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THREE ESSAYS ON ENDURING LENDING RELATIONSHIPS AND FIRMS' PERFORMANCE

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ABSTRACT

The present thesis is a collection of three essays investigating the role of enduring lending relationships as a determinant of firms' performance.

The first chapter aims to assess the link between lasting lending relationships and firms' productivity by using microdata on French and Italian manufacturing small and medium-sized enterprises (SMEs), in the period 2001–2008. Following Agostino et al. (2018), I hypothesise that the effect of lasting lending relationships may have mixed effects on managers' incentives and, subsequently, on firms' productivity depending on the firms' debt level. To model the relationship between either labour productivity or Total factor productivity (TFP) and their respective determinants I apply the system GMM proposed by Blundell and Bond (1999). The results show that, in line with Agostino et al. (2018), the positive effect of enduring credit relationships on firms' productivity decreases as firms' debt level increases.

The second chapter inspects the role that the local social capital endowment plays in affecting the costs and benefits of lending relationships. By estimating the link between lending relationships duration and Italian SMEs' productivity over the 2004 – 2009 period, I empirically test whether there is complementarity or substitutability between credit relations and social capital. On a methodological ground, first I adopt the two-step estimation method of TFP proposed by Levinsohn and Petrin (2003), and then the system GMM estimator proposed by Blundell and Bond (1999). The results show that the (positive) influence of enduring lending relationships decreases as social capital increases, suggesting that social capital might act as a substitute for lending relationships. The latter, however, appear to be important for SMEs performance in less civic regions.

Finally, using microdata on manufacturing firms operating in France, Italy and Spain, the third chapter empirically examine whether, during the period 2005-2009, enduring credit relationships have influenced firms' default. Based on the theoretical predictions of the research on costs and benefits of lending relationships and considering that close bank-firm relations can have opposite effects on a firm's failure, the influence of enduring lending relationships on firms' default is an open empirical question. Adopting econometric models for binary response variables and survival models, I find that the duration of lending relationships is negatively associated with firms' failure, reducing the probability of default. These findings are in line with the theoretical predictions of the strand of literature highlighting the benefits of lending relationships.

RIASSUNTO

Il presente lavoro di tesi è articolato in tre capitoli indipendenti in cui si indaga il ruolo svolto dalla durata delle relazioni di credito sulle *performance* delle imprese.

Il primo capitolo valuta il legame tra *enduring lending relationships* e la produttività delle piccole e medie imprese (PMI) operanti in Francia e Italia nel periodo 2001-2008. Seguendo Agostino et al. (2018), si ipotizza che l'impatto della durata dei rapporti di prestito possa essere eterogeneo sugli incentivi dei *manager* e, successivamente, sulla produttività a seconda del livello di debito delle imprese. Per modellare la relazione tra produttività del lavoro e *Total factor productivity* (TFP) e le loro rispettive determinanti, si applica il *system* GMM proposto da Blundell e Bond (1999). In linea con Agostino et al. (2018), i risultati principali mostrano che l'effetto positivo della durata delle relazioni di credito sulla produttività delle PMI diminuisce all'aumentare del livello del debito delle imprese. In particolare, al di là di una certa soglia di debito, tale impatto diventa non significativo o, addirittura, negativo.

Il secondo capitolo analizza il ruolo che la dotazione di capitale sociale a livello regionale svolge nell'influenzare i costi e i benefici delle relazioni di prestito. Stimando il legame tra la durata dei rapporti di prestito e la produttività delle PMI italiane nel periodo 2004-2009, ho verificato empiricamente se vi sia complementarietà o sostituibilità tra le relazioni di credito e capitale sociale. Sul piano metodologico, prima si adotta un metodo di stima a due stadi della TFP, calcolata col metodo proposto da Levinsohn e Petrin (2003), e poi lo stimatore *system* GMM proposto da Blundell e Bond (1999). I risultati mostrano che l'impatto (positivo) di *enduring lending relationships* diminuisce all'aumentare del capitale sociale, suggerendo che *social capital* potrebbe fungere da sostituto delle relazioni di credito. Queste ultime, tuttavia, sembrano essere importanti per le *performance* delle PMI nelle regioni meno civiche.

Il terzo capitolo offre un'analisi empirica sul ruolo che le *close lending relationships* potrebbero svolgere sul *default* delle imprese. L'indagine empirica impiega micro dati su imprese manifatturiere operanti in Francia, Italia e Spagna nel periodo 2005-2009. Sulla base della letteratura sui costi e sui benefici delle relazioni di prestito e considerando che strette relazioni banca-impresa possono avere effetti opposti sul fallimento di un'impresa, l'influenza della durata delle relazioni di credito sul *default* delle imprese è una questione empirica aperta. Applicando modelli per variabili dipendenti binarie e modelli di *survival analysis*, i risultati principali mostrano che la durata delle relazioni di credito sembra ridurre la probabilità di default delle imprese. In altri termini, *close lending relationships* tendono ad espandere l'accesso ai finanziamenti esterni e, a loro volta, a ridurre il *default* delle imprese, coerentemente con i risultati della letteratura sugli effetti benefici delle *lasting lending relationships* sul fallimento delle imprese.

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Contents

List of Tables

CHAPTER 1

CHAPTER 2

CHAPTER 3

List of Figures

CHAPTER 1

CHAPTER 2

INTRODUCTION

Firms' dynamics are an important issue for both the academic debate and policymakers, justifying the development of a rich literature investigating this topic. The literature suggests that the financial system can affect enterprises' decisions relating to firms' investment in fixed capital (Fazzari et al., 1987) and employment (Nickell and Nicolitsas, 1999), which are the critical factors involved in the firm production (Chen and Guariglia, 2013). Moreover, it is well-known that access to finance positively influences economic growth in terms of saving rates, investment decision and productivity by reducing transaction costs and asymmetric information. As a result, the ability of a firm to grow is directly influenced by the degree of access to finance (Binks and Ennew, 1996; Demirgüç-Kunt and Maksimovic, 1998; Rajan and Zingales, 1998; Oliveira and Fortunato, 2006; Ayyagari et al., 2011). In other words, firms that face limited access to external sources of finance record lower growth and they are less likely to innovate and to invest in fixed capital (Winker, 1999; Beck et al., 2005; Ojha et al., 2010).

Under imperfect market conditions, information asymmetries and agency problems may arise, implying a *wedge* between the cost of external finance and the cost of internal finance, namely financial constraints (Mayers, 1984). Prompt response in terms of acquiring funds might be guaranteed by banks which, according to the modern theory of financial intermediation, emerge as one of the most efficient allocative mechanism, in terms of favouring the correspondence between firm credit demand and financial intermediaries' credit supply. Indeed, banks can specialise in collecting proprietary information, evaluating firms' creditworthiness and monitoring firms' performance (e.g. Diamond, 1984; Boot, 2000; Carletti, 2004; Freixas, 2005; Corigliano, 2007; Cosci et al., 2016). Thus, by establishing close lending relationships with firms through repeated interactions, they may expand their access to credit (Boot, 2000; Petersen and Rajan, 1994) and reducing firm default (Ongena and Smith, 2000; Berger and Udell, 2002; Bannier, 2007).

Enduring lending relationships could be beneficial for firms' financing and performance. Specifically, lasting lending relationships have been found beneficial for firms as deep bank-firm ties: increase credit availability (Berger and Udell, 1995; Hernández-Cánovas and Martínez-Solano, 2010; Kano et al., 2011), decrease loan interest rate (Petersen and Rajan, 1995; Brick and Palia, 2007), reduce collaterals requirements (Harhoff and Korting, 1998; Jimenez et al., 2006; Brick and Palia, 2007), lessen firms' dependence on trade debt (Petersen and Rajan 1994, 1995), foster firms' product and process innovations (Herrera and Minetti, 2007; Benfratello et al., 2008; Giannetti, 2012), stimulate firms' foreign direct investment (De Bonis et al., 2010) and promote firms' efficiency (Agostino et al., 2018). What is more, close lending relationships should reduce firms'

default risk through screening and monitoring processes arising from the acquisition of propriety information on the firm (Diamond, 1984; Carletti, 2004). This mechanism appears to discipline borrower firms' behaviour, yielding to lower default (Foglia et al., 1998; Ongena and Smith, 2000) as well as allowing firms to signal their willingness to abstain from strategic default (Bannier, 2007). On the other hand, the banking literature has also shown that close bank-firm ties might have some "dark sides". (Boot, 2000). Banks might monopolise the information gained on borrowers during the time. Such a *hold-up* mechanism allows banks to exploit rents from borrowers and causes distortions in investment incentives (Rajan, 1992). Moreover, by *softening budget* constraints, borrowers could adopt risk-taking behaviours, increasing firms' default probability (Bolton and Scharfstein, 1996). These pitfalls could yield to higher interest rates (Blackwell and Winters, 1997), to greater *ex-ante* likelihood of financial hazard (Carmignani and Omiccioli, 2007) and worsen firms' performance (Montoriol Garriga, 2006).

Moving from these considerations, this thesis contributes to both banking literature and to the studies which separately investigate the factors that can affect firms' performance. In what follows, the development of the work is illustrated by extensively focusing on any single chapter.

The first chapter assesses the link between enduring lending relationships and French and Italian manufacturing SMEs' productivity, observed in the period 2001–2008. As far as this issue is concerned, very few contributions have investigated the link between credit relationships and several indicators of firms' performance (Montoriol Garriga, 2006), labour productivity (Franklin et al, 2015) or technical efficiency (Agostino et al., 2018). Employing the duration of credit relationships, commonly used as the main indicator of its closeness, and following Agostino et al. (2018), I hypothesise that the effect of lasting lending relationships may have mixed effects on managers' incentives and, subsequently, on firms' productivity depending on the firms' debt level. To model the relationship between either labour productivity or Total Factor Productivity and their respective determinants, I apply the system GMM proposed by Blundell and Bond (1999). This empirical strategy allows to address the potential endogeneity (due to omitted variables or reverse causality) of most productivity determinants and control for firms' heterogeneity (due to time-invariant unobserved firm characteristics). In line with Agostino et al. (2018) findings, the main results show that the positive effect of enduring credit relationships on firms' productivity decreases as firms' debt level increases. In particular, beyond a certain threshold of debt, the impact of lasting lending relationships becomes insignificant or, even, negative. As an interpretation of this evidence, therefore, it could be argued that, in correspondence to a higher level of debt, the costs associated to a close lending relationship may aggravate the managers' opportunistic behaviour, who may not pursue the optimal resource allocation.

In the second chapter, I investigate the role of social capital with respect to the relevance of lending relationships for firms. A recent issue, addressed by some contributions, is whether the (*net*) impact of costs and benefits of enduring lending relationships on firms' performance might depend on some characteristics of the environmental context in which both banks and firms operate (e.g. Agostino et al., 2012; Giannetti, 2012; Mancusi et al., 2018). The research on this topic appears quite scant – and, to the best of my knowledge – there is no attempt to investigate the role that the social capital endowment at the local level may play in affecting costs and benefits of lending relationships. In a nutshell, social capital might contribute to mitigating adverse selection and moral hazard problems in credit markets (Coleman, 1990; Spagnolo, 1999; Guiso et al., 2006), facilitating banks in collecting *soft information* on borrowers (Stiglitz, 1990; Varian, 1990) and exerting pressure on borrowers to reduce opportunistic behaviours, these being contrary to moral and social rules (Agarwal et al., 2011; Guiso et al., 2013). By relying on the consideration that – for its nature – social capital helps the banks in collecting *soft information* on borrowers, thus facilitating the establishment as well as the preservation of a lending relationship, it is plausible to assume that the former might act as a *complementary public good* for lenders' screening and monitoring activities, hence favouring the financing of creditworthiness firms. However, as an implication of being a public good, social capital might weaken the need for lasting bank-firm relationships. Indeed, these latter could not be of crucial importance for firms in regions with a higher level of social capital, as it might act as a substitute for lending relations. To investigate the role of social capital with respect to the relevance of credit relationships for firms, I focus on Italian SMEs' productivity over the 2004 – 2009 period. Specifically, by estimating the link between lending relationships duration and productivity, I empirically test whether there is complementarity or substitutability between lending relations and social capital. On a methodological ground, first I adopt the two-step estimation method of TFP proposed by Levinsohn and Petrin (2003), and then the system GMM estimator proposed by Blundell and Bond (1999). The results show that the (positive) influence of enduring lending relationships decreases as social capital increases, suggesting that social capital might act as a substitute for lending relationships. The latter, however, appear to be important for SMEs performance in less civic regions. This evidence highlights the need to design specific policies that should enable SMEs to easily access credit through both relationship lending and social engagement.

The third chapter offers an empirical analysis on the role that enduring credit relationships might play in affecting firms' default. Firm failure is a relevant topic in the academic debate as it substantially represents the inability of a business to survive adverse economic conditions (Chan and Chen, 1991). As shown in the literature, firm failure may be determined by several factors,

internal and external (e.g. Carling et al., 2007; Mata et al., 2007). Among the internal ones, financial constraints seem to play an important role for firm survival (Hutchinson and Xavier, 2006; Musso and Schiavo, 2008). Barriers in financial markets can affect firms' optimal resource allocation and credit risk behaviour, increasing their likelihood to fail (Caves, 1998; Jovanovic and Rousseau, 2002; Chen and Guariglia, 2013). As noted by Modina and Pietrovito (2014), all variables related to the firm capital structure and to the cost of borrowing external funds are predictors firms' defaults. In a framework of limited access to credit, that may compromise firms' survival, relationship lending can represent an effective technology in terms of overcoming information asymmetries problems (Berger and Udell, 2002), which can help to relax firms' credit constraints (Carbó-Valverde et al., 2012) and to prevent firms' default (Agostino et al., 2012; Cotugno et al., 2013; Fiordelisi et al., 2014; Ono et al., 2014). Taking into account the results of the research on costs and benefits of close lending relationships on firms' performance, and considering that close bank-firm relations can have opposite effects on a firm's failure, the influence of enduring lending relationships on firms' default is an open empirical question. The empirical investigation of the third chapter employs microdata on manufacturing firms operating in France, Italy and Spain over the period 2005-2009, by matching survey and accounting data. Firm default is defined as a changing from an active status to distress/temporary (Active dormant, Active receivership) default or permanent default (Bankruptcy, In Liquidation, Dissolved). The econometric analysis is carried out first by applying the most common model for binary dependent variables (Logit, Probit, Cloglog) without accounting for the exact time in which a firm changed status. Then, exploiting survival analysis methods, I estimated discrete-time models to assess the effect of the enduring lending relationships on firm changing status, the latter being observed on a yearly basis. The main results show that close lending relationships seem to decrease the probability of firms' default. Stated differently, close bank-firm ties tend to expand access to external finance and, in turn, reduce firm default, consistently with the results of the literature on the beneficial effect lasting credit relationships on firms' failure (e.g. Petersen and Rajan, 1994; Foglia et al., 1998; Ongena and Smith, 2000; Berger and Udell, 2002; Bannier, 2007; Agostino et al., 2012; Fiordelisi et al., 2014; Agostino and Trivieri, 2018; Yildirim, 2019).

CHAPTER 1

LENDING RELATIONSHIPS AND PRODUCTIVITY. EVIDENCE FROM FRANCE AND ITALY

ABSTRACT

Using microdata on European manufacturing SMEs, in the period 2001–2008, this chapter aims to assess the link between lasting lending relationship and firms' productivity. Following Agostino et al. (2018), I hypothesise that the effect of lasting lending relationships may have mixed effects on managers' incentives and, subsequently, on firms' productivity depending on the firms' debt level. To model the relationship between either labour productivity or TFP and their respective determinants I apply the system GMM proposed by Blundell and Bond (1999). The results show that, in line with Agostino et al. (2018), the positive effect of enduring credit relationships on firms' productivity decreases as firms' debt level increases.

Keywords: lending relationships, TFP, SMEs, SYS-GMM, EFIGE data.

1.1. INTRODUCTION

The key element of bank financing, that differentiates it from the supply of funds provided by capital markets, is the bank's propensity to establish customer-bank relationships rather than single transactions. Little is known, though, on how these relationships impact on firms' productivity.

The modern theory of financial intermediation highlights the value of relationship lending for financing enterprises within a framework of asymmetric information. Indeed, close relationships may facilitate the exchange of information between the lender and the customer through a coordinated system of *soft information* gathering and processing. As moral hazard and adverse selection problems decrease, close lending relationships may increase credit availability (Berger and Udell, 1995), decline loan interest rate (Petersen and Rajan, 1995), decrease collaterals requirements (Jimenez et al., 2006) and foster firms' product and process innovations (Giannetti, 2012). On the other hand, close bank-firm relationships may present some "dark sides" (Boot, 2000). Banks might monopolise the information on borrowers acquired during the relationship and grant future loans to a non-competitive price to borrowers. Such a *hold-up* mechanism allows banks to exploit rents from borrowers and causes distortions in investment incentives (Rajan, 1992). Moreover, by *softening budget* constraints, borrowers could adopt risk-taking behaviours, increasing the firm's default probability (Bolton and Scharfstein, 1996). These pitfalls could yield to higher interest rates (Blackwell and Winters, 1997) and decrease firms' performance (Montoriol Garriga, 2006).

The above findings suggest that banking relationships play a role with respect to the financing constraints of firms, especially when considering small and medium-sized enterprises (SMEs), for which banks represent the main source of external finance (Bank of Italy, 2007; European Commission, 2010). By affecting firms' financial constraints, costs and benefits related to (close) lending relationships might impact on firms' performance.

Financial constraints refer to the *wedge* between the cost of external finance and the cost of internal finance, which occurs in a context of information asymmetries and agency problems. It is well-established in the literature that firms facing greater finance constraints record lower growth and they are less likely to innovate and to invest in fixed capital (Beck et al., 2005; Ojha et al., 2010). Also, as firms' dimension decreases, the detrimental effect of financial constraints increase (Angelini and Generale, 2008).

In the literature, several methods have been drawn to identify suitable measures of financial constraints as the latter are not directly observable. Focusing on firms' leverage as a measure of external financial constraint, agency costs theory can be particularly useful to explain how firms' level debt can affect firms' performance (Jensen and Meckling, 1976). On one hand, a higher

indebtedness may lead managers to behave opportunistically at the expenses of debtholders, by investing in riskier projects, due to the asymmetry of gains and losses from hazardous investments. On the other hand, higher indebtedness could incentive and discipline managers' conduct. Indeed, the discretion of the management is reduced by increasing the leverage level, limiting the use of the free cash flow and, hence, opportunistic behaviour.[1]

Bearing that in mind, I hypothesise that the effect of lasting lending relationships may have mixed effects on managers' incentives and, subsequently, on firms' productivity depending on the firms' debt level. At low indebtedness level, enduring credit relationships may benefit firms' productivity, by easing access to funds that allow smoothing the production process and, hence, increase the productivity of firms. By contrast, at higher indebtedness levels, the prevalence of the benefits of relationship lending over its costs is not obvious. If managers are interested in preserving the advantages of a lasting lending relationship, *hold-up* costs could reinforce their disciplined behaviour, leading to a positive effect on productivity. On the other hand, higher *hold-up* costs and easier debt renegotiation may aggravate moral hazard behaviours of managers, due to higher indebtedness, and, therefore, reduce or nullify the effect of the lending relationship on firms' productivity.

The aim of this work is to assess the link between lasting lending relationships and firms' productivity, using microdata from the EFIGE dataset on manufacturing SMEs operating in France and Italy between 2001and 2008. These countries, among other European nations, are bank-based economies in which relationship lending is a common practice. To estimate the relationship between either labour productivity or TFP and their respective determinants, I apply the system GMM estimator proposed by Blundell and Bond (1999).

The contribution to the literature is twofold. First, I examine the effect of lasting lending relationships on firms' productivity that has not been addressed by the extant literature. Second, using the system GMM approach allows to take into account firms' heterogeneity (due to time-invariant unobserved firm characteristics), and endogeneity issues. Indeed, EFIGE data are self-reported data and answers may be influenced by past experiences and performances of the firm; furthermore, there could be unobserved variables affecting both lending relationships and productivity or reverse causality. More in detail, longer lending relationships may benefit firms' performance

[1] Agency costs theory is originally developed for investigating the issue of the separation between ownership and control in large companies. However, the application of this theory is extended to SMEs (McMahon, 2004) in a context of interest conflicts "between insiders and outside suppliers of funds" (McMahon 2004, p.123). Considering this, in this paper, the term manager is used for referring to owner-managers.

rising credit availability; conversely, higher productivity levels may lead to a more stable relationship between firms and banks. As a matter of fact, firms could choose banks and the intensity of the lending relationships according to their level of productivity, and/or banks might create closer relationships with more productive firms considering the higher productivity level as a signal of creditworthiness.

Consistently with Agostino et al. (2018) findings, the main results show that the positive effect of enduring credit relationships on firms' productivity decreases as firms' debt level increases. In particular, beyond a certain threshold of debt, the impact of lasting lending relationships becomes insignificant or, even, negative.

The remainder of this work is organised as follows: Section 2 and 3 review the literature of the lending relationship and financial constraints, respectively; while Section 4 sets out the Research Hypotheses. Section 5 describes the data used. In Section 6 I define the empirical methodology. Section 7 illustrates the results obtained and robustness checks performed. Finally, Section 8 concludes.

1.2 RELATED LITERATURE: RELATIONSHIP LENDING

1.2.1 Definition and features

According to the modern theory of financial intermediation, based on information asymmetries, banks emerge as a more efficient allocative mechanism than the market because they can produce confidential information and generate advantages for borrowers through the so-called relationship lending. The concept of relationship lending refers to close ties between firms and financial institutions (Petersen and Rajan, 1994). Since the 1990s, several authors offer supplementary definitions, such as Ongena and Smith (2000a, p. 4) who define relationship lending as "the connection between a bank and customer that goes beyond the execution of simple, anonymous, financial transactions". Boot (2000, p. 10) points out that relationship banking constitutes "the provision of financial services by a financial intermediary that: (i) invest in obtaining customer-specific information, often proprietary in nature; and (ii) evaluates the profitability of these investments through multiple interactions with the same customer over time and/or across products". Moreover, Freixas (2005, p. 4) defines relationship lending as "the investment in providing financial services that will allow to repeatedly deal with the same customer" and Elsas (2005, p. 34) as "a long-term implicit contract between a bank and its debtor".

All definitions pertain to peculiar synergies between the bank and its customer in which banks accumulate confidential information through repeated interactions with the same borrowing firm.

Hence, the key feature is the acquisition of additional information beyond those already available. Such extra information is first obtained in an *ex-ante* screening process and, then, in a monitoring phase during the relationship, with the provision of multiple financial services. The investment in costly search of information is justified by the expected reuse of the data in the future. Indeed, recently, several contributions emphasize the role of the banks in collecting proprietary *soft information* (non-quantifiable information got via linkages with the firm and its stakeholders), that cannot be easily transmitted either within the bank or across financial institutions (Stein, 2002). In this respect, the lender takes its decisions basing on *soft information*, characterizing lending relationships as a lending technology (Berger and Udell, 2002, 2006). Although the "relationship banking goes beyond lending and includes other services as well" (Boot, 2000, p. 9) relationship lending is the focus of a wide literature, referring to the fact that the bank is the most important agent adequately investing to get borrower-specific information in the lending process (Freixas, 2005). In addition, with stable and lasting relationships, bank credit yields major benefits for both parts, in terms of close monitoring of firms, debt renegotiation, implicit long-term contracts, soft-information acquisition and liquidity transformation (Corigliano, 2007).

Recent contributions highlight that there are a variety of technologies that banks can adopt for their lending activities, that could be categorised as relationships and transactions lending technologies. The former is based on *soft information*, as described above, while the latter is associated with the arm's-length lending and based on *hard information* (Berger and Udell, 2006; Udell, 2008) generated at the time of loan origination.[2] The main differences between these two types of technologies are related to the nature of the information, which is transparent in transactions lending and, by contrary, opaque in relationship lending. As a result, transaction lending technologies would be used by high-quality borrowers, while relationship lending would be preferred by low-creditworthiness customers, especially including small and young firms that have little credit history or collaterals. Therefore, the importance of relationship lending is particularly emphasized for SMEs, which tend to be young, inflexible to market changes and rely on banks as the main source of external funds.[3]

[2] Berger and Udell (2006) give examples of transactions lending technologies: financial statement lending, asset-based lending, factoring, leasing, equipment lending and real estate-based lending. Therefore, hard information is usually objective, quantifiable and public.

[3] Certain financial institutions, as small banks, have a competitive advantage in gathering soft-information via their relationship with the SMEs (Berger and Udell, 2002). In this context, the role of the credit officer in collecting soft information, and of the banking structure on using it, have been investigated by several authors as Stein (2002); Berger and Udell (2002); Berger et al. (2005). This strand of literature refers to contacting problems within lenders and borrowers' relationship.

1.2.2 Benefits of close lending relationships

Lending relationships can represent valuable assets for both banks and borrowers, especially when information about the firm and its potential investment opportunities are opaque. Relationship lending first benefit is to facilitate the exchange of information between the lender and the customer. The former one invests in processing information from its client firms and these latter are more motivated to share information because of the guarantee of certain privacy (Yosha, 1995). As a result, problems of moral hazard and adverse selection present in credit markets may be overcome by lowering information asymmetries, enhancing the project-choice and disciplining managerial behaviour (Diamond, 1991; Weinstein and Yafeh, 1998).

Boot (2000) points out that a close lending relationship allows for long-run loan contracts, more flexibility on debt renegotiation and certain discretion to use the soft information revealed during the credit relationship. Moreover, the renegotiation of contracts *ex-post* can help firms to face with delayed payment, in case of momentary difficulty of the firm to repay the loan (Boot et al., 1993, Greenbaum and Thakor, 1995, Von Thadden, 1995). In this perspective, relationship lending allows for funding that may be profitable in the long term, even if there is no gain perception in the short-run. Therefore, relationship lending increases credit availability (Petersen and Rajan 1994; Berger and Udell, 1995; Angelini et al., 1998; Cole, 1998; Elsas and Krahnen, 1998; Chakraborty and Hu, 2006; Hernandez-Canovas and Martınez-Solano, 2010; Bharath et al., 2011; Kano et al., 2011). What is more, credit relationship leads to the decrease of the interest rate (Berger and Udell, 1995; Petersen and Rajan, 1995; Brick and Palia, 2007) and acts as a shield against the interest rate cycle (Berlin and Mester, 1998, Ferri and Messori, 2000). Banks tend to invest in improving "sector specialisation" to properly satisfy their clients. As a consequence, being in a close banking relationship gives more value to the borrower because the lender exploits its expertise to increase the firm project payoff.

The benefits of close lending relationships also regard collateral requirement, which requires the monitoring of pledged collateral to be effective. In other words, enduring lending relationships may lessen the probability for firms to pledge collaterals (Jimenez et al., 2006; Brick and Palia, 2007). What is more, firms' dependence on trade debt is reduced by stable lending relationships (Petersen and Rajan, 1994, 1995). Finally, close lending relationships may foster firms' product and process innovations (Herrera and Minetti, 2007; Benfratello et al., 2008; Giannetti, 2012) and promote firms' foreign direct investment (De Bonis et al., 2010).

1.2.3 Costs of relationship lending

Costs of relationship banking are related to two main problems: *hold-up* and *soft-budget constraint*. The hold-up problem refers to the informational monopoly which the bank can create during the relationship. Indeed, the bank may take advantage of the acquired *soft information,* providing future loans to a non-competitive price. In other words, banks are able to extract monopoly rents from borrowers and gain negotiating power (Sharpe,1990; Rajan,1992). However, the *hold-up* problem does not yield perpetual earnings of positive rents during the relationship: the bank might adopt a lower interest rate because of the expectation to recuperate the investment in the future. The main consequences of the *hold-up* problem can be distortions in investment incentives (Rajan, 1992); lower effort of the borrower to fulfil the commitments (Dewatripont and Maskin, 1995), managers' risk-taking behaviour and, hence, increasing probability of default (Bolton and Scharfstein, 1996).

This issue may be attenuated through the diversification of the relationships, borrowing from multiple banks (Von Thadden, 1995; Thakor, 1996) and/or sharing of information with other banks. Von Thadden (1995) demonstrates that a contemporary relationship between at least two banks is enough to establish competition and limit the risk of *ex-post* increasing *premia* of loans. In addition, in presence of hold-up problems, firms can be less motivated to undertake high-quality projects due to the risk of gains-shifting to the banks. Then, the banks may share information with other banks because, even if this decreases future earnings, it should induce firms to invest in high-quality projects. Therefore, there is a trade-off between these two circumstances which drives the choice of the main bank to share or not *soft information* with other financial institutions (Padilla e Pagano, 1997).

As stated above, the second potential drawback of close lending relations is the *soft budget constraint*. This problem arises when a borrower, forestalling the *ex-post* soft budget constraint of her lender, has lower motivations to make effort *ex-ante* (Bolton and Scharfstein, 1996). In other words, when the renegotiation of a loan is too straightforward, the borrower may minimize her effort in preventing negative results. This misconduct may be reconducted to an excessive familiarity with the client, which leads to a distortion *ex-ante* of the motivation of the firm to perform well (Boot, 2000). The key element, in this situation, is the bank's credibility: the manager may get that the threat of the lender of revoking the loan is not real, but the main bank could prefer to grant further credit to the firm hoping for the debt repayment in the future. Therefore, managers'

opportunistic behaviour and risk-taking might be exacerbated, increasing the firm's default probability (Dewatripoint and Maskin, 1995; Bolton and Scharfstein, 1996). The problem of *soft budget constraint* could be reduced granting bank debt priority over firm's other claims.[4]

1.2.4 The origins of the theory of relationship banking

The origins of the theory of relationship banking must be researched in the modern literature of financial intermediation.[5] Lending relationships have been investigated with regard to the features of loan contracts, banking competition, and determinants of the number of credit relationships.

Historically, the peculiar role attributed to banks, compared to other sources of finance, is to overcome the informational asymmetries in the credit markets. In this respect, the main benefit related to banking activity, evaluated through the information production function of banks, is to examine information and design convenient loan contracts that improve borrowers' incentives to perform well and decrease default probability (Diamond, 1984, 1991; Ramakrishnan and Thakor, 1984; Fama, 1985; Boyd and Prescott, 1986). On the other hand, bank financing involves some costs as, for example, higher interest rate (Greenbaum et al., 1989), lenders do not have control over the owner's continuation decision when there is an optimal level of borrower's effort (Rajan, 1992). Hence, the literature provides contrasting views on the features of the optimal contract. In the models of Greenbaum et al. (1989), Sharpe (1990), Rajan (1992) and Freixas (2005), increasing the duration of the relationship leads to the rise of the interest rate. By contrary, the interest rate should fall as relationships become long and stable (Diamond,1989; Boot and Thakor,1994). Finally, Petersen and Rajan (1995), Berlin and Mester (1998) argue that optimal contract between lender and borrower drives to a loan rate smoothing over the lifetime of the relationship.

The traditional theory about the optimal number of bank relationships shows that the best solution occurs when only one bank is involved. In this respect, Diamond (1984) affirms that a single banking relationship is optimal because duplication of screening and monitoring actions tend to be excluded. On the other hand, having a single relationship provides to the bank an informational monopoly. Hence, firms might choose for multiple banking relationships to avoid a potential hold-up problem (Sharpe, 1990; Rajan, 1992). According to Bolton and Scharfstein (1996), in equilibrium, the optimal number of bank relationships is two, in fact, albeit increasing the number of

[4] Several studies found that close lending relationships are negatively, or unclearly, related to loans interest rates (Petersen and Rajan, 1994; Blackwell and Winters, 1997; D'Auria et al., 1999; Degryse and Van Cayseele, 2000; Kano et al., 2011), may induce banks to avoid financing risky long-term investment projects, even though profitable (Weinstein and Yafeh, 1998), increase collateral requirements (Ono and Uesugi, 2009), tend to lower firms' profitability (Montoriol Garriga, 2006), and to hamper the growth of small firms (Gambini and Zazzaro, 2013).

[5] For instance, Freixas and Rochet (1997) offer a review of modern theory of financial intermediation.

creditors complicates debt renegotiation, the loss of *ex-ante* efficiency may be helpful afterward, limiting the incentives for strategic default.

Another stand of studies identifies as more than two the optimal number of banks. It can reduce the probability of being credit rationed (Thakor, 1996) and provides insurance against liquidity shortage (Detraguiache et al., 2000). Multiple relationships can be helpful also for the bank in order to reach better monitoring of firms. In fact, banks could take advantage of funding more projects of smaller size which increases aggregate monitoring (Carletti, 2004; Carletti et al., 2004).

Finally, Yosha (1995) considers the costs of confidential information dispersion. Specifically, he found a trade-off between bilateral and multilateral relationships: a multilateral relationship gives to firms an exogenous cost of revealing information to many lenders. Contrariwise, bilateral relationships involve an endogenous cost since firm competitors may believe that opting for bilateral financing could mean that the firm has some sensitive information. Consequently, they react aggressively in the product market which and, thus, impact on firm's profits occur. As a result, in equilibrium, high-quality firms select bilateral relationships.

1.2.5 Measures of the intensity of lending relationships

As the intensity of a lending relationship is not directly observable, empirical studies use different proxies to measure the strength of the relationship between bank and borrower.

The most broadly used proxy is the duration of the relationship, which should reflect the accumulation over time of private information by the lender. Some caveats are in order here: according to Berger and Udell (1995) and Cole (1998), the duration of the bank-borrower relationship is highly correlated with the firm age. On one hand, the duration of the relationship catches private information got by the lender; on the other hand, age accounts for public evidence on the reputation of the firm. Hence, the estimated effect of duration might be biased if a study does not control for age. Furthermore, this measure is right-censored, i.e. it can control only for a past relationship between borrower and bank (Elsas, 2005).

Another proxy used is the number of simultaneous bank relationships of a firm or, similarly, an indicator variable for firms with an exclusive bank relationship. As aforementioned, an exclusive relationship allows the main bank to have a monopoly of information *ex-post*, implying a close connection between the bank and the borrower (Sharpe, 1990; Rajan, 1992).

Lastly, other common measures used are the share of the borrower's total debt provided by the main lender, the Herfindahl index of borrowing concentration and measures of trust.[6]

[6] The Herfindahl index is defined as the sum square of the share of debt provided by each lender.

1.2.6 Empirical evidence

A still limited number of studies assess the influence of close lending relationships on different dimensions of SMEs. For instance, De Bonis et al. (2010), analysing Italian firms, show that a longer relationship with the main bank increases firms' foreign direct investment (FDI) and production off-shoring abroad. Instead, no evidence in this direction has been found by observing large firms only. Moreover, Minetti and Zhu (2011) show that the duration of the relationship with the main bank does not appear to influence the firm's extensive margin of export. Then, a positive effect of the bank-firm relationship on export margins and the probability to introduce product innovation has been found in Herrera and Minetti (2007) and Mancusi et al. (2018). Specifically, the latter authors, examining 4341 Italian SMEs observed between 2004 and 2009, show that the magnitude of the effect of relationship lending on innovation is weaker than that on exports. According to Giannetti (2012), longer relationships have a positive influence on the capacity of high-tech small firms to innovate. Likewise, Micucci and Rossi (2012) illustrate that longer relationships positively affect both the propensity and the intensity of R&D activities. Furthermore, Alessandrini et al. (2010), based on the idea that *soft information* deteriorates in the transmission within the bank organization as the distance between hierarchical levels increases, discover that whenever there is higher distance between bank branches and headquarters, firms are less inclined to introduce process and product innovations.

Differently from these studies, that use indirect proxies of relationship lending such as the repeated interactions between the borrower and the lender and the duration of the relationship (Petersen, 1999; Ongena and Smith, 2001), Cosci et al. (2016) use a direct measure by observing the type of information the bank asks in order to give credit. Using the (EFIGE) Bruegel-Unicredit dataset, they discover a strong influence of the so-called soft-information intensive relationships on firm's innovation. Conversely, a less positive effect of long-lasting relationships and a negative effect of credit concentration on firms' innovative performance have been found.

Another field of studies examines the connection between long-lasting bank relationships and firm growth. In this respect, the pioneer study of Nakatani (1984), considering the growth rate of sales revenue for 317 Japanese firms in the period 1974–1982, discovers that firms belonging to a keiretsu, (i.e. a set of firms showing joint relationships and shareholdings around one main bank), do not perform better compared to no-keiretsu firms. Weinstein and Yafeh (1998) and Miarka (1999), focusing on large Japanese firms depict a similar pattern – namely main clients of the bank do not grow more rapidly than other firms. On the same wave, strong bank-firm relationships are not related to faster growth rates of firms in Germany (Agarwal and Elston, 2001). What is more, Shin and Kolari (2004) do not find any robust evidence of whether fast-growing firms are more

inclined to borrow from the main bank. More recently, Gambini and Zazzaro (2013), drawing on data from the *Indagine sulle Imprese Manifatturiere*, assess the impact of long-lasting bank relationships on asset growth employment of a large sample of Italian firms. They find out that relationship lending negatively influences firms' dimension, whilst it dampens the negative growth of medium-large enterprises that present financial problems. Furthermore, Bucă and Vermeulen (2017) evaluate the impact of closeness firm-bank on investment for a set of European countries between 2004 and 2009. The increase of standards to obtain a loan may justify the credit crunch occurred during the financial crisis and provokes the rise of constrained firms that have substantially reduced their investment.

