas long-term bank loans are defined as bank loans with maturity more than two (2)

years. Regarding the debt maturity and agency theory, it is generally found that SMEs would have a higher being long-term bank debt rationed rather than the short-term bank debt rationed. Another novelty of this study is the addition of a human capital indicator into the disequilibrium model. Based on the data availability, I recognize some human-specific variables that would decrease the number of credit-rationed firms.

The remaining part of the paper is organized as follows. In section 3.2, I provide a brief overview of the theoretical credit rationing literature, which is the foundation of the empirical research. Section 3.3 provides the empirical methodology with a focus on the equilibrium model of bank lending. Section 3.4 describes the model specification is presented. Section 3.5 reports the data used and the data description, while section 3.6 provides the empirical results and interprets the results, including the proportion of credit constrained SMEs. Finally, section 3.7 concludes the chapter.

3.2 Literature Review

3.2.1 Early Theoretical Work of Credit Rationing

Referring back to the study by Rosa (1951), which provides the explanation of disequilibrium credit rationing by presenting the availability theory, according to this theory, credit availability is determined by the supply condition and real economic activity. It does not consider the demand-side characteristics. Therefore, the changes in monetary policy would have a direct effect on the credit supply, for example, the changes in money supply may have a direct effect on credit availability.

Later work by Keeton (1979) presents a clearer explanation about the definition of equilibrium rationing by stating that the credit supply curve has a backward bending shape,

which indicates that an increased level in the lending rate may increase the lender's probability of not being able to repay debt. Credit rationing may occur when the price or the quoted interest rate is rigid and some borrowers will still be rationed, even if they are willing to pay not only the price but also the non-price element of the loan contract.

Subsequent credit rationing models have emphasized the importance of the non-price element that may affect the credit rationing problem, and most of them consider the problem created by asymmetric information into model estimation. Stiglitz and Weiss (1981) were the first to include asymmetrical information in the analysis of the credit decision in their Stiglitz-Weiss-model (Henceforth SW model).

The idea of the SW model is that in a competitive equilibrium market, bank debt may be characterized by credit rationing. Banks will rather ration credit than increase the interest rates due to adverse selection (Akerlof, 1970) and *moral hazard* problems (Arrow, 1963). The SW model stated that lenders opt to reject some credit applicants on account of adverse selection and incentive effects. The adverse selection effect may occur when high interest rates only attract higher risk borrowers and the lower risk borrower will drop out. In the same way, the borrower will prefer a higher risk project by expecting the higher return but the bankruptcy risk increases. This is what I refer to as a moral hazard problem.

From the SW model, many theoretical models also try to explain credit rationing, for example, by taking into account the existence of information asymmetry (e. g., Besanko and Thakor, 1987). The contract between borrower and lender may be characterized by the presence of asymmetric information that may give rise to credit rationing (Steijvers and Voordeckers, 2009). Based on information asymmetry, borrowers have different

probabilities of repaying the bank loans; however, the banks cannot distinguish the good borrowers from the bad ones. Hence, the price will be used as a screening device and the bank's expected return increases non-monotonously when the interest rate increases.

From the lender side, a higher interest rate charge also means there is a costly monitoring cost. A monitoring system is needed to ensure that the borrower has sufficient funds to repay its debt. If the asymmetric information problem remains unsolved, then it will cause the credit rationing condition, since the lender's expected return will decrease when offering a high interest rate (Leland and Pyle, 1977).

Until now, large amounts of literature have discussed the effect of asymmetric information on credit rationing. However, the theoretical foundation of their work has been questioned (see De Meza and Webb, 1987, 1989 and 1990).

3.2.2 Credit Rationing Typology

Two research papers that proposed the typology of credit rationing come from Keeton (1979) and Jaffee and Stiglitz (1990) Keeton (1997) proposed two types of credit rationing, Type I and Type II. Meanwhile Jaffee and Stiglitz (1990) classified four main categories of credit rationing, Type I through Type IV. Those classifications are made based on the level of asymmetric information between the borrower and lender. Keeton (1979) assumed that lenders are not able to observe the probability of default but they can observe the return of the investment project that is made by the borrower. Type I credit rationing by Keeton (1979) is also known as size credit rationing because the borrower only receives loans that are smaller than they desire. Type II credit rationing by Keeton (1979), or type IV credit rationing by

Jaffee and Stiglitz (1990), is also known as pure credit rationing, where some random borrowers are fully funded, and some are credit rationed.

Type II credit rationing by Jaffee and Stiglitz (1990) is also called divergent views rationing credit rationing, where some borrowers perceive that the quoted interest rate is too high compared to their probability of default. Some good borrowers may not apply for loans because they perceive the quoted interest rate to be too high. By assuming that the probability of default for the borrower can be observed by the lender, Type III supposes that credit rationing occurs when asymmetric information between the borrower and lender is rather weak. Table 3. 1 presents a summary of credit rationing typology.

The existing empirical literature used two different measures for the credit rationing, namely the indirect approach and direct approach. Indirect measures are provided by the disequilibrium CR approach and the use of proxy, while a direct measure is provided by primary data collection addressing the demand size point of view. The disequilibrium credit market was first developed by Fair & Jaffee (1972). Many empirical studies have used this methodology to measure CR in both developing and developed countries.

Table 3.1 Credit rationing typology

Author	Credit Rationing Classification	Definition based on the result of the study
Keeton (1979)	Type 1 (Size credit rationing)	• Credit rationing occurs when borrowers get a smaller amount than they desire at the quoted interest rate. • The quoted price is rigid.
	Type II (Pure credit rationing)	• Credit rationing happens when some random borrowers are rationed, but identical borrowers are receiving the loan. • The rationed borrowers are willing to pay higher interest rates and accept the loan contract requirement
Stiglitz and Weiss (1981)	Pure Credit rationing	• Credit rationing happens when some random borrowers are rationed, but identical borrowers are receiving the loan. • The rationed borrowers are willing to pay higher interest rates and accept the loan contract requirement
Jaffe and Stiglitz (1990)	Type 1 (Size credit rationing)	• Credit rationing occurs when borrowers get a smaller amount than they desire at the quoted interest rate. • The quoted price is rigid. • The credit rationed borrowers may obtain the loan if they willing to pay a higher price.
	Type II (Divergent views)	• Some borrowers perceive that the quoted interest rate is too high compared to their probability of default.
	Type III (Redlining)	• Credit rationing is based on the observation of risk and return. • Credit rationing happens when the lender does not get the required rate of return at any price. • The lender knows the probability of default of the borrowers. • Lenders also know the return of the borrower's investment.
	Type IV (Pure credit rationing)	• Credit rationing happens when some random borrowers are rationed, but identical borrowers are receiving the loan. • The rationed borrowers are willing to pay higher interest rates and accept the loan contract requirement.

Another indirect measure of credit rationing used in the empirical literature is a proxy. Trade credit is the first proxy of credit rationing to be proposed by Petersen and Rajan (1994) and Harhoff and Korting (1998). Petersen and Rajan (1994) investigate credit rationing for 3404 SMEs in the United States by using data 1987 NSSBF. An SMEs are classified as a credit rationed firm if it has more than 50 % of delayed payment of trade credit. The use of trade credit as a proxy for credit rationing is supported by the pecking order theory (Myers and Majluf, 1984), where firms that are credit rationed by banks will switch to alternative external sources of financing, such as trade credit, even if they are more costly (Elliehausen and Wolken, 1993). In such a framework, trade credit acts as a substitute for bank credit, and the volume of trade credit will be positively correlated with credit rationing.

An extensive use of trade credit suggests that the firm is potentially credit rationed. However, the use of trade credit as a proxy for credit rationing remains controversial, and many firms that have easy access to bank loans use trade credit to reduce transaction costs (Elliehausen and Wolken, 1993; Petersen and Rajan, 1994, 1997). In this context, an extensive use of trade credit does not mean that the firm is credit rationed. Cosci and Meliciani (2002) proposed the utilization ratio of a credit line as another proxy for credit rationing. The utilization ratio is defined as the relationship between the amount of credit offered by banks and the amount used. The higher the ratio, the more an SMEs are rationed.

3.2.3 Collateral, Loan Contract and Credit Rationing

Bester (1985) shows that no credit rationing will occur in equilibrium if lenders compete by choosing collateral requirements and interest margins in a way designed to differentiate the risk levels of credit applicants. The ability of borrowers to self-select into their risk types depends on a key assumption of simultaneity. Bester argues that self-selection will work if a

bank makes a lending decision by simultaneously taking into account the interest rate and collateral requirement. Therefore, borrowers with a low probability of bankruptcy are more willing to accept an increase in collateral requirements in return for a lower interest margin.

Besanko and Thakor (1987) propose a model that presents an inverse relationship between collateral and the interest rate. According to the model, the high-risk borrower tends to choose a loan contract with a high lending rate and low collateral, and vice versa. The pledging collateral by the borrower may gives a signal of creditworthiness of the borrower. Then, credit rationing only occurs when the pledging collateral is greater than the borrower's assets. Coco (2000), in his recent review of the SW model and the de Meza and Webb (1987) models, argues that consideration of interest margins alone leaves theorists open to the challenge that if interest margins fail to achieve a separation equilibrium, collateral can then be deployed in order to achieve separation between good and bad borrowers and thus solve the credit rationing problem.

Some empirical studies on collateral as a tool for reducing the asymmetric information problem show mixed results (see : Steijvers and Voordeckers (2009) for a comprehensive survey). In some studies, collateral seems to have an important role in reducing the moral hazard problem of the borrower (e.g. Brick and Palia, 2007). However, other empirical studies found that the signalling value of collateral will solve the adverse selection problem (e.g. Jimenez et al., 2007).

In the case of collateral having an important role in reducing the asymmetric information problem, a high-risk borrower will pledge more collateral and collateral will prevent the high-

risk firm from switching from a low-risk project to high-risk project after the loan is granted. However, a study from Lehman and Neuberger (2001) found that borrower with a high-risk project will pledge less collateral. Collateral can be used as a signaling tool that solves the adverse selection problem where low-risk borrowers will pledge more collateral to signal themselves as good borrowers. However, Cressy and Toivanen (2001), using individual loans from a large UK bank, found that only the loan duration seems to have positive impact on the probability of pledging collateral, and there is no relationship between the risk and collateral.

One important factor, which underpins the ability of collateral to induce borrower effort or risk aversion, is the underlying level of borrower wealth. Stiglitz and Weiss (1981) point out that individuals with no wealth to offer as collateral may also pose a comparatively high risk of failure if their projects are under budget. Wealthy entrepreneurs, all things equal, should place a comparatively low value on their collateral bond and accordingly, the role of collateral is considerably weakened. The wealthiest entrepreneurs are also those who engage in risky behaviour, and borrower risk is expected to rise with increases in wealth.

3.3 Methodology

3.3.1 A Demand-Supply Disequilibrium Model

I use the simultaneous equation model to assess the existence of disequilibrium in the market. From an econometric point of view, the main challenge associated with estimating the market model in disequilibrium is that one has to obtain estimators for the parameters of loan supply and demand functions using only observed variables in the loan market. Maddala and Nelson (1974) discuss the appropriate maximum likelihood method for this class of disequilibrium

models, which has been used for empirical analysis of credit markets in different countries (see e.g. Sealey (1979), Perez (1998), Atanasova and Wilson (2004) and Steijvers (2008)).

A disequilibrium model with unknown sample separation, as described by Maddala (1980), is employed. The basic structure of the model consists of two reduced-form equations: a desired demand equation for bank loans and an availability equation that reflects the maximum amount of loans that banks are willing to lend (bank supply). While, the third equation is a transaction equation.

$$\mathbf{L^d_t = \beta_1 X_{1t} + u_{1t}}$$

$$\mathbf{L^s_t = \beta_2 X_{2t} + u_{2t}}$$

$$\mathbf{L_t = \min (L^d_t , L^s_t)} \qquad (3.1)$$

Where L^d_t, is the demand equation, L^s_t is a supply equation and L_t is the nominal transaction of loan. $\mathbf{X_{1t}}$ and $\mathbf{X_{2t}}$ reflect the exogenous, independent variables that are predicted that may have an influence on credit demand and supply. u_{1t} and u_{2t} are the disturbances.

L_t is the only the amount of bank credit that was actually received, and the data can be found in the firm balance sheet. L^d_t and L^s_t are the quantities of bank credit demanded and supplied, but not detected by any external party. I estimate not only market disequilibrium model for long-term bank debt, but also for short- term bank debt. Short-term bank debt is as credit with a duration of less than 2 years, while long-term bank credit is defined as credit with a duration of more than 2 years.

By estimating the disequilibrium model using this simultaneous model, I do not know ex ante which firms in our sample deal with credit rationing. Therefore, there is 'unknown sample

separation' (Maddala, 1987; Perez 1998). The detailed explanation of $\mathbf{X_{1t}}$ and $\mathbf{X_{2t}}$ as exogenous independent variables will be discussed in the next section.

3.3.2 The Formulation of Hypotheses

Our empirical study can be split in two stages. First, I estimate the disequilibrium model of demand and supply for long-term bank debt and short-term bank debt for new start-up SMEs in France. Then, the estimated models are used to estimate the proportion of credit rationed firms, for long- and short-term bank credit, for each year between 1995 and 2000. Before estimating the model, I formulate the hypotheses concerning the demand and supply of long-term and short-term bank credit. Various explanatory variables were selected and combined according to previous research (Ogawa and Suzuki, 2000; Atanasova and Wilson, 2004).

3.3.2.1 Hypotheses Concerning the Demand for Bank Debt

1. Level of activity

The desired demand for bank credit is affected by the level of activity or production level of a firm (Atanasova and Wilson, 2004). A firm with a higher activity level has to be supported by investment in working capital and production assets to support the business activity

2. Internal funds

The pecking order theory was claimed by numerous empirical studies as the most fit theory to explain the capital structure choices of SMEs (Chittenden et al., 1996). According to this theory, SMEs tend to use internal finances first before raising some funds from external sources.

The availability of internal funds also may increase the demand for bank loans because at that time, the firm knows that the probability of getting additional bank

loans will increase as banks often see the profitability of the borrower through creditworthiness. This phenomenon can be explained by static trade-off theory, which posits that every firm has an optimal debt ratio, which is determined by the trade-off between the cost and benefit of using debt. Obtaining external funds may be beneficial when the advantages of a tax shield will reduce the cost of using debt.

3. Trade credit

As an alternative to bank debt, SMEs often use trade credit as a sources of short-term financing (Atanasova and Wilson, 2004). SMEs also have a lower probability of being credit rationed and appear to appeal less to trade credit (Petersen and Rajan, 1994, 1995). Market imperfections can also bring about the use of trade credit without necessarily being credit rationed (Lewellen et al., 1980). Due to the lower evaluation and transaction costs, a firm can get less costly financing by having trade credit rather than borrowing some money from financial institutions. The use of trade credit can also be a good signal to the bank that the firm is a good borrower.

4. Human capital

Human capital can be defined as a possession of valuable knowledge and skills by the owner. Becker (1993) created a distinction between general and specific human capital, where general human capital is defined in the context of years of education and work experience. Whereas, specific human capital is described with factors associated with the specific domain, such as managerial and industry specific experience (Bosma et al., 2004). Human capital can have various effects on the desired demand for bank loans. Someone who has a diploma and has newly graduated from university may have better knowledge; however, they may not have wealth or accumulated wealth, so they still need to apply for bank loans (See Evan and

Jovanovic, 1989). A different case is someone who had a previous job and experience in other businesses.

Finally, from the review of the literature above, the hypotheses were propounded in alternative hypotheses forms and I expect not to reject this alternative hypothesis. The hypothesis statements are as follows:

H1A : The demand for long-term bank debt increases if the activity level of the firm is higher.

H1B : The demand for short-term bank debt increases if the activity level of the firm is higher.

H2A : The demand for long-term bank debt decreases if a firm has more internal funds.

H2B : The demand for short-term bank debt increases if a firm has more internal funds.

H3A : The demand for long-term bank debt increases if the use of trade credit increases.

H3B : The demand for short- term bank debt increases if the use of trade credit increases

H4A : The demand for long-term bank debt increases if the owner has a diploma degree.

H4B : The demand for short-term bank debt increases if the owner has a diploma degree.

H5A : The demand for long-term bank debt decreases if the owner has previous experience.

H5B : The demand for short-term bank debt decreases if the owner has previous experience.

H6A : The demand for long-term bank debt decreases if the owner has previous job experience.

H6B : The demand for short-term bank credit decreases if the owner has previous job experience

3.3.2.2 Hypotheses Concerning the Supply of Bank Debt

1. Firm risk

Firms characterized by a higher level of lending or interest costs may represent a bad risk for financial institutions. The more uncertain the repayment of the loan is, the more risky it is for a bank to offer a loan. The risk for the bank suggests the default risk. The main cause for default of a firm is mismanagement (Ooghe et al., 1995). However, when using the financial ratio as a measure of firm risk, it can also have a signaling effect of borrower quality; then the banks are willing to offer more debt. Following the work from Atanasova and Wilson (2004), I use the loan cost over total assets as the proxy for firm risk.

2. Pledging collateral

Collateral may reduce the information asymmetry between the SMEs and the financial institution. Collateral could have a signaling value for the bank when considering the creditworthiness of the firm (Bester, 1985) and can also prevent a firm from switching from a low-risk project to the high-risk one. Thus, collateral can solve not only the adverse selection project but also the moral hazard problem.

Related to collateral being a tool to reduce the moral hazard problem, Stiglitz and Weiss (1981) also studied if a higher demand for collateral could reduce the risk and increase the returns for the bank. Meanwhile, there is also a negative adverse selection effect working when an increasing demand for collateral makes the average and marginal borrower become more risky. The SW model shows that the negative adverse selection affects more than compensates for the positive moral hazard effect. Therefore, the SW model predicts that offering more collateral will not increase the supply of credit to firms. Generally, there is no consensus on the effect of collateral on the supply of credit. Atanasova and Wilson (2004) mainly confirmed the signaling theory mentioned above.

3. Trade credit as a signaling tool

Trade credit can have a signaling value for the bank, reducing the adverse selection problem. Banks perceive a firm with trade credit as a good borrower because the firm is being trusted by the supplier. However, relying heavily on trade credit could also provide a negative signal to the bank, indicating that the firm cannot get enough (cheaper) bank credit at any bank in the market.

4. Lending rate loan premium

As a proxy for the bank interest rate, I used the lending rate in the supply equation. The higher the level of the lending rate is, the bank tends to offer more credit due to the possible profit. The limitation on data availability forces us to only use the lending rate in the equation.

Finally, from the review of the literature above, the hypotheses were propounded in alternative hypotheses forms and I expect not to reject this alternative hypothesis. The hypotheses are as follows:

H7A : The supply of long-term bank debt decreases if a firm is characterized by a higher risk degree.

H7B : The supply of short-term bank debt decreases if a firm is characterized by a higher risk degree.

H8A : The supply of long-term bank debt increases if a firm can pledge more assets as collateral.

H8B : The supply of short-term bank debt increases if a firm can pledge more assets as collateral.

H9A : The supply of long-term bank debt increases if a firm uses more trade credit.

H9B : The supply of short-term bank debt increases if a firm uses more trade credit

H10A : The supply of long-term bank debt increases if the lending rate increases.

H10B : The supply of short-term bank debt increases if the lending rate increases.

3.3.3 Model Specification

Based on the hypothesis development mentioned above, I construct the model for banks loans as functions of firm activity, internal funds, trade credit and human capital indicators. The supply of bank loans is modeled as a function of the value of collateral trade credit received and the lending rate. I estimate two disequilibrium models for short-term bank debt and long-term bank debt. When estimating model 1, I do not add the human capital indicator variable

into the model. The human capital variables will be introduced in model 2, both for short-term debt and long-term bank debt.

Model 1

Demand equation

$$\frac{I_{it}^{d}}{a_{i,t-1}} = \beta_0 + \beta_1 \frac{CF_{it}^{d}}{a_{i,t-1}} + \beta_2 \frac{S_{it}^{d}}{a_{i,t-1}} + \beta_3 \frac{TD_{it}^{d}}{a_{i,t-1}} + \beta_4 \sum_{j=1}^{T} \gamma (DYEAR)_j + \beta_5 \sum_{j=1}^{T} \phi (DIND)_j + \nu_{it} \quad (3.2)$$

Supply equation

$$\frac{I_{it}^{s}}{a_{i,t-1}} = \beta_0 + \beta_1 \frac{FA_{it}}{a_{i,t-1}} + \beta_2 \frac{LC_{it}}{a_{i,t-1}} + \beta_3 \frac{TD_{it}}{a_{i,t-1}} + \beta_4 (Lending)_{it} + \beta_5 \sum_{j=1}^{T} \gamma (DYEAR)_j + \beta_6 \sum_{j=1}^{T} \phi (DIND)_j + \nu_{it} \quad (3.3)$$

$$I_{it} = Min (I_{it}^{d}, I_{it}^{s}) \quad (3.4)$$

Model 2

Demand equation

$$\frac{I_{it}^{d}}{a_{i,t-1}} = \beta_0 + \beta_1 \frac{CF_{it}^{d}}{a_{i,t-1}} + \beta_2 \frac{S_{it}^{d}}{a_{i,t-1}} + \beta_3 \frac{TD_{it}^{d}}{a_{i,t-1}} + \beta_4 \sum_{j=1}^{T} \gamma (DYEAR)_j + \beta_5 \sum_{j=1}^{T} \phi (DIND)_j + \beta_6 (Diploma)_{it} + \beta_7 (Prev\ Jobs)_{it} + \beta_8 (Prev\ Exper)_{it} + \nu_{it} \quad (3.5)$$

Supply equation

$$\frac{I_{it}^{s}}{a_{i,t-1}} = \beta_0 + \beta_1 \frac{FA_{it}}{a_{i,t-1}} + \beta_2 \frac{LC_{it}}{a_{i,t-1}} + \beta_3 \frac{TD_{it}}{a_{i,t-1}} + \beta_4 (Lending)_{it} + \beta_5 \sum_{j=1}^{T} \gamma (DYEAR)_j + \beta_6 \sum_{j=1}^{T} \phi (DIND)_j + \beta_7 (Diploma)_{it} + \beta_8 (Prev\ Jobs)_{it} + \beta_9 (Prev\ Exper)_{it} + \nu_{it} \quad (3.6)$$

$$I_{it} = Min (I_{it}^{d}, I_{it}^{s}) \quad (3.7)$$

The model cannot be estimated by an ordinary least squares **(OLS**) regression since it would produce biased and inconsistent estimates (simultaneous equation bias). One of the fundamental assumptions of OLS is violated: for each equation, When the OLS assumptions are violated, a simultaneous equation model can be estimated by an instrumental variable technique, namely 3-stage least squares (**3SLS**). 3SLS is a system method where all the equations in the system are estimated simultaneously. An advantage of using 3SLS is that it may allow the estimation of one equation at a time and does not allow for correlations between the disturbances of the different equations.