Finally, Montoriol Garriga (2006), employing several measures of firms' performance, shows that Spanish SMEs' profitability seems to be negatively influenced by exclusive bank relationships. Franklin et al. (2015) study the influence of a reduction in credit supply due to 2008 financial crisis on UK firms' labour productivity, among other outcomes Exploiting information on pre-crisis lending relationships, their results show that a reduction in credit supply yields to a drop in labour productivity. Similarly, Agostino et al. (2018), observing a large sample of European SMEs in the period 2001-2008, discover that the positive impact of credit relationships duration on firms' technical efficiency tends to decline in absolute value, at increasing level of indebtedness.

1.3 RELATED LITERATURE: FINANCIAL CONSTRAINTS

1.3.1 Measures

Information asymmetries and agency problems may generate financial constraints, that have an ambiguous impact on firms' real activities. When a *wedge* between the cost of external finance and the cost of internal finance occurs, firms will prefer the cheapest internal source of finance (Mayers, 1984). As a result, the dimension of financial constraint is widely characterized by the availability of funds internally generated by the firm (Povel and Raith, 2001; Cleary et al., 2007). Financial constraints are not directly observable. This implies that to identify measures of financial restrictions, researchers have developed several methodologies using different sources of information since balance sheet data may miss a specific measure of such constraints.

The first question addressed in the literature concerns the features that should characterise a good measure of financial constraints. Financial constraints should be objective, firm-specific, continuous, and time-varying (Silvia and Carreira, 2010). The access to external finance should

be heterogeneous among firms, albeit the aim is to evaluate the effect on a particular firm characteristic (e.g. firm size) or firm behaviour (e.g. performance). Moreover, defining a strict edge in which circumscribe "constrained" and "not-constrained" firms may be very ambiguous work. Indeed, firms could change their status, getting constrained after an economic shock or, *vice versa*, seeing relatively improve their financial structure. Therefore, different states of constraints along the timeline may be expected (e.g. Hubbard, 1998; Cleary, 1999). Finally, there are different degrees of constraint that could affect firms (Musso and Schiavo, 2008).

Several methods have been proposed and applied in order to define financial constraints. Measurements can be in a sort of way classified as indirect – derived from balance sheet data – or direct – taken from self-reported data. Alternatively, indexes have been constructed to avoid drawbacks related to the two previous approaches.

The first empirical definition of financial constraints is due to Fazzari et al. (1988) that, investigating their impact on investment by using a sample of SMEs US firms in the period 1970-1984, introduce the so-called investment to cash-flow sensitivity (ICFS) as a measure of constraints. This approach exploits *a priori* classification of firms, based on their dividend policy, to distinguish firms as constrained and unconstrained. Since that financially constrained firms are not able to access to external finance, they may rely on their internal funds to undertake investment opportunity. In the meanwhile, unconstrained firms can straightforward finance their investment accessing to external sources. According to with this reasoning, a positive and significant relationship should be found between investment and cash-flows since constrained firms tend to rely on their cash-flows to finance investment; whilst, no connection should be estimated for unconstrained enterprises.

Although this method became very popular, many critiques have been done. First, Kaplan and Zingales (1997) challenge it because of the inadequate classification scheme. The dividend policy may be inappropriate due to potential saving policies and risk-averse management. A second criticism is that cash flow might proxy for other unobservable determinants of investment, such as growth opportunities. Indeed, a firm that presents more liquidity could have better investment opportunities and invest more in the future. Therefore, cash flow may indicate the profitability of current and expected investments.[7] Finally, according to Povel and Raith (2002), Cleary et al.

[7] To overcome this problematic, it could be estimated the Tobin's Q (the ratio of the market value of the firm to the replacement cost of its assets) accounting for expected profitability of investment. Theoretically, if Tobin's Q is the only predictor of investment, then financial constraint should not be relevant. However, in practice, determining the Tobin's Q is difficult, especially in the case of the calculation of its marginal value. Alternatively, the investment function can be estimated by using the Euler Equation. This corresponds to the intertemporal optimization problem of cash flow that a firm generates. Since it assumes of perfect capital market, the violation of this hypothesis is interpreted as presence of financial constraints in imperfect market conditions.

(2007) or Lyandres (2007), there is not a monotonic relationship between cash flow and investment. In fact, they point out that ICFS evidences a U-shaped relationship with some constraints due to the risk of firm default. In some circumstances, investors could decide to provide a greater amount of funding in the presence of low levels of internal sources. A reduction of cash flow after a certain edge may cause a rise in investment.[8]

The *ex-ante* classification of firms represents the main drawbacks of the above-mentioned methods of measuring financial constraints. The first reason is related to the suitability of the segmenting variable that categorises firms in constrained and unconstrained, which may incorrectly define two groups (Musso and Schiavo, 2008). Second, there may be endogeneity problems between the segmenting variable and the financial constraint. Indeed, it is not precluded that financial restrictions also influence such variables (Bond et al., 2003). In addition, a not arbitrary cut-off point has to be defined if the segment variable is continuous because the relationship between segmenting variable and financial constraints may be non-monotonic (e.g. Hadlock and Pierce, 2010). Finally, firms could change their status, getting constrained after an economic shock or, vice versa, seeing relatively improved their financial structure. This implies several issues when firms are circumscribed in a given group considering a dynamic analysis.

To avoid theoretical and measurement issues characterizing the previous methodologies, a direct measure of financial constraints can be applied. First, financial constraints can be measured by using the information contained in the annual reports, that firms provide with the financial statement. In this document, firms sign their financial position and needs of external finance.[9] Recently, more scholars rely on survey data to obtain a measure of financial constraint. In this case, firms are asked whether they are financially constrained and if they are limited to access to external finance by using one or more questions. More in detail, questions can be related to various aspects such as the cost of external funds, credit denials, and requests of collaterals. This method has the advantage to have different information about investment and firms' perception of constraints that should be real because provided by firms themselves. In addition, it makes possible to distinguish between firms differently sized or aged. On the other hand, since the nature of self-

[8] The approach proposed by Fazzari et al. (1988) is extended to firms' growth. In particular, the growth can be measured as employment growth (Oliveira and Fortunato, 2006), growth of total assets (Carpenter and Petersen, 2002) and sales growth (Fagiolo and Luzzi, 2006). According to these authors, financial constraints negatively affect firm growth.

[9] This approach is convenient because allow to give to each firm a correct level of financial constraints (e.g. Kaplan and Zingales, 1997; Hadlock and Pierce, 2010). However, the main problem is related to the size, representativeness of samples and misreporting data since that a small number of firms provide this annual report.

reported data, answers may be influenced by the experience and performance of the firm: managers might under or overestimate the constraints that they face.[10]

Alternatively, to avoid drawbacks related to the two previous approaches, Lamont et al. (2001) propose the first index in the literature the so-called KZ index that is a firm-specific and time-varying index of constraints. This measure is obtained by using an ordered logit regression and can be used in the presence of a qualitative dependent variable of financial constraint.[11] Then, Whited and Wu (2006) introduce an index (WW index) based on balance sheet data and financial market information. The method consists of estimating the equation resultant from Euler equation model and using these estimated coefficients to construct the index, considering that the cost of finance is a function of observable variables about firm's financial health.[12] An alternative index is proposed by Musso and Schiavo (2008), who divide firms among specific classes, as region or industry, believed to be homogeneous. They choose a set of variables[13] that have a relationship with proxies of financial constraints and, among these predictors, define the rankings.[14] In addition, to overcome concerns relating to cash-flow sensitivities some authors have proposed to introduce a firm-level heterogeneity element in the measure of financial constraints. In this respect, Hovakimien and Hovakimien (2009) compare the time average of investment weighted by cash-flow with the simple average investment. The resulting HH index assumes a positive value when a firm invests more relying on higher cash flow since that investment, in this case, has a higher weight.[15] All types of indexes above described can be used either as dependent or independent

[10] Alternatively, analysing the bank lending relationships, there may take information about the intensity to which firm credit is denied and for which motivations directly to the financial institution (banks). This approach is quite hard to apply for the difficulty to obtain data from banks. Moreover, the match with firm level data is necessary when researchers want to evaluate the impact of financial constraints on firms' dimension. These direct measures are firm-specific and time-varying if the survey is conducted periodically. In addition, there is the possibility to use this information either as a dependent or independent variable. Example of authors that use survey data: Savignac (2006); Angelini and Generale, (2008); Campello et al. (2010); Caggese and Cuñat (2011); Coad et al. (2016); Neicu et al. (2016).

[11] The reasoning is that the index is obtained by the linear combination of the estimated coefficients of each determinants of the constraint, that should influence the capability to obtain external source of finance. This measure is limited to the qualitative nature of the constraint and is sensitive to changing of the firms' sample. Since it only tracks the financial constraint leading to bias in case of omitted variables that significantly influence the financial constraint.

[12] The WW index is the more complex to obtain since the number of parameter involved and, in addition, it is again sensitive to changing of the firms' sample.

[13] For instance, size, profitability, liquidity, cash flow generating ability, solvency, trade credit over total assets and repaying ability.

[14] The reasoning is that, within a certain group, some variable may have a particular relationship with financial constraints that must to be accounted for. With this procedure is possible, hence, to obtain different degrees of constraint built on the relative rankings of a certain number of variables for each firm within a certain class. The first problem of this approach is that the score of the constraint is an ordinal variable that limit the choice of the estimation method. Second, the relationship between the proxy and the level of restriction could be non-linear and, lastly, the division in homogenous classes may make difficult the comparison between them.

[15] D'Espallier, Vandemaele and Peeters (2008) propose a similar index obtained by the estimates a coefficient vector of heterogeneous cash-flow slopes which allow to obtain cash-flow sensitivity for each firm. This approach involves

variable, since their continuous nature. Notwithstanding, the concern relate to them is the impossibility to capture when a firm moves from a constrained to unconstrained status and *vice versa*.[16]

Finally, financial constraints can be measured by using different proxies as explanatory variables. Some of the most common proxies found in the empirical works are: R&D intensity, dividend pay-out ratio, group membership and ownership, collateral and even age and size (Headlock and Pierce 2010); borrowing ratio, leverage ratio, interest ratio (Chen, 2007); total leverage over total assets (Sharpe, 1994; Bernanke et al., 1999; Satphathy, 2017; Xu et al. 2018); long-term debt maturing in the short-run (Almeida and Campello, 2007); long-term debt (Schiantarelli and Sembenelli, 1997; Vermoesen et al., 2013). In addition, cash flow (Chen and Guaraglia, 2013; Lööf and Nabavi, 2016; Satphathy 2017; Xu et al. 2018); liquidity (Buch et al., 2009; Chen and Guariglia, 2013); credit rationing (Guiso, 1998; Das, 2004; Rizov, 2004; Minetti and Zhu, 2011; Diaz-Serrano and Sackey, 2018).[17] Not least, several different measures of financial constraints could be compared and used (Chen; 2007). The positive aspect of adopting a proxy as a measure of financial constraint is the simplicity to apply it. To evaluate if a variable is suitable, it should be highly correlated with a certain variable or, in presence of several proxies, a strong correlation between these should be expected. Moreover, this approach is often firm-specific and time-varying, and it can be easily adaptable as an independent or dependent variable. The main drawback is that, although high correlation, finding a good proxy is hard (Cleary et al., 2007). Additionally, the use of proxies relies on previous relationships between financial constraints and the selected variable. Finally, if these relationships are non-monotonic, then the corresponding variable will only work as a good proxy for a subset of its space.

1.3.2 Empirical evidence

Many studies in the literature document how financial development can impact economic growth through different channels. Specifically, the financial system can affect enterprises' decisions relating to firms' investment in fixed capital (Fazzari et al., 1987) and employment (Nickell and Nicolitsas, 1999), which are the critical factors involved in the firm production (Chen and Guariglia, 2013). Moreover, it is well-known that access to finance positively influences economic growth in terms of saving rates, investment decision and productivity by reducing transaction costs

more sophisticated techniques in its implementation but, differently from the previous case allow to account for variables that may affect the investment opportunity.

[16] Another prevalent approach is to consider firms without a credit rating as constrained because the absence of access the public debt markets for unrated firms (Faulkender and Petersen, 2006) yield to the possibility to get loans only from banks and, therefore, they are considered financially constrained. The unrated firms are less likely to clearly give information and so more likely to be rationed by lenders (Whited, 1992).

[17] According to Chen (2007), several different measures of financial constraints may be compared and used.

and asymmetric information. As a result, the ability of a firm to grow is directly influenced by the degree of access to finance and its relative cost (Binks and Ennew, 1996; Oliveira and Fortunato, 2006). According to Rajan and Zingales (1998) and Demirgüç-Kunt and Maksimovic (1998), access to finance increases firm growth and, by contrary, financial constraints dampen it (Ayyagari et al., 2011). Indeed, firms that face greater finance constraints record lower growth and are less likely to invest in fixed capital and to innovate (Winker, 1999; Beck et al., 2005; Ojha et al., 2010).

However, the effect of financial restrictions on firms' behaviours and performance changes among a group of enterprises differently sized: the magnitude of the effect increases when the dimension of the firm is reducing (Beck et al.,2005; Angelini and Generale, 2008). Indeed, small firms are financially more constrained than large firms (Beck et al., 2005; Beck and Demirgüç-Kunt, 2006; Beck, 2007; Kuntchev et al., 2012) and these restrictions limit small firms' growth (Oliveira and Fortunato, 2006). These differences justify the special attention of researchers to small and medium-sized enterprises (SMEs) and the aim to explain their ambiguous relationship with the financial system.[18]

Since the pioneer contribution of Modigliani and Miller (1958), firms' financial structure and decision have acquired relevance in the literature. This theorem state that, under perfect market conditions, a firm's financial structure is irrelevant to its market value. As a result, a firm's investment choices are independent from its financial decisions. In this context, external and internal resources are perfect substitutes and financial factors do not affect firms' investment decisions.

However, under imperfect market conditions, the Modigliani and Miller theorem loses its validity. Indeed, in the presence of agency costs and asymmetric information, the cost of external and internal funds differs. Financial constraints, therefore, might have relevant and distortive effects on real features of a firm and its investment decisions may be affected by the availability of external finance.

The impact of financial constraints is analysed for the first time in the literature by Fazzari et al. (1988) with regard to the sensitivity of investment to cash flows. Authors find that in more financially constrained firms the investment is driven by the fluctuation of cash flows. By contrast,

[18] SMEs play an essential role in the world economies. The definition of this kind of organization could follow several criteria, relating to the number of employees, sales, amount of investment, annual turnover, capital assets, skilled labour, turnover level, firm size, legal status, and method of production (Ardic et al., 2012; Abor and Quartey, 2010; Nyanzu and Quaidoo 2017). Notwithstanding, the more common definition is based on the number of employees (Ayyagari et al.,2003). Indeed, SMEs account for two-thirds of total EU-28 employment (66.6 %) (Muller et al., 2017), contribute to generate employment in all sectors and drive economic growth Ayyagari et al. (2003, 2011). In this work, I adopt the size classification of the European Commission to define SMEs, considering firm with less than 250 employees as SME.

an empirical study conducted by Kaplan and Zingales (1997) challenges the previous work sustaining that investment cash flow sensitivity does not represent a suitable measure of financial constraint and demonstrate that the sensitivity of investment to cash flow of less constrained firms is greater than those more financially constrained.[19] Recently, other contributions show that external source of finance drives the decision of investment in fixed capital (Ojah et al., 2010). By contrast, financial constraints dampen innovation and firm's investment (Canepa and Stoneman, 2007; Ughetto, 2008; Hottenrott and Peters, 2012).[20]

In addition to the investment, some contributions show that financial constraints also have an impact on firms' decision related to dimensions such as growth, employment, investment on R&D, internationalisation and productivity. With specific regard to SMEs, in both developed and developing countries, they seem to have less opportunity to access to external finance and to be much more constrained in their performance and growth. (Berger and Udell, 1998; Schiffer and Weder, 2001; Galindo et al., 2005). Small firms' growth is positively influenced by increasing the access to finance, indeed, as documented by Oliveira and Fortunato (2006) for Portuguese firms, SMEs are more likely to grow than large firms by relaxing financial constraints. Similarly, Aghion et al. (2007) analyse the relationship between finance and entry of small firms in financially dependent sectors, finding that access to external finance helps small firms to grow faster and compete with larger firms. In the presence of easy access to finance, SMEs can enhance more and more their growth than large firms (Dalberg, 2011). Therefore, financial constraints obstacle firms' growth and lead to malfunctioning of SMEs (Butler and Cornaggia, 2009).[21]

Some authors argue that financial constraints also have an impact on the decision of firms related to innovation and investment in R&D. Access to external finance stimulate innovations of SMEs and enable them to invest more in R&D (Hyytinen and Toivanen, 2005) and leads small firms to innovate with increasing rate (Ayyagari et al., 2007). A positive relationship between internal cash flow, as a proxy of financial constraints, and R&D expenditure is evidenced by Hall (1992) and Himmelberg and Petersen (1994) about firm-level data on US sectors. Moreover, Brown et al. (2012) find that investment in R&D for high-tech US young firms highly depends on cash flow between 1990 and 2004. Similar results are found for some European countries such as

[19] The pioneer method of Fazzari, Hubbard and Petersen (1988) has been also applied by Farre-Mensa and Ljungqvist (2016) for a large sample of US firms, arguing that this approach may not correctly identify measures of financial constraints. Evidence show that financially constrained firms do not present difficult to access to external finance and take investment opportunity.

[20] Other evidence is offered, for example by Campello et al. (2010) and Ferrando and Mulier (2013).

[21] The impact of barriers in firms' growth is smaller in countries with developed financial and efficient legal systems which, together with business environment, seems to have an important role on the driving SMEs' growth (Sleuwaegen and Goedhuys, 2002; Djankov et al., 2004; Beck et al., 2005; Aghion et al., 2007).

Germany, Ireland, Belgium, and the Netherlands, Italy and France by Harhoff (1998), Bougheas et al., 2003, Ughetto (2008) and Savignac (2008), respectively.[22] On the other hand, some authors argue that firms' innovation activities are not affected by financial constraints. Bhagat and Welch (1995) evidence that there is no connection between past cash flow and current R&D investments in the US and European countries. Similarly, German firms and British firms do not choose their R&D expenditures according to their level of cash flow Chen and Chen (2012).

Another firm's dimension that could be affected by financial constraints is employment growth. The measure of external financial constraint, defined as total interest payments over cash flow, seems to negatively influence the employment of British manufacturing firms (Nickel and Nicolitsas,1999). Similar results are found by Benito and Hernando (2002, 2008), by using the same measure of financial restriction, but applied to a sample of Spanish firms. Recently, some authors focus on whether financial constraints hardly affected the employment growth during the economic crisis of 2008. Spain and Greece are analysed by Rahaman (2011) and Voulgaris et al. (2015), respectively.[23]

The decision of a firm to locate certain phases of its production process abroad depends on a number of factors, including access to finance and financial constraints. Internationalisation can involve several activities such as exporting, importing or international production through FDI or international outsourcing.[24] Empirically, Manova (2008) examines the effect of credit constraints on the exporting decision of 91 countries between 1980 and 1997, concluding that financing constraints restrict exports. SMEs, operating in small and limited markets, particularly face constrained to exports activities.[25] Leonidou (2000), Ahmed et al. (2004), and Bellone et al. (2010) gauge the limits of the internationalization process, focusing on the scarcity of financial resources faced by SMEs. Forte and Moreira (2018) analyse a sample of Portuguese manufacturing SMEs finding that financial constraints, measured as the liquidity and leverage ratio, have a relatively small effect on Portuguese manufacturing SMEs firms. Likely, Spanish manufacturing SMEs

[22] Concerning developing country see, for example, Guariglia and Liu (2014) and Sasidharan et al. (2015).
[23] The former, distinguishing in pre and post crisis, uses both internal and external measures of financial constraint: the difference of equity funds in two consecutive years and the ratio of short-term debt over total liabilities. Voulgaris et al. (2014), in line with Rahaman (2011), find a different behaviour of firms in response of the financial crisis, conducing to a negative influence on employment growth.
[24] Existing literature on the relationship between financial system and firm's exports decision is based on the primordial model of Melitz (2003), that identifies the importance of fixed costs when firms decide to export. Then, Chaney (2016) introduce the feature of financing constraints as an additional source of heterogeneity across firms (i.e. firms with more liquidity can pay in in advance for the fixed costs of exporting; while, those that cannot face these costs are exogenously financially constrained, determining different equilibria than in absence of financial constraints) Then, Manova (2008) extends this reasoning by considering financing constraints as endogenous factors.
[25] Barrier to export are usually classified as internal (financial and human resources) and external (obstacles originated in industries and markets).

firms seem to be influenced by the degree of liquidity that affect their probability of entering export markets. However, this effect varies across SMEs and those with higher costs derived from export activities have greater financial needs (Miravitlles et al., 2018).

Regarding FDI, according to Agmon (2006), the decision to undertake FDI in SMEs and its relationship with financial variables have deeply been analysed in the literature.[26] More in detail, SMEs firms may prefer to internationalise through a less capital-intensive way, instead to adopt FDI.[27] Evidence shows that there is a negative correlation between a firm's intangible assets and leverage (Gompers & Lerner, 1999). These limits imply a higher weakness to environmental changes and lower competitiveness to international markets (Buckley, 1989). Moreover, SMEs may face higher financial constraints than larger firms in terms of credit rationing because of the higher costs for banks to collect *soft information*. In such a context, developing closer relationships with banks could mitigate the lack of collateral and rising the opportunity to reach financial funds for FDI.

Finally, financial development can affect firms' productivity through different channels. For instance, the existence of frictions in accessing an external source of finance, due to asymmetric information and default possibility, may significant preclude the feasibility of productive and long-run investments opportunities. Also, internal sources of financing (e.g. cash flow) play a role in the implementation of prolific projects, but they are an exhaustible resource of finance. Hence, these limitations may distort the efficient allocation of resources and reduce firms' productivity.

Beyond this evident connection between limited access to finance and firms' productivity, the related literature is still growing and flows in mixed and sometimes contrast evidence. On one side, some authors argue the presence of a positive and significant impact of the financial system on long-term productivity and, contrariwise, the adverse effect of financial ties on firms' performances. Indeed, financial constraints are one of the most important obstacles to the innovation and development of Italian small enterprises in high-tech sectors (Giudici and Paleari, 2000) and an efficient banking system would foster the propensity of undertaking innovation process and would increase the productivity (Benfratello et al., 2008). What is more, barriers such as high cost and limited availability of finance negatively affect the productivity (Coad et al., 2016); conversely, financial restrictions, measured as cash flow and liquidity, exert a positive impact on total factor productivity (Satpathy et al., 2017). Some contributions have shown, for a set of European

[26] Some evidence is proved by Klein et al., (2002), Todo (2011), Buch, et al. (2014), Yan et al (2018).
[27] Features of FDI (as highly variable returns, asymmetric information and a lack of collateral) lead to an inadequate financing for FDI from financial institutions and to an increase of the risk of losses for creditors since FDI does not afford collaterals but require intangible assets.

countries, that productivity progress changes with debt growing (Levine and Warusawitharana, 2014) and it is significantly reduced by financial constraints (Ferrando and Ruggeri, 2018). Vice versa, access to credit leads to increase the production and productivity (Gatti and Love, 2008), especially for firms located in more financial opened zones (Butler and Cornaggia, 2011). Similarly, the availability of internal finance stimulates manufacturing firms' productivity and growth (Chen and Guariglia, 2013).

Furthermore, focusing on firms' capital structure, Pushner (1995) finds that leverage and firm productivity are adversely correlated in Japanese firms, which is in line with the findings of Nucci et al. (2005) for Italy. Indeed, they consider the firms' leverage as the ratio of immaterial to total assets and conclude that there is a negative correlation between firms' leverage and productivity. On the other hand, Schiantarelli and Sembenelli (1997) evidence that the length of debt maturity (i.e. long-term debt) fosters productivity of both the UK and Italian firms. Finally, according to Nunes et al. (2007), there is a non-linear relationship between firms' leverage and labour productivity of Portuguese firms. Indebtedness negatively affects enterprises which register a lower level of labour productivity and, by contrary, has a positive influence on those with high labour productivity. These results could be explained referring to the agency costs theory: higher indebtedness induces managers to perform well and improve firms' productivity. Conversely, since banks prefer to grant loans with collaterals that can be easily mobilized, firms' productivity-enhancing activities, as an investment in R&D, are negatively connected to leverage due to their higher share of intangible assets. In particular, when considering the application of this theory to SMEs, a context of interest conflicts refers to those "between insiders and outside suppliers of funds" (McMahon 2004, p.123). Other studies have shown that the productivity impact of financial constraints is not obvious as seems to be. Firms with already relatively low productivity levels may be negatively affected by credit restrictions (Maçãs et al., 2007), rather than productive enterprises. Moreno-Badia and Slootmaekers (2009) find that a different degree of financial constraints does not decrease firms' productivity in most sectors, with the exception of R&D. Similarly, access to credit might negatively and insignificantly affect productivity (Mwangi, 2014).

1.4. RESEARCH HYPOTHESES

This work aims to gauge to what extent close lending relationships, proxied by the duration of a credit relationship, may influence the productivity of SMEs, relying on the theoretical predictions of the research on costs and benefits of lending relationships and the literature of financial constraints.

More in detail, building on the literature reviewed in section 1 my research hypotheses can be articulated as follows:

H1: since the main source of external funds for small businesses are commercial banks, and relationship banking can have opposite effects on firms' performance, the influence of lasting lending relationships on SMEs' productivity is an open empirical question.

H2: the benefits and costs of lasting lending relationships may have heterogeneous effects on managers' incentives depending on the firms' debt level. At low indebtedness, enduring credit relationships might have a positive impact on firms' productivity because relationship lending benefits should overcome their costs. Hence, easier access to funding should help managers to smooth the production process. However, *hold-up* problems should be relevant as the firm's debt increases and, as a consequence, one of two situations may emerge. If managers are interested in preserving the benefits of a credit relationship, higher *hold-up* costs should reinforce disciplined behaviour, prevailing on moral hazard related to higher indebtedness and softer budget constraints. In this case, as managers may pursue higher efficiency in the production process, the impact of longer banking relations on firm's productivity could be positive. On the other hand, if greater *hold-up* costs – as well opportunistic incentives related to straightforward debt renegotiation – aggravate moral hazard behaviour due to higher indebtedness, managers' interests to reach the best technical practice may be compromised, and the positive impact of enduring credit relationship on firm's productivity could diminish or even disappear.[28]

1.5. DATA

The data used are drawn from the EFIGE-Bruegel-Unicredit dataset, containing firm-level information on 14,759 manufacturing firms with more than ten employees across European countries (Austria, France, Germany, Hungary, Italy, Spain, and the United Kingdom).[29] The dataset includes a survey completed in 2010, which collects cross-sectional information referring to the year 2008, or the period 2007-2009 (in average terms). Survey data are combined with panel balance sheet data from the Amadeus database, held by Bureau van Dijk, available from 2001 to 2009.[30]

[28] It is worth to remind that, in this paper, the term manager is used for referring to owner-managers.
[29] EFIGE stands for "*European Firms in a Global Economy*". For more information on the EU-EFIGE dataset, see: http://bruegel.org/2012/10/the-eu-efigebruegel-unicredit-dataset/.
[30] It should be recalled that the EFIGE dataset omit firms with less than 10 employees, thus implying that my results might not be extended to the smallest of firms. Moreover, my findings are conditional on firms' survival since accounting data concerns to entities that are surveyed in 2010 and defaulted enterprises are excluded (e.g. Agostino and Trivieri, 2018).

This econometric analysis focuses on two countries – Italy and France – since several variables employed display too many missing values for the other countries. Following Milana et al. (2013), production function variables are deflated by using industry level indexes, taken from the EU KLEMS database, and potential outliers are treated by eliminating the observations lying in the first and last centiles of each variables' distribution.[31] Moreover, in defining SMEs, I adopt the size classification of the European Commission and consider firms with less than 250 employees as SME. Finally, in order to rule out the consequences of the "great recession" in Europe, I consider the period 2001-2008.

Table 1.1 shows the variables' descriptive statistics for SMEs in Italy and France and their description and Table 1.2 presents the correlation matrix of covariates.

[TABLES 1.1 AND 1.2]

1.6. EMPIRICAL METHODOLOGY

1.6.1 Labour productivity

When considering labour productivity, I estimate the following equation (in dynamic form):

$$y_{it} = \alpha_i + \alpha_K k_{it} + \alpha_M m_{it} + \alpha_X X_{it} + \alpha_D D_t + \varepsilon_{it} \quad (1.1)$$

where y is (the logarithm of) the measure of labour productivity, computed as the ratio between turnover and number of employees of firm i at time t, k the capital stock, and m is intermediate inputs, both in logarithm form. The vector of determinants X comprises the variables of interest duration of lending relationships, leverage ratio and their interaction, and other controls such as firm age, cash flow, working capital, and a Herfindahl index. Finally, fixed effects (α_i) and time dummies (D_t) are included to account for firms' unobservable heterogeneity and economic cycle effects, respectively.[32]

To estimate (1.1) I adopt the system GMM estimator, which allows to take into account firms' fixed effects and the endogeneity of the right-hand-side variables by using lagged values of the endogenous variables for the equations in first differences and first-differences of the variables as instruments for the equations in level (Blundell and Bond 1999).[33] In this application, all explanatory variables are considered endogenous except age and the Herfindahl index, which are treated

[31] For more information on the EU KLEMS database, see: http://www.euklems.net/.
[32] Productivity distributions are significantly 'spread' out with large 'tails' of firms with low TFP, and firms tend to spend long periods in the same part of the distribution (Bartelsman and Dhrymes, 1998; Haskel, 2000; Martin, 2008).
[33] This method is implemented is STATA by using *xtabond2* (Roodman, 2009).

as predetermined. Finally, Arellano and Bond (1991) tests for autocorrelation are used to exclude the presence of second-order autocorrelation in the residuals.

1.6.2 Computing TFP

Total factor productivity (TFP) is a measure that explains the residual part of total output unaccounted for traditionally measured inputs of labour and capital. To estimate TFP using data at a micro level, several approaches have been developed in the literature, highlighting numerous advantages over aggregate analysis. For instance, firm-level data allow to control for firms' heterogeneity and increasing return to scale (Del Gatto et al., 2011).

Notwithstanding, different problems may occur in estimating TFP at micro level such as simultaneity bias coming from endogeneity of input choices; omitted variable bias if relevant explanatory variables are not available; sample selection bias when no information is available on firms' entry and exit, and heterogeneous characteristics of firms that need to be taken into account, for instance when technology differs across products produced by a single firm (Van Beveren, 2012).

Many estimation models have been proposed in the literature in order to obtain unbiased estimates. Commonly used methods are fixed effects panel models, semiparametric estimators as Olley and Pakes (1996) and Levinsohn and Petrin (2003) and GMM, which is considered the most robust methodology to tackle measurement errors, endogeneity issues, and technological heterogeneity (Van Biesebroeck, 2007).[34]

Formally, in this work I define TFP adopting a Cobb-Douglas log-linear production function:

$$y_{it} = \alpha_i + \alpha_K k_{it} + \alpha_L l_{it} + \alpha_M m_{it} + \alpha_X X_{it} + \alpha_T t + \varepsilon_{it} \qquad (1.2)$$

where *y, k*, *l,* and *m* represent, respectively, the logarithms of real gross output, the capital stock, labour and intermediate inputs of firm *i* at time *t*.[35] The vector of determinants X_{it} described in section 6.1, a time trend and fixed effects α_i are also accounted for.[36]

[34] Olley and Pakes (1996) and Levinsohn and Petrin (2003) consist in two-stage procedures and are analogous methods except for two main differences that regard the proxy of unobserved TFP (the former employs investments, while the latter uses intermediate inputs levels as, for example, materials or energy). Moreover, Olley and Pakes (1996) accounts for the firm's survival probability in the second stage. However, these approaches do not allow to account for fixed effects and are based on strong assumptions (Ackerberg et al. 2006), compared to the systems GMM approach, which is here adopted.

[35] The outcome is approximated by the total amount of sales. Regarding inputs, capital is the sum of tangible and intangible fixed assets and depreciation; intermediate inputs are given by material costs. These variables are expressed in thousands of euros and they have been deflated by using Price Indexes for Gross Output and Intermediate Inputs, respectively. Finally, labour is the number of employees.

[36] Productivity distributions are significantly 'spread' out with large 'tails' of firms with low TFP, and firms tend to spend long periods in the same part of the distribution (Bartelsman and Dhrymes, 1998; Haskel, 2000; Martin, 2008).

Following Harris and Moffat (2015) and Ding et al. (2016), equation (1.2) has been estimated in dynamic form (with additional lagged values of output and factor inputs) using the system GMM estimator, thus directly obtaining values of the elasticities of output with respect to inputs $\alpha_K, \alpha_L, and\ \alpha_M$ (Harris, 2005; Harris and Moffat 2015). TFP can, then, be calculated as the level of output that is not attributable to factor inputs (capital, labour, and intermediate inputs), meaning that productivity is due to efficiency levels and technical progress.

Hence, this measure of TFP is expressed as follows:[37]

$$\widehat{lnTFP}_{it} = y_{it} - \hat{\alpha}_K k_{it} - \hat{\alpha}_L l_{it} - \hat{\alpha}_M m_{it} = \hat{\alpha}_i + \hat{\alpha}_X X_{it} + \hat{\alpha}_T t + \hat{\varepsilon}_{it} \quad (1.3)$$

TFP is determined by the variables captured in X_{it}, firm-level fixed effects, the time trend and idiosyncratic shocks captured by the error term.[38]

1.6.3 The determinants of TFP

The inclusion of the X_{it} variables in the production function is necessary in order to avoid (bias due to omitted variables and, hence) biased values of TFP. The vector of productivity determinants is built following previous works that use similar approaches (Harris and Moffat, 2015; Ding et al., 2016) or share my research field (Agostino et al., 2018), conditionally on the availability of information in the EFIGE dataset.

The key variable of my analysis is the duration of the lending relationship that a firm has with its main bank (DURAT) and refers to the last year of the survey (2009).[39] Following Agostino et al. (2012); Gambini and Zazzaro (2013); Agostino and Trivieri (2017, 2018), its values in the

[37] In the Cobb-Douglas production function, TFP can be defined as A_{it}:

$$Y_{it} = A_{it} L_{it}^{\alpha_L} M_{it}^{\alpha_M} K_{it}^{\alpha_K} \quad (1.4)$$

As a result,

$$A_{it} = \frac{Y_{it}}{L_{it}^{\alpha_L} M_{it}^{\alpha_M} K_{it}^{\alpha_K}} \quad (1.5)$$

Thus, in equation (1.3), $lnTFP_{it}$ replaces lnA_{it}. Since any changes in the denominator on the right-hand-side of (1.5), as factor inputs change, is matched by changes in output, with A_{it} unchanged, the TFP is not influenced, directly, by returns to scale as $\hat{\alpha}_L l_{it} - \hat{\alpha}_M m_{it} - \hat{\alpha}_K k_{it}$. An alternative methodology consists to use the Fare and Primont (1995) input index to ensure the validity of proportionality axiom stated by O'Donnell (2015) for the case of increasing returns-to-scale. In this respect, the measure of TFP could be rewritten as:

$$\widehat{lnTFP}_{it}^{FP} = y_{it} - \frac{1}{(\hat{\alpha}_L + \hat{\alpha}_M + \hat{\alpha}_K)} (\hat{\alpha}_L l_{it} - \hat{\alpha}_M m_{it} - \hat{\alpha}_K k_{it}) \quad (1.6)$$

[38] A common alternative approach consists in estimating equation (1.2) without including X_{it} on the right-hand-side of the equation and then use (1.3) to obtain TFP. In this case X_{it} is included in the random error term ($\hat{\varepsilon}_{it}$). Then, $\widehat{lnTFP}_{it}$ is regressed on X_{it} as part of a two-stage procedure. However, due to an omitted variable(s) problem, the estimates of the $\widehat{lnTFP}_{it}$ are expected to be biased.

[39] In the survey, the question is formulated as "For how many years has this bank been the firm's main bank?", preceded by "What % of your firm's total bank debt is held at your main bank?".

period 2001-2008 are obtained by subtracting from the original figure a number from 8 to 1, treating as missing values negative numbers.[40] A variable frequently used in the literature as an indicator of external financial constraint is the leverage ratio (Nucci et al., 2005; Coricelli et al., 2012; Sataphy 2017). Higher indebtedness leads to an increase of *premia* to access an external source of finance because of the greater probability of a firm's default. This situation is further aggravated for firms that are exposed to more serious information asymmetries and agency problems: firm-specific conditions (high indebtedness, low liquidity), industry peculiarities (e.g. high tech) and institutions (development of the financial system and enforcement) are factors that may explain this condition (La Rocca, 2007). In such a context, higher leverage would make it more difficult for these firms to obtain further loans, making it harder to increase their productivity.