Table 3.2 Variable definitions

Variable	Definition
Short-term loans/lagged total assets	Total short-term bank debt over lagged total assets. All financial variables are deflated by using GDP Deflator
Long-term loans/lagged total assets	Total long-term bank debt over lagged total assets.
Cash flow/lagged total assets	Total cash flow over lagged total assets.
Sales/lagged total assets	Total sales over lagged total assets.
Trade credit/lagged total assets	Total trade credit over lagged total assets.
Fixed assets/lagged total assets	Total gross fixed assets over lagged total assets.
Lending cost/ total assets	Total lending cost over total assets.
Lending rate	Average lending rate offered. The data is taken from http://www1.unece.org/stat/platform/display/Statgloss/
Diploma	1 if one has a diploma, 0 otherwise
Experience	1 if one has prior experience in the same or different business, 0 otherwise
Previous jobs	1 if one possessed a previous job, 0 otherwise

3.4 Data Description

The database used for this paper is a single cohort from the French SINE database. This data is taken from a survey of French start-ups conducted by the French National Institute of Statistical and Economic Studies. The survey section used is the 1994 cohort. New firms that were surveyed are known based on of their registration in the *'Systèmed'Information set de Répertoire des Entreprises et des Etablissements'* (SIRENE repertory). The data used is similar to the data used in chapter 2. Conducting research concerning the existence of credit rationing by using micro survey based data is still very rare; therefore, it may give a different point of view of assessing the credit rationing based on the market disequilibrium model.

Table 3.3 Descriptive statistics of key variables

NO	Variable	Mean	Std. Dev.
1	Short-term bank debt/lagged total assets	0.0387	0.1181
2	Long-term bank debt/lagged total assets	0.1242	0.1951
3	Cash flow/lagged total assets	0.0194	0.0311
4	Sales/lagged total assets	2.2772	1.8851
5	Trade credit/lagged total assets	0.2502	0.2527
6	Fixed assets/lagged total assets	0.4387	0.3278
7	Lending cost/ total assets	0.0178	0.0318
8	Lending rate	7.0119	0.6987

Table 3.4 Correlation across the key variables

NO	Variable	Correlation							
		1	2	3	4	5	6	7	8
1	Short-term bank debt/lagged total assets	1							
2	Long-term bank debt/lagged total assets	-0.0691	1						
3	Cash flow/lagged total assets	0.1704	0.3195	1					
4	Sales/lagged total assets	0.1276	-0.1166	0.0407	1				
5	Trade credit/lagged total assets	0.0598	-0.1337	0.0226	0.4312	1			
6	Fixed asset/lagged total assets	0.0727	0.5637	0.2135	-0.1808	-0.2625	1		
7	Lending cost/ total assets	0.1533	0.3542	0.9013	-0.0399	-0.0776	0.2113	1	
8	Lending rate	0.0502	0.0609	0.0676	0.1219	0.0744	-0.0084	0.0563	1

As can be seen from Table 3.3, the mean of long-term bank loans over lagged total assets is higher than mean of short-term bank loans. More interestingly, most firms have higher trade credit rather than bank loans. It can be said that most of the firms rely on trade credit as an alternative to the short- and/or long-term bank debt. Long-term bank debt and short-term bank debt have a negative relationship; as the long-term bank debt increases, the short-term bank loans will decrease. Both short-term bank debt and long-term debt have a positive relationship with the lending rate, indicating that most firms are less sensitive to price.

3.5 Empirical Results

3.5.1 Disequilibrium Model Estimation

The estimation result for the disequilibrium model for short-term bank debt and long-term debt without human capital is presented in Tables 3.5 and 3.6. From the estimation results of the equations of the **supply** of **long-** and **short-term** bank debt, as predicted, I find that the level of activity, sales over lagged total assets, has a significant positive effect, but it is not significant on the demand for short-term bank credit. However, the sales variable has a negative and significant effect on long-term bank debt. This indicates that a firm relies on the retained earnings coming from the operation output to support the business. The result may confirm that SMEs follow the pecking order theory.

Cash flow and trade credit have a positive and significant effect on desired demand for both short- and long-term bank debt. The result indicates that a bank or lender believes that by having enough cash, it will increase the probability to repay the debt. By having trade credit, a firm is perceived as a good borrower and gives the signal to the bank to offer more debt. The positive sign of cash flow to the short-term bank debt supports the static trade off theory. As hypothesized, this indicates that the more trade credit a firm uses, the more long-term bank credit they would actually desire. This could indicate that the firms that are rationed by banks rely on heavily on suppliers to get additional long-term financing. In that case, trade credit may play a role in mitigating the credit-rationing problem, as firms can appeal to trade credit when faced with borrowing constraints. Interestingly, trade credit uses a negative effect and is significant on long-term debt, indicating that banks often view that the excessive use of trade credit in the long run will increase the default risk.

In reference to the *time dummies*, I find significant negative effects for the model for short-term bank credit for all year dummies, and the results suggest that the desired demand for short-term bank debt and long-term bank debt decreases throughout time. The estimation results of the equations of the **supply** of **long-** and **short-term** bank credit are consistent with our hypotheses. The results indicate that fixed assets as a proxy for collateral has a significant positive effect on the amount of bank credit supplied to a firm. Collateral can be used as risk mitigation towards the bank. The availability of collateral is positively related to the amount of long-term credit offered by banks. However, it is not significant for short-term bank loans. For both short- and long-term bank debt, the lending cost has a significant and positive effect on supply fund. This indicates that banks view the ability of a borrower to repay the bank debt and the borrower's debt level has not reach to the point that the bankruptcy risk outweighs the benefit of using debt.

Table 3.5 Disequilibrium model for short-term bank debt

This table gives the estimation result of disequilibrium model for short term bank debt (See Equation 3.2-3.4).. ***, **, and * indicate significance at the 1%, 5% and 10 % levels respectively. Standard errors in parentheses

Independent variables	**Desired demand for short-term bank debt**	**Independent variables**	**Supply for short-term bank debt**
Cash flow/lagged total assets	0.0758***	Fixed Cost/lagged total assets	0.0005
	(0.0171)		(0.0008)
Sales/lagged total assets	0.00005	Lending cost/ total assets	0.0964***
	(0.00014)		(0.0231)
Trade credit/lagged total assets	0.0248***	Trade credit/lagged total assets	0.0261***
	(0.00606)		(0.0060)
Year Dummy		Lending rate	0.0083***
1996	-0.0109***		(0.0023)
	(0.0032)		
1997	-0.0146***	**Industry dummy**	
	(0.0042)	Food industry	-0.0108
1998	-0.0129***		(0.0083)
	(0.0037)	Construction	0.00569
1999	-0.0146***		(0.0050)
	(0.0042)	Commerce	0.00905**
2000	-0.0119***		(0.0039)
	(0.0034)	Transport	0.00349
Industry dummy			(0.0063)
Food industry	-0.0107	Services for entrepreneurs	0.00645
	(0.0083)		(0.0054)
Construction	0.00565	Catering	0.00242
	(0.0049)		(0.0068)
Commerce	0.00919**		
	(0.0039)		
Transport	0.00345		
	(0.0063)		
Services for entrepreneurs	0.00628		
	(0.0054)		
Catering	0.00263		
	(0.0068)		

Table 3.6 Disequilibrium model for long-term bank debt

This table gives the estimation result of disequilibrium model for short term bank debt (See Equation 3.2-3.4).. ***, **, and * indicate significance at the 1%, 5% and 10 % levels respectively. Standard errors in parentheses

Independent variables	**Desired demand for long-term bank debt**	**Independent variables**	**Supply for short-term bank debt**
Cash flow/lagged total assets	1.399***	Fixed cost/lagged total assets	0.0973***
	(0.0623)		(0.0035)
Sales/lagged total assets	-0.00300***	Lending cost/ total assets	1.756***
	(0.0007)		(0.0712)
Trade credit/lagged total assets	-0.105***	Trade credit/lagged total assets	-0.0674***
	(0.0096)		(0.0080)
Year Dummy		Lending rate	0.0169***
1996	-0.0221***		(0.0031)
	(0.0059)		
1997	-0.0316***	**Industry dummy**	
	(0.0069)	Food industry	0.0708***
1998	-0.0280***		(0.0109)
	(0.0064)	Construction	-0.000645
1999	-0.0302***		(0.0065)
	(0.0069)	Commerce	0.0584***
2000	-0.0262***		(0.0051)
	(0.0061)	Transport	0.00584
Industry dummy			(0.0082)
Food industry	0.0920***	Services for entrepreneurs	-0.00942
	(0.0128)		(0.0071)
Construction	-0.00785	Catering	0.0335***
	(0.0076)		(0.0089)
Commerce	0.0633***		
	(0.0060)		
Transport	0.0096		
	(0.0097)		
Services for entrepreneurs	-0.0203**		
	(0.0083)		
Catering	0.0655***		
	(0.0105)		

3.5.2 Disequilibrium Model for Short-Term & Long-Term Bank Debt with Human Capital

Table 3.7 Disequilibrium model for short-term bank debt with human capital

Independent variables	Desired demand for short-term bank debt	Independent variables	Supply for short-term bank debt
Cash flow/lagged total assets	0.0750***	Fixed cost/lagged total assets	0.00056
	(0.017)		(0.0007)
Sales/lagged total assets	0.00004	Lending cost/ total assets	0.0955***
	(0.0001)		(0.0229)
Trade credit/lagged total assets	0.0251***	Trade credit/lagged total assets	0.0263***
	(0.0060)		(0.0060)
Diploma	0.00794*	Lending rate	0.00841***
	(0.0042)		(0.0023)
Experience	-0.00235	Diploma	0.00790*
	(0.0066)		(0.0042)
Previous jobs	-0.0220*	Experience	-0.00243
	(0.0117)		(0.0066)
		Previous jobs	-0.0221*
			(0.0118)
Year Dummy		**Industry dummy**	
1996	-0.0110***	Food industry	-0.011
	(0.0032)		(0.0083)
1997	-0.0148***	Construction	0.00633
	(0.0042)		(0.0050)
1998	-0.0131***	Commerce	0.00921**
	(0.0037)		(0.0039)
1999	-0.0148***		0.00353
	(0.0042)		(0.0063)
2000	-0.0121***	Services for entrepreneurs	0.00666
	(0.0034)		(0.0054)
Industry dummy		Catering	0.00316
Food industry	-0.0109		(0.0068)
	(0.0083)		
Construction	0.00629		
	(0.005)		
Commerce	0.00936**		
	(0.0039)		
Transport	0.0035		
	(0.0063)		
Services for entrepreneurs	0.00649		
	(0.0054)		
Catering	0.00338		
	(0.0068)		

This table gives the estimation result of disequilibrium model for short term bank debt (See Equation 3.5-3.7). ***, **, and * indicate significance at the 1%, 5% and 10 % levels respectively.

The estimation result for the disequilibrium model for short-term bank debt and long-term debt with human capital is presented in Table 3.7 and 3.9. From the estimation results of the equations of the **supply** of **long-** and **short-term** banks, I see that the level of activity has a significant and positive effect but is not significant on the demand for short-term bank credit. It may be said that the result confirms that SMEs still rely on internal financing or any other types of fund to finance the activities. Hence, again Pecking order hypothesis does hold for SMEs choice for financing. However, the sales variable has a negative and significant effect on long-term bank debt. The effect of cash flow, sales and trade credit slightly decrease when adding the human specific variable. Interestingly, a diploma has a positive and significant effect on bank loans, while having previous jobs and experience does not significantly affect the demand for short- and long-term bank debt. Someone who are university or college graduated may be perceived as a good borrower in a way he can manage the business well by having knowledge from school. As robustness check, I also estimate a different disequilibrium model by assuming that only the demand equation is influenced by the human capital of the entrepreneur. The results support and are consistent with the main model. The detailed results can be found in appendix B.

Table 3.8 Disequilibrium model for long-term bank debt with human capital

Independent variables	Desired demand for long-term bank debt	Independent variables	Supply for long-term bank debt
Cash flow/lagged total assets	1.384***	Fixed cost/lagged total assets	0.0968***
	-0.0621		(0.0035)
Sales/lagged total assets	-0.00299***	Lending cost/ total assets	1.737***
	(0.0007)		(0.0711)
Trade debt/lagged total assets	-0.103***	Trade debt/lagged total assets	-0.0660***
	(0.0095)		(0.008)
Diploma	0.0369***	Lending rate	0.0173***
	(0.0065)		(0.0031)
Experience	0.0369***	Diploma	0.0347***
	(0.0102)		(0.0055)
Previous jobs	0.0114	Experience	0.0305***
	(0.0181)		(0.0086)
		Previous jobs	0.0152
			(0.0153)
Year Dummy		**Industry dummy**	
1996	-0.0226***	Food industry	0.0735***
	(0.0059)		(0.0109)
1997	-0.0323***	Construction	0.00124
	(0.0069)		(0.0065)
1998	-0.0286***	Commerce	0.0589***
	(0.0064)		(0.0051)
1999	-0.0309***	Transport	0.00852
	(0.0068)		(0.0082)
2000	-0.0267***	Services for entrepreneurs	-0.0106
	(0.0061)		(0.0071)
Industry dummy		Catering	0.0383***
Food industry	0.0947***		(0.0089)
	(0.0128)		
Construction	-0.00599		
	(0.0076)		
Commerce	0.0638***		
	(0.0060)		
Transport	0.0123		
	(0.0097)		
Services for entrepreneurs	-0.0214**		
	(0.0083)		
Catering	0.0703***		
	(0.0105)		

This table gives the estimation result of disequilibrium model for long term bank debt (See Equation 3.5-3.7).. ***, **, and * indicate significance at the 1%, 5% and 10 % levels respectively. Standard errors in parentheses

3.5.3 Proportion of Credit Rationed Firms

Table 3.9 Proportion of credit rationed firms

Year	Proportion of credit rationed firms (Short-term bank debt)	Proportion of credit rationed firms (Long-term bank debt)
1995	62.43%	48.79%
1996	64.61%	47.43%
1997	44.59%	43.24%
1998	47.88%	45.03%
1999	31.90%	46.29%
2000	23.20%	44.27%
Average	45.77%	45.84%

After estimating our simultaneous equation models consisting of the demand and supply functions for short- and long-term bank credit, I can obtain the fitted values for our model concerning the quantity of bank credit demanded and supplied. When the demand for long (or short) term bank credit exceeds the supply of long (or short) term credit in a certain year t for a firm i, firm i copes with credit rationing for long (or short) term bank debt in that particular year t. Table 3.9 presents the results of this calculation.

Over the entire period, the results of our study suggest that 45.84% of the French SMEs are credit rationed for long-term bank credit and 45.77% for short-term bank credit. Meanwhile, Atanasova and Wilson (2004) estimated that 42.7% of SMEs in the UK in the period of 1989-1999 were credit rationed for bank debt.

3.6 Conclusion

A large panel data set consisting of 9417 French SMEs was used to estimate the disequilibrium models of demand and supply of long-term and short-term corporate bank loans. No previous study was found to estimate the existence of credit rationing in a bank-based economic system. The contribution of this study is that the model estimated is a disequilibrium model, allowing for the existence of credit rationing. Moreover, firms are endogenously classified as credit rationed or non-rationed. No ex ante separation in two groups has to be made, and thus firms can switch between both groups from one year to another. The results of our study indicate that, over the entire period, over 45.84% of the French SMEs are credit rationed for long-term bank credit, and 45.77%for short-term bank credit.

As predicted, I see that the level of activity, sales over lagged total assets, has a significant positive effect but is not significant on the demand for short-term bank credit. However, the sales variable has a negative and significant effect on long-term bank debt. This indicates that a firm relies on the retained earnings coming from the operation output to support the business. The result may confirm that SMEs follow the pecking order theory (e.g., Mateev et al., 2013; Rossi et al., 2015; Palacin-Sanchez et al., 2012) The effects of cash flow, sales and trade credit slightly decrease when adding the human specific variable. Interestingly, a diploma has a positive and significant effect on bank loans, while having previous jobs and experience does not significantly affect the demand for short- and long-term bank debt. I can conclude from both analyses that in France, especially for start-up and small SMEs with little internal resources and a lack of assets to guarantee the repayment of debt are most likely to be suffering from credit rationing. Policy implication may be proposed based the result of this

study, especially in enhancing the level of education and knowledge of the entrepreneur or new-start up business by providing the training or any specific education, formal and informal, which can increase the knowledge. Other sources of alternative financing besides of bank financing may be more needed for the new start-up business, such as crowd-funding, angel capital or any other financing scheme that are not classified as collateral-based financing.

CHAPTER 4 FINANCIAL CONSTRAINTS, LEVERAGE, AND FIRM INVESTMENT: A SWITCHING REGRESSION APPROACH

4.1 Introduction

The classic theorem from Modigliani and Miller (1958) states that the financial structure of a firm is irrelevant to its investment decisions. In assuming a perfect capital market exists, there would be no differential cost between external and internal financing. The model assumes that there is symmetric information and no agency or transaction costs associated with the debt-equity mix. However, once capital market imperfections are introduced, the cost of external financing will be higher than internally generated funds. Thus, financially constrained firms will rely first on internal funds to invest in profitable projects.

The pioneering work from by Fazzari, Hubbard, and Petersen in 1988 (hereafter FHP) argued that if internal and external funds were perfect substitutes (as would be the case in a perfect capital market), there would be no association between cash flow and investment. However, under the assumption that the cost of external financing surpasses the cost of internal financing, changes in internal financing could be important factors that determine a firm's capital spending. FHP's empirical work used firm-level data to investigate the relationship between firms' investment behaviour and cash flow. Firms are priori classified as constrained and unconstrained by using dividend payout ratios. Firms with a low dividend payout ratio are classified as financially constrained because these firms mostly use their internal finances to fund investment. To interpret their findings as indicating Financial constraints, FHP needs to control for another factor that might make investment positively correlated with cash flow, namely, controlling the variable for investment opportunities. FHP found not only that there

is a correlation between cash flow and investment, but also that the investment decisions of firms that are priori classified as constrained firms are more sensitive to the availability of internal cash flow. They claimed this result as evidence for the degree of financial constraint and conclude that investment cash flow sensitivity (ICFS) could be a convenient measure of financial constraint. Since then, a large body of literature has developed using similar methodologies that have confirmed the findings in the FHP's paper (Allayanis and Mozundar, 2004; Aggarwal and Zong, 2006; Almedia and Campello, 2007; Cleary et al., 2007; Agca and Mozundar, 2007; Guariglia, 2007; Silva and Carreira, 2012).

Another point underlying the issue of investment cash flow sensitivity issue is that firms grouped into constrained and unconstrained types by using a priori classification. Cleary et al. (2007) argued that it is rather difficult to find a good variable as a measure of financial constraint. Therefore, empirical research has provided a set of alternative variables that can be used as a priori classification for firms; these range from a single variable to multiple variables and finally, to an index. FHP (1988) classified firms as financially constrained on the basis of one single quantitative factor, namely the dividend payout ratio. In some studies, however, two or more qualitative and quantitative indicators are used for a priori classification. For example, Rauh (2006) used five different variables to measure financial constraints: age, S&P credit rating, dividend payout ratio, cash, and capital expenditure. Meanwhile, Devereux and Schiantarelli (1990) and Oliner and Rudebusch (1992) used size, age, and pattern of insider trading of the company's shares.

Another debate associated with the investment cash flow model is related to the issue of investment opportunity biases. Some researchers argued that within the reduced form of Q model of investment, a significant cash flow coefficient may simply reflect an investment

opportunity that is not covered by the investment opportunity variables such as Tobin's Q variable (Gilchrist and Himmelberg, 1995; Erickson and Whited, 2000; Bond et al., 2004; Cummins et al., 2006). The problem associated with Tobin's Q variable may be related to its priori classification to identify financially constrained firms. In general, firms that are classified as financially constrained are smaller and newer than other firms in the sample. Therefore, Tobin's Q may have less information about these firms.

To resolve this issue, alternative proxies have been proposed, including the so-called fundamental Q model, Tobin's Q corrected for measurement error (Erickson and Whited, 2000), earning forecasts for financial analysts (Cummins et al., 2006), and contracted capital expenditures (Guagrilia and Carpenter, 2008). However, for unlisted firms, the object of this study, it is impossible to use proxies based on stock market value data. Therefore, I propose using a sales accelerator model to capture investment opportunities for unlisted firms. The sales accelerator model, which will be described later, relies on accounting information only and can thus be calculated for unquoted firms (Kadapakkam et al., 1998; Konings et al., 2003; Scellato, 2007; Guagrilia, 2008; Bakucs et al., 2009).