According to the agency costs theory on interest conflicts between equity holders and managers, higher indebtedness may lead managers to behave opportunistically at the expenses of debtholders, by investing in riskier projects given the asymmetry of gains and losses from hazardous investments. On the other hand, higher indebtedness could incentive and discipline managers' conduct. Indeed, the discretion of the management is reduced by increasing the leverage level, limiting the use of the free cash flow (Jensing, 1986) and, hence, opportunistic behaviour. In this study, leverage (LEV) is measured as the ratio of firm total debt over total assets. The interaction term between DURAT and LEV is included to test my research hypothesis (*H2*).

Turning the attention to the control variables, cash flow is a common measure of internal funds, with a direct effect on firms' real activities, such as capital investment, employment and the accumulation of inventories (Carpenter et al., 1998; Fazzari et al., 1988; Nickell and Nicolitsas, 1999). Including this variable allows assessing whether relying on internal finance affects firm productivity. Indeed, if firms have extra cash flow, they may undertake productivity-enhancing activities as an investment in R&D and innovation on new processes/products. Therefore, having a higher cash flow could push firms to optimize their real activities, which may further enhance their productivity. Moreover, more stable cash flow provides greater assurances to lenders that the firm will be able to service its obligations (Cheng and Guariglia, 2013). In this study cash flow (CASHFLOW) is measured as the ratio of net income plus depreciation to total assets.[41]

[40] One could argue that, by doing so, DURAT cannot capture the effect of lasting lending relationships for those firms that, after a long period, changed the main bank a few years before (or just in) 2009. However, the EFIGE data do not allow to make a different imputation, as there is no way to know whether – before the relationship for which the duration is declared – firms had a relationship with another main bank or not. Besides, the EFIGE survey does not provide the identity of a firm's main bank, and information concerning other lending relationships' characteristics – such as the percentage of the firm's total bank debt held by the main bank, and the number of lending banks – is available for 2009 only.

[41] Albeit to this variable is often used as indicator of internal financial constraint, in this study it just allows to control for financial independency of the firm. In addition, cash flow may reflect growth opportunities of a firm, as a result

Working capital (WORKCAP) is calculated as the difference between a firm's current assets and its current liabilities on total assets. This variable represents the availability of liquidity, which plays a crucial role in firms' decisions and activities. Indeed, firms are more likely to increase their cash in a short period if they have more liquid assets. More liquid firms may be able to organise their assets to increase their cash and carry out productivity-enhancing activities and, in addition, they may have enough working capital to face daily processes. On the other hand, the lack of liquidity leads a firm to depend on own cash flow for productivity-enhancing activities (Cheng and Guariglia, 2013; Ding et al.,2016).

Firms age (AGE) is included to capture whether younger firms may produce in more efficient ways being characterized by higher absorptive capacity or, on the other hand, productivity rises for older firms due to the exploitation of "learning by doing" mechanisms.

Finally, the Herfindahl-Hirschman index based on assets (HHIa) is inserted to measure the degree of industry concentration. According to Efficient-Structure Hypothesis, higher concentration might indicate market selection and consolidation with the persistence of more efficient firms, hence positively affecting productivity (Margaritis and Psillaki, 2007). On the other hand, following the Structure-Conduct-Performance paradigm, a higher concentration may be associated with a decreasing in competition encouraging collusive behaviour among enterprises, thus reducing firms' productivity.

1.7. ESTIMATION RESULTS

Estimation results concerning Equation (1.1) and (1.2) are presented in Tables 1.3 and 1.4, respectively. Firstly, all models pass various tests for the validity of the instruments used and tests for autocorrelation (in first-difference residuals).[42]

The benchmark results on labour productivity - obtained by implementing a System GMM estimator (Blundell and Bond, 1998) – are reported in column 1 of Table 1.3. Results show that my key variables are statistically significant: while DURAT has a positive impact on productivity, the interaction term coefficient is negative. This evidence seems to support the hypothesis that a longer lending relationship might boost productivity. Moreover, its positive effect varies according to the level of debt. Figure 1.1, based on the column 1 estimates of Table 1.3, shows

the inclusion of such measure should be necessary to properly isolate the casual effect of cash flow on firms' productivity.

[42] More in detail, all models pass the Hansen test for overidentification (sometimes at the 10% level), indicating the validity of the instruments used. Regarding to tests of autocorrelation, significant first-order correlation in differenced residuals is verified in all models, whilst second-order correlation in the differenced residuals is not significant. Overall, estimates can be considered consistent.

the DURAT marginal effect for all the values of indebtedness reported on the *x-axis*, while the dashed lines define 95% confidence intervals. The use of a graphical illustration is helpful, as the effect of DURAT could change sign and/or become not statistically significant for different levels of LEV. When the zero line is not included in the confidence band, occurring at low levels of firms' leverage, the DURAT marginal effect is positive and statistically significant. At increasing level of indebtedness, the influence of DURAT declines, becoming not significant beyond a leverage value of about 60% and, even, negative further than 85%. This evidence can be interpreted by appealing to the beneficial effect of longer lending relationships and the incentivizing role of the debt. Indeed, when firms are less indebted, the benefits of lasting credit relationships overcome their costs, reinforcing managers' motivations to perform well, hence, increasing firms' productivity. In correspondence to higher levels of debt, the costs of close lending relationships may aggravate the managers' opportunistic behaviour, who may not pursue an optimal resource allocation.

[TABLE 1.3]

This finding is confirmed when considering Total Factor Productivity. Table 1.4, column 1, describes the benchmark results obtained by the System GMM estimator proposed by Blundell and Bond (1998). Similar to the previous case, to analyse the DURAT marginal effect on TFP, Figure 1.2 graphically illustrates how the impact of credit relationship varies according to the value of debt. Below to a leverage level of about 50%, the estimated marginal effect is positive and significant. Beyond this threshold, its impact is insignificant, becoming negative and significant for values of debt greater than 75% circa. This finding, in line with previous results on labour productivity, reflects the ambiguous influence of longer lending relationships on firms' productivity for different levels of indebtedness. Indeed, at a low level of leverage, having a close firm-bank relationship tends to increase firms' productivity. On the other hand, at a higher level of indebtedness, the costs of credit relationships seem to aggravate the moral hazard problems due to higher debt and reduce firms' productivity.[43]

[FIGURES 1.1 AND 1.2]

[43] I would like to stress that using two different measures of productivity is only aimed to verify the sensitivity of results. Indeed, I am aware that the magnitude of estimated coefficients on the key variables, as reported in Tables 1.3 and 1.4, is slightly different since they represent the effect on dependent variables defined and scaled differently. It is worth recalling that LABPROD refers to the contribution that labour gives to the production, while, the TFP accounts for all inputs involved in the production process.

Briefly considering the explanatory variables, according to Table 1.4 – column 1, CASHFLOW, WORKCAP, AGE and HHIa are statistically significant. Indeed, a unitary increase of internal funds leads to a higher TFP of about 26% and a higher working capital yields a rise of TFP (about 10%). These results suggest that if firms have additional cash flows they may invest in R&D or on new technology adoption and, therefore, optimize their real activities. Similarly, firms with high liquidity levels could face less financial constraints, have more funds to undertake productivity-enhancing activities (Chen and Guariglia, 2013). TFP growths with firm age, in line with the prediction of learning-by-doing (Jovanovic and Nyarko, 1996). By contrary, the competition in the same industry seems to decrease firms' productivity, in line with the Structure-Conduct-Performance paradigm.

In order to verify the sensitivity of my results, I change the specification for both labour productivity and TFP equations. Columns 2 and 3 of both Tables 1.3 and 1.4 show the findings obtained adding HUMKAP – a dummy variable equal to one if a firm has a higher share of graduate employees with respect to the national average share of graduates – and adding SIZE - binary variable accounting for firms with total assets less than ten million of Euros, respectively. In column 4, the inclusion of ZCORE is justified by the evidence about the positive linkage between banking relationships and the efficiency of firms that register higher default probability (Yildirim, 2017). This variable represents an indicator of financial health (Houston et al., 2010; Kanagaretnam et al., 2012; Jin et al., 2013; Mihet, 2013, Agostino and Trivieri, 2018), which measures the distance from insolvency. Thus, higher Z-score values indicate more stable and financially healthy firms.[44]

Column 5 contains results obtained adding the JACOB index, number of sectors (2-digit level) in each region, with more than 10 firms. In column 6, I change the specification of the productivity model by including the imputed variable TRAIN and GROUP, which represent whether firm's employees have participated in formal training programs and firms belonging to a group; and computing the Herfindahl index (HHI) on sales rather than assets. Finally, the benchmark models referring to labour productivity and TFP, are estimated accounting for specific sectors, classified following the Pavitt's Taxonomy.[45] Columns 7 to 9 (Tables 1.3 and 1.4) present the estimates for the categories Pavitt 1, Pavitt 2 and aggregation of Pavitt 3 and 4, respectively. My results seem

[44] The Z-score is the sum of return on assets plus the capital asset ratio divided by the standard deviation (S.D.) of return on assets, the latter being computed over three-year rolling time windows (Panetta and Pozzolo 2,010; Schaeck et al., 2012).

[45] Pavitt's Taxonomy, due to Pavitt (1984) consists of four categories of industrial firms: (i) supplier-dominated: firms engaged on traditional manufacturing (i.e. food, drink and textiles) to whom innovation is external to the firm; (ii) scale-intensive: large firms involved on production of basic materials and consumer durables. They rely on internal and external sources of innovation; (iii) specialized suppliers: smaller and specialized enterprises that sell the produced technology; (iv) science-based: high-tech firms which rely on R&D from both internal or external (i.e. university and industry as pharmaceutics) source of innovation.

robust to all specification adjustments mentioned above, except for the subsector Pavitt 2 considering TFP.[46]

[TABLE 1.4]

1.8. CONCLUSION

This chapter provides evidence on the link between lasting lending relationships and firms' productivity. To the best of my knowledge, the literature on this topic is quite scant. Indeed, very few contributions have investigated the link between credit relationships and several indicators of firms' performance, such as sales growth and asset turnover (Montoriol Garriga, 2006), labour productivity (Franklin et al, 2015) or technical efficiency (Agostino et al., 2018).

Employing the duration of a credit relationship, commonly used as the main indicator of its closeness, and following Agostino et al. (2018), I formulate my research hypotheses by relating the theoretical literature of the research on costs and benefits of lending relationships with predictions of the agency costs theory (Jensen and Meckling, 1976). In a nutshell, close credit relationships are expected to have an impact on firms' productivity depending on the firms' debt level.

This work employs microdata on French and Italian manufacturing SMEs in the period between 2001 and 2008. To carry out the empirical analysis, I apply the system GMM proposed by Blundell and Bond (1999) because of its ability to capture firm-level fixed effects and to deal with endogenous regressors and potential measurement bias. First, system GMM is used to model the relationship between labour productivity and its determinants and, then, to obtain consistent measures of TFP and estimates of its predictors.

The results of both productivity models show that the effect of credit relationships on SMEs' productivity is positive for low firms' debt levels. However, in line with my research hypothesis, beyond a certain threshold of about 60%, the impact of a longer lending relationship becomes insignificant or, even, negative for values of debt greater than circa 80%. As an interpretation of this evidence, therefore, it could be argued that, in correspondence to a higher level of debt, the costs associated with a close lending relationship may aggravate the managers' opportunistic behaviour, who may not pursue the optimal resource allocation.

[46] As the correlation between KAP and RAWM is lightly high, I also estimated equation (1) by getting rid of intermediate inputs. The results, not reported for the sake of brevity, tend to confirm the evidence displayed in Table 1.3.

Much research is still needed in the area of lending relationships and their effect on firms' productivity. Future works may address whether the global financial crisis has altered the evolution of firm-bank relationships. Moreover, the direction and the intensity of the impact of lasting lending relationships on firms' performance may be dissimilar in market-based financial systems. Finally, rather than the traditional measures, a direct indicator of the type of information that the bank asks in order to assess the borrower's creditworthiness could be employed to investigate whether the link between lending relationships and firms' productivity assumes the same characteristics.

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TABLE 1.1 - Description and summary statistics of the variables used in the estimations

VARIABLE	DESCRIPTION	Mean	StdD	Min	Max	Obs
LABPR	Total sales to number of employees	1.70	1.67	0.02	35.74	32,281
TOTREV [(a)]	Total sales	62.16	84.76	3.20	1,415	32,281
KAP [(a)]	Tangible plus intangible fixed assets plus depreciation	14.29	24.20	0.19	385.46	32,281
LAB [(b)]	Number of employees	37	34.57	10	248	32,281
RAWM [(a)]	Expenditure for raw materials	30.78	56.40	0.15	1331	32,281
DURAT [(c)]	Duration of the relationships with the main bank	14	10.57	0	52	15,008
LEV [(d)]	(Current plus non-current liabilities) to total assets	66.19	19.14	17.11	96.44	32,281
CASHFLOW [(d)]	Cash flow to total assets	8.13	6.94	-18.84	33.88	32,281
WORKCAP [(d)]	(Currents assets minus current liabilities) to total assets	21.78	21.83	-45.57	76.59	32,281
AGE [(c)]	Current year minus firm's year of establishment	34	24.96	3	159	32,218
HHIa	Herfindahl-Hirschman index on firms' total assets	0.02	0.07	0	0.42	32,281
Robustness checks						
HUMKAP	Dummy = 1 if firm has a higher share of graduate employees with respect to the national average share of graduates	0.33	0.47	0	1	32,281
SIZE	Dummy = 1 if total assets ≤ 10 million of Euros	0.89	0.31	0	1	32,281
ZSCORE	(ROA + capital asset ratio) / standard deviation of ROA	0.20	0.27	-0.03	2.67	24,412
JACOB [(b)]	Jacob index: number of sectors (2-digit level) in each region, with more than 10 firms	7	5.34	0	16	32,281
TRAIN	Dummy = 1 if employees have participated to formal training programs	0.68	0.47	0	1	32,281
GROUP	Dummy = 1 if a firm belongs to a group	0.21	0.41	0	1	32,281
HHIs	Herfindahl-Hirschman index on firms' sales	0.02	0.07	0	0.46	32,281

All the variables come from the EU-EFIGE/Bruegel-UniCredit dataset; (a) in thousands of Euros (deflated values); (b) in unit; (c) in years; (d) in percentage.

TABLE 1.2 - Correlation matrix

	KAP	LAB	RAWM	DURAT	LEV	CASHFLOW	WORKCAP	AGE	HHIa	HUMKAP	SIZE	ZSCORE	JACOB	TRAIN	GROUP	HHIs
KAP	1															
LAB	0.4286	1														
RAWM	0.4837	0.4532	1													
DURAT	0.0431	0.006	0.0025	1												
LEV	-0.0046	-0.034	0.0695	-0.1671	1											
CASHFLOW	-0.0739	-0.038	-0.1039	0.0206	-0.3478	1										
WORKCAP	-0.2567	0.0037	-0.058	0.1162	-0.6511	0.2018	1									
AGE	0.0773	0.1308	0.0424	0.3212	-0.1744	-0.0227	0.1137	1								
HHIa	0.0399	0.0403	0.0196	-0.019	0.0217	-0.0322	-0.0212	0.0028	1							
HUMKAP	0.0349	-0.0737	0.0274	-0.0193	-0.054	0.0147	0.043	0.0397	0.0074	1						
SIZE	-0.6208	-0.5037	-0.6487	-0.0238	-0.0043	0.107	0.0492	-0.0858	-0.0419	-0.0551	1					
ZSCORE	0.125	0.0202	0.0704	0.0779	-0.2148	0.017	0.0903	0.0688	-0.0002	0.0051	-0.0808	1				
JACOB	0.0359	-0.0364	0.0307	0.0235	0.1914	-0.1402	-0.0575	-0.0218	-0.0048	-0.0548	-0.038	-0.0008	1			
TRAIN	0.0417	0.181	0.0578	0.0473	-0.1526	0.1154	0.0735	0.0886	-0.0182	0.1279	-0.0679	0.0082	-0.1466	1		
GROUP	0.1546	0.2878	0.2221	-0.0413	-0.0834	0.0424	0.0378	0.0279	0.0048	0.043	-0.2021	-0.0179	-0.0691	0.134	1	
HHIs	0.0682	0.0629	0.0476	-0.0082	-0.0054	-0.0251	-0.01	0.0247	0.5357	0.0389	-0.0752	0.0013	-0.0043	0.0128	0.0492	1

For the description of the variables see Table 1.1.

TABLE 1.3 - SYS-GMM results: labour productivity

	Benchmark Model	Adding HUMKAP	Adding SIZE	Adding ZSCORE	Adding JACOB	Changing specification	PAVITT 1	PAVITT 2	PAVITT 3 - 4
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
DURAT	0.0250***	0.0198**	0.0239**	0.0293***	0.0175**	0.0250***	0.0240**	0.0149*	0.0231**
	0.009	*0.018*	*0.012*	*0.000*	*0.015*	*0.000*	*0.025*	*0.074*	*0.013*
LEV	1.2043***	1.0756***	1.1380***	1.1820***	0.9600***	1.2342***	0.9475**	1.0591***	1.0203***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.024*	*0.006*	*0.000*
DURAT*LEV	-0.0357**	-0.0255**	-0.0353**	-0.0422***	-0.0237**	-0.0347***	-0.0298**	-0.0247**	-0.0369***
	0.014	*0.034*	*0.013*	*0.000*	*0.020*	*0.001*	*0.042*	*0.048*	*0.004*
KAP	0.0024	0.0065	-0.0641	0.001	-0.0051	0.0071	-0.008	0.0364	-0.0148
	0.94	*0.864*	*0.183*	*0.978*	*0.919*	*0.792*	*0.910*	*0.429*	*0.701*
RAWM	0.2821***	0.2843***	0.2359***	0.3397***	0.2785***	0.2713***	0.1916***	0.1635***	0.2654***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.009*	*0.000*
CASHFLOW	0.1966	0.2697	0.3053	0.0293	0.2046	0.3032	1.1781*	0.9493***	0.5153
	0.362	*0.305*	*0.188*	*0.921*	*0.405*	*0.202*	*0.051*	*0.002*	*0.121*
WORKCAP	0.0749	0.0901	-0.0585	0.0207	0.066	0.0913	0.0703	0.0325	0.025
	0.505	*0.536*	*0.699*	*0.889*	*0.571*	*0.296*	*0.784*	*0.858*	*0.901*
AGE	-0.0006	0.0001	-0.0017	0.0002	-0.0016	-0.0017	0.0012	-0.0015	-0.0005
	0.763	*0.999*	*0.389*	*0.913*	*0.384*	*0.471*	*0.503*	*0.338*	*0.789*
HHIa	-0.0172*	-0.0145	-0.0163*	-0.012	-0.0131		-0.0168	-0.0270*	-0.0057
	0.087	*0.161*	*0.072*	*0.400*	*0.166*		*0.211*	*0.061*	*0.740*
HUMKAP		0.6278**							
		0.028							
SIZE			-0.2771***						
			0.005						
ZSCORE				-0.0013					
				0.968					
JACOB					-0.0038				
					0.243				
TRAIN						-0.1971			
						0.367			
GROUP						0.3002			
						0.111			
HHIs						-0.0198**			
						0.027			
Observations	12,346	12,346	12,346	11,047	12,346	12,346	3,007	6,602	2,466
Model test	4,829.39	3,447.82	5,834.80	102,784.97	5,275.37	4,657.68	6,635.67	5,776.87	1,282.86
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*

(continued)

TABLE 1.3 (continued) - SYS-GMM results: labour productivity

	Benchmark Model	Adding HUMKAP	Adding SIZE	Adding ZSCORE	Adding JACOB	Changing specification	PAVITT 1	PAVITT 2	PAVITT 3 - 4
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
χ2 test (DURAT,LEV)	22.89	15.37	12.93	31.89	17.12	41.6	5.45	8.00	12.35
	0.000	*0.000*	*0.002*	*0.000*	*0.000*	*0.000*	*0.065*	*0.018*	*0.002*
AR(1) z-statistic	-3.00	-3.03	-3.00	-2.67	-3.01	-3.01	-2.29	-2.18	-4.44
	0.003	*0.002*	*0.003*	*0.008*	*0.003*	*0.003*	*0.022*	*0.029*	*0.000*
AR(2) z-statistic	1.05	1.05	1.03	0.97	1.05	1.05	-0.04	1.24	0.97
	0.296	*0.293*	*0.302*	*0.333*	*0.294*	*0.296*	*0.967*	*0.215*	*0.331*
Hansen test	1,051.64	1,060.52	1,086.07	998.23	1,102.42	1,079.68	256.99	817.8	207.78
	0.188	*0.262*	*0.184*	*0.319*	*0.084*	*0.270*	*0.107*	*0.612*	*0.237*

For the description of the variables see Table 1.1. In Italics are reported the p values of the tests. Superscripts ***, ** and * denote statistical significance at the 1, 5 and 10 percent level, respectively. The dependent variable is (the log of) labour productivity (LABPR). Constant, country, sectoral, year dummies and lagged values of LABPR always included but not reported. KAP and RAWM are in log terms.

TABLE 1.4 - SYS-GMM results: total factor productivity

	Benchmark Model	Adding HUMKAP	Adding SIZE	Adding ZSCORE	Adding JACOB	Changing specification	PAVITT 1	PAVITT 2	PAVITT 3 - 4
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
DURAT	0.0051***	0.0054***	0.0046**	0.0052***	0.0050**	0.0061***	0.0042*	0.0032	0.0044*
	0.007	*0.007*	*0.015*	*0.009*	*0.016*	*0.004*	*0.080*	*0.209*	*0.099*
LEV	0.3884***	0.4017***	0.3765***	0.4216***	0.3722***	0.4254***	0.2662***	0.3993***	0.3890***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.004*	*0.000*	*0.000*
DURAT*LEV	-0.0079***	-0.0083***	-0.0071***	-0.0080***	-0.0075**	-0.0088***	-0.0066*	-0.0043	-0.0074*
	0.004	*0.004*	*0.008*	*0.005*	*0.011*	*0.003*	*0.055*	*0.244*	*0.068*
KAP	0.0348*	0.0371*	0.0405*	0.0395***	0.0463**	0.0420**	0.0068	0.0601***	0.1181***
	0.054	*0.051*	*0.060*	*0.005*	*0.014*	*0.028*	*0.802*	*0.004*	*0.002*
LAB	0.0779***	0.0760***	0.0729***	0.0807***	0.0939***	0.0700***	0.0673***	0.1611***	
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.003*	*0.005*	*0.000*	
RAWM	0.5701***	0.5714***	0.5781***	0.5782***	0.5707***	0.5657***	0.6604***	0.5353***	0.5829***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
CASHFLOW	0.2765***	0.2847***	0.2796***	0.3133***	0.2765***	0.3384***	0.3208***	0.3782***	0.2372**
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.002*	*0.000*	*0.043*
WORKCAP	0.1166***	0.1189***	0.1227***	0.1477***	0.1263***	0.1361***	0.0962	0.2310***	0.2417***
	0.002	*0.001*	*0.001*	*0.000*	*0.000*	*0.001*	*0.103*	*0.000*	*0.004*
AGE	0.0007*	0.0007*	0.0006*	0.0006	0.0004	0.0006	0.0005	-0.0005	-0.0001
	0.070	*0.078*	*0.056*	*0.108*	*0.265*	*0.123*	*0.343*	*0.413*	*0.769*
HHIa	-0.0085***	-0.0078**	-0.0077**	0.0001	-0.0070**		0.0057**	-0.0280***	0.0063
	0.008	*0.018*	*0.024*	*0.976*	*0.030*		*0.044*	*0.000*	*0.226*
HUMKAP		-0.015							
		0.581							
SIZE			-0.0174						
			0.236						
ZSCORE				0.0058					
				0.372					
JACOB					0.0014***				
					0.003				
TRAIN						0.0178			
						0.562			
GROUP						0.0987**			
						0.012			
HHIs						-0.0091***			
						0.004			
TREND	0.0029***	0.0029***	0.0025***	0.0041***	0.0028***	0.0031***	0.0037**	0.0006	0.0008
	0.000	*0.000*	*0.002*	*0.000*	*0.000*	*0.000*	*0.010*	*0.578*	*0.566*

(continued)

TABLE 1.4 (continued) - SYS-GMM results: total factor productivity

	Benchmark Model	Adding HUMKAP	Adding SIZE	Adding ZSCORE	Adding JACOB	Changing specification	PAVITT 1	PAVITT 2	PAVITT 3 - 4
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
Observations	12,346	12,346	12,346	11,047	12,346	12,346	3,007	6,602	2,466
Model test	104,731.80	106,776.55	70,523.62	86,517.33	62,956.62	52,858.56	23,465.22	16,661.12	64,275.32
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
AR(1) z-statistic	-9.56	-9.52	-9.52	-12.75	-9.59	-9.45	-7.05	-9.61	-3.54
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
AR(2) z-statistic	4.11	4.09	4.14	3.76	4.05	4.02	3.54	2.8	1.3
	0.398	*0.421*	*0.438*	*0.639*	*0.397*	*0.409*	*0.108*	*0.157*	*0.195*
Hansen test	1,068.56	1,084.58	1,094.08	1,037.15	1,098.87	1,081.49	264.41	735.61	308.44
	0.338	*0.371*	*0.401*	*0.347*	*0.315*	*0.567*	*0.447*	*0.414*	*0.312*

For the description of the variables see Table 1.1. In Italics are reported the p values of the tests. Superscripts ***, ** and * denote statistical significance at the 1, 5 and 10 percent level, respectively. The dependent variable is (the log of) total sales (TOTREV). Constant, country, sectoral dummies, time trend and lagged values of TOTREV, KAP, LAB and RAWM always included but not reported. KAP and RAWM are in log terms.

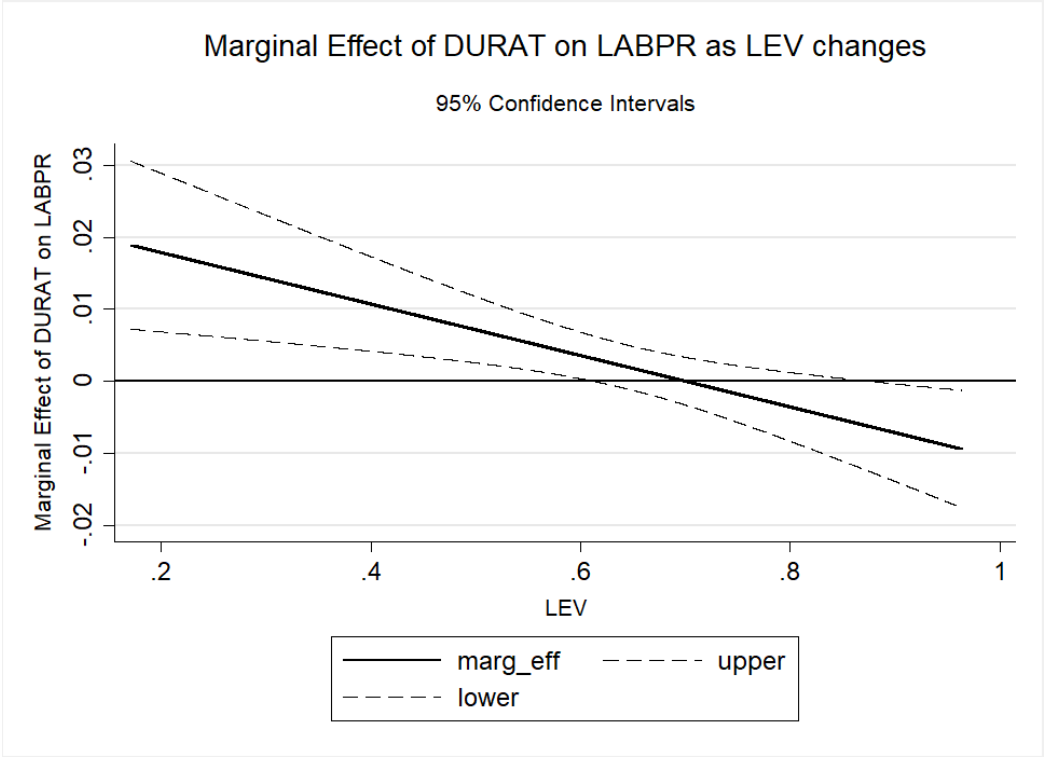

Figure 1.1. Marginal Effect of DURAT on LABPR as LEV changes

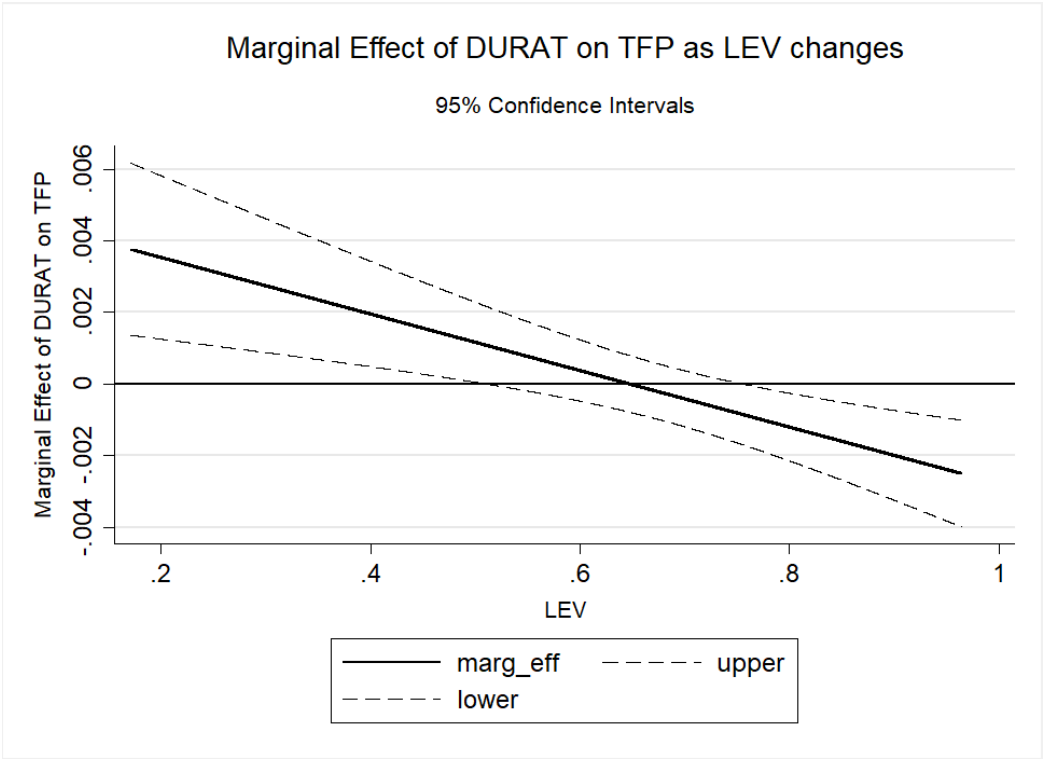

Figure 1.2. Marginal Effect of DURAT on TFP as LEV changes

CHAPTER 2

DOES SOCIAL CAPITAL SUBSTITUTE FOR LENDING RELATIONSHIPS? A STUDY ON ITALIAN SMEs

ABSTRACT

This chapter investigates the role that the local social capital endowment plays in affecting the costs and benefits of lending relationships. By estimating the link between lending relationships duration and Italian SMEs' productivity over the 2004 – 2009 period, I empirically test whether there is complementarity or substitutability between credit relations and social capital. The results show that the (positive) influence of enduring lending relationships decreases as social capital increases, suggesting that social capital might act as a substitute for lending relationships. The latter, however, appear to be important for SMEs performance in less civic regions. This evidence highlights the need to design specific policies that should enable SMEs to easily access credit through both relationship lending and social engagement.

Keywords: lending relationships, social capital, TFP, SMEs, SYS-GMM, EFIGE data.

2.1. INTRODUCTION

A considerable number of studies have analysed the role of lending relationships in shaping firms' economic performance (e.g.: Montoriol Garriga, 2006; Benfratello et al., 2008; Giannetti, 2012; Agostino et at., 2018). In this strand of research, a close lending relationship refers to strong connections between firms and banks that go beyond the execution of simple financial transactions (e.g. Petersen and Rajan, 1994; Boot, 2000; Ongena and Smith, 2000). Indeed, the characterizing ingredient of a relationship lending is the acquisition and the accumulation of *soft information* on firms by banks over time, so that the intensity of a lending relationship is usually proxied by its duration (Udell, 2008).

By mitigating asymmetric information problems and enhancing screening and monitoring mechanisms, the accumulation of *soft information* might have several beneficial effects for firms, such as increasing credit availability (Berger and Udell, 1995; Hernández-Cánovas and Martínez-Solano, 2010; Kano et al., 2011), decreasing loan interest rate (Petersen and Rajan, 1995; Brick and Palia, 2007), reducing collaterals requirements (Harhoff and Korting, 1998; Jimenez et al., 2006; Brick and Palia, 2007), lessening firms' dependence on trade debt (Petersen and Rajan 1994, 1995), fostering firms' product and process innovations (Herrera and Minetti, 2007; Benfratello et al., 2008; Giannetti, 2012), stimulating firms' foreign direct investment (De Bonis et al., 2010) and promoting firms' efficiency (Agostino et al., 2018).

Nevertheless, the banking literature has also shown that close bank-firm ties might have some "dark sides" (Boot, 2000). Indeed, banks might monopolise the information on borrowers gained during the time and lock them in a credit relationship. Such a *hold-up* mechanism would allow banks to exploit rents from borrowers by charging higher interest rates, which could cause distortions in investment incentives (Rajan, 1992). Besides, by *softening budget* constraints, close banking relationships might induce borrowers to adopt risk-taking behaviours, then increasing firms' default probability (Bolton and Scharfstein, 1996).

A more recent issue, addressed by some contributions, is whether the (*net*) impact of costs and benefits of enduring lending relationships on firms' performance might depend on some characteristics of the environmental context in which both banks and firms operate, that is on *external factors* to the bank-firm relation itself (e.g. De la Torre et al., 2008; Agostino et al., 2012; Giannetti, 2012; Mancusi et al., 2018). The research on this topic appears quite scant – and, to the best of my knowledge – there is no attempt to investigate the role that the social capital endowment at the local level may play in affecting costs and benefits of lending relationships.

Why should one ask such a question? According to Putman et al. (1994, p. 167), social capital refers to the "features of social organisation such as networks, norms, and social trust that facilitate

coordination and cooperation for mutual benefit". By creating mutual trust, social capital promotes the consolidation of informal *enforcement* mechanisms – as shared values and social norms encourage compliance of contractual agreements. By doing so, social capital might contribute to mitigating adverse selection and moral hazard problems in credit markets (Coleman, 1990; Spagnolo, 1999; Guiso et al., 2006). What is more, favouring *social collateral* creation and *peer monitoring* activities, social capital might facilitate banks in collecting *soft information* on borrowers (Stiglitz, 1990; Varian, 1990; Karlan et al., 2009). Not least, mutual trust may exert pressure on borrowers to reduce opportunistic behaviours, these being contrary to moral and social rules (Hernandez-Canovas and Martınez-Solano, 2010; Agarwal et al., 2011; Guiso et al., 2013).

By relying on the consideration that – for its nature – social capital helps banks in collecting *soft information* on borrowers, thus facilitating the establishment as well as the preservation of a lending relationship, it is plausible to assume that the former might act as a *complementary public good* for lenders' screening and monitoring activities, hence favouring the financing of creditworthiness firms. However, as an implication of being a public good, social capital might weaken the need for lasting bank-firm relationships. Indeed, these latter could not be of crucial importance for firms in the more civic regions, as it might act as a *substitute* for lending relations.

To investigate the role of social capital with respect to the relevance of lending relationships for firms, I adopt the following research strategy. The (*net*) effect of costs and benefits of close bank-firm relations is assessed by estimating the link between lending relationship duration and a firms' performance profile. I focus on firms' productivity for three reasons. First, lack of information on the amount of firms' bank debt for each year of my analysis (EFIGE data only reports the percentage of the firm's total bank debt held by the main bank for 2008), preclude me from carrying out the investigation in terms of firms' credit availability or loan pricing. Second, looking at firms' productivity rather than other performance profiles (i.e. profitability), allows me to employ a quite refined measure of firms' performance, instead to use standard balance-sheet ratios. Finally, to the best of my knowledge, the link between lending relationships and firm productivity has been so far neglected in the literature. Indeed, only a very few recent studies have addressed such an issue (e.g.: Franklin et al., 2015; Agostino et al., 2018). A key aspect of my research strategy is that the link between lending relationship duration and firms' productivity is estimated by conditioning the former on the level of social capital at regional level – to test the following research hypothesis: if social capital is a substitute of enduring lending relationships, the *net* impact of the latter on SMEs' productivity should be stronger when social capital is low, and this effect should be observed smaller as the level of social capital increases. On the other hand, if

lasting lending relationships and social capital interplay as complementary, I should observe an increasing effect of close bank-firm relations on SMEs' productivity in high-social capital regions.

To conduct the empirical investigation, I focus on small and medium-sized firms (SMEs), as banks represent the primary source of external finance for these enterprises – thus playing a central role in determining their financial constraints (Bank of Italy, 2007; European Commission, 2010). Besides, as shown in the literature, lending relationships are of crucial relevance for SMEs – in consideration of their opaqueness in terms of size and age (Petersen and Rajan 1994, 1995; Berger and Udell, 1995, 2006; Cole, 1998; D'Auria et al., 1998; Harhoff and Korting, 1998; Foglia, and Marullo Reedtz, 1999; Cole et al., 2004; Udell 2009).

This chapter takes advantage of microdata provided by the EU-EFIGE dataset on manufacturing SMEs operating in Italy between 2004 and 2009. The social capital endowment is measured at the regional level by the indicator *Voice and Accountability* included in the IQI index built by Nifo and Vecchione (2014, 2015). This indicator refers to the participation in public elections, the level of association, the number of social cooperatives and cultural activities computed in terms of books published and purchased in bookshops.

Three main reasons justify the choice to focus on Italy. First of all, the Italian business landscape is dominated by SMEs, which are the main drivers of growth and may produce a more efficient resource allocation (e.g.: Yang and Chen 2009). What is more, among other European nations, Italy is a bank-based economy in which relationship lending is a common practice (Demirgüç-Kunt and Levine, 1999). Finally, the social capital endowment of Northern-centre regions is relatively higher than that of *Mezzogiorno*, making Italy particularly appropriate for my analysis (Putman, 1993; Guiso et al., 2004b). In general, adopting a regional approach is strongly justified by recent literature, which evidence that national productivity follows the shape of regional productivity (McCann, 2018).

On a methodological ground, first, I adopt the two-step estimation method of TFP proposed by Levinsohn and Petrin (2003), and then the system GMM estimator proposed by Blundell and Bond (1999). This empirical strategy allows addressing the potential endogeneity of most productivity determinants and control for firms' heterogeneity.

The results of my econometric analysis suggest that the (positive) impact of lasting lending relationships on SMEs' productivity is stronger at lower levels of social capital, and tends to decrease as social capital increases. Therefore, in line with my research hypothesis, I find that social capital might act as a substitute for lending relationships. The latter, however, appear to be relevant for SMEs performance where there is a lack of shared values and social norms.

The remainder of this work is organised as follows: Section 2 and 3 review the literature of the lending relationship and social capital, respectively. Section 4 describes the data used, and Section 5 defines the empirical methodology. Section 6 illustrates the results obtained and robustness checks performed, and, Section 7 concludes.

2.2. RELATED LITERATURE: RELATIONSHIP LENDING

2.2.1 Definition and features

The theory of financial intermediation suggests that, in a context of information asymmetries, banks emerge as a more efficient allocative mechanism than the market because they are able to yield confidential information and produce advantages for borrowers via the so-called relationship lending. As thoroughly reviewed in the previous chapter, the concept of relationship lending pertains to close ties between firms and financial institutions (Petersen and Rajan, 1994). Boot (2000, p. 10) argues that relationship banking is "the provision of financial services by a financial intermediary that: (i) invests in obtaining customer-specific information, often proprietary in nature; and (ii) evaluates the profitability of these investments through multiple interactions with the same customer over time and/or across products". In addition, relationship lending is defined as "the investment in providing financial services that will allow to repeatedly deal with the same customer" (Freixas, 2005, p. 4) and as "a long-term implicit contract between a bank and its debtor" (Elsas, 2005, p. 34).

Peculiar synergies between banks and their customers are contemplated in all definitions which allow banks to collect confidential information through repeated interactions with the same borrowing firm. Therefore, the principal characteristic of relationship lending is the presence of additional information on borrowers beyond that already available from the bank. In obtaining such extra information, the first phase of the *ex-ante* screening process occurs, followed by a monitoring activity during the time with the provision of multiple financial services. Since the high cost of gathering information by a bank, *soft information* (non-quantifiable information got through links with the firm and its stakeholders) cannot be easily transmitted either within the bank or across financial institutions (Stein, 2002) and the lender takes its decisions basing on *soft information*, characterizing lending relationship as a lending technology (Berger and Udell, 2002, 2005). The main feature of the relationship lending technology is its opaque nature since it is based on information hard to quantify. This type of technology would be more important for SMEs which tend to be young, less flexible to market changes and rely on banks as the main source of external funds. By contrary, hard information generated at the time of loan origination, typifies

the so-called transaction lending technologies which are associated with the arm's-length lending, to transparent information and they would be used by high-quality borrowers.

Therefore, an extensive literature focuses on relationship lending, even if "relationship banking goes beyond lending and includes other services as well" (Boot, 2000, p. 9) because the bank represents the main institution effectively investing to acquire borrower-specific information in the lending process (Freixas, 2005). Moreover, benefits for both parts emerge in the presence of stable and lasting relationships such as close monitoring of firms, easy debt renegotiation, liquidity transformation and more plausible long-term contracts (Corigliano, 2007).

2.2.2 Benefits of close lending relationships

When information on firms and their potential investment opportunities are opaque, lending relationships can represent valuable assets for both the banks and borrowers. Indeed, the first benefit of relationship lending is to facilitate the exchange of information between the lender and the customer. The former invests in gaining information from its client firms and these latter are more motivated to share information because of the guarantee of certain privacy (Yosha, 1995). In this mechanism, the problems of moral hazard and adverse selection present in credit markets might be overcome by lowering information asymmetries, enhancing the project-choice and disciplining managerial behaviour (Diamond, 1991; Weinstein and Yafeh, 1998).

Other benefits, as argued by Boot (2000), could regard the possibility of long-run loan contracts, more flexibility on debt renegotiation and certain discretion in using the *soft information* revealed during the credit relationship. In other words, relationship lending allows to obtain profitable funding in the long run and, moreover, the renegotiation of contracts *ex-post* can support firms to face with delayed payment, in case of momentary difficulty of the firm to repay the loan (Boot et al., 1993, Greenbaum and Thakor, 1995, Von Thadden, 1995). Therefore, relationship lending increases credit availability (Petersen and Rajan, 1994; Berger and Udell, 1995; Angelini et al., 1998; Cole, 1998; Elsas and Krahnen, 1998; Chakraborty and Hu, 2006; Bharath et al., 2009; Hernandez-Canovas and Martınez-Solano, 2010; Kano et al., 2011). What is more, credit relationship leads to the decrease of the interest rate (Berger and Udell, 1995; Petersen and Rajan, 1995; Brick and Palia, 2007), decreases the interest rate cycle (Ferri and Messori, 2000) and diminishes the probability for firms to pledge collaterals (Jimenez et al., 2006; Brick and Palia, 2007). What is more, benefits of close lending relationship are also connected to the reduction of firms' dependence on trade debt (Petersen and Rajan, 1994, 1995), to fostering firms' product and process innovations (Herrera and Minetti 2007; Benfratello et al., 2008; Giannetti 2012;) and to promoting firms' foreign direct investment (De Bonis et al., 2010).

2.2.3 Cost of relationship lending

Two main problems – *hold-up* and *soft-budget* constraint – affect relationship banking, leading to the creation of potential costs. The *hold-up* drawback refers to the situation in which the bank can monopolise the information gathered during the relationship to the detriment of the client firm. Indeed, the bank may take advantage of the acquired *soft information*, providing future loans to a non-competitive price. In other words, banks are able to extract monopoly rents from borrowers and gain negotiating power (Sharpe,1990; Rajan,1992). The principal consequence of this problem can be distortions in investment incentives (Rajan, 1992); the minor effort of the borrower to accomplish the obligations (Dewatripont and Maskin, 1995), managers' risk-taking behaviour and, hence, increasing probability of default (Bolton and Scharfstein, 1996). One possible solution could be to borrowing from multiple banks by diversifying the relationships (Von Thadden, 1995; Thakor, 1996) and/or sharing of information with other financial institutions. According to Von Thadden (1995), a competition between banks and the limit of the risk of *ex-post* increasing *premia* of loans can be activated with a contemporary relationship between at least two banks.

The second potential problem of close lending relations refers to the *soft budget* constraint. This circumstance rises with the lower motivation of a borrower to make an effort *ex-ante* to fulfil her obligation because of the expecting *ex-post soft budget* constraint of her lender (Bolton and Scharfstein, 1996). In other words, the borrower might minimize her effort in preventing negative outcomes when the renegotiation of a loan is too easy. The motivation of this misbehaviour might be due to disproportionate familiarity between the two parts, yielding to the alteration *ex-ante* of the firm's incentive to perform well (Boot, 2000). Therefore, in this circumstance, the bank's credibility represents the decisive point to solve this problem. In fact, lower credibility, and as a result less risk of loan revoking may exacerbate managers' opportunistic behaviour and risk-taking, increasing the firm's default probability (Bolton and Scharfstein, 1996; Dewatripoint and Maskin, 1995). The problem of *soft budget* constraints could be overcome allowing bank debt priority over firm's other entitlements.

2.2.4 Measures of the strength of lending relationships

Since the intensity of the relationship between banks and borrowers is not directly observable, empirical studies use different proxies to measure the closeness of the lending relationship. The most common proxy used in the literature is the duration of the credit relationship, which should reflect the accumulation over time of private information on borrowers by lenders. Some caveats are in order here: the duration of the bank-borrower relationship is highly correlated with the firm age (Berger and Udell, 1995; Cole, 1998). Indeed, the duration of the relationship captures private

information got by the bank over time; however, age accounts for the reputation built by the firm over time. Therefore, on estimating the effect of duration, it should be controlled for age to avoid biased results. Moreover, the duration is right-censored, i.e. it can account only for past relationships between borrowers and banks (Elsas, 2005).

Another proxy used in the literature is the number of simultaneous bank relationships of a firm or, likewise, an indicator variable for firms with an exclusive bank relationship. As above-mentioned, an exclusive relationship grants the main bank to have a monopoly of information *ex-post*, implying a close link between the bank and the borrower (Sharpe, 1990; Rajan, 1992). Finally, other measures employed are, for instance, the share of the borrower's total debt provided by the main bank and the Herfindahl index of borrowing concentration computed as the sum square of the share of debt provided by each lender. The reason for the use of these proxies is also to consider asymmetric financing among several lenders, which is not possible with the number of bank relationships.

2.2.5 Empirical evidence

The literature is still scant on the effects of close lending relationships on different SMEs' features. De Bonis et al. (2010) find that a longer relationship with the main bank increases Italian firms' foreign direct investment (FDI). Similarly, according to Herrera and Minetti (2007) and Mancusi et al. (2018), the bank-firm relationship has a positive effect on export margins and the probability to introduce product innovation. Specifically, Mancusi et al. (2018) also show that the effect of relationship lending on innovation is weaker than that on exports for 4341 Italian SMEs. Instead, the duration of the relationship with the main bank seems to have no impact on the firm's extensive margin of export (Minetti and Zhu, 2011). Moreover, longer relationships foster the capacity of small high-tech firms to innovate (Giannetti, 2012) and positively affect both the propensity and the intensity of R&D activities (Micucci and Rossi, 2012). Then, Alessandrini et al. (2010), based on the idea that *soft information* deteriorates in the transmission within the bank organisation as the distance between hierarchical levels increases, discover that whenever there is a higher distance between bank branches and headquarters, firms are less inclined to introduce process and product innovations. Conversely to previous studies that use indirect proxies of relationship lending, Cosci et al. (2016) use a direct measure by observing the type of information the bank asks in order to give credit. Authors evidence a positive impact of the soft-information intensive relationships on the European firm's innovation; by contrast, credit concentration negatively affects firms' innovative performances.

Another strand of literature studies the link between enduring bank relationships and firm growth. For instance, the pioneer study of Nakatani (1984) shows that Japanese small firms belonging to a keiretsu (i.e. a set of firms showing joint relationships and shareholdings around one main bank) do not perform better, in terms of the growth rate of sales revenue, compared to no-keiretsu firms. Similar results are found for large Japanese firms by Weinstein and Yafeh (1998) and Miarka (1999). On the same wave, Agarwal and Elston (2001) find that growth rates of firms in Germany are not related to the strong bank-firm relationships and Shin and Kolari (2004) do not find any robust evidence whether fast-growing firms are more inclined to borrow from the main bank. More recently, Gambini and Zazzaro (2013) illustrate that relationship lending negatively influences the Italian firms' dimension, whilst it dampens the negative growth of medium-large enterprises that present financial problems. In addition, the impact of closeness firm-bank on investment for a set of European countries is negative, maybe because of the increase of standards to obtain a loan justifying the credit crunch occurred during the financial crisis and provoking the crunch of firms' investment (Bucă and Vermeulen, 2017).

Finally, Montoriol Garriga (2006) shows that Spanish SMEs' performance, accounted for several indicators, in the period 1993-2004 seems to be negatively influenced by exclusive bank relationships. Instead, Franklin et al. (2015) examine the effect of credit supply on UK firms' labour productivity, among other outcomes, in the aftermath of the 2008 financial crisis. The authors exploit information on pre-crisis lending relationships, finding that a reduction in credit supply yields to a drop in labour productivity. Similarly, Agostino et al. (2018) analysis the connection between the duration of credit relationship and European SMEs' technical efficiency, evidencing that the positive effect of stable credit relationships on a firm's technical efficiency tends to decline in absolute value, at increasing level of indebtedness.

2.3. RELATED LITERATURE: SOCIAL CAPITAL

2.3.1 Evolution and definitions

The origin of the concept of social capital can be traced to the theorists of the eighteenth and nineteenth centuries and evolves in several areas as economics, sociology, anthropology, and political science. From a historical point of view, the idea of social capital is connected with intellectuals as Weber, Locke, Rousseau, and Marx and it is linked to several concepts as civil society and social connectedness (Putnam, 1995; Brewer, 2003). However, the debate between authors concerns the first use of the term social capital.[47] More in detail, economists argue that the root of

[47] See Woolcock (1998) for a review.

the social capital theory is drawn in the work of Weber (Trigilia, 2001) connected with that of Smith (Portes and Landolt, 1996). Moving from that, the evolution of the current notion of social capital could be reconducted to three important scholars Bourdieu, Coleman, and Putnam (Lang and Hornburg, 1998; Carroll and Stanfield, 2003).

In the wake of Marx's principles, Bourdieu's work starts illustrating the importance of capital as the main driver of inequality that can explain why "everything is not equally possible or impossible" (Bourdieu, 1986, p. 241) since "capital is accumulated labor" (Bourdieu, 1986, p. 241) which enables those who possess it to "appropriate social energy in the form of reified or living labor" (Bourdieu, 1986, p. 241). However, Bourdieu (1986) identifies three kinds of capital - economic, cultural and social – and focuses his work on examining the concept of the last type. Bourdieu (1986) defines social capital as "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition or in other words, to membership in a group which provides each of its members with the backing of the collectivity-owned capital, a credential which entitles them to credit, in the various senses of the word" (Bourdieu 1986, p. 248). Thus, being membership in a "network [...] of mutual acquaintance and recognition" (Bourdieu, 1986, p. 248), yield to advantages for its members, as it permits entree to the assets of other network associates and the belonging to an aristocratic network might function as a signal to outsiders about the resources, hence collateral, that an individual could access thank to his membership. Therefore, the social capital that an actor can possess "depends on the size of the network of connections he can effectively mobilize" (Bourdieu 1986, p. 249). This definition subtends a degree of egocentrism inserted in a context of representative capital and of a critical theory of society (Wall et al., 1998). Moreover, the author explains that social interaction between individuals, which leads to durable relationships, creates and maintains social capital; but, it also yields to a network structure of social ties that are costly for individuals. Then, groups are homogeneous because individuals select to have contact with other individuals that have similar characteristics and preferences; as a result, there is a sort of isolation between different groups. These features represent the main differences from the normative approach of Coleman (1988) and Putnam et al. (1994).

Coleman (1988)'s work is in line with the previous ones concerning the idea that social capital is created in social interaction and it derives from a risky investment acted following individual strategy. However, Coleman's point of view signifies a breaking point, signalling the passage to outcomes for groups, organizations, institutions or societies and, hence, the shift to socio-centric aspects (Adam and Roncevic, 2003). Coleman (1988) suggests that social capital disentangles in several forms of social structure that enable social action depending on the network of authority,

trust, and norms: obligations and expectations which depend on the trustworthiness of the social context; networks of relationship used for collecting information and the presence of norms accompanied by effective penalty. Unlike Bourdieu and Passeron (1979) who consider the entry in a group to be costly, Coleman (1988) points out that the interconnection of individuals, or closure, is a phenomenon that is exclusively found on obligations and expectations, norms and effective sanctions and only settle within a small-sized group. Finally, Coleman (1988) enriches the literature on social capital by carrying out empirical analysis and formulating indicators.

The concept of social capital becomes widespread thanks to the seminal works of Putman et al. (1994). His approach follows Coleman's (1988) configuration of two forms of social capital: obligations and expectations and norms, also respectively defined as relational capital and system capital (Esser, 2008). However, Putman et al. (1994) pay attention to the latter form (norms). The innovative contribution of Putman et al. (1994) is to connect the micro and the macro-level of social capital introduced by Coleman (1988). Indeed, the authors identify the macro-level social capital as an essential channel or tool of connection to explain the performance of macro-level institutions. In *Making Democracy Work*, "Social capital here refers to features of social organization such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit" (Putnam et al., 1994, p. 167). The authors examine the gap between regional governance in the north and south of Italy by treating the level of civic engagement as an explanatory variable. In *Bowling Alone,* Putnam (2000) focuses on the downfall of social capital in the United States, making the example of bowling as an activity that involves a high level of social interaction, a component of social capital. Putman identifies "that social networks have value" (Putnam, 2000, p. 19) for individuals because they "affect the productivity of individuals and groups" (Putnam, 2000, p. 19). In addition, he emphasized the benefits of social capital tenure for the individual, defining them as "individual clout and companionship" (Putnam, 2000, p. 20). Therefore, social capital concerns institutions, relationships and values governing connections among individuals and conducing to economic and social development (Iyer et al., 2005).

As mentioned above, Putman et al. (1994) share with the point of view of Coleman (1988) the general definition of two forms of social capital.[48] However, the formers integrate these two forms by employing the concept of the "norm of reciprocity" that arises from social networks. The underlying mechanism can be synthesized as follow: repeated social interaction, due to the conforming to norms, builds trust; in turn, trust diminishes the perceived risk of not receiving a return for

[48] Id est, obligations and expectations and norms, also respectively defined as relational capital and system capital (Esser, 2008).

unpaid obligations, increases the sanctioning of those who violate a norm and, as a result, favour further social interaction. Hence, as trust plays a central role, Putman (2000, p. 136) distinguishes between "thick trust" and "thin trust". The former refers to trust as a by-product of repeated interaction (Coleman, 1988) and as a requirement for the transmitting of information between contacts (Burt, 1997). Instead, the latter indicates a generalized trust in other individuals, which cannot decrease transaction costs. This idea of trust requires that also other individuals are trustworthy, leading to the possibility that an individual can trust other individuals because they have demonstrated to be trustworthy in repeated interactions. However, since the impossibility of repeated interactions with "the generalized other" (Putnam, 2000, p. 136), Putnam (2000) proposes as solution "honesty based on a general community norm", that it is easier to work in communities characterized by a dense social network because of the higher probability to transmitting and sustaining reputations" (Putnam, 2000, p. 136). Therefore, the principal feature of Putman et al. (1994) and Putman (2000)'s view is the derivation of externalities connected to social capital creation: social interaction at the micro-level and the presence of norms at the macro level are approximately linked through the channels of thin trust and general reciprocity. Thus, the construction of norms is an external effect of social interaction. Putman et al. (1994)'s arguments are integrated by empirical analysis and by the development of the measure so-called "Putman instrument" which consists on an index of civicness that includes four indicators: trust in people and institutions, norms of reciprocity, networks, and membership in voluntary associations (Adam and Roncevic, 2003). The popularity of Putman's contribution derives, therefore, from the first attempt of explaining the efficiency of institutions in society via the level of social capital.

Although its origin and its concept are not new, social capital misses of a generalized definition. Indeed, its meaning does not arise by specific ideological reasons and its speculative definitions depend on the discipline and level of investigation (Robison et al., 2002). The common features of definitions in the literature concern the aspect that social relations lead to productivity benefits. Moreover, the variety of definitions presented in the literature derive from the contextual particular nature of social capital and are substantially based on the motivation of the analysis. Three main focus are the relations which an individual preserve with other individuals, that is also called as 'bridging' social capital, based on external relationships; the structure of the relations among individuals within a community that pay attention on internal relations 'bonding' or 'linking' (Adler and Kwon, 2002); or both kinds of connections. For instance, Bourdieu (1979) follows the formerly mentioned approach and, basing on his contribution, Portes (1998, p. 6) defines social capital as "the ability of actors to secure benefits through membership in networks and other social structures". Thus, since the previous authors have only focused on the benefits of social capital,

Portes and Landolt (1996) analyse its drawbacks and, furthermore, its role in development (Portes and Landolt, 2000). In addition, Baker (1990) considers social capital as "a resource that actors derive from specific social structures and then use to pursue their interests; it is created by changes in the relationship among actors" (Baker 1990, p. 619).

On the other hand, Coleman's (1990) and Putnam et al. (1994)'s contributions follow the bonding social capital and, in the wake of their works, several authors try to enrich our knowledge about social capital. For example, Burt (1997) looks at the position of the individual inside social networks, arguing that social capital refers to those contacts, such as friends and colleagues, which allow bringing financial, human capital and "the brokerage opportunities in a network" (Burt 1997, p. 355).[49] Moreover, the approach of Putman et al., (1994), based on interactive variables and attitudes (trust, norms, values) as representative of social capital, has been followed by many scholars. For instance, Fukuyama (1995, p. 10), considering trust as a single measure, defines social capital as "the ability of people to work together for common purposes in groups and organizations", leading to cooperation among them (Fukuyama, 1997). Furthermore, considering both types of social capital, Woolcock (1998, p. 153) defines it as "the information, trust, and norms of reciprocity inhering in one's social networks".[50] Finally, Nahapiet and Ghosal (1998, p. 243) argue that social capital refers to "the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit. Social capital thus comprises both the network and the assets that may be mobilized through that network".

2.3.2 Social capital features

As mentioned above, social capital can be classified as bridging and bonding (linking). The former refers to vertical relationships between communities (Narayan and Pritchett, 2000; Narayan, 2002) and, hence, involves individuals and organizations that are more distant, characterized by thin trust. For instance, bridging social capital can be encountered between social groups, social classes, different races, and religions, or other important characteristics socio-economic and socio-demographic. The bonding social capital describes horizontal connections between actors within a group or community characterized by a high degree of similarity of demographic attributes, behavioural, information and the resources available. According to Wallis (1998), bonding social

[49] The author considers a measure of social capital in terms of network constraints: the increase of ties leads to lower social capital levels through a decrease of structural holes that are source of social capital.

[50] Woolcock (2001) has contributed to develop a multilevel model of social capital by accounting for the distinction between bridging and bonding social capital, concluding that without bridging social capital, societies do not have what is necessary in order to move on.

capital has the main feature to be localized and originated among citizens who live in the same family or neighbouring society. In this context, social capital is narrowly related to strong trust.

However, there are divergent views in the literature about the level to which social capital can be located, which is not univocal. Authors identify individuals, informal social groups, the formal organization, the community, the ethnic group and even the nation levels (Coleman, 1988; Putnam, 1995; Portes, 1998; Sampson et al., 1999; Bankston and Zhou, 2002). Starting from the two extreme points of view of Bourdieu (1979) and Putman (1995), which go from an individual to a community level, several authors contribute to enriching the motivations on the most appropriate social capital level (Baum and Ziersch, 2003). For example, Brewer (2003) argues that social capital is observable at the individual level. However, according to Adler and Kwon (2002) social capital arises within the level in which each individual is located (i.e. family, community, profession, and country), being by the whole group or by the individuals belong to the group. On the other hand, Coleman (1988) points out that social capital is an aspect that depends on a specific context feature and post-Coleman literature mostly adopts social capital notion as a community-level characteristic (Robinson, 2000). Therefore, social capital exists because of the relationships between individuals and groups and it does not exclusively belong to an individual (Newton, 2001). For properly examining social capital, the general consensus in the literature is, hence, that it is discernible from the individual to the national level.

Further discordancy in the literature concerns the determinants of social capital that diverse and various, but there is scant of evidence to fully sustain the suggestions. According to Putnam et al. (1994) and Fukuyama (1995), the root of social capital lies in centuries of cultural evolution. Conversely, other contributions argue that social capital can arise in the short run, supporting political and economic development (Fox 1994; Tendler and Freedheim, 1994; Brown and Ashman, 1996). Based on empirical research, Pantoja (1999) identifies as key determinants of social capital family kinship linkages; a wide range of formal and informal horizontal associational activities; social networks; formal rules and norms that regulate the society; and social norms and values.

2.3.3 Benefits and disadvantages

Although the lack of a rigorous method of measurements, the benefits and the importance of social capital is argued by several authors for different reasons. The social capital theory combines macro-sociological historical factors with micro-level instruments, which is an exceptional characteristic in the social sciences (Rothstein, 2003). In addition, according to Kenworthy (1997) and Fukuyama (2001), social capital is an essential driver of modern economies, which fosters cooperation across sectors and organisational differences leading to the shape and the share of regional

development arrangements (Lyon, 2000). Social capital involves, therefore, a variety of probable beneficial impacts such as promoting the growth of gross domestic product (GDP); easing the efficient functioning of labour markets; reducing the level of crime; improving the efficacy of institutions of government (Putnam et al., 1994; Kawachi et al., 1999; Halpern, 2001; Aldridge et al., 2002). In addition, social capital improves public health (Coulthard et al., 2001; Subramanian et al., 2003), educational achievement (Israel et al., 2001; Aldridge et al., 2002) and economic problems solving (Bowles and Gintis, 2002). Finally, production and, in general, economic and business performance at both the national and sub-national level can be affected by social capital (Aldridge et al., 2002).

On the other hand, social capital may have undesirable impacts, which causes negative externalities. The first contribution documenting the downsides of social capital is offered by Portes and Landolt (1996) who show how social capital could have a perverse effect on societal wellbeing. Indeed, particular situations and organisations, that can generate social capital, could use it to exclude others (Morrow, 1999; Szreter, 2000). As a result, social capital could encourage bad behaviour that may produce detrimental effects for economic performance, obstacle the social inclusion and mobility, facilitate crime and divide communities (Aldridge et al., 2002).

2.3.4 Measures

Social capital cannot be directly measured as it refers to relations between individuals and their social interactions. The first problem with measuring social capital concerns the difficult to define a single indicator for it. In addition, the measures require dealings with the social context that varies the nature and structure of the social capital. That is, a fundamental question is whether social capital can be identified and it changes in the short run. According to Putman et al. (1994), social capital derives by historical factors, so that it cannot be determined in the short term. On the other hand, social capital can be connected with ability building in terms of community development and it can be built in the short period by the government, nongovernmental groups, local administrations and external organisations in the society, both in combination and in isolation (Mondal, 2000; Huntoon, 2001). By contrast, little attention is given to the several settings or levels in which social capital can arise and the role of specific actors, such as public institutions, on the generating and maintaining processes (Maloney et al., 2000; Preece, 2002). In particular, the mechanism of social capital creation needs of repeated contacts that are simplified by geographical closeness (Soubeyran and Weber, 2002). According to Onyx and Bullen (2000), the activities of citizens within a community generate the development of social capital. While, local

government can be considered suitable to create local social capital through community-based interventions (Warner, 2001).

As far as measuring social capital is concerned, several problems arise: "one of the greatest weaknesses of the social capital concept is the absence of consensus on how to measure it" (Fukuyama, 2001, p. 12). An example of such disagreements is the meaning of trust as a component of social capital. Fukuyama (1995, 1997) entirely associate social capital to trust; while, some authors consider trust as a source of social capital (Putnam et al., 1994) or as a form of social capital (Coleman, 1988). The gap between the concept of social capital given by scholars and its measures is due to the attractiveness of the term social capital that leads to the overuse of heterogeneous index (Knack, 2002a) and, since its abstract nature and discordant definitions, it is often inconsistently measured between studies (Liu and Besser, 2003).[51]

Several works consider numerous indicators of social capital in diverse contexts. For example, trust (Cox and Caldwell, 2000; Glaeser et al., 2000); membership (Price, 2002; Baum and Ziersch, 2003; O'Connell, 2003; Warde et al., 2003; Wollebaek and Selle, 2003); membership and trust (Lochner et al., 2003; Veenstra, 2002); membership, trust and norms of reciprocity (Skrabski et al., 2003; Staveren, 2003); and network resources (Zhao, 2002). The achievement and suitability of these indicators vary depending on the local context in which they are developed and applied.[52] Finally, social capital can be considered as the structure and quality of social networks: the key dimensions of social capital are networks of social relations (structure), which are characterized by norms of trust and reciprocity (quality) (Stone, 2001). Indeed, "by linking social capital measurement directly to theoretical understandings of the concept, we are able to: first, recognize that social capital is a multidimensional concept comprising social networks, norms of trust, and norms of reciprocity; second, understand social capital properly as a resource to action; and third, empir-

[51] Cavaye (2004, p. 13) lists several issues in the measurement of social capital that have not yet resolved: a clear understanding of the context and purpose of the measurement of social capital; understanding the limitations of evaluation and measurement, and ensuring that the interpretation of measures is held within these limitation; the practical mechanics of gaining community feedback like community representation and coverage, use in local decision making and resourcing measurement; dealing with qualitative information, diversity, variation and complexity; the nature and rigor of indicators; the interpretation and use of measurement information and how evaluation itself can contribute to fostering social capital. Finally, the author provides the description of a consistent framework and the key characteristics that should drive the choice of appropriate indicators: specificity targeted to the variable to be measured; easiness of measurement; dimension of a range of social features; integrity and consistency; ability to adapt across contexts and be reliable in local state or national situations.

[52] However, these indicators do not account for the multi-dimension of social capital. More multi-dimensional measures have been carried out by other studies, including one of the pioneer works of Putman (2000). Indeed, Putnam's indicators of social capital are developed for United States consider several aspects of associational social life, containing: measures of community or organizational life, measures of engagement in public affairs; measures of community volunteerism; measures of informal sociability; measures of social trust.

ically distinguish between social capital and its outcomes" Stone (2001, p. 6). This statement appears as an input to develop a measurement framework that requires intensive effort in order to deal with the evident complexity of the problem and adjusting indicators with a theoretical basis.

2.3.5 Social capital in Economics

The general consensus in the literature is that social capital has pervasive effects on numerous aspects of the social and economic life of individuals. This scenario is already identified with the intuitions of Arrow in 1972, who argues that any economic transaction is characterised by a degree of uncertainty that cannot be only eliminate thought the use of insurance methods and, therefore, it contains a certain trust factor. The channel through which social capital could increase the economic performance of a country can be diverse. For example, firms with higher trust are potentially more efficient and able to better allocate resource because social capital reduces monitoring costs of contracts. Moreover, higher social capital could decrease the risk of the *hold-up* of the policymaker by particular stakeholders, leading to the adoption of beneficial policies for all the community.

In the past centuries, many studies have tried to empirically quantify the impact of social capital on economic growth. Knack e Keefer (1997), among others, document that social capital endowments positively influenced the GDP growth in the period between 1980 and 1992 for a sample of both advanced and developing economies. In particular, for the Italian case, the authors evidence an increase in GDP of about 2 per cent, lower values rather than other countries.

With specific regard to Italy has ever represented an ideal place in which analysing the effect of social capital on economic dynamics. Indeed, albeit to the uniform regional and government features, the country suffers from relevant heterogeneity on social capital endowments across regions. As a result, empirical comparing Italian regions could be more robust and informative than comparing different countries in which the institutions and regulation assets are heterogeneous, influencing both social capital endowments and economics outcomes. The seminal study of Putman et al. (1994), focusing on Italy in the 1970s, evidence that less social capital level is correlated with lower growth of southern regions. The motivation of such territorial differences in social capital endowments in Italy is hypothesized to depend on historical socio-politics conditions which characterised the diverse areas. Indeed, following Putman et al. (1994)'s arguments, the several politics structures of the Middle Ages – Municipalities in the North-Centre and the Kingdom of Sicily in the South – have determined the regional gaps in the degree of civicness that are survived for centuries.

2.3.6 Empirical evidence

Several authors pay attention to the effect of social capital on economic transitions and, in general, on economic performance. For instance, Ring and Van de Ven (1992) have evidenced that interpersonal relationships between and across organisations influence their governance structure useful to organize their transactions. According to Gulati (1995), repeated contacts and ties between firms cause trust leading to alliances and cooperation, reducing economics transaction costs and foster economic system. In addition, Gulati (1998, p. 308) points out that "trust not only enables the greater exchange of information, but it also promotes ease of interaction and a flexible orientation on the part of each partner". Furthermore, in societies with higher trust, there is a generalized social capital that promotes the success of modern economies competition. Since general trust derives from moral principles and common obligations belonging to each member of a community (Fukuyama, 1995), high social capital is present when individuals in a community understand the positive effect of collective action in following collective goods (Leonardi, 1995). According to Knack (2002b), high-trust societies benefit from higher growth levels due to minor transactions costs. Putman et al. (1994) consider Italian regions in the period 1870 and 1970 to evaluate the impact of civic traditions as a proxy of social capital on industrial rate, finding a positive effect. Similarly, Putnam (1995) and Helliwell (1996 a, b) evidence a positive effect on GDP growth. Halpern (1999) argues that social capital could reduce social stress generating a sense of wellbeing and belonging.[53] Then, La Porta et al. (2001) found a significant positive relationship between trust and economic growth, using cross-sectional data on 39 countries. According to Zak and Knack (2001), considering the interpersonal trust of actors in 1970-1992 across 37 countries, evidence a positive impact of social capital on income growth. Moreover, several aspects of Italian household's activities and expenditures are mainly affected by social capital, which also benefits on Italian provinces' economic prosperity and financial development (Guiso et al., 2004b). Furthermore, Beugelsdijk and Smulders (2004) and Beugelsdijk and van Schaik (2005) extend Putman et al. (1994)'s arguments to European regions where different social capital endowments explain the economic growth gap between countries and find a positive relationship with regional economic development. Indeed, the works evidence a positive correlation between social capital and GDP growth. This effect is also due to the higher institutional quality and lowers corruption level deriving by the higher trust (Uslaner, 2008; Buonanno et al., 2009; Arrighetti and Lasagni, 2010). A positive correlation between trust and civic involvement and economic performance also

[53] Moreover, the author evidences a positive association between social capital and countries' economic growth measured by GDP. He argues that trust, reputation and informal sanctions could replace the legal scheme and formal agreements.

concerns British regions (Casey, 2004) and between social capital proxies and GDP and number of patents in 27 European countries (Adam, 2008). In the period 1970 and 2001, OECD economies record a positive impact of social capital on GDP (Perez et al., 2006) and trust has a positive effect on GDP growth (Bjørnskov, 2006). Neira (2009) find that GDP is positively affected by trust and membership in EU countries between 1980 and 2000. Dincer and Uslaner (2010) confirm the positive relationship between trust and growth by using data from the United States. In addition, Doh and McNeely (2012) carry out an analysis of the impact of social capital on economic development across 47 countries finding a direct positive relationship and, an indirect impact of social capital via entrepreneurship and human capital channels. Social capital, considered as generalized trust, could cluster in space and over time leading to the creation of "spatial traps" which could dampen the equal and balanced regional economic development and convergence (Fazio and Lavecchia, 2013). The positive relationship between local socio-economic development and social capital leads to consider the latter as an essential driver of local communities, especially those located in peripheral regions (Pileček et al., 2013).

More recently, McShane et al. (2016) reveal that perceived social capital is an important factor for farming sustainability and regional development in Australia, pointing out the dependence of the higher and effective progress on social capital. However, the effect of social capital on the economic growth of regions is heterogeneous and changes over time (Peiró-Palomino, 2016). According to Ahmad and Hall (2014, 2017), social capital is a key element for explaining growth and its effect is indirect through property right canal, however, Xiong et al. (2017) examine the effect of social capital on total factor productivity in China, funding scares evidence of impact and arguing that this relationship is conditional on local social and economic contexts. Moreover, Holtkamp and Weaver (2018) evidence a robust and opposite link between the social capital indicator and economic downturn in Appalachian regions by applying spatial analysis tools. Finally, Andini and Andini (2019) extend previous research studies concerning the Italian case by accounting for unobserved heterogeneity and endogeneity problems. The authors confirm that the growing gap between the Northern and Southern regions has its roots in social capital endowment differences.[54]

[54] Some recent contributions also focus on other socio-economic conditions. For instance, Botzen (2016) points out that social capital is not equally intense in Germany, however, its impact on economic well-being is positive in the majority of regions. Benefit of social capital on well-being are also evidenced in rural Chinese communities (Fan and Mahadevan, 2018).

On the other hand, some contributions evidence an ambiguous effect of social capital in economic performance measures. According to Granato et al. (1996), GDP growth is positively affected by achievement motivation, but negatively by post-materialistic values in 25 countries observed between 1960 and 1989. In addition, Knack and Keefer (1997) find that trust and civic norms benefits to GDP growth, but association membership dampens it in 29 countries. Then, GDP growth is fostered by political arguments and reduced by trust and cultural values (Schneider et al., 2000). Rupasingha et al. (2000) find that the effect of associations and crime on income growth is, respectively, positive and negative. Moreover, income growth of Swedish municipalities is not affected or positively affected by social capital, depending on the involved measures (Eliasson et al., 2005). Lyon (2005) evaluates the impact of social capital on value-added, growth and TFP growth of Italian regions, finding that its effect is positive for the former measure of performance and negative for the latter, underlining the intensity of the impact is greater in the South. GDP growth is differently affected by several measures of social capital (Roth, 2006), innovation and income are positively affected by associational activities but not influenced by the trust (Hauser et al., 2007; Raiser, 2008). Therefore, the impact of social capital varies depending on the adopted measures of social capital and growth variables (Westlund and Calidoni-Lundberg, 2006; Hoyman et al., 2016).