To solve the problem associated with the investment opportunity biases, the previous literature has offered alternative approaches. For example, it has been suggested that the interaction terms be used between cash flow and variables that measure the severity of market imperfections. The basic idea is that investment cash flow sensitivity should change with the degree of market imperfections. Then by adding the interaction variable, I would expect that the cash flow coefficient of the unconstrained firms would still be much lower than that of the constrained firms.

Almeida and Campello (2007) developed a model to identify whether financial imperfections affect firm investment behaviour by exploring the idea that those variables that increase a firm's ability to obtain external funding may also increase its investment when the firm is having difficulty obtaining external financing. Asset tangibility can be used to pledge collateral because this is likely to play an important role in investment decisions. Tangible assets may support a firm's borrowing capability and thus allow for further investments to be made. Tangible assets serve to pledge collateral by mitigating the contractibility problem,[10] and they can also be used as screening devices to separate good from bad borrowers in an environment with asymmetric information. They found that ICFS decreases with a constrained firm's degree of tangibility. Another main contribution of Almeida and Campello (2007) is that they endogenously classified firms according to their financial constraint status using a switching regression approach rather than an a priori classification variable (as in most studies) to distinguish between constrained and unconstrained firms.

Accordance with the main objectives of the thesis, this chapter basically analyzes the degree of financial constraint by using indirect measurement, namely investment cash flow sensitivity. The main novelty of this empirical research is by applying the switching regression model that can be used as alternative to priori classification scheme that commonly used in the previous study.

The rest of this chapter will proceed as follows: Section 2 provides a brief literature review of financial constraints and investment, with a specific emphasis on unlisted firms. Methodology is presented in section 3. Section 4 presents the estimation framework and the

[10] The contractibility problem is defined as problem associated with the lack of contractibility between borrower and lender and may result on moral hazard action.

empirical model to be tested. Section 5 describes the data and provides the descriptive statistics of the sample. The main empirical results are shown and discussed in section 6. Section 5 presents the conclusions of the paper and suggests some possible future research directions.

4.2 Literature Review

4.2.1 Theory of Capital Structure

To identify financially constrained and unconstrained firms, I assume that financial constraint is endogenously related to the capital structure of a firm; hence, in this section of the chapter, I present the most relevant theories of capital firm structure, starting from the work from Modigliani and Miller (1958), then proceeding to static trade-off theory, pecking order theory, agency cost, and asymmetric information cost theories.

4.2.1.1 Modigliani and Miller's (MM) Irrelevance Proposition

The modern theory of capital structure was primarily developed by Modigliani and Miller (1958). The MM theory is based on the assumption that the probability distribution of a firm's cash flow does not depend on capital structure decisions, so all investors have the same expectations regarding cash flows. It also assumes that there is a perfect capital market where information is available freely to all market participants and that the investor will behave rationally. Another important assumption is that there are no transaction costs or corporate taxes. Modigliani and Miller (1958, p. 268) explicitly state as their Proposition I that "The market value of any firm is independent of its capital structure and is given by capitalizing its expected return at the rate appropriate to its class" (p. 268). The underlying logic of this proposition implies that the value of a levered firm is equal to the value of an unlevered firm.

This theory has been widely criticized for its limitations. For example, Myers (1984) questioned the credibility of this theory and argues that the value of a firm actually depends on its capital structure because some investors are willing to pay more for shares rather than the equivalent whole. The theory only holds in the synthetic world of M&M if I assume that the capital market is perfect, i.e., no taxes or transaction costs. "The irrelevance proposition" in this theory has provoked a wave of new theoretical and empirical research to support or deny this proposition.

4.2.1.2 The Static Trade-off Theory and Agency Cost

The objective of trade-off theory is to explain why firms are financed partly by debt and partly by equity. The idea of an optimal capital structure for a firm is often explained as a trade-off between the cost and benefit of debt. The cost of using debt is represented by the agency cost among creditors and equity holders (Jensen and Meckling, 1976; Myers, 1984) and the cost of financial distress (Kraus and Litzenberger, 1973), and the benefit of using debt is measured by its tax shield (Myers, 1984).

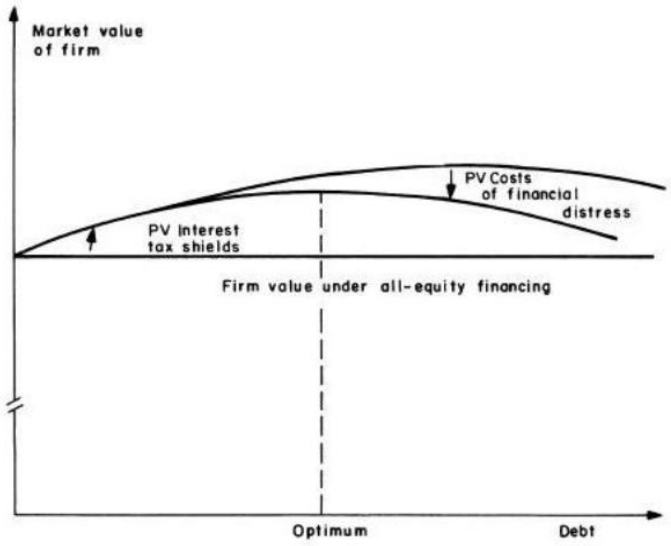


Figure 4.1 The Trade-off theory: Optimum capital structures
Source: Myers (1984)

The optimal capital structure may differ from one firm to another due to the characteristics of each firm. Thus, according to the static trade-off theory of corporate capital structure, the firm chooses the firm's leverage by comparing the present value of interest tax shields and present value of financial distress or bankruptcy costs. And when there are no adjustment costs for a new leverage ratio, the chosen firm leverage is considered to be optimal if it maximizes the firm's value (Myers, 1984) and minimizes cost of capital. Aside from the "fiscally deductible" benefit from the firm's taxes as a result of paying interest, another advantage of using debt is to lessen the free cash flow problem (Jensen and Meckling,1976; Stulz, 1990).

The agency cost theory is concerned with the relationship between the agent (e.g., the manager) and the principal (e.g., the shareholders). The basic statement of this theory is that

the separation of ownership and management creates conflict among principals and agents and will create the agency cost.

The socially efficient objective of the firm is to maximize stockholder's wealth, but agents (managers who are not major shareholders) may have other objectives. The main argument behind agency theory is that corporate manager's act in their own best interests. They are looking for job security, prerequisites, and in the worst cases, to get their hands on assets and cash flow. Managers may therefore have incentives to decrease a firm's value unless the free cash flow is distributed among stakeholders.

Related to agency theory for small–medium firms, Jensen and Meckling (1976) claimed that there is less conflict between principals and agents in small–medium enterprises. The reason is that in SMEs, the owner and the manager is one person. In general, family and small businesses create fewer agency conflicts between agents and principals. However, when the principal and agent are separate, small–medium firms may experience agency problems. Moreover, problems such as entrenched ownership and asymmetric altruism within SMEs may create other difficulties.

4.2.1.3 Pecking Order Theory

Pecking order theory can be applied by financial managers in comparison to the trade-off theory. The underlying assumption of this theory is there is asymmetric information among the managers of a firm and its outside stakeholders. I assume that managers have better information than the firm's stockholders and other stakeholder, who in turn have better information about the future prospect of the company than outside potential investors. A stock issue will be perceived as a bad sign by perspective investors because they will assume

that the goal of management is to maximize the value to existing shareholders. The rational hypothesis of outside investors is that a firm issues shares because management thinks that the shares of the firm are overvalued. Hence, this perceived information only makes an equity issue possible at a lower price. By assuming that debt issuance is not possible, when a firm needs fund to finance a positive NPV-project, the firm will only consider issuing undervalued shares. This also means that even if a company has significant growth opportunities; these will not be reflected in its stock prices.

The main cause of this undervaluation phenomenon is the signaling effect. Several studies have confirmed this by finding that the announcement of stock issue has a consequent negative impact on stock prices. Moreover, it has been shown that the extent of the price drop is related to the degree of information asymmetry between inside management and outside investors. The fact that debt has a senior claim on assets and earnings of the firm implies that creditors face less risk compared to equity holders. It can be said that only pessimistic managers will issue new equity if debt is available at fair value.

This theory explains the preference of financial managers for raising new funds. According to this theory, a manager's first choice is to use internal fund in the form of retained earnings. The second option will be external finance. . External Finance is divided into issuing debt and equity, and there is a preference for the issuance of debt and equity. External debt will be used as the first option of external financing. Debt financing is safer security and less risky than equity. The pecking order allows for issuing equity when the capacity of the debt is fully used (Myers and Majluf, 1984). In this framework, there is no optimal debt ratio, but the debt–equity mix of a firm is determined by its need for external financing (Myers, 1984).

Compared to the trade-off theory, the pecking order theory can explain why profitable firms have less debt compared to less profitable firms. The main explanation behind this fact is that profitable firms can generate enough internal financing to finance investment (Myers, 2001). The development of pecking order theory was mostly based on empirical results from large listed companies in the US. However, empirical tests on SMEs financing show that pecking order theory can explain the behaviour of SMEs regarding capital structure decisions as well. One of the possible reasons is because SMEs are often owned by a single shareholder who is also the owner of the firm. Issuing new equity will reduce the owner's share. To avoid this, the most natural response is to choose debt financing instead equity financing[11]. Another possible explanation is that SMEs' cost of external equity is higher compared to large firms (Chittenden et al., 1996). The fact that small firms rely more on short-term financing than large firms also strengthens the argument that the size of a firm has an impact on the availability of debt financing. Related to the issue of the financing gap for SMEs, the pecking order theory for SMEs can be extended to explain why they have a propensity toward short-term over long-term financing.

4.2.1.4 Determinant of Capital Structure and Hypothesis

As Harris and Raviv (1991) mentioned, "Several studies shed light on the specific characteristic of firms and industries that determine leverage ratio. These studies generally agree that leverage increases with fixed assets, growth opportunities, and firm size and decreases with volatility, advertising costs, research and development costs, bankruptcy probability, profitability, growth opportunity and uniqueness of the product." Since then, many empirical and theoretical studies have been done to analyze the determinant of capital

[11] Cressy (1995), however, explains the use of debt in terms of entrepreneurial control aversion. This was demonstrated in Cressy and Olofsson (1997) using Swedish data.

structure for firms. However, the result of these studies is always ambiguous and it is still an interesting subject to be explored.

The following determinants of capital structure are used in this paper: size, age, profitability, tangibility, and growth opportunities.

1. Size

Rajan and Zingales (1995) state that larger firms are more likely to be more diversified and successful than smaller firms, so size may be an inverse proxy for bankruptcy probability, and they also assumed that large firms have a greater debt capacity. Moreover, large listed companies might be able to incur lower transaction costs associated with debt, and the cost of information asymmetric in large firms is lower than in small firms due to accuracy and transparency (Daskalakis and Psollaki, 2008).

However, size may also be used as a proxy for the information of outside investors, which should increase their preference for equity over debt. Some studies found a positive relationship between size and leverage (see Huang and Song, 2002; Rajan and Zingales, 1995). However, some authors also found a negative relationship (see Kim-Sorensen, 1986; Titman and Wessels, 1988). Then, the hypothesis is propounded in alternative hypothesis forms as follows :

H4.1: There is a positive relationship between size and leverage

2. Age

Firm age can be considered as a proxy for creditworthiness for SMEs (Hyytinen and Pajarinen, 2008). Regarding the issue of creditworthiness, Diamond (1984) suggests that it is due to a firm's reputation, which develops over years. By implication, a good

reputation will be recognized by the market, which has observed the firm's ability to meet its obligations.

The trade-off theory would predict a positive association between age and leverage, because financial distress costs are lower for older firms. However, according to pecking order theory, the relationship lending between older firms and banks reduce adverse selection costs. Hence, I would expect a positive relationship between firm age and leverage. As a firm survives and grows over time, it becomes more established and capable of using more debt. Then, the hypothesis is propounded in alternative hypothesis forms as follows:

H4.2: There is a positive relationship between age and leverage.

3. Profitability

From the perspective of trade-off theory, more profitable firms should have higher leverage to get the tax shield benefits of using debt. Moreover, profitable firms also are encouraged to use more external financing to discipline managers not to spend money on unprofitable projects.

However, Myers (1984) mentioned that firms with the ability to produce acceptable amounts of profit and earnings tend to use their internal capital rather than look for external funds. More profitable firms will have less need for external financing and therefore may have lower leverage. This way of financing could be easily applied to the SMEs because the SMEs managers are also the owners or shareholder, and such managers do not like to lose control over their firms. Agency costs and the problem of information asymmetry have an effect on the availability and cost of credit for SMEs.

Pettit and Singer (1985) believe that small firms have a higher level of information asymmetry than large firms, due to the quality of their financial statements. Moreover, the cost of external funds is higher for them than for large firms. SMEs tend to choose retained earnings as the first choice of financing, then debt, and finally, equity. Thus, it is also can be said that the pecking order hypothesis is very relevant for SMEs. Because of this, the most rational response for SMEs is to avoid the use of external financing. Then, the hypothesis is propounded in alternative hypothesis forms as follows:

H4.3: There is a negative relationship between profitability and leverage.

4. Tangibility

Tangible assets can be used as collateral. Higher tangibility decreases the risk of creditors and increases the value of the firms in case of the bankruptcy. Storey (1994) argued that, in many cases, banks choose to lend money to firms with more tangible assets. It is also claimed that firms with a high level of tangible fixed assets are considered as mature firms; hence, they come with less risk. It is therefore believed that tangibility is positively correlated with leverage.

Barnea et al. (1981) stated that there is a positive relationship between the agency problem and the level of asymmetric information. Barnea et al. (1981) argued that the agency cost is higher in SMEs because the owner of tends to follow his interests prior to those of other stakeholders. Monitoring is even more difficult and expensive for SMEs because small firms are not required to disclose much information regarding their financial statements. Therefore, providing audited financial information poses a significant cost for SMEs. Adverse selection and moral hazard problems are also more severe for SMEs than for large firms, because of close-ended nature of SMEs.

As Booth et al. (2001, p.101) said, "the more tangible the firm's assets, the greater its ability to issue secured debt and the less information revealed about the future profit." Some empirical studies that also support this idea are Rajan and Zingales (1995) and Titman and Wessel (1988). Thus, the hypothesis is propounded in alternative hypothesis forms as follows :

H4.4: There is a positive relationship between tangibility and leverage.

5. Firm Growth

Empirically, previous studies found ambiguous results in the relationship between growth and leverage. Conferring to Jensen and Meckling (1976), bankruptcy cost and agency cost are the main determinant of a firm's leverage. The agency cost may increase significantly from the conflict between shareholders and debt holders. Shareholders will take on a project with high risk because of a higher expected level of return, and in some cases, this might not always maximize the firm's value. However, this action is at the expense of the debt holders, and to protect themselves, debt holders use different types of covenant and monitoring devices. Firms with high-growth opportunities should use more equity financing and will decline investment in profitable projects. This type of investment will effectively transfer wealth from the stockholder to the debt holder. Therefore, I expect to find a negative relation between growth opportunities and leverage. Some empirical studies also confirm this finding, including Rajan and Zingales (1995), and Titman and Wessel (1988).

However, according to the pecking order theory, there may be a positive relationship between growth and leverage due to the existence of information asymmetry. The newly issued equity may be undervalued, which gives the investors a value higher than the Net

Present Value (NPV). In this case, even a project with a positive NPV will be rejected. Managers prefer to use less risky sources of finance to fund their expansionary investment projects. Past firm growth has typically been found to be positively related with leverage in previous SMEs studies. Some empirical studies confirm this finding, including Cassar and Holmes (2003). Thus, the hypothesis is propounded in alternative hypothesis forms as follows:

H4.5: Firm growth is positively related to leverage.

4.2.2 Stylized Approach to the Investment Cash Flow Sensitivity Model

FHP (1988) were the first researchers to adopt an empirical methodology to study the relationship between investment, cash flow, and financial constraints using sample of quoted US manufacturing firms. The study suggests that the investment decisions of firms that are more financially constrained are more sensitive to internal cash flows. They found that if firms were not financially constrained, the investment decision would depend on its investment opportunity. Their methodology involved splitting the sample into sub-samples according to the degree of financial constraint; they used the dividend payout ratio as the variable to measure this. Low-dividend paying firms are more likely to have more severe financial constraints, whereas high-dividend paying firms are considered unconstrained as the level of investment in such firms are not affected by the relative availability of cash flow.

FHP derived the following reduced-form investment equation for empirical implementation of their model.

$$IK_{it} = f\left(\frac{K}{K}\right)_{it} + \alpha\left(\frac{CF}{K}\right)_{it} + \varepsilon_{it}$$

(4.1)

where I_{it} is the level of investment of the firm *i* at time *t*; K_{it} is the value of invested assets for firm *i* at the end of time *t*; X_{it} is the vector variable that captures investment opportunities, and ε_{it} is the independently and identically distributed noise term.

4.2.3 Classification of Firms into More or Less Financially Constrained Groups

One of the most influential criticisms of the FHP model was provided Kaplan and Zingales (1997). This study used a formal framework to account for firm type (by using an exogenously determined indicator for the cost of internal capital) and argued that an investment cash flow sensitivity measure of the degree of financial constraints is imperfect. They used size and earning retention policy as priori classifications to split the sample according to the degree of financial constraint. They use the data from FHP on 49 low-dividend paying firms that were grouped as the most financially constrained firms. They also collected more detailed financial information of these companies and further classified them into five categories: 1) definitely not financially constrained; 2) likely not financially constrained; 3) possibly financially constrained; 4) likely financially constrained; 5) definitely financially constrained. They confirm that an investment of low dividend firms is less sensitive to cash flow. KZ suggests that if the relationship between investment and internal finance is not present, then the observed sensitivity may be due to non-optimizing management behaviour or excessive managerial conservatism.

KZ confirms the theoretical model to show that any sensitivity of investment to cash flow does not have to be interpreted as evidence of financial constraint. This finding clearly presents a result that conflict with FHP and other previous studies. KZ argues that certain assumptions of the classification scheme are insufficient. A low payout ratio can be caused

by risk adverse management and/or precautionary savings behaviour rather than by financial constraint (Lins et al., 2010). They also found that the sensitivity of investment to cash flow is non-monotonic, and it is likely lowest for financially constrained firms. This contradicts the assumptions of FHP. Moyen (2004), however, proposes an explanation for the conflicting findings on investment cash flow sensitivity. She presents two different models based on the ability of a firm to raise external funds. The unconstrained model is a model in which the firm can get external funds; while the constrained model is one in which the firm cannot raise external funds to finance its investment. She found evidence to support both FHP (1988) and KZ (1997) using both models.

Later on, Fazzari et al. (2000) criticized that non-optimizing management behavior may not be reliable evidence of the absence of financial constraint in most situations. Moreover, they also stated that the classification criteria used in KZ (1997) might be unreliable measures of the relative degree of financial constraint as KZ make their classification from a static perspective only. Moreover, FHP (1988) also claimed that the KZ theoretical model and classification approach in determining the degree of financial constraint across firm are non-informative, subjective, and ineffective. A later response by KZ (2000) added to the discussion of the usefulness of investment and cash flow sensitivities.

However, the research by KZ (1997) is followed by a number of studies that support their findings. Cleary (1999) extended their classification scheme based on a firm's ability to raise external funds and constructed an index of a firm's financial strength using multiple discriminant analysis that which transformed the characteristics shared by firms into a univariate analysis. The number of variables that were chosen was firm liquidity, leverage, current profitability and growth ratios, debt ratio, and net income margin, financial slack, and

sales growth. Using multiple discriminant analysis (MDS), which variables are likely to influence the characterization of the firm as either financially constrained or non-financially constrained. This requires two novel processes. First, I have to use a segmenting variable that enables the division of firms into two or more groups. I then use MDA to assess the ability of each independent variable to distinguish firms between the groups. In the end, I can use the segmenting variable to distinguish two or more groups and estimate a probit or logit on determinants of financial constraint. I also need to have a superior segmenting variable that correctly discriminates between constrained and unconstrained firms. Other works that used an index to measure Financial constraint were conducted by Whited and Wu (2006), who proposed the WW index and Hadlock and Pierce (2010), who proposed the SA index.

The WW index by Whited and Wu (2006) is constructed by using generalized methods of moments (GMM). The WW index is a linear combination of cash ratio, a dummy firm for paying dividends, debt ratio, size, industry sales growth, and a firm's sales growth. They use a structural parameter model by Whited (1992), which clearly presented the shadow cost of equity financing. The model was set to be a function of observable firm characteristics, i.e., the financial health of a firm. The major concern, when using this index, is the fact that this index comes from a high parameter involved in the underlying model. It is more complex compared to other index models. The SA index by Hadlock and Pierce (2010) used firm size and age to measure financial constraint. Firm size is calculated as the natural log of deflated total assets, whereas age is the number of years the firm has been in the *Compustat* database or the number of years since the date of incorporation.

The single or multiple factors and indexes used in previous studies may not successfully separate firms with different investment cash flow sensitivities. Hu and Schiantarelli (1998)

first address this potential problem be using a priori classification and offering a switching regression model of investment. The switching regression model assumes that there is unknown sample separation in which the probability of a firm being in a constrained or an unconstrained regime is determined by a switching function of a vector of firm-specific variables that measure the severity of informational and agency problems.

Therefore, I can directly test the effect of various factors on a firm's likelihood of facing financial constraint. Other studies that also apply switching regression methods are Hovakimian and Titman (2006), Almeida and Campello (2007), and Hobdari et al (2009). This chapter basically follows the work from Hobdari et al. (2009) by using the accelerator model of investment.

4.2.4 Proxies for Investment Opportunities for Unlisted Firms

To empirically test financial constraint and investment behavior, it is crucially important to measure firms' investment opportunities accurately so that the significance of cash flow in the investment equation does not reflect future profitability but rather the effect of informational asymmetry. Most of the studies of investment cash flow sensitivity are based on panels of listed firms. A smaller number of studies focus on small to medium firms (Guariglia, 2008; Bechetti et al., 2009). SMEs have unique characteristics because they are subject to more severe asymmetric information problems than large firms, particularly large quoted companies. This results in greater difficulties in getting external financing. Moreover, SMEs also have a lower borrowing capacity because of a poor track record (being more frequently in the service industries) and lower collateral value. Thus, focusing on SMEs to assess investment cash flow sensitivity could be challenging in that I need to find a suitable control variable to indicate investment opportunities. Because market information is not

available, it is impossible to compute traditional proxies of investment opportunities such as the book-to-market ratio, fundamental Q, or forecasted analyst earnings for these unlisted firms.

Studies of investment cash flow sensitivity that use data from unquoted UK firms have appeared recently. In particular, Guariglia (2008) analyzes data from 24,184 unquoted UK firms over the period 1993–2003. Firms were classified a priori as being financially constrained according to the size of internal funds; firms with more internal funds will be less constrained compared to those without internal funds. Using priori classification certainly has flaw in a way that it may creates biases and it need more than one proxy to strengthen the results

4.2.5 Alternative Ways to Verify Investment Flow Sensitivity

Guariglia and Carpenter (2008) found that when calculating contracted capital expenditures, the effect of cash flow on investment is reduced for large firms, but still has a significant effect for small firms. The contracted capital expenditures variable is used to capture information about available internal opportunities, it is not included in the Q, and it also reflects insider evaluation of investment opportunities. They used size, which is calculated by the number of employees, as a proxy to classify firms into financially constrained or unconstrained firms. By using panel data of UK firms over the 1982–2000 period, they estimate investment regression by applying IV regression and first difference GMM developed by Arellano and Bond (1991). The findings of this study explains that cash flow may still play a significant role in capturing the effect of market imperfections, especially for small firms that are more likely to face financial constraint.

Another paper by Guariglia (2008) found that investment cash flow responds differently according to the type of constraint. Using a panel of unquoted firms in the UK, she estimated investment cash flow sensitivity by using error-correction specification instead of the Q model. The result suggested that there is a U shaped relationship between investment and cash flow when firms are grouped according to the severity of financial constraint. Another important result from this study was that it presented evidence that the controversy around using investment cash flow sensitivity to measure financial constraint is probably due to a priori classification schemes, and it may not be because of the improper measurement of Q.

Another study by Agca and Mozundar (2008) studied the investment cash flow sensitivity of some US manufacturing firms by looking at factors associated with capital market imperfections, namely fund flows, institutional ownership, analyst following, bond rating, and index of antitakeover amendments. By using the Erickson-Whited error correction estimation, they found that in US manufacturing firms, cash flow has a significant effect on investment, and the level of investment cash flow sensitivity may be reduced with increasing cash flows, institutional ownership, analyst following, antitakeover amendment, and the availability of bond ratings.

Because financial constraint is endogenously related to factors that reflect the severity of financial constraint, Hu and Schiantarelli (1998) suggested that the cash flow coefficient for constrained firms is relatively higher than that of unconstrained firms. As an alternative to the Tobin's Q, they also use the sales-to-capital ratio as an additional independent variable in the investment equation to control for investment opportunity. Hovakimian and Titman (2006) also used a similar endogenous switching regression mode to examine the importance of financial constraint on firm investment expenditures. They specifically examined whether

asset sales had a greater influence on investment expenditure for financially constrained firms and revealed that the cash obtained from asset sales has a significant effect on firm investment. Financially constrained firms are more likely to invest when they have cash from asset sales.

The work of Hu and Schiantarelli (1998), Hovakimian and Titman (2006), and Almeida and Campello (2007) showed that investment cash flow sensitivity for constrained firms increases with the tangibility of their assets (a proxy for pledgeable assets). They claimed that their studies did not rely on a single comparison of the level of estimated cash flow coefficients for constrained and unconstrained firms. Therefore, it is not subject to KZ's (1997) critique but focuses instead on the marginal effect of pledgeable assets on income shocks and spending under credit constraint. Moreover, they also found that asset tangibility supports more borrowing, and the investment cash flow sensitivities of those firms are not monotonically related to the degree of financial constraint. A study from Ascioglu et al. (2008) claimed that financial constraint only matters when firms have a high level of informational friction. They found that firms with information asymmetry may have higher investment cash flow sensitivity. As an a priori classification of constrained and unconstrained firms, they use the probability of informed trade (PIN), which is also considered to be a more direct measure of financial constraint.

This chapter basically will follow the work from Almeida and Campello (2007), but rather than use tangibility as the factor that indicates the severity of financial constraint, this study will use leverage and assume that financial constraint status is endogenously related to a firm's leverage level. The firms with relatively high leverage are expected to face more difficulty in obtaining external funding; therefore, these firms are more financially

constrained than those firms with low leverage. As suggested by Whited (1992), debt policies may play an important role a proxy for market imperfection. High leverage increases the firm's probability of default and also induces a restricted access to external funds (Cleary, 2002). Thus, there is a possibility that firm leverage may affect a firm's investment cash flow sensitivity. The interpretation of constrained and unconstrained firms is mainly based on the different coefficients for cash flow and interaction terms.

4.3 Methodology

4.3.1 Endogenous Switching Regression

I use the endogenous switching regression model (ESRM) with unknown separation (see Maddala, 1986) to provide estimates of separate investment regressions without a priori classification of firms as constrained or unconstrained firms. This approach addresses the criticisms of the FHP approach discussed above, namely, that FHP rely on questionable classification criteria. The ESRM is based on the assumption that the number of different regimes in which firms operate is known, but the point of structural change (regime switch) is not observable. The advantage of this approach is that it shows (a) the extent that investment behavior differs across groups of firms and (b) the characteristics that make firms more likely to demonstrate higher or lower sensitivity are determined simultaneously by the data. I assume I have two different regimes. Available regimes may reflect the severity of financial constraint faced by firms depending on the severity of liquidity constrains in either of the two unobservable investment regimes.

Following the work by Almeida and Campello (2007), Hu and Schiantarelli (1998), and Hovakimian and Titman (2006), I use the switching regression approach to determine the likelihood of financial constraint. While, Almeida and Campello (2007) used asset tangibility

as a predictor of financial constraint, I use leverage. The method used defined various characteristics on the assumption (to be tested) that firms in the different groups have different investment behaviors. The main benefit of this approach is that it controls for multiple variables that jointly determine the group in which a firm is likely to belong without the need for splitting the sample based on a priori classification. The switching regression model thus allows us to empirically classify the sample into two different groups without making any a priori classification.

When applying the switching regression model, I assumed that there would be two different investment regimes, regime 1 and regime 2. The point of structural change is not unobservable and was estimated together with the investment equation for both regimes. A firm may operate in one of the two unobservable investment regimes depending on the extent of financial constraint. To estimate the model, I construct the following system of equations:

$$I_{1it} = X_{it}\beta_1 + \varepsilon_{1it} \quad (4.2)$$

$$I_{2it} = X_{it}\beta_2 + \varepsilon_{2it} \quad (4.3)$$

$$Y^{*}_{it} = Z_{it}\alpha + \mu_{it}. \quad (4.4)$$

The structural equations that describe the investment behaviour of the firms in both regimes are presented in equations (4.2) and (4.3). X_{it} is the determinant of firm investment, β_1 and β_2 are the vectors of parameter, and ε_{1it} and ε_{2it} are residuals. Equation (4.4) is the selection equation that determines a firm's propensity to be in one of the two-investment regime. Z_{it} is the determinant of a firm's likelihood of being in one or the other investment regime, while μ represents the residuals. The selection equation also allows us to estimate the statistical significance of some factors that are assumed to be proxies for the degree of financial

constraint. Moreover, it also incorporates more information into the estimation of separate investment regimes because it directly includes firm characteristics in the selection estimation (Hovakimian and Titman, 2006).

The observed investment, I_{it}, undertaken by firm *I* at time *t*, is defined as follows:

$$I_{it} = I_{1it} \; if \; Y_{it}^{*} < 0 \tag{4.5}$$

$$I_{it} = I_{2it} \; if \; Y_{it}^{*} < 0 \tag{4.6}$$

Firms will not be fixed in one regime. A transfer between the regimes happens if Y_{it}^{*} reaches a certain unobservable threshold value. A vector of error is also assumed in the investment and switching functions (ε_1, ε_2 and μ_{it}) that are jointly distributed with the mean vector at 0 and the covariance matrix as $\sum = \begin{vmatrix} \sigma_{11} & \sigma_{12} & \sigma_{1e} \\ \sigma_{12} & \sigma_{22} & \sigma_{2e} \\ \sigma_{1e} & \sigma_{2e} & 1 \end{vmatrix}$. **T**his zero mean and covariance matrix permit a nonzero correlation between the shock to firm characteristic and endogenous switching between the two investment regimes.

The extent to which investment behavior differs across both regimes and the likelihood that firms are assigned to one of the regimes is simultaneously determined based on the chosen multiple indicators. Therefore, I am able to split the sample without the ex-ante a priori classification. I need to determine which regime is constrained and which one is unconstrained to fully define the switching regression model. The model is estimated by the method of maximum likelihoods (see Maddala and Nelson, 1994; Hovakimian and Titman, 2006). The model allows for observing the probability in which each of the regimes occur, and the probability can be calculated as follows:

Probability of being in regime 1 is Pr $(\varepsilon_{it} < -Z_{it}\alpha \,|I_{1it} = X_{it}\beta_1 + \varepsilon_{1it})$ (4.7)

Probability of being in regime 2 is Pr $(\varepsilon_{it} < -Z_{it}\alpha \,|I_{2it} = X_{it}\beta_2 + \varepsilon_{2it})$ (4.8)

The likelihood function is as follows:

$$I_{1it} = \Pr(\varepsilon_{it} < -Z_{it}\alpha \,|I_{1it} = X_{it}\beta_1 + \varepsilon_{1it}) \Pr(I_{1it} = X_{it}\beta_1 + \varepsilon_{1it}) + \Pr(\varepsilon_{it} < -Z_{it}\alpha \,|I_{2it} = X_{it}\beta_2 + \varepsilon_{2it}) \Pr(I_{2it} = X_{it}\beta_2 + \varepsilon_{2it})$$

(4.9)

To estimate the model, the *switchr* package for STATA written by Zimmerman (1998) will be used for estimation as can be seen in equations 4.2–4.4. The investment variables functions as the dependent variable in both regimes (equation 4.2 and 4.3). Meanwhile, a classification variable will be used as the dependent variable in the selection equation (equation 4.3). To determine the estimation selection vector, an initial guess of the correct classification has to be provided for each observation. In this study, a dummy variable, leverage, is used to do this by assuming firms with relatively high leverage levels are more likely to have difficulty in obtaining additional external funds than those firms with low leverage. I define the leverage dummy as equal to 1 if the firm's leverage is below the median and zero elsewhere. Therefore, an observation will be coded as 1 (unconstrained) if their leverage level is below the 50th percentile and 0 (constrained) otherwise.

4.3.2 Ex-Ante Sample Separation Criteria

For a robustness check, I also estimate the baseline regression (see equation 4.1) using four different a priori classification variables. Firms are classified into constrained and unconstrained firms based on size, age, firm risk, and SA index. Size is measured using firm sales and number of employees. Smaller and younger firms generally have more severe

financial constraints because they have more asymmetric information problems. It is particularly difficult for them to get external funding.

The second sample separation criterion is the firm's risk. The data for the firm's risk is taken from the variables available from the *QuiScores* database. The *QuiScores* is calculated based on information about a firm's the credit rating. The higher its *QuiScores* value, the less risky a firm is considered.

Besides size and *QuiScores*, SA index by Hadlock and Pierce (2010) is used to perform a priori classification of the degree of financial constraint. Hadlock and Pierce (2010) argue that the variable that measures financial constraint should contain exogenous variables. The SA index can cope with time-varying changes. The SA index formula is as follows

$$SA_{it} = -0.737S_{it} + 0.043S_{it}^2 - 0.040A_{it} \quad (4.10)$$

Where S_{it} is size of the firm *I* at time *t*, and A_{it} measures the firm's age. Size is defined as a natural logarithm of assets, or the natural logarithm of sales/turnover, while age is defined as the number of years since incorporation. The sample is divided into mutually exclusive groups with the use of tertiles in which the top of the sample is financially constrained and the bottom financially unconstrained. Hadlock and Pierce (2010) used a cut-off point at 95% for both variables. They argued that below the cut-off, the relationship between age and size is quadratic and non-monotonic, but when applying the cut-off, the relation between age and size are rather flat.

4.3.3 Model Specification

Investment Equation

According to neoclassical theory, investment can be defined as a process of optimal capital stock adjustment by having the cost of capital and technology as input and determinant of investment as output (Jorgensen, 1963; Hall and Jorgenson, 1967). Regarding the relationship between investment and cash flow, this theory also predicts that the current financial performance, proxied by cash flow, should have no influence on investment (Coad, 2010).

As an alternative to the neoclassical theory, Q theory is also considered as one of the dominant theories of investment. The Q theory argues that the level of investment should be determined by future returns. Assuming that stock returns can be used as indicators of future returns, then the investment can be determined by the firm's marginal Q (i.e., the market value/book value of an asset).

In this chapter, I rely on the reduced-form investment model to identify the difference in investment behavior across groups of firms. Two different models in line with the existing literature will be estimated. The model 1, I include leverage and its interaction with cash flow in the investment equations to determine the direction of investment cash flow sensitivity

Model 1

$$Investment_{i,t} = \alpha_1 Sales_{i,t-1} + \alpha_2 CashFlow_{i,t} + \alpha_3 Leverage_{i,t} + \alpha_4 (Leverage\ x\ CashFlow)_{i,t} + \alpha_5 [(D^{year})] + \alpha_6 [(D^{industry})] + \varepsilon_{i,t} \quad (4.11)$$

Following the work of Almedia and Campello (2007), I also include tangibility and its interaction term with cash flow in Model 2 to check for consistency in patterns of investment (see Model 2).

Model 2

$$Investment_{i,t} \quad \alpha_1 Sales_{i,t-1} + \alpha_2 CashFlow_{i,t} + \alpha_3 Leverage_{i,t} + \alpha_4 (Leverage\ x\ CashFlow)_{i,t} + \alpha_5 Tangibility_{i,t} + \alpha_6 (Tangibility\ x\ CashFlow)_{i,t} + \alpha_7 |(D^{year})| + \alpha_7 |(D^{industry})| + \varepsilon_{i,t} \tag{4.12}$$

To measure the impact of the financial crisis in late 2008 until 2009, I also add the dummy of a crisis year and an interaction term between the dummy crisis and some independent variables into the main equation:

Model 2a

$$Investment_{i,t} \quad \alpha_1 Sales_{i,t-1} + \alpha_2 CashFlow_{i,t} + \alpha_3 Leverage_{i,t} + \alpha_4 (Leverage\ x\ CashFlow)_{i,t} + \alpha_5 (D^{crisis}) + \alpha_6 |(D^{crisis}) x (CashFlow)_{i,t}| + \alpha_7 |(D^{crisis}) x (Leverage)_{i,t}| + \alpha_8 |(D^{crisis}) x (Tangibility)_{i,t}| + \alpha_9 |(D^{year})| + \alpha_{10} |(D^{industry})| + \varepsilon_{i,t} \tag{4.13}$$

Definitions of Variables Used

Investment: The dependent variable is measured as a ratio between fixed assets and the total value of capital stock (I/K). Addition to fixed assets is calculated as the difference between the book value of tangible of fixed assets at the end of year *t* and end of year *t-1* plus depreciation of year *t.* The replacement value of capital stock (K) is constructed using the

perpetual inventory formula (Blundell et al., 1992). Tangible fixed assets are used as the historic value of capital stock. By assuming that the replacement cost and historic cost are the same in the first year for each firm, I apply the following formula:

$$K_{i,t+1} = K_{i,t}(1 - \delta)\left(\frac{P_{t+1}}{P_t}\right) + I_{i,t+1} \tag{4.14}$$

where δ is the depreciation rate, which I assume to be constant at 5.5 % for all firms, and P_t represents the price of investment goods, which I proxy with the implicit deflator for gross fixed capital formation.

Cash Flow: Cash flow is used as standard proxy for a firm's internal net worth. It is defined as the ratio of profit after tax plus depreciation to capital stock (CF/K). I may expect that the estimated coefficient of cash flow for constrained firms is higher than the coefficient for unconstrained firms.

Sales: Sales are calculated as ratio of lagged sales to capital (Lagged S/K). As suggested by FHP (1988), a substantial part of investment cash flow study is to add investment opportunity variables to capture investment opportunities.

Leverage: As suggested by Whited (1992), debt policies may play an important role as a proxy for market imperfection. The existing literature states that firms with relatively high leverage are expected to have more difficulty in obtaining external financing. This is calculated as ratio of total liabilities to total assets (total liabilities/total assets). An interaction term between leverage and cash flow is also added to see how the effect of cash flow varies with leverage.

Tangibility: This is calculated as the ratio of total tangible assets to total assets (Hovakimian, 2009). An interaction term between tangibility and cash flow was also added to the investment equation.

***Dummy Crisis Year*:** A dummy variable was created to capture the effects of financial crisis on investment cash flow sensitivity for SMEs in the UK

Selection Equation

The likelihood of a firm being constrained is endogenously determined for each year. The selection equation contains multiple variables to determine the variable that proxies the severity of the informational and agency problem. I include variables that have already been described in section 4.2, such as firm size, age, sales growth, tangibility, and profit margin to indicate leverage.

Selection Equation

$$Y_{it}^{*} = \alpha_0 + \alpha_1 Size_{it} + \alpha_2 Age_{it} + \alpha_3 Tangibility_{it} + \alpha_4 Salesgrowth_{it} + \alpha_5 Salesgrowth_{i,t-1} + \alpha_6 Profit\ Margin_{it} + \varepsilon_{i,t} \quad (4.15)$$

Variable Description

Size: I calculate size as the natural logarithm of a firm's total assets (Titman and Wessels, 1988). According to the static trade-off theory, the cost of financial distress represents the probability of bankruptcy. It is assumed that large firms are less likely to default because these large firms have a greater debt capacity (Titman and Wessels, 1988).

Age: Age is calculated as the natural logarithm of number of years according to each firm's incorporation date (Hall et al., 2004). As a firm survives and grows, the market assesses the firm's capability and the firm may increase the use of leverage to support its growing business.

Tangibility: This is calculated as the ratio of total tangible assets to total assets (Hovakimian, 2009; Chittenden et al., 1996; Michaelas et al., 1999). An interaction term between tangibility and cash flow was also added to the investment equation.

Sales Growth: Sales growth is calculated as the percentage increase of sales turnover (Hall et al., 2004). Current sales growth and lagged sales growth are included in the model to determine the opportunity for investment growth.

Profit Margin: Profit margin is the ratio of profit after tax to sales turnover (Titman and Wessels, 1988). According to pecking order theory, SMEs are more willing to use their internal funds than to look for external funds (Myers, 1984).

4.4 Data and Descriptive Statistics

Balance sheets and income statements were extracted from the FAME dataset published for a large sample of UK SMEs over the period of 2003–2011. This dataset included information from unquoted and unlisted firms. According to the standard OECD definition, a small medium firm is as a firm with less than 250 full-time equivalent employees, total assets of less than €45,000,000, and a turnover of less than €50,000,000. Based on 2007 SIC classifications, I excluded some firms from the financial sector.

The final dataset consisted of 7,185 firms from the years 2003–2011 from a total of 35,136 observed firms. Only active firms are considered in the empirical test to avoid possible survival bias. Outliers were removed from the dataset by trimming the highest and lowest 1% from the distribution of key variables. This is a standard procedure in the literature on financial constraints (Bond et al., 2003; Bhagat et al., 2005; Cummins et al., 2006).

Table 4.1 reports the means and standard deviation of some key variables for all regression variables, while Table 4.2 presents the correlation matrix among key variables used in the estimation across the two firm groups—those with high leverage levels and those with low leverage levels. In general, low-levered firms have higher sales growth and profitability; however, low-levered firms also have lower levels of investment than high-levered firms. As expected, investment and cash flow have a positive correlation, while interestingly; size and investment had a negative correlation, which indicates that small firms had more investment capital expenditures than the large firms in the sample.

Table 4.1 Summary statistics of key variables for low and high-levered firms

This table displays summary statistics for the groups of low- and high-levered firms. Investment is calculated as the ratio of investment to capital. Cash flow is estimated as the ratio of cash flow to capital. Sales were calculated as the ratio of a firm's turnover to capital. Leverage is the ratio of long-term debt over total assets. The natural logarithm of total assets was used as a proxy for firm size. Tangibility is the ratio of tangible fixed assets over total assets; sales growth is the percentage increase/decrease in sales between the two periods; the profit margin is the ratio of profit after tax to total sales.