Finally, some authors evidence a negative relationship between social capital measures and economic growth. For instance, Helliwell (1996a, 1996b), using data on OECD countries and US states/ Canada, finds that social capital negatively affects productivity and income growth, respectively. According to Kunz (2000), social trust and membership dampen employment in agriculture and import. Employing several social capital indices and growth measures, Casey and Christ (2003) evidence a negative or insignificant relation depending on the considered measure. Similarly, income growth and investment in several countries are not influenced by associational membership (Knack, 2002b). In addition, Coates and Heckelman (2003) find that the effect of social capital on investment is mainly negative in OECD countries. Similarly, Miguel et al. (2005) evidence a negative correlation by considering the growth of manufacturing workers' share and GDP, respectively. Sabatini (2008b) considers Italian regions to show whether several proxies of social capital affect the status of well-being, mainly finding a negative relationship. In the same vein, social capital could have a negative consequence even on a firm's activities, yielding to the reduction to its performance. For instance, the over-reliant to social capital could dampen larger businesses because they are blocked in a certain network or context, that precludes the possibility to enter in new markets or having access to greater sources of finance (Putman, 2000).

The availability of firm-level data encourages the analysis of social capital's impact on enterprises' performance. For example, by adopting firms' opinion on their success as performance variable, Kilkenny et al. (1999) evidence a positive effect of social capital for small firms in several towns in Iowa and Landry et al. (2002) evidence that relational assets, as proxy of social capital, foster firms' innovations. In addition, considering Russian companies, Batjargal (2000) finds that social capital does not affect or positive affect sales growth and return on assets depending on the used measures. In particular, the amount of revenue and workers of Columbian farms are positively affected by the number and the intensity of firms' networks (Johnson et al., 2002). Similar results are found by Fafchamps and Minten (2002) when considering sale of agricultural farms in Madagascar and by Inge Jenssen and Greve (2002) for Norwegian start-ups revenues. Instead, De Clercq and Dakhli (2003) consider social and institutional trust and associational activities as proxies of social capital in order to evaluate the impact in R&D investments, patent and high-tech export. Authors find that all variables have a positive influence on these firms' engagements. In addition, Bosma et al. (2004) show that firms' information acquired thought numerous networks with other entrepreneurs have a positive impact on firms' profit and probability to survive.

Furthermore, the relation between social capital and UK firms' innovation and growth is investigated by Cooke and Clifton (2004), Cooke et al. (2005), Cooke (2007) that point out that social capital is an essential factor in explaining SMEs' performance. Then, according to Westlund and Nilsson (2005) firms' growth of turnover and employment are positively affected by social capital. While, using data on Biotech firms in California, Japan, and Sweden, Westlund (2006) points out that there is no impact of several types of social capital and number of employment and turnover sales. However, Wu and Leung (2005) consider Chinese SMEs to evidence a positive correlation between firms' performance and competitiveness and trust and networks. According to Lechner et al. (2006), the mixture of relations is more important than network size for firms' performance measured as sales. Moreover, in Italy, there is evidence a positive relationship between social capital and income (Rizzi and Popara, 2006), working choices of employees (Ferrante and Sabatini, 2007) and entrepreneurship, female labour market participation and worker productivity are more likely to be affected by social capital since trust plays an important role on their determinations (De Blasio and Nuzzo, 2006). Zhang and Fung (2006) evidence that Chinese firms' performance is positively influenced by investment in social capital and greater social capital lead to higher firms' success (Smerek and Denison, 2007). Hence, the impact of social capital on firm's performance is mainly positive (Chen et al., 2007) and several measures of social capital

are key elements in explaining performance (Lock Lee, 2008). In addition, social capital is a determinant of improving living standards (Andriani and Karyampas, 2009), reducing income inequality and promoting social behaviours in those Italian areas with more equal distribution (De Blasio and Nuzzo, 2010), improving the performance of exports and employment (Mazzola et al., 2012) and fostering innovation (Crescenzi et al., 2013).

Social capital increases the likelihood of individual entrepreneurship commercial entry, especially in a context characterized by sure formal institutions (Estrin et al. 2013) and it has different effects on entrepreneurial processes and activities depending on the involved dimensions (Afandi et al. 2017). Moreover, social capital foster innovation in a different way depending on its nature: bridging social capital maintain the early stage of innovation (i.e. idea creation) then bonding social capital foster the implementation and diffusion of innovation (Ceci et al., 2015). Then, Audretsch et al. (2018) investigate the role of trust and institutions in enhancing innovation performance, finding that they have a crucial role although the particular feature of the linkage changes with the different economic contexts. Social capital increases the inventive activity of the entrepreneur (Akçomak and Müller-Zick, 2018) and enhances the average number of employees per firm (Salas-Fumás and Sanchez-Asin, 2018). In innovation ecosystems context, start-ups that use social capital are able to overcome the performance of those that do not use it (Bandera and Thomas, 2018) and, moreover, the role of social capital matters in the regional start-up creation process having a positive influence on start-up activities (Eriksson and Rataj, 2019). Diverse types of social capital – production-related and environment-related – could have different impacts on firms' performance. According to Habersetzer et al. (2019), environment-related social capital positively impacts firm growth, even in peripheral areas. While production-related social capital produces benefits only in case the firm has contacts with clients and suppliers that are geographically near.

Although production and, in general, economic and business performance at both the national and sub-national level can be affected by social capital (Aldridge et al., 2002), the literature is scant of studies investigating the influence of social capital on productivity at the local level. For instance, Knack e Keefer (1997) and Casey and Christ (2003), among others, document that the influence of social capital endowments on productivity was positive but insignificant. Instead, Lall and Ghosh (2002) and Bjørnskov and Méon (2015) evidence a strong positive correlation between social capital and productivity. With regard to Italian case, Sabatini (2008a) examines the impact of different types of social capital on SMEs' labour productivity, finding that bonding and bridging social capital negatively impact labour productivity, while linking social capital – closely related to Putman et al. (1994)' definition – has a positive effect on this performance measure.

2.4. DATA

I retrieve data from several sources. The EFIGE-Bruegel-Unicredit dataset contains firm-level information on 14,759 manufacturing firms with more than ten employees across seven European countries (Austria, France, Germany, Hungary, Italy, Spain, and the United Kingdom).[55] The dataset includes a survey carried out in 2010, which collects cross-sectional information referring to the year 2008, or the period 2007-2009 (in average terms). Survey data are combined (by Bruegel organization) with panel balance sheet data from the Amadeus database, held by Bureau van Dijk, available from 2001 to 2009.[56]

The focus of this work is Italy, which has one of the most bank-based financial systems among developed countries (Deeg, 2005; Moschella, 2011). Moreover, as they are the main drivers of growth and may produce a more efficient resource allocation (e.g.: Yang and Chen 2009), the statistical unit of analysis are SMEs defined according to the European Commission's size classification (i.e. firm with less than 250 employees). Following Milana et al. (2013), production function variables are deflated by using industry level indexes, taken from the EU KLEMS database, and potential outliers are treated by eliminating the observations lying in the first and last centiles of each variables' distribution.[57]

Concerning the regional social capital measure, the indicator employed is one dimension of the Institutional Quality Index (IQI) proposed by Nifo and Vecchione (2014), referring to the period 2004-2009 (therefore, my econometric analysis refers to the same period).[58] This item is named *Voice and Accountability* and catches the involvement in public and social life in terms of participating in election processes, being membership in association or volunteers, and operating in social cooperatives. It also accounts for the cultural activity by considering the number of books published and purchased in bookshops. Indeed, following a concept of social capital *à la* Putman,

[55] EFIGE stands for "*European Firms in a Global Economy*". For more information on the EU-EFIGE dataset, see: http://bruegel.org/2012/10/the-eu-efigebruegel-unicredit-dataset/.

[56] It should be recalled that the EFIGE dataset omit firms with less than 10 employees, thus implying that my results might not be extended to the smallest of firms. Moreover, my findings are conditional on firms' survival since accounting data concerns to entities that are surveyed in 2010 and defaulted enterprises are excluded (e.g. Agostino and Trivieri, 2018).

[57] For more information on the EU KLEMS database, see: http://www.euklems.net/.

[58] The index is built inspiring from the World Governance Indicator (WGI) proposed by Kaufmann et al. (2011) in the perspective of the Knowledge for Change Programme sponsored by The World Bank. IQI gauges institutional quality in Italian provinces in the period 2004 – 2009 as a complex indicator derived by 24 elementary indexes clustered into five institutional dimensions: Government effectiveness, Regulatory Quality, Rule of Law, Control and Corruption and Voice and Accountability. In "Do Institutions Play a Role in Skilled Migration? The Case of Italy" and "Measuring Institutional Quality in Italy", Nifo and Vecchione (2014, 2015) deeply illustrate the methodology adopted to obtain the Institutional Quality Index from elementary indexes consisting in three steps: normalization, attribution of weights and aggregation of indexes.

it draws a picture of traditional associations among individuals that, thanks to the creation of sharing culture and values, have an impact on the well-being of a community.

The source of data on regional characteristics employed as control variables is the Italian National Institute of Statistics (ISTAT, 2019). Finally, data on regional deposits and loans are drawn from the Bank of Italy, while information on the number of banks is taken from ABI Banking dataset provided by the Italian Banking Association.

Table 2.1 shows the variables' descriptive statistics for Italian SMEs and Table 2.2 presents the correlation matrix of covariates. While, Figure 2.1 shows the geographical pattern of the dimension of *Voice and Accountability* in Italy: for social capital a distinct gap between Centre-Northern and Southern regions occurs, since, on the whole, the "*Mezzogiorno*" registers lower level of social capital endowment than the rest of Italy.[59]

[TABLES 2.1 AND 2.2]

[FIGURE 2.1]

2.5. EMPIRICAL METHODOLOGY

2.5.1 Computing TFP - Levinsohn and Petrin (2003) method

Total factor productivity (TFP) is a measure that explains the residual part of total output unaccounted for traditionally measured inputs of labour and capital. In the literature, numerous advantages emerge in employing different approaches for estimating TFP by using data at a micro-level such as, for instance, firm-level data allows to control for firms' heterogeneity and increasing return to scale (Del Gatto et al., 2011). However, in estimating TFP at micro level, several issues might occur: simultaneity bias due to endogenous inputs; omitted variable bias if relevant explanatory variables are not available; sample selection bias when no information is available on firms' entry and exit; heterogeneity problems (e.g. when technology differs across products produced by a single firm) (Van Beveren, 2012). In order to obtain unbiased estimates, the most commonly used methods are fixed effects panel models, semiparametric estimators as Olley and Pakes (1996) and Levinsohn and Petrin (2003), and GMM (Arellano and Bond, 1991).

In this empirical analysis, the first estimation method of TFP adopted is Levinsohn and Petrin (2003) (hereafter LP), a semiparametric technique similar to Olley and Pakes (1996) (hereafter

[59] Figure A2.1 illustrates the hierarchical scheme of IQI compositions, for which each item comes from the aggregation of indexes of a subordinate rank.

OP). These two analogous methodologies allow accounting for both selection bias and endogeneity of inputs in the production function. These issues may occur because of the potential correlation between firms' unobserved productivity and their input decision because more productive firms could allocate more capital and labour given the expected future investment opportunities. Both OP and LP consist in two-stage procedures and are similar methods except for the main difference that regards the proxy of unobserved TFP: the former uses investments, while the latter considers intermediate inputs levels (e.g., materials or energy); furthermore, OP accounts for the firm's survival probability in the second stage. Nevertheless, the major drawback of OP approach is that the fundamental monotonicity condition may be easily compromised: only positive investments can be used in the analysis causing loss of efficiency and, moreover, firms may report zero investments. The LP approach allows overcoming the OP limit by considering materials as a proxy variable for unobserved productivity.[60]

Formally, in this work I define TFP adopting a Cobb-Douglas production function:

$$Y_{it} = A_{it} L_{it}^{\alpha_L} K_{it}^{\alpha_K} M_{it}^{\alpha_M} \tag{2.1}$$

Where *i* and *t* represent observations and time, respectively; A_{it} represents TFP, Y_{it} are the gross revenue and the three inputs are labour L_{it}, capital $K_{it}$and materials M_{it}.[61]

The logarithmic form is:

$$y_{it} = \alpha_i + \alpha_L l_{it} + \alpha_K k_{it} + \alpha_M m_{it} + \omega_{it} + \eta_{it} \tag{2.2}$$

In the LP procedure, labour is used as free variable (l_{it}); capital (k_{it}) is the state variable and materials (m_{it}) represents the proxy variable of unobserved productivity. The error term includes a variable ω_{it}which affects firms' behaviour and an i.i.d. component η_{it}which has no effect on firms' strategies.

LP method is based on some assumptions:

1. firms adjust their optimal level of materials according to the demand function $m_{it}(\omega_{it}, k_{it})$, after observing their productivity shocks;
2. the intermediate inputs function (e.g. $m_{it} = f(\omega_{it}, k_{it})$) is invertible and monotonically increasing in ω_{it};

[60] In this analysis, OP estimator cannot be applied because of the lack of information on firms' survival conditions (e.g. firms exit rate).

[61] The outcome *Y* is approximated by the total amount of sales. Regarding inputs, *K* is the sum of tangible, intangible fixed assets and depreciation; *M* represents material costs. Finally, *L* is the number of employees. See Table 2.1 for more details.

3. the state variable evolves basing on investment decisions taken at previous time *t-1*;
4. the free variable does not affect future revenues and is decided once firm productivity shocks are observed at time *t*.

Under these assumptions, m_{it} can be inverted and written as:[62]

$$\omega_{it} = s_{it}(m_{it}, k_{it}) \tag{2.3}$$

Therefore, inserting (2.3) in (2.2), I can rewrite:

$$y_{it} = \alpha_i + \alpha_L l_{it} + \alpha_K k_{it} + \alpha_M m_{it} + s_{it}(m_{it}, k_{it}) + \eta_{it} \tag{2.4}$$

$$y_{it} = \alpha_i + \alpha_L l_{it} + \varphi_{it}(m_{it}, k_{it}) + \eta_{it} \tag{2.5}$$

where $\varphi_{it}(m_{it}, k_{it}) = \alpha_K k_{it} + \alpha_M m_{it} + s_{it}(m_{it}, k_{it})$, that is a partially linear model in the free variable l_{it} but not in the proxy variable m_{it}. In the first stage, hence, the estimates of α_L and φ_{it} are obtainable by estimating an nth order polynomial regression.

The second phase identifies the coefficient α_K and α_M ($\alpha_K^* \; and \; \alpha_M^*$). For any candidates value $\alpha_K^* \; and \; \alpha_M^*$, it is possible to obtain $\widehat{\omega}_{it}$ as:

$$\widehat{\omega}_{it} = \hat{\varphi}_{it} - \alpha_K^* k_{it} - \alpha_M^* m_{it} \tag{2.6}$$

as a result, by using the ω for each *i* at all *t*, $E[\widehat{\omega_{it}|\omega_{it-1}}]$ is consistently approximated by exploiting the monotonic assumption and used to compute the residuals of the production function, η_{it}, for any true values (α_K^*, α_M^*):

$$\widehat{\eta_{it} + \epsilon_t} = y_{it} - \hat{\alpha}_l l_{it} - \alpha_K^* k_{it} - \alpha_M^* m_{it} - E[\widehat{\omega_{it}|\omega_{it-1}}] \tag{2.7}$$

However, to identify both α_K and α_M the residual $\eta_{it} + \epsilon_t$ should be interacted with a set of instruments built as the set of moment condition $E\left[e_{it} z_{it}^j\right] = 0, \forall j$, where j is the number of the instrument vector z = (k_{it}, m_{it-1}), to obtain a GMM criterion function (second step):[63]

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[65] Levinsohn and Petrin (2003) illustrate that the demand function is monotonically increasing in ω_t, which allows the inversion of intermediate demand function. As a results, the unobservable productivity term is expressed as a function of two observed inputs. Finally, LP assumes that productivity follows a first-order Markov process:

$$\omega_t = E[\omega_t|\omega_{t-1}] + \epsilon_t$$

where ϵ_t is an innovation to productivity that is not correlated with k_t. However, it could be correlated with l_t and could be part of the source of the simultaneity problem.

[63] This interaction is necessary since the possible correlation between materials and the error term because of potential firms' adjustment to the technology efficiency shock (ϵ_{it}).

$$[\alpha_K^*, \alpha_M^*] = argmax\left\{\sum_j\left(\sum_i\sum_t e_{it}z_{it}^j\right)^2\right\} \quad (2.8)$$

Therefore, after obtaining TFP measures with the LP method as expressed in (2.7) in a first step, I estimate the following equation (second step):

$$TFP_{it} = \alpha_i + \alpha_X X_{it} + \alpha_T t + \varepsilon_{it} \quad (2.9)$$

where *TFP* is (the logarithm of) the Total Factor Productivity obtained with the LP method as explained above. The vector of determinants *X* comprises the variables of interest, namely duration of lending relationships, social capital and their interaction, and other controls referring to firm's characteristics (i.e. age and size, leverage, cash flow, liquidity ratio); economic context features (i.e. regional real gross domestic product, regional density; regional exports and Herfindahl index) and banks characteristics (regional number of branches and the amount of credit provided by banks over deposits). Finally, to account for firms' unobservable heterogeneity and economic cycle effects, fixed effects (α_i) and time trend (t_{it}) are included.[64]

In the second step, the equation (2.9) is estimated in dynamic form (with additional lagged values of output) by adopting the system GMM estimator. This technique allows to take into account the endogeneity of the right-hand-side variables – by using lagged values of the endogenous variables for the equations in first differences and first-differences of the variables as instruments for the equations in level (Blundell and Bond, 1999) – and firms' specific effects.[65]

Notwithstanding, according to the literature, such a two-step procedure may give biased results, because of the misspecification of the model estimated at the first stage. Indeed, in the first step, the firms' TFP levels are estimated considering only a set of inputs and ignoring variables that might affect productivity. Then, in the second step, the measure of productivity is regressed on other covariates.[66] The solution to this problem is a one-step procedure in which the productivity model is correctly specified considering both inputs of production and other determinants (Wang and Schmidt, 2002).

[64] See section 2.5.3 for an exhaustive description of the X variables used in the second stage.
[65] In this analysis, all explanatory variables are considered endogenous except age, which is treated as predetermined. Finally, Arellano and Bond (1991) tests for autocorrelation are used to exclude the presence of second-order autocorrelation in the residuals.
[66] Simultaneity bias may come from endogeneity of such determinants, which requires the use of methods based on instruments.

2.5.2 Computing TFP - the System GMM method

In this section, I apply the system GMM estimator to directly obtain the elasticities of output with respect to inputs. This technique, proposed by Blundell and Bond (1999), is a one-step procedure based on the use of internal instruments.[67] Despite the fact that even system GMM estimator could present weakness, it is considered as the most robust method when technological heterogeneity and measurement errors occur (Van Biesebroeck, 2007), allowing to overcome two-step estimation problems described above.

I assume a Cobb-Douglas log-linear production function:

$$y_{it} = \alpha_i + \alpha_L l_{it} + \alpha_K k_{it} + \alpha_M m_{it} + \alpha_X X_{it} + \alpha_T t + \varepsilon_{it} \qquad (2.10)$$

where *y, l, k,* and *m* represent, respectively, the logarithms of real gross output, labour, the capital stock, and intermediate inputs of firm *i* at time *t*; X_{it}, α_i and t represent the vector of determinants, fixed effects, and a time trend, respectively.[68]

By using the system GMM method to estimate equation (2.10), as in Harris and Moffat (2015) and Ding et al. (2016), I directly obtain values of the elasticities of output with respect to inputs $\alpha_L, \alpha_K \; and \; \alpha_M$. TFP can, then, be calculated as the level of output that is not attributable to factor inputs (labour, capital, and intermediate inputs), meaning that productivity is due to efficiency levels and technical progress. Therefore, this measure of TFP is determined by the variables captured in X_{it}, firm-level fixed effects, the time trend and idiosyncratic shocks captured by the error term and it is expressed as follows:[69]

$$\widehat{lnTFP}_{it} = y_{it} - \hat{\alpha}_L l_{it} - \hat{\alpha}_K k_{it} - \hat{\alpha}_M m_{it} = \hat{\alpha}_i + \hat{\alpha}_x X_{it} + \hat{\alpha}_T t + \hat{\varepsilon}_{it} \qquad (2.11)$$

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[67] The system GMM estimator originates from making additional moment restrictions over the assumptions presented in the "difference GMM" proposed by Arellano-Bond (1991): first differences of instrumenting variables are uncorrelated with the fixed effects, allowing for the introduction of more instruments and improving efficiency (Roodman, 2009).

[68] Both Production Function variables and the vector of determinants are defined as described above. See Table 2.1 for more details.

[69] In the Cobb-Douglas production function, TFP can be defined as A_{it}:

$$Y_{it} = A_{it} L_{it}^{\alpha_L} K_{it}^{\alpha_K} M_{it}^{\alpha_M} \qquad (2.12)$$

As a result,

$$A_{it} = \frac{Y_{it}}{L_{it}^{\alpha_L} K_{it}^{\alpha_K} M_{it}^{\alpha_M}} \qquad (2.13)$$

Thus, in equation (2.11), $lnTFP_{it}$ replaces lnA_{it}. Since any changes in the denominator on the right-hand-side of (2.13), as factor inputs change, is matched by changes in output, with A_{it} unchanged, the TFP is not influenced, directly, by returns to scale as $\hat{\alpha}_L l_{it} - \hat{\alpha}_K k_{it} - \hat{\alpha}_M m_{it}$. An alternative methodology consists to use the Fare and Primont (1995) input index to ensure the validity of proportionality axiom stated by O'Donnell (2015) for the case of increasing returns-to-scale. In this respect, the measure of TFP could be rewritten as:

$$\widehat{lnTFP}_{it}^{FP} = y_{it} - \frac{1}{(\hat{\alpha}_L + \hat{\alpha}_K + \hat{\alpha}_M)} (\hat{\alpha}_L l_{it} - \hat{\alpha}_K k_{it} - \hat{\alpha}_M m_{it}) \qquad (2.14)$$

Figures 2.2 and 2.3 map the distribution of Total Factor Productivity obtained by employing the methods described above. At first glance, the lowest TFP levels are always associated with Southern regions; conversely, the highest ones refer to regions located in Centre-North.

[FIGURES 2.2 AND 2.3]

2.5.3 The determinants of TFP

This section presents the set of predictors included in the system GMM method.[70]

The key variable of my analysis is only the duration of the lending relationship that a firm has with its main bank (DURAT). In the EFIGE dataset, it refers to the last year of the survey (2009).[71] Since the period of this analysis is 2004-2009, following Agostino et al. (2012); Gambini and Zazzaro (2013); Agostino and Trivieri (2017, 2018), its values back to the year 2004 are obtained by subtracting from the original figure a number up to 5, treating as missing values negative numbers.[72]

As far as a proxy of social capital endowment is concerned, I employ an indicator (VOICE) of civicness as well as cultural activity, represented by *Voice and Accountability*, one of the items composing the Institutional Quality Index (IQI), due to Nifo and Vecchione (2014, 2015), based on Putman et al. (1994)'s social capital concept. In order to test my research hypotheses, the interaction term between DURAT and VOICE is included.

Turning the attention to the firm's characteristic variables, the firm's age (AGE) control is included to capture whether younger firms may produce in more efficient ways being characterized by higher absorptive capacity or, on the other hand, productivity rises for older firms due to the exploitation of "learning by doing" mechanisms. I include AGE^2 to inspect for potential non-linear effects. The firm's size (SIZE) covers for potential effects of the dimension on the capability of firms to optimally achieve their input combinations. For instance, larger firms have easier access to external finance, leading them to improve qualified personnel and the openness to international markets and "learning by exporting" effects. On the other hand, the productivity of larger

[70] The inclusion of the X_{it} variables in the production function is necessary in order to avoid (bias due to omitted variables and, hence) biased values of TFP. It should be recalled that the vector X_{it} is also used in the second step estimation when considering TFP obtained with LP method.

[71] In the survey, the question is formulated as "For how many years has this bank been the firm's main bank?", preceded by "What % of your firm's total bank debt is held at your main bank?".

[72] One could argue that, by doing so, DURAT cannot capture the effect of lasting lending relationships for those firms that, after a long period, changed the main bank a few years before (or just in) 2009. However, the EFIGE data do not allow to make a different imputation, as there is no way to know whether – before the relationship for which the duration is declared – firms had a relationship with another main bank or not. Besides, the EFIGE survey does not provide the identity of a firm's main bank, and information concerning other lending relationships' characteristics – such as the percentage of the firm's total bank debt held by the main bank, and the number of lending banks – is available for 2009 only.

firms could be compromised due to the inefficient hierarchical organizational structure (Margaritis and Psillaki, 2007). Whit regard to firms' financial indicators, a common measure of external funds is leverage ratio (LEV) which affects firms' productivity in different ways. On the one hand, high debt level could discipline managers' behaviour, by reducing the discretion of the management and limiting the use of the free cash flow (Jensing, 1986). On the other hand, higher indebtedness might aggravate managers' conduct, who may invest, at the expense of debtholders, in riskier projects known the asymmetry of profits and losses from risky investments. Cash flow (CASHFLOW) is an indicator of firms' internal funds measured, in this work, as the ratio of net income plus depreciation to total assets. It allows assessing whether relying on internal finance influences firm productivity. Indeed, cash flow has an important role in financing activities because improves firm's technology and, thus, impact on TFP. Similarly, firms' ability to obtain cash in the short run is helped by the availability of liquidity assets (LIQUI) accounted for by the ratio between current assets and current liabilities. Liquidity may push undertaking productivity-enhancing activities as investment in R&D and innovation on new processes/products and dealing with the financing of daily operations (Chen and Guariglia, 2013).

The regional characteristics controls I include in the model are regional export level (regional export over regional gross domestic product, EXPREG), local development (regional real gross domestic product, RGDP), regional population density (DENS). All these regional variables are expected to have a positive effect on firms' productivity. Moreover, I control for the degree of industry concentration (proxied by the Herfindahl-Hirschman index based on assets, HHIa), which might have an ambiguous effect on enterprises' performance. On the one hand, a higher concentration may positively affect productivity due to the selection and presence of more efficient firms (Margaritis and Psillaki, 2007). On the other hand, following the Structure-Conduct-Performance paradigm, higher concentration may diminish the competition within the market encouraging collusive behaviour among firms and, hence, reducing their productivity.

Finally, the vector of determinants also includes the regional branch density (number of branches for the region to regional population, BRANCH) and the amount of credit provided by banks over deposits (PREDEP) in order to account for local banking development.

2.6. ESTIMATION RESULTS

The estimation outcomes of my benchmark model are reported in column 1 of Tables 2.3 and 2.4, respectively. Firstly, as the diagnostics show (bottom of Tables 2.3 and 2.4), all models pass

various tests for the validity of the instruments used and tests for autocorrelation (in first-difference residuals).[73]

Looking first at the results concerning the TFP retrieved applying the Levinsohn and Petrin (2003) algorithm, I find that the effect of my key variables is statistically significant. In particular, as can be seen from column 1 of Table 2.3, both DURAT and VOICE have a positive impact on productivity, while the interaction term coefficient is negative. To assess the variation of the impact of credit relationship on TFP, the analysis is supported by a graph, showing the DURAT marginal effect for all the values of VOICE.[74] According to Figure 2.4, based on column 1 estimates (Table 2.3), at low levels of social capital, the zero line is not included in the confidence band meaning that the DURAT marginal effect is positive and statistically significant. At increasing degree of social participation, the influence of DURAT decreases, becoming not significant beyond a threshold of about 0.5. These results suggest that the (positive) impact of enduring lending relationships on SMEs' productivity is stronger at lower levels of social capital, and tends to decrease as social capital increases. Therefore, in line with my research hypothesis, I find that social capital might act as a substitute for lending relationships. The latter, however, appear to be relevant for SMEs performance where common values and social norms are lacking.

[TABLE 2.3]

This finding is confirmed when considering the Total Factor Productivity obtained by applying the System GMM estimator proposed by Blundell and Bond (1998). Table 2.4, column 1, illustrates the results relating to the benchmark model, that confirm the direction and significance of the effect of the key variables. Figure 2.5, analogous to Figure 2.4, illustrates how the influence of long-lasting relationships varies according to the value of social capital. The DURAT marginal effect on SMEs' productivity changes depending on the level of civic engagement in regions: it is positive until values of about 0.5 and not significant for higher levels.

[FIGURES 2.4 AND 2.5]

[73] More in detail, all models pass the Hansen test for overidentification (sometimes at the 10% level), indicating the validity of the instruments used. Regarding the tests of autocorrelation, significant first-order correlation in differenced residuals is verified in all models, whilst second-order correlation in the differenced residuals is not significant. Overall, estimates can be considered consistent.

[74] The y-axis represents the marginal effect of relationship lending for all the values of social capital, while the dashed lines define 95% confidence intervals. The use of a graphical illustration is worthwhile, as the effect of DURAT could change sign or become not statistically significant for different level of VOICE.

The estimated effect of control variables is also quite informative. According to Tables 2.3 and 2.4 firm dimensions (SIZE) positively affects productivity, implying that productivity *premia* for medium-sized firms are related also with other factors (e.g. internationalization, hiring qualified personnel). Leverage level (LEV) rises the TFP because higher indebtedness might reinforce managers' motivations to perform well and could help them to smooth the production process. Similarly, CASHFLOW positively influences firms' productivity: indeed, firms with supplementary cash flow may invest in R&D, adopt new technology and, therefore, optimize their real activities. Considering the regional variables, I find that firms' productivity is higher where the local economic development (RGDP) and the openness to international trade (EXPREG) are more intense. Indeed, ensuring a favourable business environment encourages the efficient allocation of resources. Concerning the local banking development variables, according to Table 2.4, regional branch density (BRANCH) positively affects firms' productivity when considering TFP obtained by the System GMM estimator. However, the coefficient of DENS is negative, suggesting that an increase in population might decrease productivity because of the conventional decreasing proceeds from the more intensive use of natural resources (Becker and Murphy, 2009). Finally, higher industry concentration (HHIa) seems decreasing firms' productivity.

[TABLE 2.4]

2.6.1 Robustness Checks

To check the sensitivity of the main findings presented in the previous section, in what follows I discuss further results obtained by changing some characteristics of Equations (2.9) and (2.10). First, I regress my baseline model by replacing the variable LIQUI with an alternative indicator of liquidity assets (WORKCAP), calculated as the ratio between currents assets minus current liabilities and total assets. As a second robustness check, I substitute HHIa with HHIs, the Herfindahl-Hirschman index based on sales. In both cases, results do not change as shown in columns 2 and 3 of both Tables 2.3 and 2.4.

In addition, I separately introduce additional variables among regressors: EXP and INNO (column 4), TRAIN (column 5), GROUP (column 6), NBANK (column 7), JACOB (column 8) and SOUTH (column 9). More in detail, both EXP and INNO are binary variables which take value one whether a firm exported any of its products in 2008 and if firms carried out innovation activities (process and/or product) in the period 2007-2009 (in average terms), respectively. Similar, TRAIN is equal to one if employees have participated in formal training programs in 2008 and

the dummy GROUP categorizes firms belonging to a group. In addition, to account for the phenomenon of multiple borrowing and for inter-industry externalities, the number of bank relationships per firm (NBANK) and the JACOB index is separately included in the model. Finally, to control if the location matters for productivity, a dummy taking values equal to one if a firm is located in South Italy is considered. Once again, these findings are in line with the ones of the previous section. Therefore, the results seem robust to all specification adjustments mentioned above.

2.7. CONCLUSION

This chapter has aimed to verify whether the social capital endowment at the local level may influence the importance of costs and benefits of lending relationships for firms. This issue has been so far neglected in the literature investigating the *external factors* that could condition the impact of banking relationships on firms' performance. The investigation has been carried out by focusing on firms' productivity, which constitutes an advantage in terms of using a fairly elaborate measure of firms' performance. What is more, to the best of my knowledge, only a very few studies have investigated the link between lending relationships and firm productivity (e.g.: Franklin et al., 2015; Agostino et al., 2018).

To this aim, this work has estimated the link between lending relationship duration and firms' productivity by conditioning the former on the level of social capital at the regional level. In other words, I have tested the complementarity or substitutability between enduring lending relationships and social capital: in the former case, the influence of close credit relationships on firms' productivity is expected to rise as the level of social capital increases; *vice versa*, the *net* impact of close lending relationships on SMEs' productivity should be stronger when social capital is low, and this effect should be observed smaller as the level of social capital increases.

Employing firm-level data on manufacturing SMEs operating in Italy between 2004 and 2009 and regional data on social capital endowment, an econometric examination has been carried out using measures of TFP obtained by implementing, first, the two-step algorithm proposed by Levinsohn and Petrin (2003) and, then, the system GMM estimator proposed by Blundell and Bond (1999).

The main findings suggest that social capital tends to play a substitute role with respect to the importance of lending relationships for firms. Specifically, the duration of credit relationships seems to have a positive effect on productivity as long as common values and social norms are

lacking. However, at higher social capital levels (i.e. more than about 0.5), close firm-bank relationships tend not affecting SMEs' productivity. Stated differently, this study has found a positive and significant relation between close lending relationships and SMEs' productivity, and this link seems shaped by the level of the social capital endowment. In the less civic regions – characterized by low levels of cooperation, trust, reciprocity and civic engagement – firms should rely on relationships with the bank in order to efficiently safe loan financing.

In conclusion, since lending relationships and social capital interplay as substitutes in affecting firms' productivity, specific policy formulation could be designed to facilitate SMEs' access to credit through both relationship lending and reinforcing of the norms and values of the civic community. This work provides recommendations, specifically, in terms of defining supportive public policies promoting social practices in the less civic regions of Italy. Such implementations should enhance a virtuous cycle: they can incentivize firms to take part in the debate about community well-being and reinforce the mutual trust that, in turn, increase their chance to access to credit and improving their performance.

Three limitations of my study can suggest directions for future research. First, the investigation is carried out during the years 2004-2009, but a challenge would be to repeat the analysis with updated sources since EFIGE is the only and most recent providing information on the duration of lending relationships. Second, future work could be carried out to assess whether my results might be generalised to micro firms as data used does not include businesses with fewer than ten employees. Finally, expanding the analysis to other European countries, which present diverse social capital endowments, may be supportive so as to derive an exhaustive overview.

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TABLE 2.1 - Description and summary statistics of the variables used in the estimations

VARIABLE	DESCRIPTION	Mean	StdD	Min	Max	Obs
TFP	Total factor productivity based on Levinsohn-Petrin (2003) method	1.69	0.69	0.02	15.69	14,115
TOTREV [(a)]	Total sales	73.40	123.53	0.10	1,924	14,115
LAB [(b)]	Number of employees	34	30.94	10	248	14,115
KAP [(a)]	Tangible plus intangible fixed assets plus depreciation	22.19	47.07	0.03	921	14,115
RAWM [(a)]	Expenditure for raw materials	39.47	80.39	0.00	1365	14,115
DURAT [(d)]	Duration of the relationships with the main bank	14	10.56	0	50	8,369
VOICE	Proxy of social capital	0.49	0.13	0.16	0.70	13,365
AGE [(d)]	Current year minus firm's year of establishment	29	18.49	0	154	14,056
SIZE[(a)]	Total assets	69.19	119.13	1.17	2099.05	14,115
LEV [(e)]	(Current plus non-current liabilities) to total assets	73.32	18.21	23.13	97.83	14,115
CASHFLOW [(e)]	Cash flow to total assets	5.36	5.42	-18.84	25.27	14,115
LIQUI	Current assets to current liabilities	1.49	0.76	0.54	23.62	14,114
HHIa	Herfindahl-Hirschman index on firms' total assets	0.02	0.02	0	0.29	14,115
RGDP[(b)]	Regional real gross domestic product	133,643	83,387	3,322	279,491	14,115
DENS[(c)]	Regional population over provincial surface (sq. km)	253	106.67	37	424	14,115
EXPREG [(e)]	Regional export over GDP	25.62	7.93	0.99	36.47	14,115
BRANCH	Number of branches for region to regional population	0.72	0.19	0.26	1.18	14,115
PREDEP	Regional total loans to firms to total deposits	0.93	0.23	0.35	1.34	14,115
Robustness checks						
WORKCAP [(e)]	(Currents assets minus current liabilities) to total assets	17.03	21.16	-40.97	71.77	14,115
HHIs	Herfindahl-Hirschman index on firms' sales	0.02	0.01	0	0.26	14,115
EXP	Dummy = 1 if a firm export exported any of its products in 2008 or before 2008	0.74	0.44	0	1	14,109
INNO	Dummy = 1 if firms carry out innovation activities (process and/or product)	0.68	0.47	0	1	14,109
TRAIN	Dummy = 1 if employees have participated to formal training programs	0.55	0.50	0	1	14,115
GROUP	Dummy = 1 if a firm belongs to a group	0.13	0.34	0	1	14,115
NBANK [(c)]	Number of bank relationship per firm	4	2.13	1	12	14,109
JACOB [(c)]	Jacob index: number of sectors (2-digit level) in each region, with more than 10 firms	9	5.72	0	16	14,115
SOUTH	Dummy = 1 if a firm is located in South Italy	0.14	0.34	0	1	14,115

All the variables come from the EU-EFIGE/Bruegel-UniCredit dataset; (a) in thousands of Euros (deflated values); (b) in millions of euro; (c) in unit; (d) in years; (e) in percentage.