Firm Classification	Variable	Number of Observations	Mean	Std. Dev.
Low-Levered Firms (Unconstrained)	**Investment**	12,612	0.7912	3.3203
	Cash Flow	12,612	2.2623	10.2564
	Sales	12,612	56.8038	251.9401
	Leverage	12,612	0.0632	0.0618
	Size	12,612	8.6388	0.9460
	Age	12,612	3.1008	0.6996
	Tangibility	12,612	0.2728	0.2217
	Sales Growth	12,612	0.4224	10.1196
	Profit Margin	12,612	0.0233	0.8447
High-Levered Firms (Constrained)	**Investment**	22,524	1.0047	3.6985
	Cash Flow	22,524	5.3157	17.9927
	Sales	22,524	108.2963	310.9499
	Leverage	22,524	0.7430	2.1247
	Size	22,524	8.3204	1.3625
	Age	22,524	3.0030	0.7181
	Tangibility	22,524	0.2067	0.2398
	Sales Growth	22,524	0.1845	8.7885
	Profit Margin	22,524	-0.0019	2.3085

Table 4.2 Correlation matrix of key variables

No	Variables	Correlation Matrix							
		1	2	3	4	5	6	7	8
1	Investment	1							
2	Cash Flow	0.7077	1						
3	Sales	0.6868	0.6556	1					
4	Leverage	0.0125	-0.0158	0.0003	1				
5	Size	-0.0854	-0.0832	-0.0672	-0.1177	1			
6	Tangibility	0.0232	0.0045	0.0011	-0.0371	0.133	1		
7	Sales Growth	0.5224	-0.0049	-0.0052	-0.0013	0.0014	0.0014	1	
8	Profit Margin	0.0046	0.0544	0.0049	-0.0502	0.0244	-0.0028	-0.0179	1

The tangibility level had a negative relationship with leverage, which indicate that as a firm gets larger, it will invest less in tangible fixed assets. This may be because small firms commit to investing more in tangible fixed assets, and as the firms become larger, the level of tangible fixed assets will gradually decrease.

4.5 Empirical Results

4.5.1 The Effects of Leverage on Investment Cash Flow Sensitivity

Table 4.3 Investment cash flow sensitivity and leverage: Endogenous constraint selection

Table 4.3a Selection Equations

Regimes Selection Variables	Model 1		Model 2	
	Coeff	Std.err	Coeff	Std.err
Size	0.3172***	0.0024	0.3261***	0.0024
Age	-0.1265***	0.0038	-0.1494***	0.0038
Tangibility	2.2547***	0.0108	2.7046***	0.0108
Sales Growth	0.2212***	0.004	0.0751***	0.0022
Lagged Sales Growth	-0.0023***	0.0003	0.0051***	0.0003
Profit Margin	-0.0676***	0.0043	-0.1375***	0.006
Constant	-2.5109***	0.079	-2.1779***	0.0792
Model *P*-Value (Likelihood Ratio Test)	0.000	0.000		

This table gives the maximum likelihood estimation results of our two switching regression models (investment equations 4.11 and 4.12 along with the selection equation 4.15). The selection equation determines a firm's likelihood of being in a constrained or unconstrained regime. The dependent variable in the selection equation is coded 1 for the unconstrained investment regime and 0 for the constrained one. A positive coefficient of any selection variable indicates that firms with higher values of that particular variable are more likely to be in the unconstrained regime and vice versa. P-values of the models reject the null hypothesis that a single investment regime is sufficient to describe the data. ***, ** and * indicate significance at the 1%, 5% and 10%, level respectively.

Continue to table 4.4b and table 4.4c

Table 4.3 gives the maximum likelihood estimation results of the switching regression model. The selection model determines the likelihood of a firm being in a constrained or unconstrained regime. The dependent variable in the selection equation is coded 1 for the unconstrained investment regime and otherwise 0, as explained in the methodology section. The observed leverage ratios below the 50^{th} percentile were coded 1 for unconstrained firms and 0 for constrained firms. This is relevant to the theory that the degree of financial constraint is higher for highly leveraged firms (Bhaumik et al., 2005).

A classification of dependent variables is needed to make the initial guess required by the *switchr* package. The package creates its own classification vector based on the selection variables in the Z vector equation. As can be found in the selection equation, a positive coefficient of any selection variables indicates that firms with a high value of that particular variable are more likely to be in financially unconstrained regimes.

The results suggest that size has a significant and positive effect on leverage (H4.1 is supported). Outside investors often see size as a proxy to determine a firm's debt capacity; therefore, large firms should have a greater debt capacity. Large firms also have less difficulty in obtaining external funding because large firms usually have lower transaction costs due to accuracy and transparency. However, age has a negative effect on leverage, which indicates that older firms use less leverage (H4.1 is not supported). The most plausible explanation is that because older firms usually already have stable business, they rely more on internal funds.

Profitability and lagged sales growth have a negative and significant effect on leverage (H4.3 and H4.5 are supported). High-growth firms and profitable firms tend to use their internal funds rather than look for external financing. The results also confirmed that pecking order theory may explain the capital structure choice of SMEs in the UK. Leverage and tangibility also had a positive relationship; thus, hypothesis H4.4 is also supported.

Table 4.3b Investment Equations-Model 1

	Model 1			
	Constrained Regime		Unconstrained Regime	
	Coefficient	St. dev	Coefficient	St. dev
Cash Flow	0.2555***	0.0159	0.0277***	0.0119
Lagged Sales	0.0009***	0.0004	0.0086***	0.0006
Leverage	-0.6863***	0.2774	0.0145	0.0155
Leverage x CashFlow	0.0744	0.0468	-0.0007	0.0029

Two different estimation result for each regimes demonstrate how different the investment behaviour across the two regimes. Industrial dummy and year dummy are also included in the model. ***, ** and * indicate significance at the 1%, 5% and 10%, level respectively

Table 4.3b shows the estimation results of the main regression of the regime-specific investment equation that was derived simultaneously with the selection equation. The results show the investment behavior between constrained and unconstrained regimes. The coefficient of cash flow and lagged sales are positive in both regimes. As can be seen from the results, both regimes show positive and significant effects of cash flow on investment; however, the magnitude of the estimated coefficient is larger in the constrained regime than in the unconstrained regime. This indicates that financially constrained firms are more sensitive to internal fund. The coefficient of lagged sales is positive in the two regimes because for firms to have better investment opportunities in the future, they are expected to invest more.

Investment cash flow sensitivity for financially unconstrained firms was discovered to increase with the leverage level as opposed to decrease as it does in constrained firms. More interestingly, those unconstrained firms have no or little response to leverage levels. The results indicate that unconstrained firms may have more advantage in using debt than constrained firms due to their debt capacity levels. Referring back to the definition of

unconstrained firms as firms that have low leverage, this indicates that those unconstrained firms have not reach their maximum capacity. They are able to get more external financing because outside investors may perceive that these firms have less risk of bankruptcy. Higher leverage makes the agency conflict more severe and prevents managers from making optimal financing and investment decisions.

When tangibility was added to the estimate (See Table 4.3c), it revealed a positive and significant effect on cash flow and investment for both unconstrained and constrained firms; however, the constrained firms were affected to greater degree. However, leverage for both regimes becomes negative and does not significantly affect investment. As expected, tangibility has a negative significance for constrained firms, which indicates the impact of tangibility on the sensitivity of investment to cash flow when a firm is severely financially constrained

Table 4.3c Investment equations–model 2

	Model 1			
	Constrained Regime		Unconstrained Regime	
	Coefficient	St. dev	Coefficient	St. dev
Cash Flow	0.2464***	0.0181	0.0231***	0.0107
Lagged Sales	0.0024***	0.0006	0.0066***	0.0007
Leverage	-0.4987*	0.3000	-0.0031	0.0087
Leverage x Cash Flow	-0.0525	0.034	-0.0054***	0.0017
Tangibility	4.2765***	0.8477	0.1634***	0.0632
Tangibility x Cash Flow	1.1229***	0.2937	0.2062***	0.0354

Two different estimation results for each regime demonstrate the different investment behavior across the two regimes. The industrial dummy and year dummy were also included in the model. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

4.5.2 Ex-Ante Standard Regression

Table 4.4 Investment cash flow sensitivity and leverage: Ex-ante constraint selection

Dependent Variable	Independent Variables				R^2	N
Investment	**Cash Flow**	**Lagged Sales**	**Leverage**	**Leverage x Cash Flow**		
1. Firm Size						
Constrained Firms	0.192***	0.068***	0.128	-0.0936***	0.311	8,945
	(0.004)	(0.0002)	(0.086)	(0.0114)		
Unconstrained Firms	0.0711**	0.00310***	0.0407	-1.15e-06	0.182	7,475
	(0.00289)	(0.000154)	(0.0272)	(0.00142)		
2. Firm Age						
Constrained Firms	0.149***	0.000184***	0.0353	-0.00263	0.286	8,698
	(0.00318)	(3.21e-05)	(0.0472)	(0.00237)		
Unconstrained Firms	0.0587***	0.000293***	0.0467	-0.00376*	0.078	7,722
	(0.00299)	(6.09e-05)	(0.0331)	(0.00197)		
3. Firm Risk (Quiscore)						
Constrained Firms	0.148***	0.000118***	-0.215***	0.0321***	0.393	9,760
	(0.00270)	(3.30e-05)	(0.0442)	(0.00378)		
Unconstrained Firms	0.0342***	0.000159***	0.0525**	-0.00262**	0.038	6,660
	(0.00323)	(3.70e-05)	(0.0244)	(0.00116)		
4. SA Index						
Constrained Firms	0.168***	0.000122***	-0.0223	0.00554	0.350	6,738
	(0.00367)	(3.16e-05)	(0.0584)	(0.00591)		
Unconstrained Firms	0.0753***	0.000319***	0.0600	-0.00292	0.110	9,682
	(0.00275)	(5.53e-05)	(0.0274)	(0.00135)		

Table 4.4 presents the estimation results using the a priori classification scheme. As in our previous estimation results, each of the regression results show that for unconstrained firms, the investment cash flow sensitivity shows little to no response to leverage. Meanwhile, cash

flow has a positive and significant effect on investment; however, the magnitude of the estimated coefficient is larger in constrained regimes than in unconstrained regimes. The interaction between cash flow and leverage attracts a negative sign. The results are fully consistent with the statement that high leverage can increase a firm's probability of default; it can also induce restricted access to external funds (Cleary, 2002).

4.5.3 Financial Crisis and Investment Cash Flow Sensitivity

Table 4.5 Investment cash flow sensitivity and leverage: Dummy crisis

Table 4.5a Selection equation

	Coeff	**Std. Err**
Size	0.3702***	0.0024
Age	-0.1985***	0.0037
Tangibility	2.5730***	0.0106
Sales Growth	0.0417***	0.0017
Lagged Sales Growth	0.0059***	0.0003
Profit Margin	-0.3020***	0.0070
Constant	-0.0492***	0.0589
Model *P*-Value (Likelihood Ratio Test)		0.0000

This table gives the maximum likelihood estimation results of our two switching regression models (investment equations 4.13 along with the selection equation 4.15. The selection equation determines a firm's likelihood of being in a constrained or unconstrained regime. The dependent variable in the selection equation is coded 1 for the unconstrained investment regime and 0 for the constrained one. A positive coefficient of any selection variable indicates that firms with higher values of that particular variable are more likely to be in the unconstrained regime and vice versa. P-values of the models reject the null hypothesis that a single investment regime is sufficient to describe the data. ***, ** and * indicate significance at the 1%, 5% and 10%, level respectively.

To see the effects of crisis in the model, I add dummy increase variables into the estimation. As expected, investment cash flow sensitivity is larger for constrained firms than for unconstrained firms. Tangibility shows little response to investment for unconstrained firms; however, the effect of tangibility on constrained firms is quite significant and has a large magnitude. Interestingly, the dummy crisis shows no effect on investment for both constrained and unconstrained groups. The results confirm that SMEs tend to survive during a crisis period, and that a crisis does not affect or has little effect on their investment behavior.

Table 4.5b Investment equation with dummy financial crisis

	Model 1			
	Constrained Regime		Unconstrained Regime	
	Coefficient	St. Dev	Coefficient	St. Dev
Cash Flow	0.1863***	0.0231	0.0515***	0.0098
Lagged Sales	0.0049***	0.0008	0.0021***	0.0003
Leverage	0.5380	0.9490	0.0314	0.0172
Leverage x Cash Flow	-0.0782**	0.0413	-0.0052***	0.0018
Tangibility	-3.8978***	1.3216	-0.1757***	0.0538
Tangibility x Cash Flow	0.9490	0.2285	0.2519***	0.0328
Dummy Crisis	1.2631	0.9648	-0.0035	0.0553
Dummy Crisis * Cash Flow	-0.0653***	0.0227	0.0175	0.0173
Dummy Crisis * Leverage	1.2860	2.6177	-0.0319***	0.0147
Dummy Crisis * Tangibility	-4.0917***	1.5987	0.0232	0.0812

Two separate investment equations assessed how different firm investment behavior differed across the two regimes. The investment equations are estimated by sector and year dummies and clustering by company. ***, ** and, * to indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 4.6 Investment cash flow sensitivity and leverage: Before and after crisis

Table 4.6a Selection equations

Regimes Selection Variables	Before crisis		After crisis	
	Coeff	Std.err	Coeff	Std.err
Size	0.2850***	0.0021	0.4584***	0.0049
Age	0.0660***	0.0032	-0.1549***	0.0083
Tangibility	5.1838***	0.0096	2.1150***	0.0205
Sales Growth	0.0108***	0.0013	0.0396***	0.0031
Lagged Sales Growth	-0.1224***	0.0006	0.0048***	0.0005
Profit Margin	0.6832***	0.0036	0.2174***	0.0101
Constant	-5.2522***	0.0503	-4.2017***	0.1250

This table gives the maximum likelihood estimation results of our two switching regression models (investment equations 4.11 along with the selection equation 4.15). The selection equation determines a firm's likelihood of being in a constrained or unconstrained regime. The dependent variable in the selection equation is coded 1 for the unconstrained investment regime and 0 for the constrained one. A positive coefficient of any selection variable indicates that firms with higher values of that particular variable are more likely to be in the unconstrained regime and vice versa. P-values of the models reject the null hypothesis that a single investment regime is sufficient to describe the data. ***, ** and * indicate significance at the 1%, 5% and 10%, level respectively

Continue on table 4.6**b**

As a robustness check, I provided separate regression results for before and after the crisis (Table 4.6). Table 4.6a presents the estimation results of the selection equation before and after the 2009 crisis in the UK. The only significant difference is the effect of age on a firm's leverage. Younger firms tend to have more leverage after a crisis period, whereas older firms tend to have more leverage before the crisis. According to pecking order theory, as firms get older, they gain more leverage because of increased creditworthiness; however, a higher leverage level will also increase the agency problem between owners and the lenders. After a crisis period, younger firms tend to have more leverage, as can be seen from the negative and significant effects of age on leverage. Older firms tend to be more careful in getting external loans after a crisis period due to the higher possibility default.

Table 4.6b Main Investment Regression

	Before Crisis			
	Constrained Regime		Unconstrained Regime	
	Coefficient	St.Dev	Coefficient	St.Dev
Cash Flow	0.3592 ***	0.0263	0.0361***	0.0140
Lagged Sales	0.0018***	0.0006	0.0062***	0.0009
Leverage	-0.1967	0.1251	0.0434	0.0289
Leverage x CashFlow	0.1280***	0.0358	-0.0008	0.0029
Tangibility	-0.1877	0.1415	0.5903***	0.1531
Tangibility X CashFlow	-0.2656**	0.1361	0.1457***	0.0540
	After Crisis			
	Constrained Regime		Unconstrained Regime	
	Coefficient	St.Dev	Coefficient	St.Dev
Cash Flow	0.2444***	0.0154	0.0056	0.0177
Lagged Sales	0.0013***	0.0006	0.0076***	0.0008
Leverage	0.7303***	0.1653	-0.0323	0.0252
Leverage x CashFlow	0.0421	0.0591	-0.0151	0.0104
Tangibility	-3.7524***	0.6649	0.2065***	0.0894
Tangibility X CashFlow	-0.1092***	0.0647	-0.0555	0.1594

Two separate investment equations assess how different the firm investment behaviour across the two regimes before and after crisis at year 2009. The investment equations are estimated with sector and year dummies and clustering by company. ***, ** and * indicate significance at the 1%, 5% and 10%, level respectively.

Table 4.6b above presents the main investment models before and after the crisis period. For any condition, cash flow has a positive effect on investment; however, the magnitude of the effect of cash flow on investment for constrained firms and unconstrained firms after the crisis is much smaller than the magnitude of the effect of this variable before the crisis period

4.6 Conclusion

This chapter presents a new perspective to the existing literature by suggesting a new approach to the impact of capital market imperfection on the investment behavior of SMEs in the UK. By using unbalanced panel data that consisted of 7,185 firms, I use the methods described in Hu and Schiantarelli (1998) and Almeida and Campello (2007) to estimate a model that incorporates the factors that reflect the severity of financial constraints in the main equation. In this chapter, I consider leverage to be the factor that reflects the severity of financial constraint. I assume that firms with a high level of leverage to be constrained firms. By using data from SMEs in the UK, I also present different findings because many studies on this subject have used large firms and quoted firms rather than SMEs.

I employed not only the switching regression model, but also baseline regression by using a priori classification. The results show that financially constrained firms' investment is more sensitive to measures of internal financing. Meanwhile, leverage has a more significant effect for constrained firms. Our results also suggest a non-monotonic effect of leverage on cash flow sensitivity, as can be seen by the decreasing level of leverage for constrained firms and the increasing level for unconstrained firms.

The chapter provides important alternative solutions to the controversial issues about the role of cash flow in investment behavior. This study also provides an important resolution to highly debated issues in FHP (1988) and Kaplan and Zingales (1997). By incorporating leverage into the main equation, I may conclude that higher investment cash flow sensitivity for financially constrained firms is not solely generated because of a measurement error issue; I can see that the magnitude of investment cash flow sensitivity decreases with a higher level of leverage. By applying the switching regression model, the results are free from ex-ante classification bias, because the groups of constrained and unconstrained firms are endogenously classified by model. I can also state that investment cash flow sensitivity can still be used to capture the effect of capital market friction on a firm's investment behavior.

CHAPTER 5 INVESTMENT CASH FLOW SENSITIVITY (ICFS), CASH-CASH FLOW SENSITIVITY AND FINANCIAL DEVELOPMENT: CROSS COUNTRY EVIDENCE

5.1 Introduction

The empirical measurement of financial constraint can be traced back to the seminal work by FHP (1988) that investigated the relationship between investment and cash flow by estimating the investment equations as a function of firm's investment opportunity and cash flow. FHP (1998) argued that in particular the investment decisions of firms that are more financially constrained are more sensitive to the availability of internal cash flows than firms that are less constrained. Therefore, the financial constrained firms will display a positive and significant relationship between investment and cash flow, while unconstrained firms will not have a positive propensity to use cash flow to fund the investment.

Since then, many empirical and theoretical researches have been done to test and question the linkage between investment and cash flow. The most well known study by Kaplan and Zingales (hereafter KZ, 1997) provided some contradictory result. They find that least financially constraint firms also have greater investment cash flow sensitivity. They re-examine the relationship between cash flows and investment by using the sample of low dividend firms and find that financially constrained firms have the lowest sensitivity compared to the other groups.

Cleary (1999) also confirmed KZ's finding that least financially constrained firms also exhibit greater cash flow sensitivity. Moreover, Alti (2003) found that the link between

investment and cash flow is still can be found even though a firm does not face a financing constraint condition. Another researches by Moyen (2004) even found a result that supports both FHP (1988) and KZ (1997) by using different criteria to classify firms into constrained group and unconstrained groups. By using data from cross-countries, Cleary (2006) found that constrained firms have lower investment cash flow sensitivity than unconstrained firms. As Alternative to the Investment cash flow sensitivity (ICFS), Almeida, Campello and Weisbach (2004) presented the cash-cash flow sensitity (CCFS). According to CCFS, Financially constrained firms can be identified by the firm's propensity to save cash. Those Financially constrained firms would save more cash to finance its future profitable investment. However, for the unconstrained firms, they will be able to raise external finance needed to finance the future investment.

I use the data from Amadeus, A commercial database provided by Bureau Van Dijk over period 2004-2013. The database has up to 10 years historical data across 38 European countries. I select the data from 14 European countries, namely Austria, Belgium, Germany, Denmark, Spain, Finland, France, United Kingdom, Greece, Hungary, Ireland, Italy, Netherland and Sweden. The final dataset consist of 7,341 firms over year 2004-2013, which covers 48,193 observations with 8,734 firms in 14 European countries. This chapter basically attempts to see the Investment cash flow sensitivity (ICFS) on cross-country level of analysis and the time-series variation, moreover I also would like to see the effect of financial development on this ICFS. As alternative, I also provide the estimation result using cash-cash flow sensitivity as alternative cash flow sensitivities as suggested by Almeida and Campello (2004), Khurana et al (2006) and Baum et al (2011).

Accordance with the main objectives of the thesis, this chapter basically analyzes the degree of financial constraint by using indirect measurement by using cross-country data. The main novelty of this empirical research is by using the cross-country data and adds the financial development in each country that may have an impact on level of financial constraint, which is proxied by the ICFS or any othe4 indirect measurement.

The rest of this chapter proceeds as follow. Section 5.2 presents a brief literature review of financial constraint and investment, with specific emphasis on unlisted firms. Section 5.3 presents the estimation framework and present empirical model to be tested in the paper. Section 5.4 describes the data used in this study and provides the descriptive statistics of the sample data. Section 5.5 provides some empirical result and section 5.6 concludes the chapter.

5.2 Literature Review

5.2.1 Hierarchy of Finance

Modigliani and Miller (1958) theorem stated that under the perfect and complete market as assumptions, a firm's investment decisions are independent from the financing sources. However, later studies find that the market imperfections that was caused by agency cost, information asymmetry and transaction cost will make cost of capital from external sources, debt or equity, higher than the cost of capital from internal sources of financing (Jensen & Meckling, 1976; Stiglitz & Weiss, 1981; Myers and Majluf, 1984).

External financing will be more costly than internally generated funds, thus financially constrained firms will rely on their internal fund to invest in any profitable projects. The hierarchy of finance approach assumes that firms prefer cheap internal finance rather than the

expensive external finance. Firms will follow the "Pecking order hypothesis" when financing the new investment by using internal finance first and then followed by issuing debt and finally will use equity as the last sources of financing. Therefore, the internal finance could be an important determinant of firm's investment.