TABLE 2.2 - Correlation matrix

	LAB	KAP	RAWM	DURAT	VOICE	AGE	SIZE	LEV	CASHFLOW	LIQUI	HHIa	RGDP	DENS	EXPREG	BRANCH	PREDEP	WORKCAP	HHIs	EXP	INNO	TRAIN	GROUP	NBANK	JACOB	SOUTH
LAB	1																								
KAP	0.5646	1																							
RAWM	0.5692	0.6656	1																						
DURAT	0.0358	0.0143	-0.0186	1																					
VOICE	0.0196	-0.0203	0.0196	0.1121	1																				
AGE	0.1705	0.1697	0.1165	0.3959	0.1221	1																			
SIZE	0.6798	0.8523	0.8275	0	0.0133	0.1764	1																		
LEV	-0.1134	-0.1494	-0.032	-0.1681	0.0352	-0.1316	-0.1151	1																	
CASHFLOW	0.0309	0.0268	0.0011	-0.0145	0.0012	-0.0661	-0.009	-0.2399	1																
LIQUI	0.0352	-0.0769	-0.0187	0.1434	0.0741	0.0996	0.0055	-0.5759	0.1444	1															
HHIa	0.0739	0.0438	0.0756	-0.0402	-0.0704	0.016	0.0799	-0.0376	-0.0154	0.0206	1														
RGDP	0.0213	0.0216	0.0357	0.0862	0.6974	0.1162	0.044	0.0011	-0.0061	0.0433	-0.0565	1													
DENS	0.0166	0.0382	0.0357	0.0341	0.3494	0.0462	0.0481	-0.0274	-0.0205	0.0201	-0.0057	0.8356	1												
EXPREG	0.0473	-0.0314	0.0272	0.077	0.5408	0.1089	0.0117	0.0711	0.0557	0.047	-0.0622	0.4201	0.1025	1											
BRANCH	0.0262	-0.0134	0.022	0.0824	0.4932	0.0673	0.0091	0.0337	0.0127	0.0444	-0.0489	0.1484	-0.135	0.7212	1										
PREDEP	0.0114	-0.0223	0.0321	0.0631	0.6492	0.0793	0.0141	0.0514	0.0294	0.0434	-0.0438	0.5659	0.3155	0.7639	0.74	1									
WORKCAP	0.0396	-0.1423	0.0043	0.1235	0.0918	0.0914	-0.0006	-0.4842	0.1157	0.8651	0.0335	0.0557	0.0233	0.0711	0.054	0.0691	1								
HHIs	0.0752	0.0409	0.0714	-0.0295	-0.0384	0.0158	0.0769	-0.0456	-0.0247	0.0299	0.9714	-0.0227	0.0189	-0.047	-0.0112	-0.0153	0.0424	1							
EXP	0.1519	0.0848	0.1276	0.0561	0.0863	0.114	0.1319	-0.0211	-0.0554	0.0293	0.0379	0.1036	0.0782	0.1289	0.1009	0.1154	0.0791	0.0405	1						
INNO	0.1159	0.0701	0.0906	-0.0182	0.0095	0.024	0.0975	-0.0031	0.0386	0.0004	0.0147	0.0109	-0.0043	0.0281	0.0335	0.0431	0.0144	0.0183	0.1811	1					
TRAIN	0.2058	0.1172	0.1085	0.0695	-0.0046	0.0878	0.1282	-0.0824	0.0679	-0.01	0.0148	-0.0294	-0.0647	0.0206	0.0277	-0.027	-0.009	0.0123	0.072	0.1616	1				
GROUP	0.2702	0.2493	0.2513	-0.069	0.0342	0.001	0.2947	-0.0757	0.0085	-0.0083	0.05	0.0248	0.0074	0.0024	0.0049	0.0044	0.0124	0.0516	0.0502	0.0444	0.1238	1			
NBANK	0.3653	0.2503	0.3457	-0.0276	0.0997	0.1034	0.3274	0.1072	-0.1092	-0.1318	0.0595	0.0703	0.0373	0.0955	0.0659	0.094	-0.0947	0.06	0.1312	0.1206	0.0858	0.1587	1		
JACOB	0.0224	-0.0114	0.0231	0.0796	0.6611	0.1195	0.0253	0.032	-0.0004	0.055	-0.0533	0.8406	0.6207	0.7103	0.4174	0.8067	0.0777	-0.0291	0.14	0.0377	-0.0363	0.0058	0.1032	1	
SOUTH	-0.0292	0.0564	-0.0111	-0.091	-0.6792	-0.1284	0.0086	-0.1155	-0.0006	-0.0589	0.0522	-0.3527	-0.0336	-0.6809	-0.6931	-0.6035	-0.09	0.0356	-0.1478	-0.0453	-0.0182	-0.0008	-0.1002	-0.5393	1

For the description of the variables see Table 2.1.

TABLE 2.3 - SYS-GMM results: total factor productivity calculated with Levinsohn-Petrin (2003)

	Benchmark Model	Replacing LIQUI with WORKCAP	Replacing HHIa with HHIs	Adding EXP and INNO	Adding TRAIN	Adding GROUP	Adding NBANK	Adding JACOB	Adding SOUTH
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
DURAT	0.0072***	0.0073***	0.0069***	0.0071***	0.0070***	0.0071***	0.0073***	0.0068***	0.0068***
	0.005	*0.004*	*0.006*	*0.007*	*0.006*	*0.008*	*0.005*	*0.007*	*0.008*
VOICE	0.3067***	0.2977***	0.3063***	0.2958***	0.3035***	0.3314***	0.3066***	0.2969***	0.2703***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.002*
DURAT*VOICE	-0.0117**	-0.0114**	-0.0112**	-0.0114**	-0.0115**	-0.0119**	-0.0119**	-0.0112**	-0.0106**
	0.011	*0.012*	*0.014*	*0.018*	*0.012*	*0.013*	*0.01*	*0.014*	*0.021*
AGE	-0.0023	-0.0033	-0.0022	-0.0026	-0.0022	-0.0024	-0.0023	-0.0023	-0.0025
	0.376	*0.194*	*0.407*	*0.365*	*0.400*	*0.400*	*0.399*	*0.375*	*0.371*
AGE2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.899	*0.842*	*0.857*	*0.990*	*0.858*	*0.819*	*0.892*	*0.993*	*0.876*
SIZE	0.0357**	0.0304*	0.0380**	0.0351*	0.0346**	0.0458**	0.0388**	0.0313*	0.0314*
	0.041	*0.076*	*0.027*	*0.052*	*0.039*	*0.022*	*0.037*	*0.059*	*0.072*
LEV	0.1822***	0.1641***	0.1838***	0.1779***	0.1755***	0.1983***	0.1840***	0.1960***	0.1500**
	0.002	*0.004*	*0.002*	*0.003*	*0.003*	*0.001*	*0.002*	*0.001*	*0.017*
CASHFLOW	0.6454***	0.6265***	0.6819***	0.6677***	0.6453***	0.5907***	0.6672***	0.6227***	0.6809***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.001*
LIQUI	0.0144		0.0117	0.012	0.0156	0.0124	0.0165	0.0143	0.0093
	0.444		*0.537*	*0.529*	*0.404*	*0.535*	*0.388*	*0.446*	*0.622*
HHIa	-0.0398*	-0.0499**		-0.0355*	-0.0383*	-0.0367*	-0.0436**	-0.0444**	-0.0377
	0.065	*0.024*		*0.094*	*0.076*	*0.088*	*0.040*	*0.042*	*0.211*
RGDP	0.0265**	0.0279**	0.0256*	0.0263*	0.0306**	0.0282*	0.0267**	0.0308**	0.0222
	0.047	*0.033*	*0.051*	*0.065*	*0.020*	*0.054*	*0.049*	*0.031*	*0.120*
DENS	-0.0395**	-0.0405**	-0.0386*	-0.0377*	-0.0454**	-0.0404*	-0.0393*	-0.0353*	-0.0358*
	0.049	*0.038*	*0.052*	*0.084*	*0.032*	*0.060*	*0.054*	*0.081*	*0.085*
EXPREG	0.0236**	0.0241**	0.0242**	0.0231	0.0241**	0.0207	0.0248**	0.0257**	0.0193
	0.033	*0.027*	*0.033*	*0.101*	*0.021*	*0.135*	*0.031*	*0.021*	*0.104*
BRANCH	0.0292	0.0285	0.0315	0.0263	0.0223	0.0312	0.0287	0.0312	0.0136
	0.245	*0.261*	*0.208*	*0.296*	*0.371*	*0.243*	*0.251*	*0.212*	*0.629*
PREDEP	-0.0092	-0.007	-0.0149	-0.0066	-0.0048	-0.0092	-0.0103	-0.0038	0.0027
	0.740	*0.798*	*0.589*	*0.817*	*0.861*	*0.758*	*0.709*	*0.893*	*0.928*
WORKCAP		0.0512							
		0.410							

(continued)

TABLE 2.3 (continued) - SYS-GMM results: total factor productivity calculated with Levinsohn-Petrin (2003)

	Benchmark Model	Replacing LIQUI with WORKCAP	Replacing HHIa with HHIs	Adding EXP and INNO	Adding TRAIN	Adding GROUP	Adding NBANK	Adding JACOB	Adding SOUTH
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
HHIs			-0.0510***						
			0.001						
EXP				-0.0131					
				0.854					
INNO				0.0036					
				0.950					
TRAIN					0.0019				
					0.965				
GROUP						-0.1785*			
						0.084			
NBANK							-0.0019		
							0.860		
JACOB								-0.0014	
								0.403	
SOUTH									-0.0311
									0.183
TREND	-0.0023	-0.0031	-0.0001	-0.0022	-0.0016	-0.0026	-0.0025	-0.0027	-0.0015
	0.355	*0.214*	*0.980*	*0.376*	*0.525*	*0.294*	*0.316*	*0.303*	*0.700*
Observations	6,613	6,614	6,613	6,613	6,613	6,613	6,613	6,613	6,613
Model test	413.42	468.72	431.90	414.96	470.55	365	404.39	441.82	439.01
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
$\chi 2$ test (DURAT,VOICE)	13.69	13.05	13.8	12.27	13.1	13.99	13.15	13.14	10.07
	0.001	*0.001*	*0.001*	*0.002*	*0.001*	*0.001*	*0.001*	*0.001*	*0.007*
AR(1) z-statistic	-4.6	-4.47	-4.56	-4.56	-4.66	-4.68	-4.6	-4.6	-4.49
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
AR(2) z-statistic	1.43	1.56	1.45	1.46	1.39	1.39	1.43	1.46	1.37
	0.153	*0.118*	*0.147*	*0.144*	*0.163*	*0.163*	*0.153*	*0.144*	*0.172*
Hansen test	228.77	238.66	228.18	249.42	236.41	232.68	236	243.27	228.55
	0.311	*0.172*	*0.321*	*0.277*	*0.337*	*0.402*	*0.278*	*0.293*	*0.298*

For the description of the variables see Table 2.1. In Italics are reported the p values of the tests. Superscripts ***, ** and * denote statistical significance at the 1, 5 and 10 percent level, respectively. The dependent variable is (the log of) total factor productivity (TFP) obtained by using Levinshon-Petrin (2003) method. Constant, sectoral dummies and lagged values of TFP always included but not reported. SIZE, HHIa, RGDP, DENS, EXPREG, HHIs are in log terms.

TABLE 2.4 - SYS-GMM results: total factor productivity

	Benchmark Model	Replacing LIQUI with WORKCAP	Replacing HHIa with HHIs	Adding EXP and INNO	Adding TRAIN	Adding GROUP	Adding NBANK	Adding JACOB	Adding SOUTH
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
DURAT	0.0069***	0.0076***	0.0067***	0.0067***	0.0065***	0.0068***	0.0062**	0.0071***	0.0064***
	0.004	*0.002*	*0.005*	*0.006*	*0.008*	*0.005*	*0.016*	*0.003*	*0.008*
VOICE	0.2697***	0.2789***	0.2711***	0.2648***	0.2709***	0.2685***	0.2577***	0.2883***	0.2212***
	0.001	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.003*	*0.000*	*0.010*
DURAT*VOICE	-0.0111**	-0.0118***	-0.0107**	-0.0106**	-0.0107**	-0.0106**	-0.0101**	-0.0117***	-0.0098**
	0.011	*0.007*	*0.013*	*0.018*	*0.016*	*0.016*	*0.031*	*0.006*	*0.026*
LAB	0.1209***	0.1098***	0.1244***	0.1172***	0.1059**	0.1161***	0.1146***	0.1237***	0.1054**
	0.004	*0.009*	*0.003*	*0.008*	*0.021*	*0.005*	*0.008*	*0.003*	*0.016*
KAP	-0.0041	-0.0015	-0.0035	-0.0021	0.0041	-0.0053	-0.0066	0.0043	-0.0055
	0.886	*0.965*	*0.896*	*0.941*	*0.885*	*0.844*	*0.813*	*0.873*	*0.846*
RAWM	0.6276***	0.6308***	0.6316***	0.6235***	0.6295***	0.6300***	0.6182***	0.6263***	0.6352***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
AGE	-0.0022	-0.0031	-0.0023	-0.0019	-0.002	-0.0028	-0.0017	-0.0024	-0.0027
	0.382	*0.223*	*0.355*	*0.497*	*0.436*	*0.275*	*0.528*	*0.336*	*0.296*
AGE2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.852	*0.994*	*0.863*	*0.711*	*0.735*	*0.994*	*0.722*	*0.970*	*0.852*
SIZE	0.2444***	0.2401***	0.2464***	0.2457***	0.2357***	0.2414***	0.2556***	0.2344***	0.2418***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
LEV	0.1675**	0.1638**	0.1654**	0.1743**	0.1706**	0.1752**	0.1852**	0.1767**	0.1232
	0.024	*0.045*	*0.024*	*0.023*	*0.022*	*0.016*	*0.016*	*0.016*	*0.110*
CASHFLOW	0.9677***	0.9860***	0.9942***	1.0256***	0.9741***	0.9230***	0.9828***	0.9669***	0.9607***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
LIQUI	0.0083		0.0053	0.0039	0.0129	0.0087	0.0091	0.0095	0.0042
	0.661		*0.774*	*0.833*	*0.500*	*0.646*	*0.637*	*0.611*	*0.826*
HHIa	-0.0410*	-0.0470**		-0.0341	-0.0371*	-0.0425*	-0.0411*	-0.0403*	-0.0395*
	0.056	*0.034*		*0.111*	*0.081*	*0.051*	*0.053*	*0.056*	*0.064*
RGDP	0.0291**	0.0299**	0.0293**	0.0301**	0.0317**	0.0261**	0.0275**	0.0333**	0.0257**
	0.023	*0.017*	*0.020*	*0.026*	*0.014*	*0.042*	*0.033*	*0.020*	*0.041*
DENS	-0.0366**	-0.0350*	-0.0359**	-0.0406**	-0.0389**	-0.0339*	-0.0360*	-0.0314*	-0.0331*
	0.044	*0.052*	*0.047*	*0.044*	*0.045*	*0.066*	*0.050*	*0.090*	*0.070*
EXPREG	0.0344***	0.0377***	0.0355***	0.0312**	0.0345***	0.0337***	0.0361***	0.0385***	0.0297**
	0.006	*0.005*	*0.005*	*0.029*	*0.006*	*0.006*	*0.007*	*0.006*	*0.029*
BRANCH	0.0605**	0.0642**	0.0653**	0.0564**	0.0508*	0.0610**	0.0582**	0.0561**	0.0444
	0.023	*0.017*	*0.014*	*0.038*	*0.053*	*0.024*	*0.030*	*0.034*	*0.113*

(continued)

TABLE 2.4 (continued) - SYS-GMM results: total factor productivity

	Benchmark Model	Replacing LIQUI with WORKCAP	Replacing HHIa with HHIs	Adding EXP and INNO	Adding TRAIN	Adding GROUP	Adding NBANK	Adding JACOB	Adding SOUTH
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
PREDEP	-0.0282	-0.0297	-0.0348	-0.0255	-0.0252	-0.0228	-0.0244	-0.0214	-0.0177
	0.294	*0.268*	*0.190*	*0.373*	*0.345*	*0.409*	*0.378*	*0.445*	*0.526*
WORKCAP		0.0347							
		0.670							
HHIs			-0.0406**						
			0.011						
EXP				0.0364					
				0.554					
INNO				-0.0024					
				0.961					
TRAIN					0.0146				
					0.720				
GROUP						0.0102			
						0.910			
NBANK							-0.003		
							0.769		
JACOB								-0.0017	
								0.338	
SOUTH									-0.0378
									0.111
TREND	-0.0049*	-0.0052*	-0.0024	-0.0045	-0.004	-0.0054**	-0.0049*	-0.0050**	-0.0043*
	0.060	*0.056*	*0.282*	*0.111*	*0.132*	*0.043*	*0.064*	*0.048*	*0.082*
Observations	6,613	6,614	6,613	6,613	6,613	6,613	6,613	6,613	6,613
Model test	15,129.27	14,705.63	15,283.04	15,482.40	14,926.04	14,844	14,455.93	15,825.85	15,545.78
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
$\chi 2$ test (DURAT,VOICE)	11.52	12.27	11.79	10.6	10.8	11.02	8.98	13.68	7.9
	0.003	*0.002*	*0.003*	*0.005*	*0.005*	*0.004*	*0.011*	*0.001*	*0.019*
AR(1) z-statistic	-4.66	-4.57	-4.61	-4.63	-4.71	-4.68	-4.71	-4.63	-4.7
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
AR(2) z-statistic	1.19	1.32	1.22	1.12	1.03	1.23	1.13	1.14	1.16
	0.236	*0.186*	*0.221*	*0.262*	*0.304*	*0.217*	*0.259*	*0.256*	*0.248*
Hansen test	234.34	241.01	233.72	255.87	247.96	245.84	232.79	251.63	232.34
	0.500	*0.380*	*0.511*	*0.438*	*0.417*	*0.455*	*0.619*	*0.424*	*0.518*

For the description of the variables see Table 2.1. In Italics are reported the p values of the tests. Superscripts ***, ** and * denote statistical significance at the 1, 5 and 10 percent level, respectively. The dependent variable is (the log of) total sales (TOTREV). Constant, sectoral dummies and lagged values of TOTREV, KAP, LAB and RAWM always included but not reported. KAP, RAWM, SIZE, HHIa, RGDP, DENS, EXPREG, HHIs are in log terms.

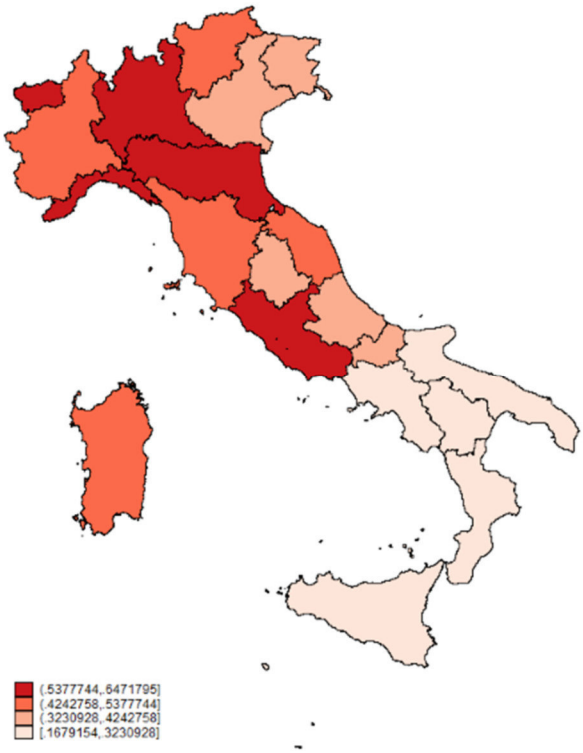

Figure 2.1. Average social capital in the Italian regions. Source: Author's elaboration.

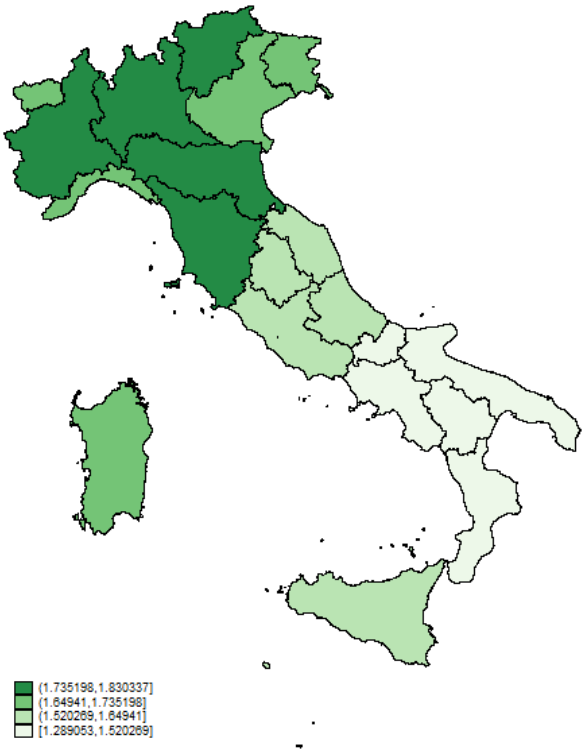

Figure 2.2. Average TFP (LP method) in the Italian regions. Source: Author's elaboration.

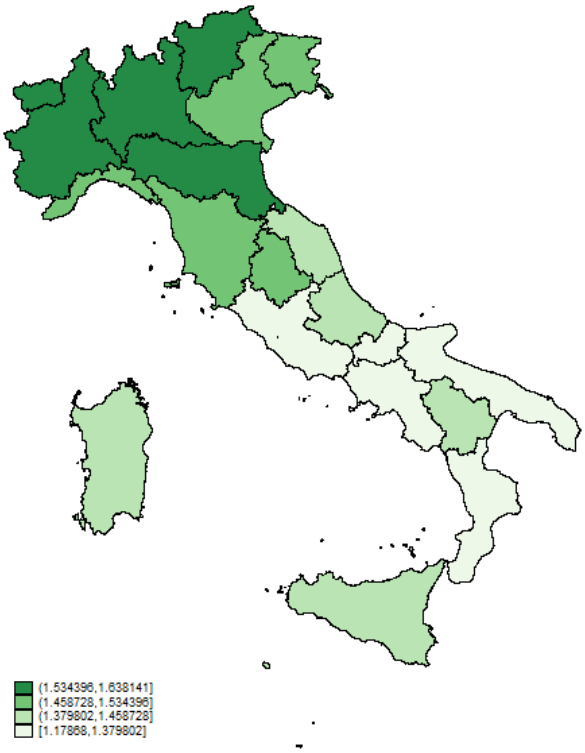

Figure 2.3. Average TFP (SYS-GMM) in the Italian regions. Source: Author's elaboration.

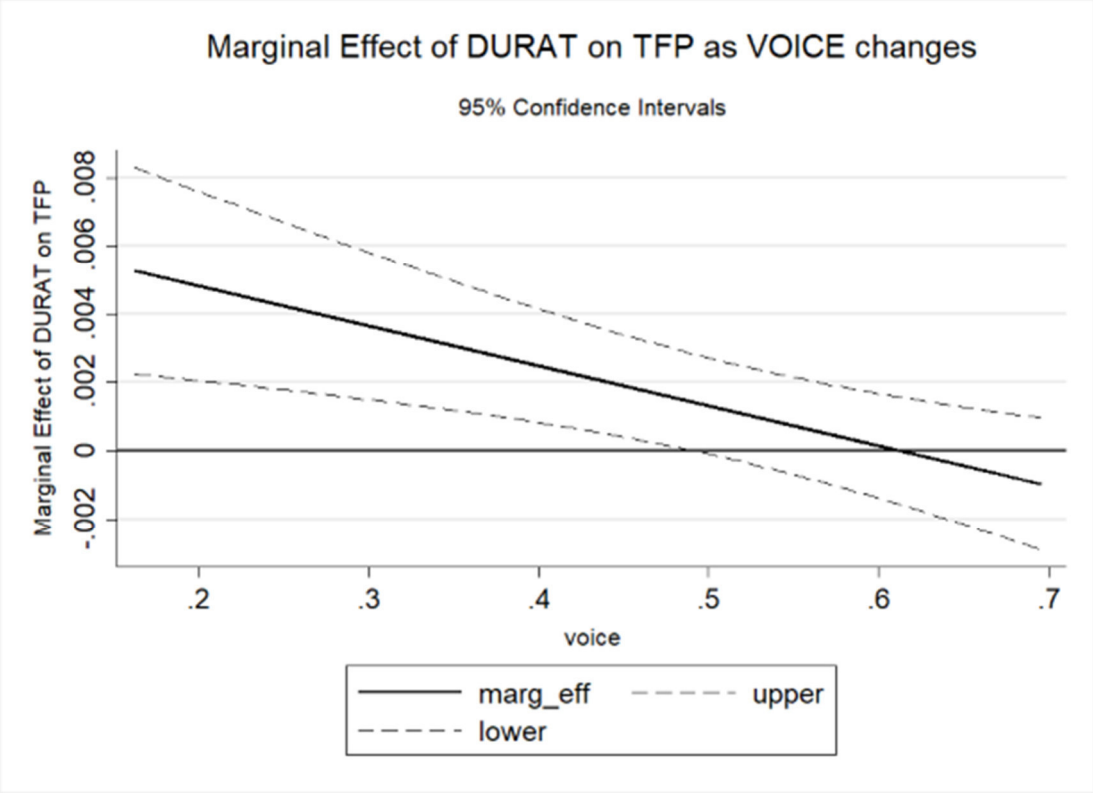

Figure 2.4. Marginal Effect of DURAT on TFP (LP method) as VOICE changes.

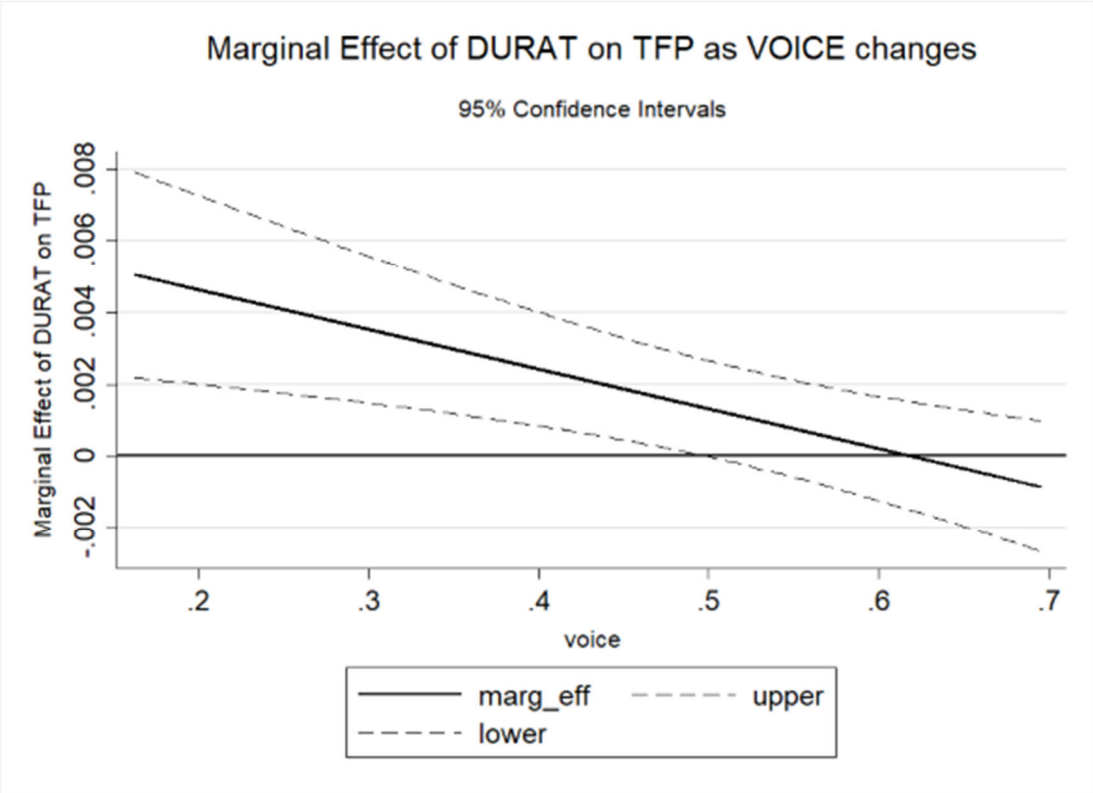

Figure 2.5. Marginal Effect of DURAT on TFP (SYS-GMM) as VOICE changes.

Appendix 2

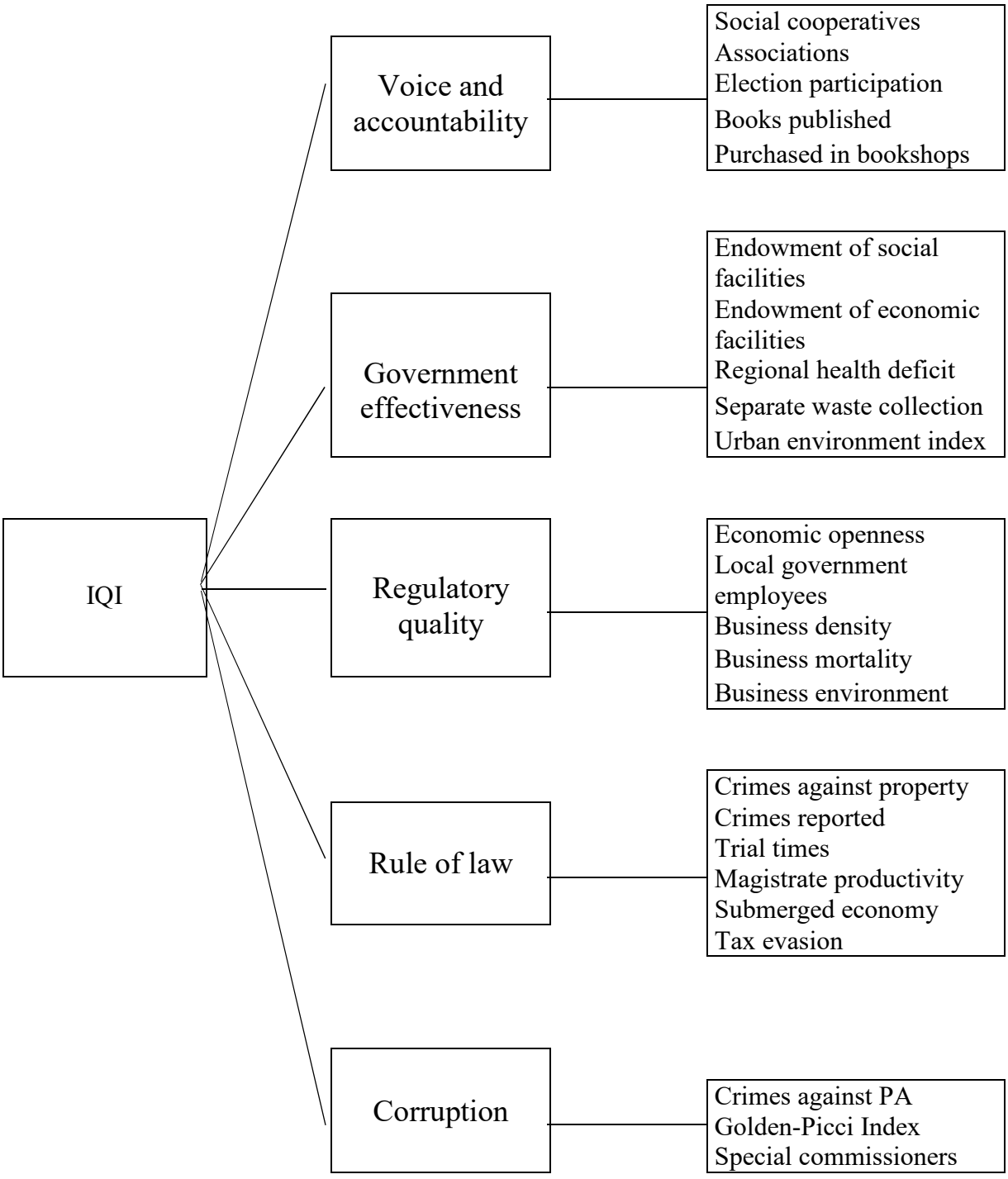

Figure A2.1. Institutional quality index composition.
Source: Author's adaptation from Nifo and Vecchione (2014, 2015).

CHAPTER 3

THE EFFECT OF LASTING LENDING RELATIONSHIPS ON FIRM DEFAULT

ABSTRACT

Using microdata on manufacturing firms operating in France, Italy and Spain, in this chapter I empirically investigate whether, during the period 2005-2009, enduring credit relationships have influenced firms' default. Adopting econometric models for binary response variables and survival models, I find that the duration of lending relationships is negatively associated with firms' failure, reducing the probability of default. These findings are in line with the theoretical predictions of the strand of literature highlighting the benefits of lending relationships.

Keywords: lending relationships, firm failure, EFIGE data.

3.1. INTRODUCTION

Firm failure is a relevant topic in the academic debate as it substantially represents the inability of a business to survive adverse economic conditions (Chan and Chen, 1991). Moreover, the failure of an enterprise implies costs for society (Altman and Hotchkiss, 2010). Thus, regulations and effective policies are needed in order to minimize the costs and time for the society in eliminating unsuccessful and unproductive firms along with safeguarding creditors, suppliers, customers, employees, and the government (Elert et al., 2019). Factors affecting firm failure might be beyond firms' control, such as economic downturns, interest rate, and macroeconomic instability (e.g. Koopman and Lucas, 2005; Hackbarth et al., 2006; Bhattacharjee et al., 2009b). Similarly, according to Jovanovic and Rousseau (2002) and Mata et al. (2007), among others, firm internal characteristics (e.g. firm's age and dimension) may be associated with the default probability.

According to a considerable number of studies, financial constraints play a fundamental role in influencing enterprises' failures (Cowling and Mitchell, 2003; Farinha, 2005; Hutchinson and Xavier, 2006; Bottazzi et al., 2007; Petrunia, 2007; Musso and Schiavo, 2008). Barriers in financial markets can affect firms' optimal resource allocation and credit risk behaviour, increasing their likelihood to fail (Bernanke and Gertler, 1995; Caves, 1998; Pakes and Ericson, 1998; Jovanovic and Rousseau, 2002; Chen and Guariglia, 2013). In other words, the degree of access to external sources of finance directly entails firms' activities growth and, in turn, their surviving (Oliveira and Fortunato, 2006; Musso and Schiavo, 2008). As noted by Modina and Pietrovito (2014), all variables related to the firm capital structure and to the cost of borrowing external funds are predictors firms' defaults. Therefore, a reliable credit environment guaranteeing a prompt response in terms of acquiring funds might be more favourable so as to ensure the business life.

The above insights place emphasis on mechanisms that may favour the matching between firm credit demand and financial intermediaries' credit supply. Indeed, as credit markets are typically incomplete due to the asymmetric information, allocative mechanisms should, insofar as possible, reduce such issues in order to increase credit availability. Banks specialise in collecting proprietary information, evaluating firms' creditworthiness and monitoring firms' performance (e.g. Diamond, 1984; Boot, 2000; Carletti, 2004; Freixas, 2005; Corigliano, 2007; Cosci et al., 2016). In so doing, banks establish close lending relationships with firms through repeated interactions in order to reduce information asymmetries, expanding their access to credit (Boot, 2000; Petersen and Rajan, 1994) and reducing firm default (Ongena and Smith, 2000; Berger and Udell, 2002; Bannier, 2007). Therefore, in a framework of limited access to credit, that may compromise firms' survival, relationship lending can represent an effective technology in terms of overcoming asymmetric information problems (Berger and Udell, 2002), which can help to relax firms' credit

constraints (Carbó-Valverde et al., 2012) and to prevent firms' default (Agostino et al., 2012; Cotugno et al., 2013; Fiordelisi et al., 2014; Ono et al., 2014).

Lending relationships, however, could be beneficial or detrimental for firms' financing, performance and, as well, failure. With regard to the latter aspect, some authors argue that close lending relationships should reduce firms' default risk through screening and monitoring processes arising from the acquisition of propriety information on firms (Diamond, 1984; Carletti, 2004). This mechanism appears to discipline borrowers' behaviour, yielding to lower default (Foglia et al., 1998; Ongena and Smith, 2000) as well as allowing firms to signal their willingness to abstain from strategic default (Bannier, 2007). On the other hand, close lending relationships might involve *softening* budget constraints and *hold-up* problems, which could lead to a greater *ex-ante* likelihood of financial hazard (Carmignani and Omiccioli, 2007) and higher loan rates charged (Hernandez-Canovas and Martınez-Solano, 2006).