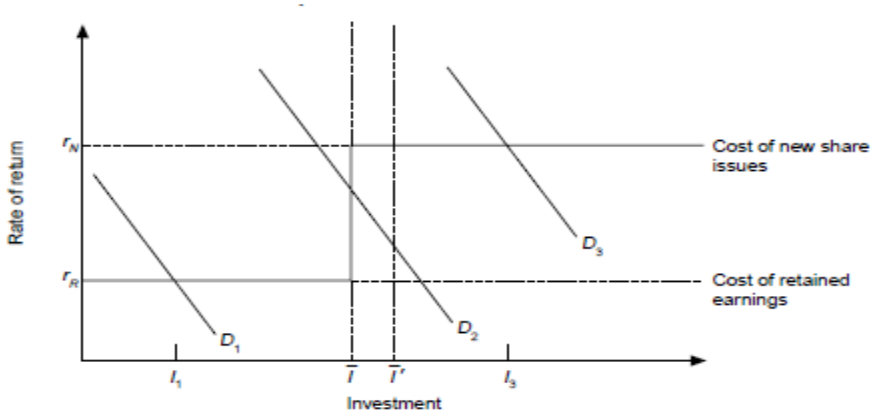


Figure 5.1 The hierarchy of finance without debt finance
Source: Bond and Meghir (1994

Bond & Meghir (1994) illustrated the condition when firm do not have access to debt financing and only rely on retained earnings and new shares as can be seen in figure 4.1. The required rate of return r_R represent the cost of internal funds, while r_N shows the cost of finance from issuing new shares. Assuming I have three different possible investment opportunities relating to the required rate of return as can be seen in the downward sloping line D_1 , D_2 and D_3.

The investment level $\bar{I}$ can be assumed as the point where the maximum level of investment can be financed by internal funds. When the investment level is lower than $\bar{I}$ as can be illustrated in curve D_1, then the firm will be able to finance its desired investment from the available internal fund. At this point, the firm can also still pay some dividend and the

investment is not affected by the volatility of internal cash flow. If the firm has relatively large profitable investment opportunities (See D_3 curve), then it would be sensible to use new share despite having the extra cost of issuing the external fund. At this point, the level of firm's investment is not affected by the changes in internal funds.

The investment opportunity line D_2 illustrates the condition where financial constraint affects the firm's investment. The firm has quite profitable investment at $\bar{I}$', but the level of investment is bigger than the maximum level of investment at $\bar{I}$. Any point above the investment level $\bar{I}$ is not so attractive enough for issuing new shares. Therefore, the firm's investment is constrained to the level $\bar{I}$ that can be financed by the internal fund. When there is an increase in internal funds, the line would shift from $\bar{I}$ to$\bar{I}$' which indicating that there is a shifting of maximum investment that can be financed internally.

According to pecking order theory, the firm prefers to use internal financing, but when the external financing is required, the firm will issue the safest external fund. That is, by issuing external debt before issuing new external equity as the last resort. Figure 4.2 illustrates the condition when I incorporate the debt finance into hierarchy of finance by assuming that the cost of borrowing will increase with the risk of default and the amount borrowed. The level of investment $\bar{I}$ still represent the maximum level of investment that can be financed by internal fund. For the firm with curve D_1 and D_3, the implications are remain the same. The firm with curve D_1 may use debt as well as retained earnings, while the firm with curve D_3 may issue new debt besides issuing new equity.

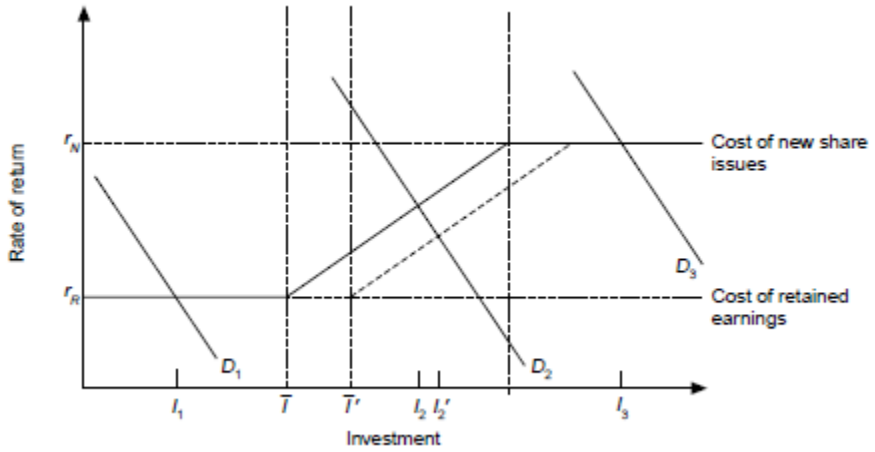


Figure 5.2 The hierarchy of finance with debt finance
Source: Bond and Meghir (1994)

For the firm with curve D_2, may increase the investment level to I_2 by issuing new debt to the extent that the cost of fund is worth enough given the required rate of investment. When the investment shift from I_2 to I_2' that occur when there is a rise in internal finance, the investment level is still restricted by the availability of internal finance, even though the firm now have access to get external debt financing. The debt finance would eliminate financial constraint in investment if only the firm has access to debt finance with the same required rate of return on using internal finance. In this case, the classic Modigliani-Miller (1958) holds when the firm financial structure does not affect the investment.

5.2.2 Investment Cash Flow Sensitivity

Modigliani and Miller's (1958) theorem argued that under the perfect and complete market, a firm's investment decisions are independent of its financial structure. The model assumes that there is symmetric information, no agency or transaction costs associated with the debt-equity mix. However, later studies dropped this assumption and argued that the market imperfections caused by agency costs, information asymmetry and transaction cost will make cost of capital from external sources, debt or equity, higher than the cost of capital from

internal sources of financing (Jensen and Meckling, 1976; Stiglitz and Weiss, 1981; Myers and Majluf, 1984). External financing, incorporating such costs, will be more expensive than internally generated funds. Thus financially constrained firms will rely on internal funds to invest in profitable projects. Additionally, firms that have high asymmetric information will also be more sensitive to internal funds, other things equal. Therefore, it is important to include a measure of internal funds in a model of the firm's investment in the presence of financial market imperfections.

Many studies have been conducted to test whether the availability of internal funds may affect the firm's investment behaviour. However, despite extensive research, the explanation of investment behaviour has not been settled yet. Thus, researchers have started to improve and try various empirical model specifications by modifying the fundamental underlying assumption. Later studies also try to investigate whether the presence of market imperfections also implies that the investment decisions of the firms are also influenced by the existence of financial constraints.

FHP (1988) first adopted an empirical methodology to study the link between investment, cash flows and financial constraint by using sample from US manufacturing firms. The study suggests that the investment decisions of firms that are more financially constrained are more sensitive to the availability of internal cash flows. The methodology involves splitting the sample into sub-samples, according to suitable theoretical priors that characterize constrained and unconstrained firms (i.e., criteria that serve as proxies for capital market imperfections such as dividend policy, net worth, and firm size).

Several reasons why cash flows can be a good predictor of firm's investment may be because of firm cannot predict the future and prefer to base their investment based on current-period indicator and firm become carefully depend on external financing (Coad, 2010), or maybe because managers are reluctant to distribute dividend and spend cash flow on investment (Jensen, 1986). However, FHP gave interpretation that any sensitivity of investment to cash flows is due to financial constraint.

One limitation of FHP study is the choice of sample. Their final sample consist of listed large firms in US stock market and found that smaller firms should be the subject to a financial constraint. They stated that "only the largest and most mature firms are likely to face a smoothly increasing loan interest rate...during period of tight credit, small medium sized borrowers are often denied loans in favour of good quality borrower" (FHP 1988, p.153). The policy implication of FHP findings that can be established to increase the investment opportunities for financially constrained firms is by offering assistance to those financially constrained firms. In later years, many studies are conducted by referring to FHP study (Whited, 2006), some of them support the FHP findings (Bond and Meghir, 1994; Gilchrist and Himmelberg, 1995) but there are also some studies contradicts their findings (Kaplan and Zingales, 1997, Cleary, 1999).

One of the extensive critics for FHP model was provided Kaplan and Zingales (1997). This study uses a formal framework that accounts for firm type (by using an exogenously determined indicator for the cost of internal capital) and argue that an investment-cash flow sensitivity measure of financing constraints may be flawed. Moreover, the findings show that when firms are split according to size and earnings retention policy, investment in firms that are expected to be more financially constrained is less sensitivity to cash flow than in less

constrained firms. KZ suggest that, if the relationship between investment and internal finance is not presence, then the observed sensitivity may be due to non-optimizing management behavior or excessive managerial conservatism. In general, a firm is defined to be financially constraint if a windfall increase in the supply of internal funds results in a higher level of investment spending. KZ also present the theoretical model to show that any sensitivity of investment to cash flows should not be interpreted as evidence of financial constraints.

In order to empirically test financial constraint and investment behavior, it is crucial important to accurately measure firm's investment opportunities. I need to fully control the investment opportunities, so that the significance of cash flow is not reflecting future profitability but the effect of information problems. Moreover, I also need have challenge to measure financial constraint in order to split sample into financially constrained firms and not financially constrained firms. Selecting a proper proxy that reflecting the level of information asymmetry faced by firms is not an easy task. Empirical evidence show that size, age, dividend policy and affiliation to industry groups are some good proxies, however the usefulness of these proxies is not robust and they tend to present different findings across datasets and countries. The existing literature of investment cash flow sensitivity identifies three empirical models of investment: The Q model, Euler model and the error correction model. The detail explanation of both models will be discussed in the next section.

5.2.2.1 Empirical Model of ICFS

One of the first empirical models in investment is the accelerator model (as used by Hobdari et al., 2010), which explains investment using current and lag changes of sales growth. However, it is said lack of convincing theoretical background. Afterward, Q theory arises as

dynamic investment model, which is developed by introducing the convex adjustment cost of capital into neoclassical investment model. According to the Q theory, no other variables including financial variables such as cash flow should be a significant determinant of investment. If the cash flow is statistically significant, I then may interpret it as evidence for financial constraint. It is very important to use sample splitting criteria then I would expect that firms that are classified as financially constrained firms to have a positive and significant cash flow coefficient and the non-financially constrained firms will have no significant cash flow coefficient.

Early research on investment cash flow sensitivity use the Q-model to test the hypothesis of the financial constraint. This model uses some proxies for investment opportunities that have been proposed in the literature, the model try to test whether the remaining cash flow effect after controlling for the investment opportunities can be considered as an adequate proxy measure the existence of financial constraint. However, the widely knows investment opportunities proxies, such as Tobin's Q and fundamental Q cannot be used for unlisted firms because the market values are not commonly available, therefore I need to identify different proxies for investment opportunities that can be used to test Investment cash flow sensitivity for unlisted firms. The general statement of the Q model is as follow:

$$\frac{I_{i,t}}{K_{i,t}} = \alpha_1 + \beta_1 Q_{i,t} + \beta_2 \left(\frac{CF_{i,t}}{K_{i,t}} \right) + \varepsilon_{i,t} \qquad (5.1)$$

Where $I_{i,t}$ is the level of investment of firm i at time t, whereas $K_{i,t}$ is the value of invested asset for firm i at the end of time t , $Q_{i,t}$ is tobins-q as proxy for investment opportunities and

$CF_{i,t}$ represent firm i's cash flows at time t. β_1 is expected to be positive and significant to reflect that a rise in future profitability should be followed by an increase in investment. β_2 is also expected to be positive and significant, then I may conclude that there is investment cash flow sensitivity.

The main advantage of the Q model is that result is more informative because it is uses some information from the capital market. However, when using the Q model to analyse the investment cash flow sensitivity for unlisted firms, I need to find another proxies that represent the expected value of future profitability. Some existing researches on unlisted and small firms use sales to capital ratio or sales growth as proxies for future profitability.

Bond and Meghir (1994) presented the Euler equation model as an alternative methodology to assess the investment cash flow sensitivity. The Euler equation model is derived under the idea that the error tern in the Euler equation reflects expectation error and should be orthogonal to available information. Some studies prefer the Euler model since it does not rely on firm's market value to measure expected profitability, therefore it can be used for unlisted firms which information problem is likely to be particularly severe. (Alti, 2003; Whited and Wu, 2006). The basic specification of the Euler model is as follows:

$$\frac{I_{i,t}}{K_{i,t}} = \alpha_1 + \beta_1\left(\frac{I_{i,t-1}}{K_{i,t-1}}\right) + \beta_2\left(\frac{I_{i,t-1}}{K_{i,t-1}}\right)^2 + \beta_3\left[\frac{CF_{i,t-1}}{K_{i,t-1}}\right] + \beta_4\left[\frac{S_{i,t-1}}{K_{i,t-1}}\right] + \beta_5\left[\frac{D_{i,t-1}}{K_{i,t-1}}\right]^2 + \varepsilon_{i,t} \quad (5.2)$$

where $S_{i,t}$ is the sales level of firm i at time t and $D_{i,t}$ total debt of firm i at the end of time t. Assuming there are capital market imperfections and the external supply of capital is upward sloping, β_3 should be positive and statistically significant.

As alternative to the Q model and Euler model, the error-correction model was introduced by Bean (1981). Basically the model tries to look for a long run or target capital stocks and it also allows the flexible specification of the dynamic adjustment. When I assume that the that the adjustment cost is not exist, the firm's desired capital stock will follow this form:

$$K_{it} = S_{it} - \theta C_{it} + v_i \qquad (5.3)$$

K_{it} represents the logarithm of firm's capital stock, C_{it} represents the cost of capital and S_{it} is the natural logarithm of sales . v_i is a firm-specific effect.

When the adjustment costs is not absence, the firm will not be able to immediately adjust the capital stock to the desired target level. In this case, I may need to have a dynamic adjustment mechanism between the firm's capita stock and firm's sales (K_{it} and S_{it}) as an autoregressive distributed model with lags. So that equation (5.3) will be nested as a long run equilibrium model.

Empirical studies from Bond et al (2003) and Guariglia (2008) used the Error correction model. Basically, when I attempt to empirically test the financial constraint, I need to augment the basic empirical specification of error-correction model with the cash flow to capital ratio. Moreover, to see the differential effect of the cash flow on different type of firm, I also need to add some dummy variable that capture the degree of financial constraint severity and some interaction variables between dummy variables and cash flow to capital

variable. For unconstrained firms, the coefficient of cash flow variable is expected to be small and insignificant, while I expect the significant coefficient for constrained firms.

5.2.2.2 Financial Development and ICFS

King and Levine (1993), using data on 80 countries for the period of 1960-1989, examined whether higher levels of financial development are positively associated with economic growth by using four indicators of financial development to measure the services provided by financial intermediaries. The results indicated that higher levels of financial development are positively related with faster rates of economic growth, physical capital accumulation and economic efficiency.

Meanwhile, the work carried out by Love (2003) investigated the effect and the role of financial development on investment decisions considering its effects on the degree of financial constraint. Using data from 40 countries for the period of 1988 to 1998, She found that the level of financial constraints lessens with higher financial development and small firms are at a disadvantage when compared to larger ones in economies with lower financial development.

Khurana, Martin and Pereira (2006) investigated the role of financial development on firms‘ financial constraints. Using firm-level data for 35 countries and with information about 12,782 firms for the period of 1994-2002, they examined the influence of financial development on the demand of firms for liquidity through an analysis on how financial development affects the sensitivity of cash holdings to firms‘ cash flows. The findings showed that financial development is related to firm‘s financial constraints because the sensitivity of firms‘ cash holdings to their cash flows decreases with financial markets development. Becker & Sivadasan (2006) investigated this possibility of the financial

development may relaxes the connection between internal resources and firm investment, by using firm level data from 38 European countries, they found that there is a positive and significant coefficient of cash flow on investment. They also found that the cash flow sensitivity of investment is lower in a country with better finance, which may suggest that investment is more likely to be constrained in countries with worse financial system.

Although studies as mentioned above show that obstacles in credit markets are correlated with a country‘s financial development, there have been only few firm-level studies that investigate both the effect of financial development and financial structure on the level of firms‘ financial constraints, as pointed out by Baum, Schäfer and Talavera (2009). To overcome this issue Baum, Schäfer and Talavera (2009), using a sample of 80,000 firm-years from 1989 to 2006, tested how the financial system‘s structure and the development of financial markets influence firms‘ financial constraints. The authors estimated the firms‘ cash flow sensitivity of cash and found that a country‘s financial system, measured both by its financial structure and financial development, influences the cash flow sensitivity of cash of financially constrained firms but do not affect unconstrained ones. The findings also suggested that bank-based financial systems provide easier access to external financing for financially constrained firms and that both the structure of the financial system and its level of development play a crucial role in reducing firms‘ financial constraints.

Therefore, given the scarce international literature about financial development and investment decisions under financial constraints, this chapter try to contribute to the literature by analyzing using cross-country data. Another issue arises when taking into account the financial system variable into investment cash flow sensitivity is about selecting the best financial development indicator that represent the condition of financial system in some particular countries. Some of the variables that can be used as indicator of financial system

condition are the ratio of domestic credit provided by the financial sector over GDP (%), the ratio of domestic credit to private sector over GDP (%) and the ratio of domestic credit to private sector by banks over GDP level of the countries (%).

5.3 Model Specification

5.3.1 Baseline Equation

Most of studies of investment cash flow sensitivity is based in panels of listed firms. A very small number of studies focus on small business (Guagrilia, 2008; Becchetti et al., 2009). SMEs have unique characteristics because they are subject to more severe asymmetric information problems than large firms, particularly large quoted companies. This results in greater difficulties in getting external financing. Moreover SMEs also have lower borrowing capacity because of poor track record system and (being more frequently in the service industries) also have lower collateral value.

However, focus on SMEs to assess the investment cash flow sensitivity could be challenging in a way I should find a suitable control variable for firm's investment opportunities. Since market information is not available this makes it impossible to compute traditional proxies of investment opportunities. I estimate the investment cash flows sensitivity by using the Accelerator model as alternative to the Q model. I include the ratio of lagged sales to replacement value of capital stock as an independent variable in the investment equation. It can be expressed as follow:

$$\frac{I_{i,t}}{K_{i,t}} = \alpha_1 + \beta_1\left(\frac{CF_{i,t}}{K_{i,t}}\right) + \beta_2\left(\frac{S_{i,t-1}}{K_{i,t}}\right) + \varepsilon_{i,t} \qquad (5.4)$$

Where $I_{i,t}$ is the level of investment of firm i at time t, whereas $K_{i,t}$ is the value of invested asset for firm i at the end of time t , $CF_{i,t}$ represent firm i's cash flows at time t and $S_{i,t-1}$ is the value of sales of firm i at time t-1. The ratio of lagged sales to capital stock is designed to reflect the sales accelerator theory of investment and has been used as a determinant for investment in Hoshi et al (1991), Kadapakkam et al (1998) and Guariglia (2008). I expect that β_2>=0 to indicate that higher cash flows (internal funds) are a significant determinant of higher investment. The also expect β_3>=0 because an increase in firm's sales should lead to an increase in firm's investment.

5.3.2 The Cash Cash-Flow Sensitivity

By using the a perspective from demand for liquidity, Almeida, Campello and Weisbach (2004) presented that financially constrained firms can be identified by the firm's propensity to save cash. If a firm were categorized as financially constrained firm, then this firm would save more cash to finance its future profitable investment. However, for the unconstrained firms, they will be able to raise external finance needed to finance the future investment. Therefore, I should expect the positive relationship between cash stock and cash-flow for constrained firm, hence I may conclude that the cash cash-flow sensitivity (hereafter CCFS) can be considered as alternative measure of financing constraint. (Almeida et al, 2004; Khurana et al, 2006; Baum et al, 2011). Following Almeida et al (2004), the basic model of CCFS is as follow:

$$\frac{\Delta Cash_{it}}{TA_{it}} = \beta_1 \left(\frac{CF_{it}}{TA_{i,t}}\right) + \beta_2 q_{it} + \beta_3 \left(\frac{x_{it}}{TA_{i,t}}\right) + \varepsilon_{it} \qquad (5.5)$$

Where $\frac{\Delta Cash_{i,t}}{TA_{i,t-1}}$ denotes the change in firm's stock of cash over total asset, $\left(\frac{CF_{i,t}}{TA_{i,t}}\right)$ represent cash flow divided by the total asset, $q_{i,t}$ is the Tobin's q and $\left(\frac{X_{i,t}}{TA_{i,t}}\right)$ contain control variables including size, source, demand and substitute of firm's cash stock.

The main advantages of this model is it is very easy to estimate and data is can be easily taken from the firm's financial statement. However, the problem may arise when using a priori classification when classify firm into constrained and unconstrained groups, such as the endogeneity problem and estimation biases. When applying the model for unlisted firm, I also have to select carefully the proxy that represents the future opportunity investment. Some empirical papers have empirically test the validity of this measure. For example, Pal and Ferrando (2010) found that all firms show positive and significant CCFS, meanwhile Lin (2007) found that the sensitivity of cash stock to cash flow tend to be higher for constrained firms.

5.4 Data and Descriptive statistics

Balance sheets and income statement for EU countries were taken from Amadeus, A commercial database provided by Bureau Van Dijk over period 2004-2013. The database has up to 10 years historical data across 38 European countries. According to the standard OECD definition, a SME is defined as a firm with less than 250 full time equivalent employees, total asset less than €45,000,000 and turn over less than €50,000,000. Amadeus contains financial information on about 2.6 million private and publicly owned firms across euro area countries. Collecting standardized data received from vendors of each European country creates data. I select the data from EU zone, however I exclude a country with less than 100 observation. Finally, I only use data from 14 European countries, namely Austria, Belgium, Germany, Denmark, Spain, Finland, France, United Kingdom, Greece, Hungary, Ireland, Italy, Netherland and Sweden. The sample composition per country can be found in appendix E.

Based on major industry classification, I exclude some firms from the financial sectors and service sectors. The list of major industry classification can be found in appendix C. The final dataset consist of 8,687 firms over year 2004-2013, which covers 48, 193 observations in 14 European countries. Outliers were removed from the dataset by trimming the highest and lowest 1% of the distribution of the key variables. This is a standard procedure in the literature on financing constraints (Bond et al., 2003; Bhagat et al., 2005: Cummins et al., 2006).

Table 5.1 Summary statistics of key variables

This table displays summary statistics for all firms in 14 European countries. IK is calculated as investment to capital. CFK is estimated as cash flow to capital. S1K is calculated as ratio of firms' lagged turn over capital. Leverage is measured as total debt over total asset. Natural logarithm of total asset is used as proxy for firm's size. Log of employee can also be used as another alternative for size of the firm. Cash holding is calculated as cash over total asset, while coefficient of variation is used to measure cash volatility.

Variable	Obs	Mean	Std. Dev.
IK	48,193	1.055	15.800
CFK	46,518	3.961	66.703
S1K	39,830	102.824	708.432
Leverage	48,092	0.291	0.332
Log of total asset	48,193	9.017	0.820
Log of employee	46,721	3.833	1.022
Cash holding	46,786	0.129	0.156
Cash volatility	47,926	0.905	0.549

I calculate investment ($I_{it:}$) as the change in the real tangible fixed assets plus depreciation. Cash flow (CF_{it}) is calculated as the sum of profit after tax plus depreciation. I measure the replacement value of capital stock (K_{it}) is proxy by real tangible fixed assets. Sales. ($S_{it:}$) is the total real sales turnover of the firm.. I defined Size lnTA as logarithm natural of firm's total asset. Age is logarithm natural of firm age since incorporation date.. Leverage ratio (Lev) is calculated as the book value of total long-term liabilities divided by firm's fixed asset. Change in cash holding is defined as the cash holding by the firm in each period. IK is defined as ratio of investment over replacement value of capital stock. S1K is measured as lagged sales over replacement value of capital stock. Table 5.1 reports summary statistics for

the main variables used in the analysis. The detail descriptive statistics of main variables per country can be found in appendix F.

5.5 Empirical Result

5.5.1 All sample Estimation

Table 5.2 Estimation result of investment cash flow sensitivity for the whole sample

This table gives the estimation result for the all sample (See equation 5.4). The dependent variable is IK, which is defined as investment over capital. All regression includes dummy variables for country, year and industry. I use FE regression to estimate the model. ***, ** and * indicate significance at 1%, 5% and 10%.

Variable	All country
CFK	0.032***
	-0.001
S1K	0.008***
	-0.000
Industry dummy	yes
Year dummy	yes
Country dummy	Yes
Observations	38,565
R-squared	0.176
Number of id	8,093

I do not classify the sample into two different groups, constrained and unconstrained firms, because the main objective of this study is to see the magnitude of investment cash flow sensitivity across countries. As can be seen from Table 5.2, there is a positive and significant effect of cash flow on investment after controlling for the industry-year and country dummies. It indicates that firms tend to invest more on average when they have higher cash flow and I may say that there is some kind of financial constraint for the firm in 14 European countries or I also say that there is some friction in the financial market.

Table 5.3 Estimation result of investment cash flow sensitivity for manufacturing and non-manufacturing firms

This table gives the estimation result for the manufacturing and non-manufacturing firms in the sample (See equation 5.4). The dependent variable is IK, which is defined as investment over capital. All regression includes dummy variables for country, year and industry. I use FE regression to estimate the model. ***, ** and * indicate significance at 1%, 5% and 10%.

	Manufacturing Firms	**Non-Manufacturing firms**
CFK	0.251***	0.084***
	-0.004	-0.001
S1K	-0.007***	0.007***
	-0.000	-0.000
Industry dummy	yes	yes
Year dummy	yes	yes
Country dummy	yes	yes
Observations	10,501	28,064
R-squared	0.254	0.239

To see the different effect of cash flow on investment between manufacturing and non-manufacturing firms, I estimate the main baseline equation for manufacturing and non-manufacturing firms. As expected, the manufacturing firms have higher magnitude of cash flow on investment, whereas non-manufacturing firms has a slight lower magnitude.

Table 5.4 shows the baseline regression with additional variable as proxy for financial development. I use three different proxy of financial development, namely DCFS, DCPS and DCPS. DCFS is the ratio of domestic credit provided by the financial sector over GDP (%), DCPS is the ratio of domestic credit to private sector over GDP (%) and DCPSB is the rati of domestic credit to private sector by banks over GDP level of the countries (%)[12]. The law,

[12] All the data are taken from World Bank database. http://databank.worldbank.org/data/home.aspx

finance and economic growth literature have mentioned that the ability of a firm to raise external capital is strongly affected by the legal and economic environment.

Domestic credit provided by the financial sector (DCFS) includes all credit to various sectors on a gross basis. The financial sector here is defines as monetary authorities and deposit money banks, as well as other financial corporations (such as: finance and leasing companies, money lenders, insurance corporations, and pension funds) that provide money to the creditors. Domestic credit to private sector (DCPS) means all financial resources provided to the private sector by financial corporations, while Domestic credit to private sector by banks (DCPSB) refers to financial resources provided to the private sector by other depository corporations (deposit taking corporations except central banks). The estimation suggests that the magnitude of cash flow to investment is lower by adding the financial development proxies into main baseline equation. By using the whole sample, the coefficient of cash flow is 0.0324, while when adding interaction variables of CFK with DCFS, DCPS and DCPSB, I see that the coefficient of cash flow is at 0.0160, 0, 0199 and 0, 0200. However, the interaction variables between CFK and financial development are positive and significant, which indicates that higher financial development does not reduce the cash–flow sensitivity of investment. This result is in contrast with the study from Becker & Sivadasan (2006).

Table 5.4 Estimation result for investment and cash Flow: The effect of financial development

This table gives the estimation result for the whole sample by adding the financial development proxies. DCFS is the ratio of domestic credit provided by the financial sector over GDP (%), DCPS is the ratio of domestic credit to private sector over GDP (%) and DCPSB is the ratio of domestic credit to private sector by banks over GDP level of the countries (%). I use FE regression to estimate the model. ***, ** and * indicate significance at 1%, 5% and 10% .

Variable	**DCFS**	**DCPS**	**DCPSB**
CFK	0.016***	0.019***	0.020***
	-0.004	-0.003	-0.00385
S1K	0.007***	0.007***	0.007***
	-0.000	-0.000	-0.000
CFK*DCFS	0.010***		
	-0.003		
CFK*DCPS		0.008***	
		-0.003	
CFK*DCPSB			0.008***
			-0.003
Industry dummy	yes	yes	yes
Year dummy	yes	yes	yes
Country dummy	yes	yes	yes
Observations	28,539	28,539	28,539
R-squared	0.123	0.123	0.123

5.5.2 Cross Country variation

Table 5.5 Estimation result of investment cash flow sensitivity per-countries

This table gives the estimation result for each country (See equation 5.4). The dependent variable is IK, which is defined as investment over capital. All regression includes dummy variables for year and industry. I use FE regression to estimate the model. ***, ** and * indicate significance at 1%, 5% and 10%.

	Austria	**Belgium**	**Germany**	**Denmark**	**Spain**
CFK	0.367***	0.104***	0.686***	0.011***	1.003***
	-0.024	-0.002	-0.0138	-0.004	-0.030
S1K	0.009***	-0.007***	-0.001	-0.001**	0.019***
	-0.002	-0.001	-0.001	-0.001	-0.002
Industry dummy	yes	yes	yes	yes	yes
Year dummy	yes	yes	yes	yes	yes
Country dummy	No	No	No	No	No
Observations	272	3,130	1,248	677	910
R-squared	0.570	0.405	0.843	0.031	0.635
Number of id	67	535	245	259	170
Variable	**Finlandia**	**France**	**Great Britain**	**Greece**	**Hungaria**
CFK	-0.298***	0.075***	0.024***	0.0868***	0.266***
	-0.015	-0.003	-0.002	-0.006	-0.034
S1K	0.027***	-0.001***	0.005***	-0.001**	0.002
	-0.001	-0.000	-0.000	-0.001	-0.002
Industry dummy	yes	yes	yes	yes	yes
Year dummy	yes	yes	yes	yes	yes
Country dummy	No	No	No	No	No
Observations	1,708	3,740	11,601	338	225
R-squared	0.34	0.148	0.084	0.464	0.425
Number of id	305	585	3,089	62	47
Variable	**Ireland**	**Italy**	**Netherlands**	**Sweden**	
CFK	0.031***	0.001**	0.181***	0.035***	
	-0.004	-0.001	-0.034	-0.0017	
S1K	0.004***	0.002***	0.027***	0.012***	
	-0.001	-0.000	-0.002	-0.001	
Industry dummy	yes	yes	yes	yes	
Year dummy	yes	yes	yes	yes	
Country dummy	No	No	No	No	
Observations	173	4,236	184	9,752	
R-squared	0.442	0.124	0.671	0.423	
Number of id	39	640	59	1,907	

Our sample covers 14 European countries with different characteristic. In Table 5.5, I present the country wise result for the baseline investment equation per country. Finland is the only country that exhibits the negative relationship between investments and cash flow, which interestingly Finland has the lowest percentage of DCPS. (See table 5.6) While the other 14 countries have a positive and significant sign of cash flow on investment. Spain has the highest magnitude of cash flow on investment, while Italy has the lowest one. As also can be seen from table 5.6, the high income countries such as the Netherlands, Denmark, Ireland, United Kingdom and Spain has high percentage of DCPS which indicating that those countries are considered as country with high degree of financial development. For example, Denmark with the highest DCPS during 2004-2013 also exhibits a small coefficient of cash flow to investment. This means that the degree of financial development indeed has an effect to the magnitude of ICFS.

Table 5.6 Domestic credit to private sector (% of GDP)

Countries	Year									
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Austria	105.97	115.63	116.37	115.44	120.29	126.00	122.82	120.35	118.45	115.48
Belgium	71.19	73.76	82.03	90.89	93.90	97.49	94.49	92.75	92.26	92.33
Germany	112.93	112.59	109.60	105.25	108.61	113.42	106.98	103.81	101.09	95.58
Denmark	158.16	171.78	185.68	202.50	216.32	223.87	215.96	208.38	205.19	202.80
Spain	124.86	145.65	166.98	187.89	202.84	212.35	215.06	209.24	192.54	176.37
Finland	67.60	75.05	78.80	81.52	85.98	93.89	95.71	97.04	99.32	102.14
France	90.61	92.67	98.43	105.58	108.76	111.55	114.21	115.90	115.96	114.26
United Kingdom	149.53	156.80	168.10	184.29	208.37	210.28	199.87	184.29	176.78	165.18
Greece	70.79	79.59	85.24	93.91	97.41	94.28	118.65	121.88	120.96	122.85
Hungary	45.94	51.25	55.60	62.57	69.80	69.51	69.37	66.21	56.75	52.10
Ireland	133.52	160.05	181.20	199.17	219.96	232.10	212.18	199.73	185.73	179.04
Italy	84.83	88.99	94.47	100.57	104.75	110.97	123.21	122.59	124.73	121.45
Netherlands	157.83	165.04	167.19	188.06	193.16	214.15	200.01	199.33	199.76	189.86
Sweden	101.33	107.86	112.81	121.47	127.64	136.23	135.40	136.64	138.90	140.36

5.5.3 Time series variation

Table 5.7 investment cash flow sensitivity before and after crisis year 2008

This table gives the estimation result for whole sample that is divided into two different main periods (See equation 5.4). The dependent variable is IK, which is defined as investment over capital. All regression includes dummy variables for year and industry. I use FE regression to estimate the model. ***, ** and * indicate significance at 1%, 5% and 10%.

Variable	Period 2004-2008	Period 2009-2013	P-value
CFK	0.006***	0.123***	0.000***
	-0.002	-0.002	
S1K	0.006***	0.004***	
	-0.001	-0.000	
Industry dummy	yes	yes	
Year dummy	yes	yes	
Country dummy	yes	yes	
Observations	14,178	24,387	
R-squared	0.063	0.236	
Number of id	5,366	7,626	

Table 5.7 presents the main investment models before and after the crisis period in order to see the time series variation of ICFS. For any condition, cash flow has a positive effect on investment; however, the magnitude of the effect of cash flow on investment after the crisis is much bigger than the magnitude of the effect of this variable before the crisis period. I see that the investment cash flow sensitivity has increased and not disappeared, especially after the crisis period. The result do not support the study from Chen and Chen (2012) that found a decline in ICFS in the US and the decline is not explained by factors such as measurement error in Tobin's q, governance improvement, and the introduction of new financing channel

5.5.4 Cash-Cash Flow Sensitivity

As alternative to the ICFS model, I also provide the CCFS estimation result in Table 5.8 for the whole sample. As I see the positive sign between cash holding and firm's cash flow, I may argue that there is some kind of financial constraint in the market and I may conclude that the cash cash-flow sensitivity (hereafter CCFS) can be considered as alternative measure of financing constraint. (Almeida et al, 2004; Khurana et al,2006; Baum et al, 2011).

Table 5.8 Cash-cash flow sensitivity estimation result

This table gives the estimation result for cash –cash flow sensitivity a (See equation 5.5). The dependent variable is cash holding which is defined as cash holding over total asset. In column 2, I also include cash flow volatility as proxy for expected future cash flow. All regression include dummy variables for year and industry. I use FE regression to estimate the model. ***, ** and * indicate significance at 1%, 5% and 10% .

Variables	1	2
CFK	0.003 ***	0.003***
	-1.08E-05	-1.08E-05
S1K	0.002**	0.001***
	-9.52E-07	-9.45E-07
Leverage	-0.062***	-0.060***
	-0.002	-0.002
Size	-0.011***	-0.012***
	-0.001	-0.001
Cash volatility		-0.064***
		-0.002
Industry dummy	yes	yes
Year dummy	yes	yes
Country dummy	yes	yes
Observations	37,459	37,434
Number of id	7,980	7,965

Following Almeida et al (2004). Leverage has negative and significant effect on cash holding that indicating firms having access to external finance not feel essential to hold more cash. By adding the cash flow volatility, this study also argues that the demand for external finance does not only depend on current cash flow, but also on expected future cash flow. I use the cash flow volatility as the variable represent a cash flow shock and expected future cash flow. The results suggest that that cash flow stock has negative and significant effect on cash holding. This means that firms will hold fewer amounts of cash if they expect that there is shock in cash flow. Despite holding cash, the firms may prefer to hold other asset with higher level of return.

5.6 Conclusion

This chapter presents the investment cash flow sensitivity (ICFS) for 14 European countries. Not only to see the magnitude of cash flow on investment on the basis of countries and time variation, but also I attempt to see whether of financial development has an effect on investment cash flow sensitivity. As alternative, I also provide the estimation result using cash-cash flow sensitivity as alternative measurement of financial constraint in EU area.

I use the data from Amadeus, a commercial database provided by Bureau Van Dijk over period 2004-2013. I select the data from 14 European countries with 48193 firm year observations. The result suggest that here is a positive and significant effect of cash flow on investment after controlling for the industry-year and country dummies which indicating that there is some friction in the financial market in EU area. When I observe the investment cash flow sensitivity across 14 countries, the result may vary in terms of magnitude and significance level, however majority of the countries have a positive and significant effect on cash flow on investment. As alternative measure of financial constraint, I also estimate a

model of cash-cash flow sensitivity and the result find that there is positive and significance relationship between cash holding and cash flow.

The decreasing trend of the effect of cash flow on investment cannot be found then I may suggest that investment cash flow sensitivity still can be used as a measure of financial constraint. However, it is strongly suggested to use longer data period in order to make a conclusion that there is possibility that investment cash flow sensitivity has disappeared in recent year. Future works can be done to see why investment cash flow sensitivity does exist in the past but show decreasing trend in recent years.

CHAPTER 6 CONCLUSION

The main objective of this thesis is to study the impact of financial market imperfections on SMEs by employing different empirical strategies and econometric techniques into four empirical papers in order to answer and fulfill the three objectives that have been mentioned in chapter 1. The first objective is to measure the degree financial constraints faced by SMEs using direct and indirect measurement. Secondly, it aims to find out the effect of financial constraint, firm-specific and human capital factors on SMEs Performance and lastly, it has an objective to identify the factors that may in turn alleviate the financing constraints for SMEs

I present four empirical papers with three different dataset. For the first two chapters, I use the data from a survey of 9,417 French start-up firms by the French National Institute of Statistical and Economic studies. For the third empirical chapter, I use the switching regression approach to estimate the investment cash flow sensitivity of SMEs in the UK. The last empirical paper basically discuss the investment cash flow sensitivity in the EU area and the final chapter summarizes the major findings from four empirical chapters of the thesis and also presents their plausible limitations.

6.1 Summary and Limitation

In the first empirical chapter, I develop and estimate a model of SMEs survival under credit rationing. Debt rationing is identified in a novel, two-stage procedure: firstly the causes of start-up loan refusal are identified and related to rationing via bank lending practices (collateral) and project quality (human capital of the entrepreneur. At the second stage, I use the rationing variable in estimating the hazard of survival. Following Evans and Jovanovic (1989) and Cressy (1996, 2006). There is no doubt that defining the credit rationing exists

and the determinant of credit rationing is very complex. However, as this result finds, I can say that asset and human capital based credit-rationing does exists, but the probability of loan refusal will mitigate by having greater assets, having more pledged collateral and better human capital.

SMEs often fail to grow due to a lack of the supporting environment that is needed to grow. Improving management skill can be done through human development and increase access to finance, whereas improving the business environment can be done by improving the investment climate, for example, by ensuring that there will be a full support for SMEs. Providing support to the SMEs owner including the programme to develop human capital may lead to endogenous growth and greater innovation.

I am also aware of some possible limitations from this study. Even the use of some explanatory variables for the determinant of loan refusal and firm survival in the model could explain the determinant for the loan refusal and firm's survival, a different set of variables, maybe more detailed variables, could provide further insight about the determinant of loan refusal and survival. I need the longitudinal dataset to study the issue in firm dynamic area, however this kind of dataset is very rare. Using more recent data may also give further insight to the area of study.

In the second empirical chapter, by using the dataset from chapter 2, this chapter estimates two different models to measure the disequilibrium loan market for short-term and long-term bank loans for panel data set consisting of 9417 French start-up SMEs. The novelty of this study is I am not only including the firm-specific variable but also human capital indicator into main disequilibrium model. The result suggests that collateral and human capital both

have effect on demand and supply of bank debt, thus collateral and good human capital indicator may alleviate the problem caused by the asymmetric information problem.

In the third and fourth empirical chapter, I use the indirect approach to measure the financial constraint for SMEs. In the third empirical chapter, I use switching regression approach to classify the sample into constrained and unconstrained groups. The results shows that financially constrained firms' investment is more sensitive to measures of internal financing. Meanwhile, leverage has a more significant effect for constrained firms. As robustness check, I also use a priori classification in the baseline regression. The results shows that financially constrained firms' investment is more sensitive to measures of internal financing.

The chapter provides important alternative solutions to the controversial issues about the role of cash flow in investment behavior and by applying the switching regression model, the results are free from ex-ante classification bias. By using switching regression model, the group of constrained and unconstrained firms is endogenously classified by model. Based on the finding, I can also state that investment cash flow sensitivity can still be used to capture the effect of capital market friction on a firm's investment behaviour. The results also suggest that the sensitivity of investment to the availability of internal funds is not solely driven by measurement error in investment opportunity, I am not claiming that sales to capital ratio as our proxy for investment opportunity is free from measurement error. An instrumental variable technique or error correction models are suggested for tackling these problems, but none of those could be incorporated within the switching regression approach. I also have not estimated our investment equation in a dynamic form for the same reason mentioned before.

But I feel confident that the benefit of using the switching regression approach will offset the disadvantages of using it.

The last empirical chapter presents the investment cash flow sensitivity (ICFS) and cash-cash flow sensitivity (CCFS) estimation for 14 European countries. I try to provide the analysis of ICFS and CCFS using international dataset. The result suggest that there is a positive and significant effect of cash flow on investment after controlling for the industry-year and country dummies which indicating that there is some friction in the financial market in EU area. I also find that that there is positive and significance relationship between cash holding and cash flow. The decreasing trend of the effect of cash flow on investment cannot be found then I may suggest that investment cash flow sensitivity still can be used as a measure of financial constraint. I do not use a priory classification because the main objective of this study to see the magnitude of cash flows on investment. As alternative to ICFS, CCFS as the indirect measure of financial constraint also suggest that there is positive and significant relationship between cash holding and cash flow.

6.2 Implication for Future Work

To study the ex-ante characteristic and post-entry performance of firm, I need a longitudinal dataset that contained not only the owner characteristic variables but also the firm's condition. The first and second empirical paper use the longitudinal from new-born SMEs in France for period 1994-2004, however using more recent dataset will also give further explanation to the issue in this area. In order to avoid the selection biases, it is also suggested to use the Heckman selection model in the analysis. It is also can be more beneficial to analyze another aspect of post-entry performance of firms, such as growth of the firm in relation to the human capital characteristic.

Our sample consists of only the SMEs and unquoted firms, therefore it is very difficult to find best alternative proxies for the investment opportunities variables. Followed the work form Hobdari et al. (2009), I use the accelerator model of investment capture the differential effects of cash flow on investment., however it will be an worthy venture to use another model, for example Euler model. In this study I have focused on investment cash flow sensitivity and cash- cash flow sensitivity of investment to determine the impact of financial constraints arising from market imperfections.