Moving from these considerations, the purpose of this work is to investigate to what extent enduring lending relationships may influence firms' default, contributing to enrich both banking relationships and firm insolvency literature. However, due to the ambiguity of the effect of the close lending relationship on firm failure emerged from the literature, no expectation is posed on the direction of the impact of lending relationships duration on firm default. In doing so, the contribution of this chapter is to assess this relation by considering firms' default as a changing status from an active to distress/temporary or permanent default. Indeed, to the best of my knowledge, previous contributions only focus on addressing the impact of credit relationships on firm default *per se* (Fiordelisi et al., 2014) and on firm financial health (Agostino and Trivieri, 2018).

The econometric analysis is carried out on a sample of French, Italian and Spanish manufacturing firms observed over the period 2005-2009. The data I use is retrieved from the EFIGE survey, combined with balance sheet data drawn from Amadeus and Orbis *Historical* databases, both held by Bureau van Dijk. These latter report firms' general information and status which allow me to consider firms' default, unlike previous works that inspecting the impact of credit relationships on firms' failure, in a twofold way. First, I define a firm as failed if its company status, registered as active in 2005, becomes that of dormant, receivership, bankruptcy, liquidation or dissolved by the end of 2009. Thus, firms' default is defined over the entire period I consider. In other words, if a firm changed its status, this might be occurred in either 2009 or any other year between 2006 and 2008. Second, I take into account the firm changing status on a yearly basis

when an active firm at the end of a given year enters into a default status (temporary or permanent) by the end of the following year.[76]

On the methodological ground, first I apply binary outcome models (i.e. Logit, Probit, Complementary log-log), then I employ discrete-time models when considering yearly based firm failure. Specifically, I use the complementary log-log model both without and with individual unobserved heterogeneity, by assuming Gamma and Normal distributions of the error term. Finally, since the firm default probability could be determined by unobservable features and the borrower's quality may determine the duration of bank-firm relationships, this may raise problems of endogeneity, that I address by using an IV Probit model only focusing on the Italian firms' sample.

According to my results, firms' default seems to be reduced by lasting lending relationships. Indeed, being in a close lending relationship with the main bank tends to decrease the firm default probability, when considering changing status either over the period or on a yearly basis. Consistent with previous studies (e.g. Foglia et al., 1998; Ongena and Smith, 2000; Bannier, 2007; Agostino et al., 2012; Fiordelisi et al., 2014; Agostino and Trivieri, 2018; Yildirim, 2019), these findings highlight the beneficial role of enduring credit relationships on firms' default.

The remainder of this work is organised as follows: Section 2 and 3 define the firm failure and review the related literature, respectively. Section 4 describes the data used and Section 5 explains the theoretical methodology. Section 6 sets out the Research Hypotheses and empirical analysis. Section 7 illustrates the results obtained and robustness checks performed. Finally, Section 8 concludes.

3.2. A TAXONOMY OF FIRM STATUS

This paragraph describes the different statuses that might characterise a firm during its business life. To begin with, a firm is active when it is operating and is regular in compiling its balance sheets and other financial documents. A state of insolvency, instead, could emerge in case of impossibility to fulfil the contracted obligations, implying the creditors' right to be satisfied in their credits. In such case, the insolvency proceedings can be active in order to adequately protect the firm's creditors, through the radical reduction of entrepreneur's autonomy and the nomination of a supervisory body with control functions over the activity.

[76] In Amadeus and Orbis *Historical* databases, each firm is codified by an identification number to which are associated some firm's information and status, relative to the last year the firm is observed.

The judicial or administrative procedures may take several forms, such as bankruptcy, liquidation, and dissolution. The former proceedings refer to a legal arrangement for regulating the business crisis through the sold of the debtor's assets and the distribution of the proceeds among its creditors so far as possible. Bankruptcy can be voluntary when it is started by the insolvent debtor or involuntary if it is required by unpaid creditors through the appeal to the court. The main goal of bankruptcy is the complete fulfilment of the debtors by ensuring the fair distribution among its creditors. Similarly, in liquidation procedure, the firm winds up by selling its un-pledged assets to convert them into cash in order to face all unsecured creditors; while, the secured creditors assume the control of the pledged assets on getting foreclosure orders. Liquidation procedure can be started by the shareholders (voluntary liquidation) or forced by court orders following the creditors complain (compulsory liquidation). Instead, the involuntary cessation of the existence of an enterprise induced by a government authority is called dissolution. This is due to the firm's failure to fulfil certain legal requirements as, for instance, to report all of the business's financial activity in an annual return or pay its taxes.

The above insolvency proceedings refer to failure circumstances which, in this work, are considered as permanent default states of firms. However, business termination could involve some temporary forms of default: dormant and receivership. The former means that a firm is inactive as it has not done business or made a monetary transaction for the accounting period in question while being wound up. Changing status can be notified by the firm or, alternatively, documented by the Registrar (i.e. government official responsible for maintaining a register in which specific transactions are recorded for public knowledge) after not receiving statutory fulfilments. Receivership refers to the state in which the firm is under the temporary administration and control of a receiver, who replaces its entrepreneur or owners (stock/shareholders). In such a case, all business's official documents have to contain the status notification of "in receivership". Although there are some similarities, receivership is fairly different from bankruptcy. Taking the control of all, or part of all, assets of a firm is a supplementary remedy which aims to repay the firm's debt without liquidating it and involve court with more moderate rules than bankruptcy regulations.[77]

What discussed so far shows that firm distress can assume several facets. In the literature about insolvency, Sharan (2011) categorises distress into economic failure and financial failure. The former refers to the situation in which a firm faces the costs of capital higher than its generated revenue. In other words, when a firm does not create profits is experiencing an economic failure.

[77] All the definitions are retrieved from IATE (InterActive Terminology for Europe). See https://e-justice.europa.eu/content_glossaries_and_terminology-119-it.do and https://iate.europa.eu/home for further information.

However, the company does not wind up its assets. On the other hand, financial distress includes those circumstances in which a firm does not repay its debt. Another classification is between insolvent firms (when firms' liabilities are higher than firms' fair market value) and illiquid firms (firms are temporarily and shortly insolvent) (Sharan, 2011). Chan and Chen (1991, p.1468) define financially distressed firms as those that "have lost market value because of poor performance, they are inefficient producers, and they are likely to have high financial leverage and cash flow problems. They are marginal in the sense that their prices tend to be more sensitive to changes in the economy, and they are less likely to survive adverse economic conditions".[78]

According to the bankruptcy and reorganization theory, the perpetual entry and exit of productive firms in the economic system are natural, but productive firms' failure implies a cost to society (Altman and Hotchkiss, 2010). For this reason, the theory predicts that when an enterprise's economic value is greater than its present liquidation value, it should be allowed to reorganizing and continuing production. Conversely, when the economic value is lower than the liquidation value, the firm should liquidate (Altman and Hotchkiss, 2010). Stated differently, efficient management of unhealthy firms requires bankruptcy and insolvency regulation that minimizes the costs and time for the society in eliminating unsuccessful and unproductive firms but safeguarding creditors, suppliers, customers, employees, and the government (Elert et al., 2019).

In line with these predictions, "in 2012, the Commission proposed to recast the 2000 Insolvency Regulation in order to address the cross-border aspects of insolvency in the EU. Adopted in 2015, the recast regulation introduced clear rules on the jurisdiction and law applicable to a debtor's insolvency proceedings and made mandatory the recognition of those proceedings in the other EU Member States. Its remit was expanded to include not only bankruptcy but also hybrid and pre-insolvency proceedings, as well as debt discharges and debt adjustments for natural persons (consumers and sole traders)" (Stamegna, 2018, p.1).[79]

[78] In the literature, other methods have been employed to investigate on firm's failure. For instance, looking at financial health, the Z-Score formula, proposed by Altman (1968), which is based on financial ratios derived from company's annual report (Altman, 1968).

[79] For the full text, see "Regulation (EU) 2015/848 of the European Parliament and of the Council of 20 May 2015 on insolvency proceedings, OJ L 141/19, 5.6.2015" available at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L:2015:141:TOC. It should be noticed, however, that each Member States of the European Union has its own legal system and apply law both at the national and sub-national level (area, region, or city). For instance: The Italian bankruptcy law is originally established by the "*Regio Decreto 16 marzo 1942, n. 267*"; in France, the corporate insolvency regime is ruled by Book VI of the Commercial Code1 (*Des Entreprises en Difficultés*); and in Spain, there is a unique procedure (*Concurso De Acreedores*) governing the insolvency of a borrowing firm, that is regulated by the Spanish "*Insolvency Act 22/2003*", dated 9 July 2003.

3.3. RELATED LITERATURE

3.3.1 Empirical evidence on firm failure

According to a large theoretical and empirical literature, firms' default is influenced by a variety of factors, including firms' characteristics, industry and macroeconomic conditions, institutional and cultural drivers (Nickell et al., 2000; Bangia et al., 2002; Allen and Saunders, 2002; Carling et al., 2007; Colombelli et al., 2013; Spaliara and Tsoukas, 2013). To begin with, Bhattacharjee et al. (2009b) argue that firms' defaults are considered to be cyclical in nature. Bankruptcies, specifically, are often related to adverse economic conditions, such as a financial crisis (Bachmann et al, 2013). Also, the conditions of a country's financial system affect the financial stability of a company, particularly during economic tumults (Allen and Gale, 2000; Bond et al., 2003; Zingales and Rajan, 2003). Thus, firms default rises in periods of economic downturns (Fama, 1986; Koopman and Lucas, 2005); while, firm's survival drastically increases if a business starts when GDP is growing (Geroski et al., 2010). Macroeconomic instability also seems to indirectly affect firms' financial distress through the rise of credit constraints. According to Greenwald and Stiglitz (1990), creditors are less likely to lend in presence of higher instability, but the negative effect of macroeconomic factors on firms' default could be reduced by the legal institution (Bhattacharjee et al., 2009a, b).[80] Firms' dynamics might be influenced by local factors: firms located in greater urban areas have a lower probability of failure than those operating faraway of those areas (Fotopoulos and Louri, 2000). Higher agglomeration is associated with lower firm survival (Honjo, 2000; Staber, 2001; Folta et al., 2006; De Silva and McComb, 2012). Contrariwise, several works discover a positive impact of clusters on entrepreneurship and firm survival (Sorenson and Audia, 2000; Delgado et al., 2010; Wennberg and Lindqvist, 2010; Renski, 2011).

Another strand of literature investigates whether institutional and cultural drivers are part of the wide set of determinants of firms' failure. These factors are estimated to negatively impact enterprise risk-taking decisions and, therefore, indirectly the probability of firm failure (Mihet, 2013).[81] Some authors have investigated the role of industry features in which the firm operates (Caves, 1998; Bhattacharjee et al., 2009b). For instance, Audretsch (1991) analyses the relationship between industry-specific variables – such as economies of scale, concentration and innovation – and firm's survival, proving that the latter is hard in the high-technology industry with large economies of scale. Also, firms are more likely to survive in fast-developing industries, where

[80] More extensive work on the link between firms' characteristics, macroeconomic instability and institutional factors is provided by (Bhattacharjee et al., 2009a).
[81] See Tse et al. (1988), Hope (2003), Licht et al. (2005), Kwok and Tadesse (2006), Doidge et al. (2007), Beraho and Elisu (2010), Griffin et al. (2012) for further insights.

innovation and R&D do not play an essential role (Audretsch and Mahmood, 1994, 1995). Indeed, firms live longer in growing industries than in declining industries (Mata and Portugal, 1994; López-García et al., 2007).

Along with external factors, firm-specific characteristics play an important role in explaining firms' financial distress and default.[82] Several contributions evidence the beneficial role of the firm's size and age (Caves, 1998; Pakes and Ericson, 1998; Jovanovic and Rousseau, 2002). For instance, Geroski and Geroski (1995) and Sutton (1997) show that there is a robust negative relationship between the business's size and bankruptcy probability.[83] Mata et al. (2010) argue that the probability of market exit is higher for younger firms than for older ones. Moreover, the effect of size and age on firms' default may be nonlinear (Agarwal et al., 2002; Cefis and Marsili, 2005). According to Mata and Portugal (1994), ownership is also a relevant factor affecting firm default probabilities: foreign firms are more likely to exit than domestic ones (Görg and Strobl, 2003). Mata and Portugal (2002) and Kimura and Fujii (2003), however, do not evidence a significant impact of foreign ownership. Firms with considerable innovation inputs and outputs are less likely to fail (Kimura and Fujii, 2003; Cefis and Marsili, 2005; Fontana and Nesta, 2009; Wagner and Cockburn, 2010). Another major concern is the impact of financial indicators, such as leverage, cash flow, and profitability on company's financial distress (Taffler, 1982; Lennox, 1999). Liquidity constraints and cash-flow problems often precipitate financial distress and failure. Contrariwise, coverage ratio and cash flows are negatively associated with the bankruptcy risk (Wędzki, 2008; Görgi and Spaliara, 2009). As noted by Bhattacharjee and Han (2014), cash flow from operations is an important determinant of firms' default, as a result financial strength generated by stronger cash flow might mitigate potential agency costs related to free cash flow. Exploring the link between leverage level and bankruptcy probabilities, Warner (1977) and Kim (1978) show that the probability of financial distress is expected to rise as firms' indebtedness level increases. As noted by Jensen (1986), a higher level of leverage increases the bankruptcy probability and, if this happens, managers are more likely to be penalized than owners. The negative effect of higher debt level on firms' default risk emerges in the reduction of UK firms' investments due to increasing costs of external financing (Guariglia, 1999). Similarly, by using the firm's debt rating as a proxy for the default probabilities and correcting for the endogeneity, Molina (2005) confirms that leverage has a negative effect on debt ratings. More recently, Bridges and Guariglia (2009), using

[82] See Siegfried and Evans (1994) and Caves (1998) for reviews.

[83] Another stand of literature investigating the impact of firm's size at the moment of its foundation on company default suggests other results. Starting a big business implies facing greater sunk costs which cannot be easy reduced and influence long-run success of the firm (Geroski et al., 2010). For further example, see Mata and Portugal (1994), Audretsch and Mahmood (1995).

a panel of 61,496 UK firms over the period 1997–2002, argue that higher leverage entails higher default probabilities for UK domestic firms than for their globally engaged counterparts. Firms having higher financial distress are expected to have a higher probability of bankruptcy (Hovakimian et al., 2012), and higher leverage level is associated with higher default probability (Di Patti et al., 2015). Contributions argue that if firms' capital structure is mainly composed of short-term debt, the risk of default increases (Chung et al., 2013); conversely when the share of long-term debt over assets is more consistent, the default risk decreases (Gul and Cho, 2019).[84]

A growing body of empirical literature suggests that, among internal factors, financial constraints are the main determinants of enterprises' failures (Fotopoulos and Louri, 2000; Cowling and Mitchell, 2003; Farinha, 2005; Hutchinson and Xavier, 2006; Bottazzi et al., 2007; Petrunia, 2007; Pfaffermayr, 2007; Musso and Schiavo, 2008).[85] Indeed, previous contributions show that firms are more likely to fail when their accessibility to credit markets is limited (Bernanke and Gertler, 1995; Geroski and Gregg, 1996; Caves, 1998; Pakes and Ericson, 1998; Jovanovic and Rousseau, 2002;). Firms' decisions, in terms of optimal resource allocation and credit risk behavior, can be influenced by the presence of barriers in financial markets (Edmister, 1972; Chen and Guariglia, 2013). As a result, the degree of access to external sources of finance and its relative cost directly entail to firms' ability to grow and, in turn, to survive (Oliveira and Fortunato, 2006; Musso and Schiavo, 2008). Consistently, as noted by Mach and Wolken (2012) credit-constrained firms are significantly more likely to fail than non-constrained firms. Therefore, all variables related to the firm capital structure and to the cost of borrowing external funds are robust determinants of a firm's default (Modina and Pietrovito, 2014).[86]

3.3.2 Relationship lending

As highlighted in the previous section, the limited access to credit of firms, due to the rising of financial constraints, leads to an increase in firm failure probability. Thus, overcoming financial

[84] A further relevant aspect investigated in the literature is the role of unobserved variables, related both to entrepreneurial human capital and macroeconomic conditions at the time of firm estabilishment, in understanding firm exits and defaults. For instance, unobserved industry variation impacts on US firms' initial experience and survival (Thompson, 2005). Unobserved human capital in management choice seems to affect the survival of newly created firms (Bhattacharjee et al., 2010). Also, intangibles and R&D investments are part of other unobserved determinants emerging in the literature (Bhattacharjee and Han, 2014).

[85] Other authors suggest that the main reasons for business failures can be found in the lack of knowledge, constraints to debt financing, and the economic climate (Carter and Auken, 2006), scarce management skills (Peacock, 2000) and lack of planning and insufficient capitalisation (Altman and Hotchkiss., 2010).

[86] Financial constraints are not directly observable, indeed, several proxies have been largely employed. Although financial ratios are strong predictors of failure at micro-level and, thus, are the most commonly used proxies, they interact with other factors that compound the financial constraints. For instance, the length of time during which the owner of the borrowing enterprise is effectively within the firm mitigates their impact (Carbó-Valverde et al., 2012; McCann and McIndoe-Calder, 2012). Furthermore, Michala et al. (2013), considering SMEs, evidence that both those located in urban areas and with less than three shareholders have higher distress probabilities.

restrictions, essentially due to asymmetric information problems, might be feasible through the aid of relationship banking. That is, "the provision of financial services by a financial intermediary that invests in obtaining customer-specific information, often proprietary in nature, and evaluates the profitability of these investments through multiple interactions with the same customer over time and/or across products" Boot (2000, p.10). This definition underlines the presence of peculiar synergies between the bank and its customer, in which banks accumulate confidential information (*soft information*) through repeated interactions over time. The key feature of a relationship lending is, hence, the acquisition of additional information beyond those already available, which is facilitated by an *ex-ante* screening process and, then, by a monitoring phase during the relationship. Alternatively, banks may adopt another type of approach – transaction lending technologies – that is based on *hard information* generated at the time of loan origination (Berger and Udell, 2002; Udell, 2008). However, in order to reduce asymmetric information and moral hazard problems, relationship lending is more appropriate than its counterpart, especially when borrowing firms are typically low-creditworthiness offering opaque information to the financial intermediate. As a result, close bank-firm relationships relax credit constraints (Carbó-Valverde et al., 2012) and expand access to external finance (Petersen and Rajan, 1994).

Relationship lending is the focus of a wide literature as the bank is the most important agent adequately investing to get borrower-specific information in the lending process (Freixas, 2005) as well as a more efficient allocative mechanism than the market (Bencivenga and Smith, 1991; King and Levine, 1993). The empirical literature on the connection between lending relationships and firms' financing and performance draws a puzzling scenario. Indeed, close lending relationship is positively related to credit availability (Petersen and Rajan, 1994; Berger and Udell, 1995; Angelini et al., 1998; Cole, 1998; Elsas and Krahnen, 1998; Bharath et al., 2009; Chakraborty and Hu, 2006; Hernandez-Canovas and Martınez-Solano, 2010; Kano et al., 2011;), firms' product and process innovations (Herrera and Minetti, 2007; Benfratello et al., 2008; Giannetti, 2012; Mancusi et al., 2018), firms' foreign direct investment (De Bonis et al., 2010), firms' technical efficiency (Agostino et al., 2018) and, by contrary, it decreases the interest rate (Berger and Udell, 1995; Petersen and Rajan, 1995; Brick and Palia, 2007) and diminishes the probability for firms to pledge collaterals (Brick and Palia, 2007; Jimenez et al., 2006). Other studies, however, show that close bank-firm ties increase loans interest rates (Petersen and Rajan, 1994; Blackwell and Winters, 1997; D'Auria et al., 1999; Degryse and Van Cayseele, 2000; Kano et al., 2011; Stein, 2011) and collateral requirements (Ono and Uesugi, 2009), lower firms' profitability (Montoriol Garriga, 2006), and hamper the growth of small firms (Gambini and Zazzaro, 2013).

A puzzling picture also emerges from the research focusing on the implications of lending relationships on firms' failure. Some authors evidence the beneficial effect of close lending relationship, that should reduce firms' default risk. Enabling banks to gather propriety information on the firm, lasting lending relationships mitigate asymmetric information problems and enhance screening and monitoring process (Diamond, 1984; Carletti, 2004).[87] This mechanism appears to discipline borrower firms' behaviour, yielding to lower default (Foglia et al., 1998; Ongena and Smith, 2000) as well as allowing firms to signal their willingness to abstain from strategic default (Bannier, 2007). Moreover, deeper bank-firm relation eases debt renegotiation, at least for low credit quality firms (Bolton and Scharfstein, 1996), and lessen the possible coordination failure that can arise among creditors in case of borrowers' default (Gertner and Scharfstein, 1991; Morris and Shin, 2004; Bris and Welch, 2005).

On the other hand, close lending relationships may involve some potential downsides (Boot, 2000), mainly referred to as the so-called *softening budget* constraints and *hold-up* problems. The former consists in the easing debt renegotiation due to the deeper connections, which could encourage excessive risk-taking and opportunistic behaviours by the firm (Dewatripont and Maskin, 1995; Bolton and Scharfstein, 1996;), leading to the greater *ex-ante* likelihood of financial hazard (Carmignani and Omiccioli, 2007). The *hold-up* problem refers to the situation in which the bank can monopolise the information gathered during the relationship to the detriment of the client firm and increase the loan rates charged (Sharpe, 1994; Rajan, 1992; Boot, 2000; Hernández-Canovas and Martínez-Solano, 2006).[88]

Recently, focusing on the 2007–2009 financial crisis, Cotugno et al. (2013) evidence that banks increase their credit exposure when Italian firms have an exclusive relationship whit the main banks, decreasing their credit rationing and their probability of default. Fiordelisi et al. (2014) show that relationship lending reduces Italian firms' probability of default in the period 2008-2010, highlighting that beneficial effects of lasting lending relationships are stronger for smaller firms. Using data on Japanese firm–bank relationships, Ono et al. (2014) find that small business credit scoring loans protracted by the main bank were linked with a reduction in the *ex-post* default probability of user firms. Rosenfeld (2014) analyses the impact of banking relationships on the

[87] See Allen and Gale (2000), Gorton and Winton (2003) and Elyasiani and Goldberg (2004) for reviews.

[88] One possible solution could be to borrowing from multiple banks by diversifying the relationships and/or sharing of information with other financial institutions. Indeed, a contemporary relationship between at least two banks actives competition among lenders and limits the risk of ex-post increasing *premia* of loans (; Von Thadden, 1992; Hubert and Schäfer, 2002; Jiménez et al., 2006). Finally, multiple but asymmetric lending relationships protect firms against liquidity risks that might derive from close ties with the main bank. When the main bank deals with liquidity problems by adopting tighter credit lines, firms' investment projects could be ended (Detragiache et al., 2000; Elsas et al.,2004; Guiso and Minetti, 2004).

future of financially distressed U.S. firms, evidencing that relationship lending can be a valuable tool for banks in order to identify, and eventually support, firms facing temporary shocks and, therefore, preventing their financial distress. According to Sette and Gobbi (2015), Italian small firms further benefit from relationship lending when ordinary conditions occur; while, the positive impact of relationship lending decrease when lenders face crisis and borrowers are highly risky. Drawing data on Italian manufacturing firms between 1995 and 2003, Agostino et al. (2012) show that firm default probability decreases as the duration of close credit relationships lengthens. Moreover, the beneficial effect of lasting lending relationships on European firm financial health, over the period 2001-2007, tends to increase when the main bank is near located to the firm (Agostino and Trivieri, 2018). Yildirim (2019) focuses on U.S. firms operating on between 1991-2011, finding that relationship banking decreases firm default risk.

3.4. DATA

My econometric analysis relies on the EFIGE-Bruegel-Unicredit dataset, which provides information on manufacturing firms of seven European countries (Austria, France, Germany, Hungary, Italy, Spain and the United Kingdom).[89] This source pools qualitative information from a survey completed in 2010, which might refer to the year 2008 or the period 2007-2009 (in average terms), and quantitative data coming from the Bureau van Dijk's Amadeus database, available from 2001 to 2009. A feature of the EFIGE dataset should be recalled as it may entail a sample selection problem. The EFIGE source omits firms with less than 10 employees, thus implying that the effect of interest could be underestimated since the smallest firms are also those more reliant on bank credit (Barba Navaretti et al., 2014).

Moreover, by considering the same sample of firms available in EFIGE, I retrieve data on firms' status from Orbis *Historical* database, held by Bureau van Dijk, available since 2005. In this database, each firm is codified by an identification number to which, along with accounting data, the firm's general information and status are related. As this latter is concerned a firm is categorized as: Active, Active (dormant), Active (receivership), Active (default of payments), Active (no accounts available); Bankruptcy, In Liquidation, Dissolved, Dissolved (merger), Inactive (no precision) and Unknown.

[89] EFIGE stands for "*European Firms in a Global Economy*". For more information on the EU-EFIGE dataset, see: http://bruegel.org/2012/10/the-eu-efigebruegel-unicredit-dataset/.

The information on the firm's status is used to obtain the dependent variables of my econometric models. More specifically, I define firm default as a changing from an active status to distress/temporary (Active dormant, Active receivership) default or permanent default (Bankruptcy, In Liquidation, Dissolved), excluding Unknown and Dissolved (merger).[90] Thus in my analysis, firm default does not necessarily mean bankruptcy.[91]

Due to many missing values in variables included in my baseline models for Austria, Germany, Hungary, and the United Kingdom, the analysis is performed by focusing on three countries: France, Italy, and Spain. Thus, the final sample consists of an unbalanced panel over the period 2005-2009.

Table 3.1 shows the variables' descriptive statistics and description for firms operating in France, Italy, and Spain and Tables 3.2 presents the correlation matrix of covariates.

[TABLES 3.1 AND 3.2]

3.5. METHODOLOGY

3.5.1 The Econometric Models

This section briefly describes the econometric models used in my analysis. Letting y_i^* be a latent variable, I assume that:

$$\begin{aligned} y_i^* &= \beta_0 + \beta' X_i + \varepsilon_i \\ y_i &= 1 \; if \; y_i^* > 0 \\ y_i &= 0 \; otherwise \end{aligned} \tag{3.1}$$

where for each unit *i,* y_i is a binary dependent variable, taking values one (with probability p) or zero (with probability 1-p) depending on values of the latent variable. X_i is the vector of covariates with coefficients β. Moreover, letting F(.) represents a symmetric cumulative distribution function, the model is specified as follows:

$$\begin{aligned} Prob\,(y_i = 1|X_i) &= Prob\,(y_i^* > 0|X_i) = Prob\,(\beta X_i + \varepsilon_i > 0|X_i) \\ &= Prob\,(\varepsilon_i > -\beta X_i|X_i) = 1 - F(-\beta X_i) \\ &= F(\beta X_i)\,. \end{aligned} \tag{3.2}$$

[90] The exclusion of Active (default of payments), Active (no accounts available) and Inactive (no precision) from the definition of the temporary inactive status is conditional to the focus on three countries.

[91] Due to computational problems, the effect of lending relationship is not separately observed for each category of default.

In the Logit model, the error term is assumed to have a standardized logistic distribution and the function is:

$$F(\beta X_i) = \frac{exp(\beta X_i)}{1 + exp(\beta X_i)}. \tag{3.3}$$

Once the distribution of the error term is specified, the model is estimated by using Maximum Likelihood Estimation (MLE) (Cameron and Trivedi,2005).

Several authors – for instance, Lennox (1999) and Bernard et al. (2006) – apply Logit models for firm survival analysis. However, other contributions estimate Probit models (e.g. Zingales, 1998; Lennox, 1999; Bunn and Redwood, 2003 and Bernard and Jensen, 1999, 2007).
The Probit model is based on the same latent process (1), assuming that the error term follows a standard normal distribution (Cameron and Trivedi,2005). In this case, F(.) is given by:

$$F(\beta X_i) = \Phi(\beta X_i) \equiv \int_{-\infty}^{\beta X_i} \phi(v)dv, \tag{3.4}$$
$$where\ \phi(v) = (2\pi)^{-\frac{1}{2}} exp(-\frac{v^2}{2}).$$

The Complementary log-log model (hereafter Cloglog) originates when F(.) is the cumulative distribution function of the extreme value distribution:

$$F(\beta X_i) = 1 - exp\big(-exp(\beta X_i)\big) \tag{3.5}$$

The main difference between the Cloglog and the Logit and Probit models is given by the asymmetry around zero. Given its skewness, the Cloglog distribution is applied when one of the outcomes is infrequent.[92]

Furthermore, to account for unobserved firm-specific characteristics (e.g., knowhow and managers' experience), which could compromise the survival of the company, I also adopt Cloglog models with unobserved heterogeneity, known as ''frailty'' in the Biostatistics literature (Hougaard, 2012).[93]

[92] The Complementary log-log model is considered the discrete-time version of the Cox model (Jenkins, 2005). Indeed, in the duration model literature, although the underlying survival process is continuous, survival times are often grouped (bounded) into some span (e.g. months, years), giving rise to discrete hazard models. The Complementary log-log model is applied in this work as the relevant information is available only annually. The Appendix provides further details on the Cloglog model and the wider category of duration-models.
[93] The assumption that all relevant observed explanatory variables are included in the model (i.e., the X covariates capture all differences between units and therefore all firm-survival variation) may be strong and misleading (Lancaster, 1990). Indeed, an essential aspect investigated in the literature is the role of unobserved heterogeneity

Finally, it has to be highlighted that the models above described do not take into account potential endogeneity problems. Indeed, the firm default probability could be even determined by unobservable features, such as cultural and historical determinants, causing omitted variables concerns. Moreover, since the duration of lending relationships could be determined by borrower's quality, simultaneous causality problem may arise. Thus, in order to control for endogeneity problems, I use an IV Probit model only focusing on the Italian firms' sample. Following, among others, Guiso et al. (2004), Agostino et al. (2012) and De Bonis et al. (2015) some indicators of the geographical distribution of banks and branches in 1936 in Italy have been used as external instruments. In this respect, Guiso et al. (2004, p. 946) argue that the territorial structure of the Italian banking system in 1936 "*was the result of historical accidents and forced consolidation, with no connection to the level of economic development at that time*". [94] Moreover, the 1936 regulation was not driven by different regional needs, "*but it was random*" (2004, p. 943). Hence, the geographical distribution of banks and branches in 1936 can be considered exogenous concerning firm performance in subsequent years, while it is significantly correlated with local banking development in the 1990s (Guiso et al., 2004).[95]

3.6. RESEARCH HYPOTHESIS AND EMPIRICAL ANALYSIS

Based on the theoretical predictions of the research on costs and benefits of lending relationships and considering that close bank-firm relations can have opposite effects on a firm's failure, the influence of enduring lending relationships on firms' default is an open empirical question.

To shed light on this issue, I estimate an equation specified as follows:

$$
\begin{aligned}
&Prob\big(STATUS_{i,2006-09} = 1 \big| X\big) = \\
&= F(\beta_0 + \beta_1 DURAT_i + \beta_2 AGE_i + \beta_3 AGE_i^2 + \beta_4 SIZE_i + \beta_5 SIZE_i^2 + \beta_6 LEV_i + \\
&+ \beta_7 CASHFLOW_i + \beta_8 PRODU_i + \beta_9 DEBTSUST_i + \beta_{10} ZSCORE_i + \\
&+ \sum_s \gamma_s S_k + \sum_c \delta_c C_c + \varepsilon_i)
\end{aligned} \tag{3.6}
$$

in understanding firm exits and defaults. See, for instance, Thompson (2005), Bhattacharjee et al. (2010) and Bhattacharjee and Han (2014).

[94] In 1936, in response to the crisis of 1930–36, strict banking regulations were introduced and that remained substantially unchanged until the second half of the 1980s.

[95] Following these considerations, the variable DURAT is instrumented by instruments defined in 1936 at regional level: the number of *Aziende di Credito Ordinario*, the share of branches *Aziende di Credito Ordinario*, the share of banks owned by cooperative Popolari, the share of branches owned by cooperative Popolari, the share of *Casse di Risparmio*, the share of branches of *Casse di Risparmio*, the number of mutual cooperative banks per million inhabitants, the share of branches owned by mutual cooperative, the total number of banks in the region, the total number of branches in the region and the regional population.

where, the dependent variable ($STATUS_{i,2006\text{-}09}$) is a binary taking value one if a firm (i) – active at the end of 2005 – is in dormant, receivership, bankruptcy, liquidation or dissolved by the end of 2009, zero otherwise.[96] Thus, in the first step of my analysis, $STATUS_{i,2006\text{-}09}$ is defined over the entire period I consider. In other words, if a firm changed its status, this might be occurred in either 2009 or any other year between 2006 and 2008. On the right-hand side, DURAT is the key variable of the analysis and represents the duration of the lending relationship that a firm has with its main bank.[97] The control variables include firms' characteristics, selecting all those suggested by previous studies and for which data are available, such as the firm's age and its square (AGE and AGE2), the firm's dimension and its square (SIZE and SIZE2), the levels of leverage and cash flow scaled by total assets (LEV and CASHFLOW), productivity (PRODU), debt sustainability (DEBT_SUST) and a measure of distance from insolvency (ZSCORE). Previous contributions show the beneficial role of firms' size and age (Caves, 1998; Pakes and Ericson, 1998; Jovanovic and Rousseau, 2002), but their effect on firms' default may be nonlinear (Agarwal et al., 2002; Cefis and Marsili, 2005). Higher leverage entails higher default probabilities (Warner, 1977; Kim, 1978; Bridges and Guariglia, 2009; Hovakimian et al., 2012; Di Patti et al., 2015; Gul and Cho, 2019), conversely, cash flows are negatively associated with the default risk (Wilson et al., 2000; Sharabani, 2004; Wędzki, 2008; Görgi and Spaliara, 2009; Bhattacharjee and Han, 2014). Firm productivity is expected to reduce the probability of default, while the latter may increase as debt sustainability rises (Bottazzi et al., 2011). Finally, firms with higher financial stability are less susceptible to financial distress (Agostino and Trivieri, 2018). Considered as the dependent variable is defined, all the covariates are included in the regression as mean value over the period 2006-2009. Moreover, I control for unobserved heterogeneity – at industry and country-level – by inserting sector (S) and country (C) dummies. Finally, ε_i is the error term.

As a robustness check, I estimate equation (3.6) by applying the Cloglog model, using the year as time dimension (t), and the firm as unit (i). In this case, the dependent variable ($STATUS_{i,t}$) is a dummy coded one if a firm active at the end of time t-1 enters into a default status (temporary or permanent) by the end of time t (t=2006, …, 2009). By doing so, the change of status is recorded

[96] See section 3.2 for the definition of each company status.

[97] In my dataset, DURAT is defined only in 2009. Following Agostino et al. (2012), Gambini and Zazzaro (2013), Agostino and Trivieri (2017, 2018), the DURAT values back to the year 2005 are obtained by subtracting from the original figure a number up to 4, treating as missing values negative numbers. One could argue that, by doing so, DURAT cannot capture the effect of lasting lending relationships for those firms that, after a long period, changed the main bank a few years before (or just in) 2009. However, the EFIGE data do not allow to make a different imputation, as there is no way to know whether—before the relationship for which the duration is declared—firms had a relationship with another main bank or not. Besides, the EFIGE survey does not provide the identity of a firm's main bank, and information concerning other lending relationships' characteristics—such as the percentage of the firm's total bank debt held by the main bank, and the number of lending banks—is available for 2009 only.

on a yearly basis.[98] The right-hand side includes the same set of variables displayed in equation (6) but considered as time-varying covariates. Indeed, "when we deal with duration phenomena, it is possible that some of the regressors vary during the spell, and it is likely that the most recent values for these covariates are more influential in predicting the survival probabilities than their corresponding values at the beginning of the period" (Mata et al., 1995, p.461). Also, I include interval-specific dummy variables (D), one for each year at risk.[99] Finally, sector (S) and country (C) dummies and the error term (ε_i) are included as before.

3.7. ESTIMATION RESULTS

The results of my estimations are reported in Tables 3.3 – 3.8. In each of them, the benchmark results are in columns (1), while the other columns include robustness checks. Before describing the results, it is worth to underline that the outcomes presented in Tables from 3.3 to 3.5 show the marginal effects of Probit, Logit and Cloglog models referring to equation (3.6), while Tables 3.6 – 3.8 display both the coefficients (odd-numbered columns) and the hazard ratios (even-numbered columns) obtained by applying discrete-time models.

Considering first the key variable – column (1) of Table 3.3 – the marginal effect of DURAT on firms' default is found negative and statistically significant, suggesting that lasting lending relationships reduce firm's default probability. For instance, doubling the duration of credit relation reduces the probability of default by almost 0.014, ceteris paribus. This effect is confirmed by the estimation shown in Tables 3.4 and 3.5, which report results obtained applying Logit and Cloglog estimators. These findings suggest that the benefits of close lending relationships appear to overcome the resultant costs, hence firms may take advantage of deeper relations with their main bank.