Following the work from Carpenter & Brown (2002) and Oliveira & Fortunato (2006), financing constraint can be measured by estimating the sensitivity of firm growth to cash flow (GCFS). Firm growth can be measured as growth of total asset (e.g. Carpenter and Brown, 2002), employment growth (e.g. Oliveira & Fortunato, 2006) and growth of total sales (e.g. Fagiolo & Luzzi, 2006). Carpenter & Petersen (2002) test whether the growth of small firm is constrained by by the availability of internal finance. However, when inferring that positive relationship between growth and internal finance merely represent the financing constraint is too straight forward and the result is inconsistent, due to the fact that a positive and significant coefficient for cash flow only show that the growth of the firm is positively affected by the availability of internal finance. Therefore, I can follow any of these in specifying our equations based on our dataset. Moreover, those three sensitivities to measure the effect of financial constraints on firms' financial policies can be used to capture not only for quoted but also for unquoted firms.

This implication for further research can give us an indication about the wideness of the field of our selected research area. Despite having some limitations, this thesis, which takes the form of four empirical papers, presents an analysis of the ‘financial market imperfections and financial constraints for SMEs Can possibly fill up some gaps in the existing literature, in particular for the research in this domain which focus on unquoted and small firms. At the end, I may expect that this thesis, which takes the form of four empirical papers, presents an analysis of the ‘financial market imperfections and financial constraints for SMEs will help us to better understand how market imperfections led financial constraint problems may affect firm performance and to get better understanding how human capital and firm-specific factors may contribute to reduce the problem.

6.3 Practical Implication for Small Business Owner, Bank and Policy Makers

The findings of all four empirical papers certainly have a practical implication for small business owner, bank managers and policy makers. Small business owners can identify that not only financial indicator but also human capital indicator can be used to alleviate the financial constraint problem by the small business. The small business owner should be motivated to enhance their knowledge and expertise, therefore it can seen as the positive signal from the fund supplier. By having greater human capital, it also can reduce the chance of failure. Since the credit rationing effect are persistent, it is strongly suggested that the business owner also look for another alternative source of financing in the market, for example by getting fund from the crowd-funding (especially for IT and creative industry related business).

For the bank managers, since small business, especially the start-up businesses, has low tangible asset, it is strongly suggested that bank has a mechanism to value non-tangible asset. Many businesses with the good prospect cannot be able to get bank financing because of this collateral issue. However, bank manager also need to develop a good monitoring scheme in order to reduce the moral hazard and adverse selection. Rigorous assessment of bank loan applicant is certainly needed to conduct properly.

Finally, the government as the policy makers can use the findings of this thesis to create a financial and non-financial assistance to help the small business owner to reduce the financial constraint problem. Financial assistance can be in form f lending scheme, national guarantee scheme and any other alternative financing scheme. While the non-financial assistance can be in form of certification, mentoring, coaching, training and development program, peer value chain networking and financial planning advice.

APPENDIX A TABLE OF FINDINGS

1. Financial Constraint and SMEs

Authors	Date of publication	Dataset	Theoretical model	Test	Debt/equity constraints	Qualifications	% firms constrained /rationed
Stiglitz & Weiss	1981	NA	Authors' own (SW) model	Equilibrium credit rationing. Sticky interest rates. Fall in interest rates would reduce rationing.	Yes	Assumes positive correlation of risk and return amongst projects	NA
De Meza & Webb	1987	NA	Authors' own model	Equilibrium credit surplus. Rise in interest rates reduces surplus.	Equilibrium credit *surplus*	Drops the Stiglitz-Weiss assumption.	None: Surplus of funds
Fazzari, Hubbard & Petersen (FHP)	1987	Panel of US manufacturing firms Period: 1970-1984 N=422 firms	Authors' own ('FHP') model	Positive correlation of cashflow and investment.	Yes, funding constraints in general (debt &/or equity). Greater for smaller, younger firms.	Endogeneity issue (cash flow a proxy for demand changes) resolved in later studies.	NA
Evans and Jovanovic	1989	American young, white males. Period: 1976,1978 N=1,949	Authors' own (EJ) model	Positive correlation of individual's assets and probability of switching	Credit	Typical firm constrained but entrepreneurial assets exogeneous	NA
Aston	1990	UK small businesses (<50 employees), N=1,095 businesses Period: 1989-1990	Survey	Reported difficulties in raising finance	Credit		Very small fraction constrained (<=6%)

Berger and Udell	1992	US loan data. Period: 1977-1988 N=1.1m loans	SW model	Commitment (vs non-commitment lending) should increase in tight credit markets. It didn't.	Credit constraints not a significant phenomenon.	NA	NA
Holtz-Eakin, et al	1994	US tax returns on individuals considering SE and conditional on SE, those exiting via failure and retirement. Period: 1981 N=1,892 individuals	EJ model		Credit		Typical firm constrained
Murray and Lott	1995	UK VCs Period: 1991 N=40 VCs	Postal survey	Rigorousness of selection criteria of technology versus non-technology investments	Yes, for technology investments. 'More rigorous' criteria applied to comparable investments. Acceptance rates lower for high tech.		NA
Cressy	1996	UK startup businesses N=2,048 firms Period: 1988	EJ model	Positive correlation of assets and switching	Human capital	Entrepreneurial assets endogenous.	Typical firm unconstrained by finance, constrained instead by human capital.
Cressy&Oloffson	1997	Swedish SMEs Period: 1993 N=550 firms	Survey approach	Attitudes to outside equity	No, primarily demand side issue (control aversion)	Attitude issue. Not market imperfection.	NA
Kaplan Zingales	1997	Panel of US	Largely empiricist	Information from	No conclusion.		15% of firm-

		manufacturing firms used by FHP. Period: 1970-84 N=422 firms	examination of FHP data.	Annual Reports of companies are a better test of whether firms are capital constrained than the cashflow-investment sensitivities of FHP.			years subject to constraints on investment. But unrelated (or inversely related) to cash flow sensitivities.
Blanchflower and Oswald.	1998	UK , National Child Development Studies Period: 1981,1991 N=6,885 individuals	Authors' own theoretical model	Inheritance increases chances of starting a business	Financial constraints	Typical individual constrained	NA
Cressy	1998	NA	Author's theoretical model	DARA amongst workers causes switching into SE as wealth increases	Not tested, but Guiso and Lusardi find DARA widespread	Testable	NA
Cressy	1999	UK Startups Period: 1988-1993 N=2,048 businesses	Informal model	Failure to learn rather than lack of finance increases chances of failure	No	Failure to acquire human capital explains entrep. failure	NA
Toivanen & Cressy	2001	UK SME loans Period: 1987-1990 N=2,767 loans	Authors' own theoretical model	NA	NA	Moral hazard and bank market power explain interest rates, collateral provision and share of contract profits. No adverse selection present.	NA
Parker and Van Praag	2003	Dutch entrepreneurs. Period: 1995 N=460 entrepreneurs	Authors' theoretical model (variant of EJ).	Positive correlation of assets and survival. Schooling decreases credit	Yes, credit constraints, but assets endogenous, enhanced by schooling,		NA

				constraints.	reducing constraints.		
Hurst &Lusardi	2004	US panel study of income dynamics (PSID) and NSSBF Period: 1994,1995 N=7,645 business owners (Same results for SE people).	Informal model. Fits probit for business ownership on linear term and fifth-order polynomial in wealth.	Examines the relationship between various proxies for changes in wealth of individuals and their subsequent propensity to start a business.	Only in the 95th percentile of the wealth distribution. Recent inheritance proxies for more than liquidity. Changes in wealth (e.g. savings or housing equity growth) just prior to SE have no impact on business entry. High wealth individuals are also less risk averse.		At most 5% of the potential entrepreneurs.
Astebro & Bernhardt	2005	US Census data on white males. Period 1987. N=1,194	Theoretical model	Two stage estimation.	Credit	Typical firm constrained but depends on productivity of human capital in wage and SE	NA
Beck et al	2006	Cross country	NA	NA	NA	SMEs are more financially constrained than large firms	
Cosh, Cumming and Hughes	2009	Panel of UK SMEs Period: 1996-7 N=2,500	Survey	Pecking Order hypothesis of Myers-Majluf	Financing by internal funds followed by bank debt and then outside equity.		NA
Cosh, Hughes, Bullock and Milner	2009	N=855 SMEs in manufacturing and business services (<500 employees) Periods: 1991,	Survey	Evidence of constraints on growth over time. Several tests, including debt	Worsening of credit conditions over 2004-8 but *product* demand constraints		NA

		2004, 2008. Panel dataset.		constraints (overdrafts and term loans) measured by % of requests accepted at different dates.	dominate the picture.		
Fraser	2009	UK SMEs Period: 2004-8 N=750	Author's own theoretical models			Flight to quality by banks as recession bites.	Upper bound of 6% in 2004 rising to 19% in 2008
Cressy	2010	UK Biotech firms Period: 2009 N=41	Survey	Reported difficulties in raising equity	Yes, equity constraints with an impact on performance.	Mainly a result of the global recession of 2007-10	NA
Hashi and Tochi	2010	SMEs in South Eastern Europe	Survey	Reported difficulties in raising equity	By using both logic and ordered logit model, several dimensions of firm perception general financing	Firm with such as high interest rates or high collateral requirements, access to long-term and short-term loans is defined as constrained firms	NA

2. Financial Constraint, Investment and Cash Flows Sensitivity : Measurement

Author	Theoretical Approach	Basic Regression Equation	Notes
Blundell et al., (1992)	**q-theory**	$\frac{I_{i,t}}{K_{i,t}} = \beta_1 q_{i,t} + \varepsilon_{i,t}$	Investment should be entirely explained by q
Fazzari et al, 1988	**FHP model/Imperfect market**	$\frac{I_{i,t}}{K_{i,t}} = \alpha_1 + \beta_1 Q_{i,t} + \beta_2 \left(\frac{CF_{i,t}}{K_{i,t}} \right) + \varepsilon_{i,t}$	Strong relationship between cash flows and investment indicate firm are constrained

Bond et al., (2003)	**Euler Equation**	$\frac{I_{i,t}}{K_{i,t-1}} = \alpha_1 + \beta_1\left(\frac{I_{i,t-1}}{K_{i,t-2}}\right) + \beta_2\left(\frac{I_{i,t-1}}{K_{i,t-2}}\right)^2 + \beta_3\left[\frac{CF_{i,t}}{K_{i,t-1}}\right] + \beta_4\left[\frac{S_{i,t}}{K_{i,t-1}}\right] + \varepsilon_{i,t}$	Theory predict that $\beta_1, \beta_2 \geq 1$ and $\beta_3 > 0$, $\beta_4 \geq 0$. If the Euler regressions perform poorly, one explanation could be that firms are financially constrained
Beck et al., (2008)	**Priory classification of Constrained firms and Unconstrained firms**	NA	NA
Coad (2007)	**Evolutionary approach**	$\frac{\Delta s_{i,t}}{s_{i,t}} = \alpha_1\left(\frac{OM_{i,t-1}}{S_{i,t-1}}\right) + \varepsilon_{i,t}$	Sales growth should be associated with operating margin according to the principle of "growth of the fitter"
Hashi and Toci (2010)	**Priory classification of Constrained firms and Unconstrained firms**	NA	NA

3. Credit Rationing and Collateral : Collateral as remedy for informational asymmetries between borrower and lender and collateral as a tool to increase the supply of bank debt

No	Study	Sample	Methods	Key Variable	Main Findings
	Leeth and Scott (1989)	National Federations and Independent Business Survey 1980 and 1982	Probit regression with the collateralization decision as dependent variable	Firm, loan characteristic and legal environment	Age of the firm has impact on pledge collateral. The pledging collateral is higher for an older firms and for the firms who were obtaining a smaller amount of loans or shorter maturity loans
	Berger and Udell (1995)	NSSBF 1988	Logit regression with collateral and account receivables as	Relationship, Governance and financial characteristic	Larger firms pledge more collateral , while older firms often have to pledge collateral.

		dependent variables		
Harhoff and Korting (1998)	Survey data from German SMEs on their lines of credit (1997)	Probity Regression with the collateralization decision as the dependent variables	Relationship, financial and Govermence Characteristics	Relationship lending give benefit for SMEs and will reduced the size of pledging collateral
Cowling (1999)	1991 survey data from SMEs in UK	Logit regression with the collateralization decision as dependent variable	Bank, firm relationship and loan characteristic	Loan size and loan duration has effect of probability of loan collaterallization
Cressy and Toivanen (2001)	Individual loans form a large UK bank over period 1987-1990	2SLS estimation to estimate a system of equations consisting of three equations with the pledging of collateral, interest rate and loan amount as dependent variable	Interest loan, loan amount, collateral requirement, risk degree and duration of project	There is no relationship between risk and collateral pledging. Only loan duration have positive impact on probability of pledging collateral
Hanley (2002)	Credit files of UK retail bank over the period 1998-2000	Logistic and Tobit regression with collateralization and amount of pledging collateral as dependent variables	Loan, owner characteristic and risk	Existing business often have to pledge more collateral than the start-up business
Atanasova and Wilson (2004)	Corporate bank lending is estimated using panel data of 639 UK firms, provided by Dun and Bradstreet International for the period 1989–1999.	Switching Regression Model	The demand for bank loans as a function of the level of firm activity, firm's size, the availability of funds that are substitutes to bank loans and the bank loan premium. The supply of bank loans is modelled as a function of the	Collateral can be considered as a determinant of the supply function for bank debt. A higher availability of collateral is expected to increase the supply of bank debt since collateral can mitigate the informational asymmetric between borrower and lender.

			value of firm's collateral, the risk perceived by the bank and the tightness of monetary policy	
Hanley and Crook (2005)	Credit application from business start ups to a major UK bank over period 1998-1999		Logistic regresion	The increase of available collateral increase the likelihood of loans are being granted
Menkhoff et al. (2006)	Credit files of Thai Bank over the Period 1992-1996		Probit and Tobit Regression with the incidence and amount of collateral pledged as dependent variables	Collateral is used to reduce the higher credit risks of small and young firms
Hernandez-Canovas and Martinez Solano (2006)	Survey data from Spanish SMEs in the period 1999-2000	Probit regression with the decision to pledge personal guarantees as a dependent variables	Relationship lending, risk and firm characteristic	Older and larger firms incur a lower probability of having to provide personal guarantees. Relationship lending does matters.
Voordeckers and Steijvers (2006)	Credit files of a large Belgian bank over the period 2000-2003	Ordered probit and continuation ratio logit estimation with the collateralization decision and the type of collateral as dependent variables	Relationship, loan and lender characteristic	Find the determinants of collateralization decision and the type of collateral. Larger and older firms often have to pledge more collateral
Brick and Palia (2007)	NSSBF 1993	Simultaneous equation estimation (2SLS) consisting of three equations with loan rate premium, business and personal collateral as dependent variables	Loan and firm characteristics	Collateral has a significant impact on loan interest rate suggesting a jointness in debt terms. There is a positive relationship between observable firm risk and pledging collateral

APPENDIX B DISEQULIBRIUM MODEL ESTIMATION (ROBUSTNESS CHECK)

Table B1. Disequilibrium model estimation with human capital variables in demand equation (Short-term bank debt)

Independent variables	**Desired demand for long term bank debt**	**Independent variables**	**Supply for long term bank debt**
Cash flow/lagged total asset	1.399***	Fixed Cost/lagged total asset	0.0973***
	(0.0623)		(0.0035)
Sales/lagged total asset	-0.00300***	Lending cost/ total asset	1.756***
	(0.0007)		(0.0712)
Trade debt/lagged total asset	-0.105***	Trade debt/lagged total asset	-0.0674***
	(0.0096)		(0.0080)
Year Dummy		Lending rate	0.0169***
1996	-0.0221***		(0.0031)
	(0.0059)		
1997	-0.0316***	**Industry dummy**	
	(0.0069)	Food Industry	0.0708***
1998	-0.0280***		(0.0109)
	(0.0064)	Construction	-0.000645
1999	-0.0302***		(0.0065)
	(0.0069)	Commerce	0.0584***
2000	-0.0262***		(0.0051)
	(0.0061)	Transport	0.00584
Industry dummy			(0.0082)
Food Industry	0.0920***	Services for entrepreneur	-0.00942
	(0.0128)		(0.0071)
Construction	-0.00785	Catering	0.0335***
	(0.0076)		(0.0089)
Commerce	0.0633***		
	(0.0060)		
Transport	0.0096		
	(0.0097)		
Services for entrepreneur	-0.0203**		
	(0.0083)		
Catering	0.0655***		
	(0.0105)		

Table B2. Disequilibrium model estimation with human capital variables in demand equation (Long term bank debt)

Independent variables	**Desired demand for long term bank debt**	**Independent variables**	**supply for long term bank debt**
Cash flow/lagged total asset	1.408***	Fixed Cost/lagged total asset	0.0976***
	-0.0623		-0.0036
Sales/lagged total asset	-0.00310***	Lending cost/ total asset	1.766***
	-0.0008		-0.0715
Trade debt/lagged total asset	-0.104***	Trade debt/lagged total asset	-0.0672***
	-0.0096		-0.0080
Diploma	0.0028	Lending rate	0.0169***
	-0.0035		-0.0031
Experience	0.0069		
	-0.0055		
Previous jobs	-0.0037		
	-0.0099		
Year Dummy		**Industry dummy**	
1996	-0.0220***	Food Industry	0.0707***
	-0.0060		-0.0109
1997	-0.0316***	Construction	-0.0006
	-0.0069		-0.0065
1998	-0.0281***	Commerce	0.0583***
	-0.0064		-0.0051
1999	-0.0303***	Transport	0.0058
	-0.0069		-0.0083
2000	-0.0264***	Services for entrepreneur	-0.0093
	-0.0061		-0.0071
Industry dummy		Catering	0.0334***
Food Industry	-0.0220***		-0.0090
	-0.0060		
Construction	-0.0316***		
	-0.0069		
Commerce	-0.0281***		
	-0.0064		
Transport	-0.0303***		
	-0.0069		
Services for entrepreneur	-0.0264***		
	-0.0061		
Catering	0.0658***		
	-0.0105		

APPENDIX C QUISCORES DEFINITION

QuiScores Definition

The QuiScore is a measure of the likelihood of company failure in the twelve months following the date of calculation.

The QuiScore is given as a number in the range 0 to 100. For ease of interpretation, that range may be considered as comprising five distinct bands:

- 81-100 The Secure Band
  Companies in this sector tend to be large and successful public companies . Failure is very unusual and normally occurs only as a result of exceptional changes within the company or its market
- 61-80 The Stable Band
  Here again, company failure is a rare occurrence and will only come about if there are major company or marketplace changes
- 41-60 The Normal Band
  This sector contains many companies that do not fail, but some that do.
- 21-40 The Unstable Band
  there is a significant risk of company failure; in fact, companies in this band are, on average, four times more likely to fail than those in the Normal Band.
- 00-20 The High Band

Percentage likelihood of failure

This indicates the predicted likelihood that the company will fail during the 12 months following the calculation, based on a range of QuiScores as follows:

QuiScore range	Percentage likelihood of failure
00-10	100.00%
11-20	50.00%
21-30	29.00%
31-40	11.00%

41-50	6.00%
51-60	1.00%
61-70	0.00%
71-80	0.00%
81-90	0.00%
91-100	0.00%

APPENDIX D INDUSTRY CLASSIFICATION

Industry classification based on major industries

1. Agriculture, Forestry and Fishing
2. Mining
3. Construction
4. Manufacturing
5. Transportation, Communication, Electric gas, and Sanitary Services
6. Wholesale trade
7. Retail Trade
8. Finance, Insurance and Real Estate
9. Services
10. Public administration

APPENDIX E SAMPLE COMPOSITION BY COUNTRY

No	Country	**Number of observation (N)**	**Number of observation (%)**
1	Austria	330	0.69%
2	Belgium	3,651	7.63%
3	Germany	1,460	3.05%
4	Denmark	878	1.83%
5	Spain	1,102	2.30%
6	Finlandia	1,994	4.17%
7	France	4,192	8.76%
8	Great britain	16,588	34.65%
9	Greece	410	0.86%
10	Hungaria	276	0.58%
11	Ireland	225	0.47%
12	Italy	4,667	9.75%
13	Lithuania	124	0.26%
14	Netherlands	260	0.54%
15	Sweden	11,716	24.47%

APPENDIX F DESCRIPTIVE STATISTICS PER COUNTRY

No	Country	IK		CFK		S1K	
		Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.
1	Austria	1.1277	0.5843	3.7623	1.3641	60.7289	15.6753
2	Belgium	0.9779	0.2447	3.4939	0.9832	63.3381	7.8271
3	Germany	1.6231	0.6331	3.2643	0.8366	96.9691	22.9528
4	Denmark	0.3850	0.0621	1.4949	0.4863	50.0749	7.7085
5	Spain	3.1534	1.1844	4.8199	1.4244	77.5434	13.4308
6	Finlandia	0.5362	0.1173	2.5480	0.5597	49.9826	6.4409
7	France	0.6934	0.1874	4.0578	1.7957	61.8926	6.6269
8	Great britain	1.0831	0.1280	5.1935	0.4997	140.8702	8.6504
9	Greece	0.4237	0.0699	3.7491	0.7399	113.4386	19.0246
10	Hungaria	0.5187	0.1095	1.9321	0.2712	46.8069	5.9322
11	Ireland	0.6599	0.1501	25.8450	8.2747	302.9376	96.1454
12	Italy	0.6302	0.0560	1.3865	0.9479	92.0754	9.7236
13	Lithuania	2.1600	0.4757	2.9797	1.6791	243.3604	67.0270
14	Netherlands	6.7586	3.8884	5.8174	6.9673	354.7595	179.4296
15	Sweden	1.0246	0.1489	3.6408	0.6061	98.1206	6.4558

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