As far as the control variables are concerned, the signs of these variables are in line with predictions of the literature. Indeed, according to Tables 3.3 – 3.5, a nonlinear function characterizes the relationship between firms' default and firms' age and dimension (AGE and SIZE). When

[98] In Amadeus and Orbis *Historical* databases, each firm is codified by an identification number to which is associated the firm status information. A similar approach is used by the traditional industrial economic literature, which studies firm failure basing on information contained in business registers. Although these exit events may assume several forms and be caused by different factors, they are treated as homogeneous exit event (see, for instance, Dunne et al., 1988; Mata and Portugal, 1994; Disney et al., 2003). Recently, some contributions try differentiating between the different forms of exit, but limitations in terms of legal conformation and precious exiting time still occur (see Schary, 1991; Agarwal and Gort, 1996; Audretsch et al., 1999).

[99] This allows to treat the shape of the baseline hazard function as non-parametric. The non-parametric approach lets the baseline hazard function to vary from one interval to another. I have events in all survival years (i.e. 1 to 4) and, hence, dummy variables corresponding to survival years 2 to 4 (DTIME2, DTIME3 and DTIME4) are included in the estimation. To avoid the dummy variable trap, the dummy referring to the first year of observation is not included.

firms' age and size increase, the default probability increases and, then, it reduces following an inverted U shape, confirming results obtained by previous studies (e.g. Agarwal et al., 2002; Cefis and Marsili, 2005). In line with Bridges and Guariglia (2009) and Di Patti et al. (2015) among others, leverage level (LEV) increases the probability of firm default. By contrary, default probability is reduced by firms' internal funds (CASHFLOW), productivity (PRODU) and financial health (ZSCORE), consistently with findings of previous works (e.g. Görgi and Spaliara, 2009; Bottazzi et al., 2011; Bhattacharjee and Han, 2014; Agostino and Trivieri, 2018).

3.7.1 Robustness checks

Columns from 2 to 6 of Tables 3.3 – 3.5 show that my results are not sensitive to several modifications in the specification of the model. To begin with, in column 2, I substitute firm size with a dummy variable equal to one if a firm has less than 250 employees. Then, I replace the level of debt with an indicator of liquidity assets (LIQUI), the ratio between current assets and current liabilities (column 3). Furthermore, I add to the benchmark equation a number of variables, capturing internal and external firm characteristics, such as the availability of collateralizable assets (TANGI), computed as the ratio between tangible fixed assets to total assets, and dummies variables accounting for firms' R&D activities (R&D), exports (EXP) and belonging to a group (GROUP) (column 4). Also, I control for the degree of industry concentration – proxied by the Herfindahl-Hirschman index based on sales – (HHIs) and for inter-industry externalities by including the JACOB index, calculated as number of sectors (2-digit level) in each region, with more than 10 firms (column 5). Moreover, results obtained by clustering on regions and by adopting the multilevel mixed-effects models are displayed in columns (6) and (7) of Tables 3.3 – 3.5, respectively. In the latter cases, the regional gross domestic product per capita is included in the model, therefore the explanatory variables are defined at two different levels (i.e. at firms and regional level).[100] Finally, column (8) of Table 3.3 reports estimates based on an IV Probit model for the only Italian sample, addressing the concerns of endogeneity mentioned in the 'Econometric Models' subsection. Since the Wald test of exogeneity of the duration of lending relationships is never statistically significant, the null hypothesis of no-endogeneity of the instrumented variable cannot be rejected, indicating that the other estimators employed can be deemed as reliable.[101]

[100] Mixed-effects models are applied when treating hierarchical or clustered data to overcome some methodological limitations of the traditional single-equation models, based on the restrictive assumption of independence among errors (De Leeuw and Meijer, 2008). Indeed, firms can be nested within geographical areas such as regions or provinces, leading to inferential problems if one does not account for this hierarchical structure.
[101] Regression results at each country level are reported in Tables A3.1 – A3.3 in the Appendix. As shown, the magnitude of the effect of DURAT on default probability does not seem to vary remarkably among countries.

My results seem robust to all specification adjustments mentioned above and, in summary, they indicate that the duration of the lending relationship is a significant and negative predictor of firms' default.

[TABLES 3.3 – 3.5]

The results obtained estimating the discrete-time proportional hazard models are displayed in Tables 3.6 to 3.8.[102] Table 3.6 shows the Cloglog estimates without taking into account any potential unobserved individual heterogeneity. Then, Tables 3.7 and 3.8 report findings when Cloglog model is estimated assuming a Normal and a Gamma distribution for the error term, respectively.

The three estimation methods provide fairly analogous results. This may be because, according to the likelihood ratio tests, reported at the bottom of Tables 3.7 and 3.8, the unobserved individual heterogeneity is negligible.[103] Thus, in what follows my comments refer to Table 3.6 only.[104]

In Tables from 3.6 to 3.8, hazard ratios correspond to exponentiated coefficients, and their values above 1 specify a greater probability of the event of interest occurs (i.e. a variable is positively related to firm failure). According to the figures in Table 3.6, the probability of default seems to be affected by enduring lending relationships. Indeed, the elasticity of the hazard of failure to the duration of lending relationships is about 0.57, ceteris paribus.[105] The hazard ratio of firm default increases with the level of indebtedness, while, it is lower as the availability of internal funds rises. Debt sustainability is slightly negatively associated with the probability of firm failure.[106]

[102] For a detailed description about discrete-time proportional hazard models, I refer to the Appendix 3.
[103] Indeed, for the Cloglog specification with Normal distributional assumption, I test the null hypothesis that the unobserved heterogeneity variance component (Rho) is equal to zero and it cannot be rejected. Similarly, in the Cloglog model with Gaussian distribution of the error term, I cannot reject the hypothesis that σ^2 (Gamma variance) is statistically not different from zero. Therefore, as frailty seems unimportant, the Cloglog model without individual unobserved heterogeneity appears the appropriate one for this analysis.
[104] It is worth to notice that no multiple events occur in a single spell. Therefore, estimates are obtained considering single firm default for each year.
[105] When using banded survival data, the estimated coefficients are the same of those obtained from regressions of continuous-time models. In particular, in Cloglog models, an estimated coefficient represents the change in cloglog(hazard) given one unit change in the respective covariate. Alternatively, as it is the most commonly-used model that is consistent with a continuous-time model, the same interpretation as in any Proportional Hazard continuous-time model can be used (Jenkins, 2005).
[106] It should be noticed that duration dependence is captured by the coefficients for dummies DTIME2, DTIME3, DTIME4, that shapes the baseline hazard. However, these dummies are not statistically significant, thus, firm changing status does not exhibit significant duration dependence.

As a further robustness check, I regress my baseline models by adding, alternatively, internal firm's characteristics (i.e. TANGI and LIQUI) and context variables (i.e. HHIs and JACOB).[107] According to columns from (3) to (10) of Table 3.6, results do not change respect to those of the benchmark model, being robust to the mentioned specification adjustments.

[TABLES 3.6 – 3.8]

3.8. CONCLUSION

The aim of this chapter has been investigating the relevance of lasting lending relationships as a determinant of firm default. Although the latter topic has been the subject of wide economic literature, it is still a debated issue. One motivation is that financially distressed firms are more sensitive to changes in the economic environment, that is, firm failure concerns the inability of a business to survive adverse economic conditions (Chan and Chen, 1991).

To investigate the role of lasting lending relationships on firm default probability, I have employed microdata on manufacturing firms operating in France, Italy and Spain over the period 2005-2009, by matching survey and accounting data. The latter has allowed me to define firm default as a changing from an active status to distress/temporary (Active dormant, Active receivership) default or permanent default (Bankruptcy, in liquidation, Dissolved). Thus in my analysis, firm default does not necessarily mean bankruptcy.

The econometric analysis has been carried out first by applying the most common model for binary dependent variables (Logit, Probit, Cloglog) without accounting for the exact time in which a firm changed status. Then, exploiting survival analysis methods, I estimated discrete-time models to assess the effect of the enduring lending relationship on firm changing status, the latter being observed on a yearly basis.

The main results show that close lending relationships are negatively associated with firms' default. Whatever the approach adopted or the methodologies applied, lasting lending relationships seem to decrease the probability of firms' default. These findings are in line with the results of the literature on the beneficial effect lasting credit relationships on firms' failure (e.g. Foglia et al., 1998; Ongena and Smith, 2000; Bannier, 2007; Agostino et al., 2012; Fiordelisi et al., 2014; Agostino and Trivieri, 2018; Yildirim, 2019). Indeed, close bank-firm ties tend to expand access to external finance and, in turn, reduce firm default (Petersen and Rajan, 1994; Ongena and Smith, 2000; Berger and Udell, 2002; Bannier, 2007).

[107] In the duration models only continuous variables are included, as a result, robustness checks do not include binary predictors as EXP, GROUP and R&D.

As an implication of my analysis, policies incentivizing firms to establish close lending relationships with their main banks should be designed. For instance, policymakers may support the transmission of information, designing proper rules and infrastructures (e.g. disclosure rules, accounting standards, and credit bureaus registers), which directly affect banks' capacity to acquire and accumulate proprietary information on firms. According to Carletti (2004), borrowing from several banks should be preferred in countries characterized by more permissive accounting and disclosure standards and weak judicial systems. Thus, as long a credit relationship generates advantages in terms of high profit and private benefit, firms do not search other sources of financing (Ongena and Smith, 2001). These policy recommendations are consistent with the results of Ogane (2019), who argues that the probability of bankruptcy rises when the firm switches to another financial institution and terminate its relationship with the current main bank.

It should be recalled that my source of data excludes firms with less than 10 employees, as a result, might not be generalized to the smallest enterprises. In addition, my analysis covers the period preceding and during the great financial crisis in Europe, therefore, observing the aftermath of the crisis when investments are more unpredictable and volatiles may be an interesting topic for my future research agenda.

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TABLE 3.1 - Description and summary statistics of the variables used in the estimations

VARIABLE	DESCRIPTION	Mean	StdD	Min	Max	Obs
$STATUS_{2006-09}$	Dummy=1 if a firm active at the end of 2005 is in bankruptcy or liquidation or dissolved or dormant or receivership by the end of 2009	0.03	0.16	0	1	26,863
$STATUS_t$	Dummy=1 if a firm active at the end of time t-1 is in bankruptcy or liquidation or dissolved or dormant or receivership by the end of time t (t=2006,…,2009)	0.01	0.08	0	1	30,336
DURAT[(c)]	Duration of the relationships with the main bank	13	10	0	53	16,768
AGE[(c)]	Current year minus firm's year of establishment	29	22	1	138	30,274
SIZE[(a)]	Total sales	9,064	20,431	372	229,895	27,625
LEV[(d)]	(Current plus non-current liabilities) to total assets	65.58	21.07	17.27	96.73	27,403
CASHFLOW[(d)]	Cash flow to total assets	6.49	7.44	-31.79	30.38	27,496
PRODU[(a)]	Added value per employee	45.91	23.15	2.04	175.53	27,608
DEBTSUST[(d)]	Interests paid to total debts	2.49	1.81	0	10.4	26,529
ZSCORE	(ROA + capital asset ratio) / standard deviation of ROA	0.21	0.29	-0.05	2.41	27,160
Robustness checks						
SMES	Dummy = 1 if a firm has less than 250 employees	0.96	0.20	0	1	30,411
TANGI[(d)]	Tangible fixed assets to total assets	23.37	17.52	0.36	76.21	27,629
LIQUI[(a)]	Current assets to current liabilities	1.67	0.96	0.35	7.5	27,629
HHIs	Herfindahl-Hirschman index on firms' sales	0.05	0.07	0	0.98	30,411
R&D	Dummy = 1 if a firm employs more than 0 employees to R&D activities	0.58	0.49	0	1	30,411
EXP	Dummy = 1 if a firm export exported any of its products in 2008	0.60	0.49	0	1	30,408
GROUP	Dummy = 1 if a firm belongs to a group	0.21	0.41	0	1	30,411
JACOB[(b)]	Jacob index: number of sectors (2-digit level) in each region, with more than 10 firms	7	5.80	0	17	30,411
GDPP	Regional gross domestic product per capita	27,648	5,999	16800	50,900	30,117

All the variables come from the EU-EFIGE/Bruegel-UniCredit dataset; (a) in thousands of Euros; (b) in unit; (c) in years; (d) in percentage.

TABLE 3.2 - Correlation matrix

	DURAT	AGE	SALES	LEV	CASHFLOW	PRODU	DEBTSUST	ZSCORE	SMES	TANGI	LIQUI	HHIs	R&D	EXP	GROUP	JACOB	GDPP
DURAT	1																
AGE	0.3645	1															
SALES	-0.0184	0.1252	1														
LEV	-0.1678	-0.1879	-0.0217	1													
CASHFLOW	-0.0198	-0.0386	0.0081	-0.2879	1												
PRODU	0.0283	0.0901	0.3433	-0.1579	0.325	1											
DEBTSUST	-0.0678	-0.0523	-0.0521	0.1733	-0.1289	-0.0673	1										
ZSCORE	0.0591	0.0551	0.029	-0.2562	0.0934	0.0745	0.0226	1									
SMES	0.0199	-0.0992	-0.6385	0.0144	-0.0096	-0.0264	0.0500	0.0058	1								
TANGI	-0.0018	-0.0154	-0.0033	-0.0653	0.0306	-0.0043	0.1532	0.0601	-0.0161	1							
LIQUI	0.1482	0.1317	-0.055	-0.6676	0.147	0.0699	-0.1424	0.1306	0.0141	-0.2106	1						
HHIs	0.0126	0.0081	0.0202	-0.0089	-0.0178	0.0282	-0.0243	0.0264	-0.0241	0.0024	0.0005	1					
R&D	-0.0342	0.0439	0.1466	-0.0165	0.0033	0.0535	0.0199	0.0025	-0.1214	-0.0195	0.0158	0.05	1				
EXP	0.0262	0.1162	0.1802	0.0132	-0.0772	0.122	-0.0165	0.0097	-0.1043	-0.0737	0.0018	0.1029	0.2382	1			
GROUP	-0.0567	0.0506	0.3558	-0.0494	0.0014	0.1399	-0.1062	-0.0328	-0.2907	-0.0474	-0.0162	0.0446	0.1077	0.1067	1		
JACOB	0.0798	0.0712	0.0378	0.169	-0.0893	0.1271	-0.0243	-0.0633	0.0007	-0.1158	-0.0576	-0.0264	0.0249	0.157	-0.0146	1	
GDPP	0.1111	0.1295	0.0553	0.1097	-0.0446	0.1817	-0.0836	-0.0845	-0.0187	-0.1599	-0.0106	-0.0349	0.0421	0.1398	0.0334	0.6676	1

For the description of the variables see Table 3.1.

TABLE 3.3 - Regression results from the Probit model: marginal effects

	Benchmark Model	Replacing SIZE	Replacing LEV	Firm Characteristics	External Variables	Clustering on regions	Mixed Effect	IV Probit Italy
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
DURAT	-0.0136***	-0.0135***	-0.0137***	-0.0140***	-0.0137***	-0.0134***	-0.0130***	-2.0254***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.009*
AGE	0.2037***	0.2227***	0.2077***	0.2029***	0.2028***	0.1858	0.2041***	-4.0594
	0.001	*0.000*	*0.001*	*0.001*	*0.001*	*0.143*	*0.003*	*0.536*
AGE2	-0.0932***	-0.1017***	-0.0955***	-0.0926***	-0.0929***	-0.0845	-0.0934***	2.4727
	0.002	*0.000*	*0.001*	*0.002*	*0.001*	*0.157*	*0.004*	*0.445*
SIZE	0.0441***		0.0423***	0.0452***	0.0443***	0.0484***	0.0607***	3.5333***
	0.000		*0.000*	*0.000*	*0.000*	*0.009*	*0.001*	*0.000*
SIZE2	-0.0022***		-0.0021***	-0.0023***	-0.0022***	-0.0025**	-0.0031***	-0.1884***
	0.000		*0.001*	*0.000*	*0.000*	*0.019*	*0.001*	*0.000*
LEV	0.0448***	0.0462***		0.0443***	0.0442***	0.0312*	0.0307***	-1.3565**
	0.000	*0.000*		*0.000*	*0.000*	*0.076*	*0.003*	*0.011*
CASHFLOW	-0.1240***	-0.1302***	-0.1410***	-0.1160***	-0.1232***	-0.1311***	-0.1166***	4.3748***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.007*	*0.000*	*0.003*
PRODU	-0.0119***	-0.0071**	-0.0127***	-0.0117***	-0.0121***	-0.0122**	-0.0125***	-1.1454***
	0.000	*0.025*	*0.000*	*0.000*	*0.000*	*0.046*	*0.000*	*0.000*
DEBTSUST	0.0013	-0.0120	0.0233	0.0356	-0.0021	0.0217	0.0011	-2.8074
	0.987	*0.876*	*0.769*	*0.646*	*0.979*	*0.874*	*0.569*	*0.617*
ZSCORE	-0.0254**	-0.0223**	-0.0315***	-0.0244**	-0.0256**	-0.0487***	-0.0492***	-1.2396***
	0.030	*0.046*	*0.008*	*0.033*	*0.029*	*0.008*	*0.000*	*0.007*
SMES		0.0008						
		0.878						
LIQUI			-0.0097***					
			0.000					
TANGI				-0.0256***				
				0.001				
R&D				0.0004				
				0.895				
EXP				-0.0080***				
				0.004				
GROUP				0.0016				
				0.651				
HHIs					0.0311			
					0.344			
JACOB					0.0002			
					0.308			
GDPP							-0.0105	
							0.613	

(continued)

TABLE 3.3 (continued) - Regression results from the Probit model: marginal effects

	Benchmark Model	Replacing SIZE	Replacing LEV	Firm Characteristics	External Variables	Clustering on regions	Mixed Effect	IV Probit Italy
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Observations	13,725	13,725	13,725	13,725	13,725	13,207	14,226	3,588
Model test	414.84	367.93	409.93	459.23	416.44	384.95	349.50	109.59
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Log pseudolikelihood	-1,259.06	-1,270.39	-1,263.78	-1,250.02	-1,258.54	-1,159.31	-1,118.90	
Pseudo R2	0.1544	0.1468	0.1513	0.1605	0.1548	0.1752		
LR test							78.43	
							0.000	
Wald test of exogeneity								1.80
								0.179

For the description of the variables see Table 3.1. In Italics are reported the p values of the tests. Superscripts ***, ** and * denote statistical significance at the 1, 5 and 10 percent level, respectively. Standard errors (not reported) are robust to heteroskedasticity and autocorrelation. The dependent variable is a dummy taking value 1 if a firm active at the end of 2005 is in bankruptcy or liquidation or dissolved by the end of 2009. Country and sector dummies are always included but not reported. DURAT, AGE, AGE2, SIZE, SIZE2 and GDPP are in log terms.

TABLE 3.4 - Regression results from the Logit model: marginal effects

	Benchmark Model	Replacing SIZE	Replacing LEV	Firm Characteristics	External Variables	Clustering on regions	Mixed Effect
	1	*2*	*3*	*4*	*5*	*6*	*7*
DURAT	-0.0137***	-0.0135***	-0.0137***	-0.0140***	-0.0137***	-0.0134***	-0.0154***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
AGE	0.2246***	0.2509***	0.2294***	0.2223***	0.2241***	0.2042*	0.2673***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.093*	*0.001*
AGE2	-0.1029***	-0.1148***	-0.1057***	-0.1015***	-0.1027***	-0.093	-0.1224***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.104*	*0.002*
SIZE	0.0376***		0.0364***	0.0400***	0.0379***	0.0425**	0.0644***
	0.001		*0.002*	*0.001*	*0.001*	*0.030*	*0.001*
SIZE2	-0.0019***		-0.0018***	-0.0020***	-0.0019***	-0.0021*	-0.0033***
	0.004		*0.005*	*0.003*	*0.004*	*0.052*	*0.003*
LEV	0.0497***	0.0512***		0.0479***	0.0492***	0.0378*	0.0438***
	0.000	*0.000*		*0.000*	*0.000*	*0.054*	*0.002*
CASHFLOW	-0.1127***	-0.1206***	-0.1271***	-0.1093***	-0.1117***	-0.1168**	-0.1281***
	0.000	*0.000*	*0.000*	*0.001*	*0.000*	*0.027*	*0.000*
PRODU	-0.0110***	-0.0068*	-0.0121***	-0.0107***	-0.0112***	-0.0116*	-0.0141***
	0.002	*0.057*	*0.001*	*0.003*	*0.002*	*0.074*	*0.000*
DEBTSUST	0.0298	0.0169	0.0576	0.0536	0.0264	0.0457	0.0013
	0.722	*0.835*	*0.477*	*0.510*	*0.753*	*0.747*	*0.590*
ZSCORE	-0.0305**	-0.0273**	-0.0402***	-0.0311**	-0.0307**	-0.0500**	-0.0607***
	0.028	*0.036*	*0.006*	*0.027*	*0.027*	*0.024*	*0.000*
SMES		0.0019					
		0.733					
LIQUI			-0.0095***				
			0.000				
TANGI				-0.0244***			
				0.003			
R&D				0.0002			
				0.931			
EXP				-0.0080***			
				0.007			
GROUP				0.0006			
				0.872			
HHIs					0.0298		
					0.429		
JACOB					0.0002		
					0.407		
GDPP							-0.0161
							0.523

(continued)

TABLE 3.4 (continued) - Regression results from the Logit model: marginal effects

	Benchmark Model	Replacing SIZE	Replacing LEV	Firm Characteristics	External Variables	Clustering on regions	Mixed Effect
	1	*2*	*3*	*4*	*5*	*6*	*7*
Observations	13,725	13,725	13,725	13,725	13,725	13,207	13,161
Model test	452.30	418.39	437.04	512.11	453.11	371.91	359.53
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Log pseudolikelihood	-1,255.84	-1,264.77	-1,262.86	-1,247.08	-1,255.46	-1,160.52	-1,122.48
Pseudo R2	0.1566	0.1506	0.1519	0.1625	0.1569	0.1743	
LR test							73.45
							0.000

For the description of the variables see Table 3.1. In Italics are reported the p values of the tests. Superscripts ***, ** and * denote statistical significance at the 1, 5 and 10 percent level, respectively. Standard errors (not reported) are robust to heteroskedasticity and autocorrelation. The dependent variable is a dummy taking value 1 if a firm active at the end of 2005 is in bankruptcy or liquidation or dissolved by the end of 2009. Country and sector dummies are always included but not reported. DURAT, AGE, AGE2, SIZE, SIZE2 and GDPP are in log terms.

TABLE 3.5 - Regression results from the Complementary log-log model: marginal effects

	Benchmark Model	Replacing SIZE	Replacing LEV	Firm Characteristics	External Variables	Clustering on regions	Mixed Effect
	1	*2*	*3*	*4*	*5*	*6*	*7*
DURAT	-0.0136***	-0.0134***	-0.0135***	-0.0140***	-0.0136***	-0.0132***	-0.0159***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
AGE	0.2414***	0.2679***	0.2472***	0.2329***	0.2415***	0.2246*	0.3199***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.052*	*0.001*
AGE2	-0.1107***	-0.1228***	-0.1140***	-0.1064***	-0.1108***	-0.1026*	-0.1467***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.059*	*0.001*
SIZE	0.0355***		0.0337***	0.0384***	0.0359***	0.0401**	0.0656***
	0.004		*0.006*	*0.002*	*0.003*	*0.047*	*0.002*
SIZE2	-0.0018***		-0.0017**	-0.0019***	-0.0018***	-0.0020*	-0.0033***
	0.009		*0.013*	*0.006*	*0.008*	*0.077*	*0.004*
LEV	0.0503***	0.0512***		0.0479***	0.0500***	0.0384*	0.0492***
	0.000	*0.000*		*0.000*	*0.000*	*0.050*	*0.001*
CASHFLOW	-0.0923***	-0.1047***	-0.1052***	-0.0947***	-0.0912***	-0.0918*	-0.1073***
	0.002	*0.000*	*0.000*	*0.002*	*0.002*	*0.061*	*0.002*
PRODU	-0.0103***	-0.0061*	-0.0114***	-0.0098***	-0.0105***	-0.011	-0.0145***
	0.006	*0.092*	*0.002*	*0.009*	*0.005*	*0.106*	*0.001*
DEBTSUST	0.0290	0.0064	0.0644	0.0469	0.0246	0.0460	0.0011
	0.728	*0.937*	*0.420*	*0.568*	*0.770*	*0.742*	*0.659*
ZSCORE	-0.0312**	-0.0281**	-0.0415***	-0.0323**	-0.0312**	-0.0505**	-0.0668***
	0.027	*0.033*	*0.006*	*0.025*	*0.026*	*0.027*	*0.000*
SMES		0.0023					
		0.678					
LIQUI			-0.0090***				
			0.001				
TANGI				-0.0240***			
				0.004			
R&D				0.0004			
				0.886			
EXP				-0.0084***			
				0.005			
GROUP				0.0002			
				0.965			
HHIs					0.0279		
					0.474		
JACOB					0.0002		
					0.399		
GDPP							-0.02
							0.470

(continued)

TABLE 3.5 (continued) - Regression results from the Complementary log-log model: marginal effects

	Benchmark Model	Replacing SIZE	Replacing LEV	Firm Characteristics	External Variables	Clustering on regions	Mixed Effect
	1	*2*	*3*	*4*	*5*	*6*	*7*
Observations	13,725	13,725	13,725	13,725	13,725	13,207	13,161
Model test	578.61	524.32	565.15	620.09	579.29	479.77	403.68
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Log pseudolikelihood	-1,258.51	-1,266.76	-1,266.50	-1,249.21	-1,258.10	-1,164.51	-1,126.35
LR test							73.65
							0.000

For the description of the variables see Table 3.1. In Italics are reported the p values of the tests. Superscripts ***, ** and * denote statistical significance at the 1, 5 and 10 percent level, respectively. Standard errors (not reported) are robust to heteroskedasticity and autocorrelation. The dependent variable is a dummy taking value 1 if a firm active at the end of 2005 is in bankruptcy or liquidation or dissolved by the end of 2009. Country and sector dummies are always included but not reported. DURAT, AGE, AGE2, SIZE, SIZE2 and GDPP are in log terms.

TABLE 3.6 - Regression results from the Complementary log-log model without individual unobserved heterogeneity

	Benchmark Model		Firm Characteristics		External Variables	
	β	exp(β)	β	exp(β)	β	exp(β)
	1	*2*	*3*	*4*	*5*	*6*
DURAT	-0.5621**	0.5700**	-0.5628**	0.5696**	-0.5570**	0.5729**
	0.040	*0.040*	*0.040*	*0.040*	*0.044*	*0.044*
AGE	1.5714	4.8135	1.6165	5.0352	1.6235	5.0706
	0.468	*0.468*	*0.457*	*0.457*	*0.456*	*0.456*
AGE2	-0.1186	0.8882	-0.1272	0.8806	-0.1201	0.8868
	0.719	*0.719*	*0.701*	*0.701*	*0.716*	*0.716*
SIZE	3.6366	37.963	3.6469	38.3559	3.5442	34.6106
	0.227	*0.227*	*0.230*	*0.230*	*0.236*	*0.236*
SIZE2	-0.2069	0.8131	-0.2075	0.8127	-0.2026	0.8166
	0.239	*0.239*	*0.243*	*0.243*	*0.247*	*0.247*
LEV	4.2339**	68.9834**	3.7813*	43.8721*	4.4281**	83.7720**
	0.015	*0.015*	*0.085*	*0.085*	*0.012*	*0.012*
CASHFLOW	-8.5076***	0.0002***	-8.4154***	0.0002***	-8.6466***	0.0002***
	0.003	*0.003*	*0.003*	*0.003*	*0.002*	*0.002*
PRODU	-0.0043	0.9957	-0.0045	0.9955	-0.0036	0.9964
	0.242	*0.242*	*0.230*	*0.230*	*0.322*	*0.322*
DEBTSUST	-45.6806**	0.0000**	-44.2853**	0.0000**	-45.9257**	0.0000**
	0.021	*0.021*	*0.027*	*0.027*	*0.021*	*0.021*
ZSCORE	-0.0418	0.9591	-0.0502	0.9511	-0.0377	0.963
	0.972	*0.972*	*0.966*	*0.966*	*0.975*	*0.975*
DTIME2	15.752	6.9E+06	16.3745	1.3E+07	17.1113	2.7E+07
	0.985	*0.985*	*0.989*	*0.989*	*0.992*	*0.992*
DTIME3	13.8297	1.0E+06	14.4636	1.9E+06	15.1587	3.8E+06
	0.987	*0.987*	*0.990*	*0.990*	*0.993*	*0.993*
DTIME4	15.5072	5.4E+06	16.1616	1.0E+07	16.7859	2.0E+07
	0.985	*0.985*	*0.989*	*0.989*	*0.992*	*0.992*
TANGI			-0.5638	0.569		
			0.717	*0.717*		
LIQUI			-0.1854	0.8307		
			0.759	*0.759*		
HHIs					22.2267	4.5E+09
					0.629	*0.629*
JACOB					-0.0324	0.9681
					0.468	*0.468*
Observations	9,894	9,894	9,892	9,892	9,894	9,894
Model test	66.56	66.56	66.73	66.73	67.32	67.32
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Log pseudolikelihood	-99.45	-99.45	-99.36	-99.36	-99.07	-99.07

For the description of the variables see Table 3.1. In Italics are reported the p values of the tests. Superscripts ***, ** and * denote statistical significance at the 1, 5 and 10 percent level, respectively. Standard errors (not reported) are robust to heteroskedasticity and autocorrelation. The dependent variable is a dummy taking value 1 if a firm active at the end of time t-1 is in bankruptcy or liquidation or dissolved by the end of time t (t=2006,…,2009). Country and sector dummies are always included but not reported. DURAT, AGE, AGE2, SIZE and SIZE2 are in log terms. β are estimated coefficients. exp(β) represents hazard ratios: its values above 1 specify a greater probability of the event of interest occurs. DTIME2, DTIME3 and DTIME4 are dummy variables corresponding to survival years 2 to 4, specifying the duration dependence. Time-variant variables are included in duration models, excluding those retrived from survey data which refer to only a given year.

TABLE 3.7 - Regression results from the Complementary log-log model with Normal individual unobserved heterogeneity

	Benchmark Model		Firm Characteristics		External Variables	
	β	exp(β)	β	exp(β)	β	exp(β)
	1	*2*	*3*	*4*	*5*	*6*
DURAT	-0.5621**	0.5700**	-0.5628**	0.5696**	-0.5570**	0.5729**
	0.040	*0.040*	*0.040*	*0.040*	*0.044*	*0.044*
AGE	1.5718	4.8152	1.6163	5.0346	1.6234	5.0703
	0.468	*0.468*	*0.457*	*0.457*	*0.456*	*0.456*
AGE2	-0.1186	0.8881	-0.1271	0.8806	-0.1201	0.8868
	0.719	*0.719*	*0.701*	*0.701*	*0.716*	*0.716*
SIZE	3.6378	38.007	3.6465	38.3401	3.5439	34.6016
	0.227	*0.227*	*0.230*	*0.230*	*0.236*	*0.236*
SIZE2	-0.207	0.813	-0.2074	0.8127	-0.2026	0.8166
	0.239	*0.239*	*0.243*	*0.243*	*0.247*	*0.247*
LEV	4.2340**	68.9958**	3.7813*	43.8715*	4.4280**	83.7661**
	0.015	*0.015*	*0.085*	*0.085*	*0.012*	*0.012*
CASHFLOW	-8.5072***	0.0002***	-8.4156***	0.0002***	-8.6467***	0.0002***
	0.003	*0.003*	*0.003*	*0.003*	*0.002*	*0.002*
PRODU	-0.0043	0.9957	-0.0045	0.9955	-0.0036	0.9964
	0.242	*0.242*	*0.230*	*0.230*	*0.322*	*0.322*
DEBTSUST	-45.6848**	0.0000**	-44.2834**	0.0000**	-45.9243**	0.0000**
	0.021	*0.021*	*0.027*	*0.027*	*0.021*	*0.021*
ZSCORE	-0.0417	0.9591	-0.0502	0.951	-0.0377	0.963
	0.972	*0.972*	*0.966*	*0.966*	*0.975*	*0.975*
DTIME2	21.0442	1.4E+09	20.5367	8.3E+08	20.7795	1.1E+09
	0.104	*0.104*	*0.116*	*0.116*	*0.108*	*0.108*
DTIME3	19.1216	2.0E+08	18.6259	1.2E+08	18.8271	1.5E+08
	0.142	*0.142*	*0.156*	*0.156*	*0.147*	*0.147*
DTIME4	20.7993	1.1E+09	20.3237	6.7E+08	20.4542	7.6E+08
	0.109	*0.109*	*0.121*	*0.121*	*0.115*	*0.115*
TANGI			-0.5638	0.5691		
			0.717	*0.717*		
LIQUI			-0.1854	0.8308		
			0.759	*0.759*		
HHIs					22.2279	4.5E+09
					0.629	*0.629*
JACOB					-0.0324	0.9681
					0.468	*0.468*
Observations	9,894	9,894	9,892	9,892	9,894	9,894
Model test	32,277.27	32,277.27	30,532.95	30,532.95	32,304.08	32,304.08
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Log pseudolikelihood	-99.45	-99.45	-99.36	-99.36	-99.07	-99.07
Rho	6.9E-05	6.9E-05	7.5E-05	7.5E-05	2.4E-04	2.4E-04
Rho SE	0.002	0.002	0.002	0.002	0.003	0.003
LR test	9.2E-05	9.2E-05	1.0E-04	1.0E-04	3.2E-04	3.2E-04
	0.496	*0.496*	*0.496*	*0.496*	*0.493*	*0.493*

For the description of the variables see Table 3.1. In Italics are reported the p values of the tests. Superscripts ***, ** and * denote statistical significance at the 1, 5 and 10 percent level, respectively. Unobserved hererogeneity (frailty) treated at observation level. The dependent variable is a dummy taking value 1 if a firm active at the end of time t-1 is in bankruptcy or liquidation or dissolved by the end of time t (t=2006,…,2009). DURAT, AGE, AGE2, SIZE and SIZE2 are in log terms. β are estimated coefficients. exp(β) represents hazard ratios: its values above 1 specify a greater probability of the event of interest occurs. LR test stands for likelihood ratio test: under the null hypothesis unobserved heterogeneity is negligible. DTIME2, DTIME3 and DTIME4 are dummy variables corresponding to survival years 2 to 4, specifying the duration dependence. Time-variant variables are included in duration models, excluding those retrived from survey data which refer to only a given year.

TABLE 3.8 - Regression results from the Complementary log-log model with Gamma individual unobserved heterogeneity

	Benchmark Model		Firm Characteristics		External Variables	
	β	exp(β)	β	exp(β)	β	exp(β)
	1	*2*	*3*	*4*	*5*	*6*
DURAT	-0.4958*	0.6091*	-0.4934*	0.6105*	-0.4709*	0.6244*
	0.060	*0.060*	*0.063*	*0.063*	*0.078*	*0.078*
AGE	1.1373	3.1183	1.1184	3.0601	1.3647	3.9146
	0.493	*0.493*	*0.619*	*0.619*	*0.429*	*0.429*
AGE2	-0.0467	0.9544	-0.0432	0.9577	-0.0782	0.9248
	0.853	*0.853*	*0.899*	*0.899*	*0.766*	*0.766*
SIZE	2.2438*	9.4293*	2.2501	9.4891	2.2114*	9.1286*
	0.087	*0.087*	*0.388*	*0.388*	*0.084*	*0.084*
SIZE2	-0.1304*	0.8777*	-0.1313	0.8769	-0.1285*	0.8794*
	0.092	*0.092*	*0.388*	*0.388*	*0.085*	*0.085*
LEV	3.8913**	48.974**	3.3902	29.6700	4.2289***	68.642***
	0.018	*0.018*	*0.101*	*0.101*	*0.007*	*0.007*
CASHFLOW	-7.7718***	0.0004***	-7.6215***	0.0005***	-7.5890***	0.0005***
	0.002	*0.002*	*0.003*	*0.003*	*0.003*	*0.003*
PRODU	-0.0037	0.9963	-0.0038	0.9962	-0.0029	0.9971
	0.297	*0.297*	*0.294*	*0.294*	*0.401*	*0.401*
DEBTSUST	-34.291**	0.0000**	-33.443*	0.0000*	-34.687**	0.0000**
	0.048	*0.048*	*0.058*	*0.058*	*0.045*	*0.045*
ZSCORE	-0.1473	0.863	-0.1525	0.8586	-0.1778	0.8371
	0.901	*0.901*	*0.897*	*0.897*	*0.879*	*0.879*
DTIME2	18.968***	1.73e+08***	21.501*	2.18e+09*	18.814*	1.49e+08*
	0.001	*0.001*	*0.067*	*0.067*	*0.086*	*0.086*
DTIME3	16.979***	2.37e+07***	19.5313*	3.04e+08*	16.8672	2.1E+07
	0.005	*0.005*	*0.097*	*0.097*	*0.125*	*0.125*
DTIME4	18.869***	1.57e+08***	21.4330*	2.04e+09*	18.766*	1.42e+08*
	0.002	*0.002*	*0.068*	*0.068*	*0.087*	*0.087*
TANGI			-0.4127	0.6618		
			0.774	*0.774*		
LIQUI			-0.2257	0.798		
			0.707	*0.707*		
HHIs					-10.3159	0.0E+00
					0.235	*0.235*
JACOB					-0.0564	0.9452
					0.179	*0.179*
Observations	14,728	14,728	14,725	14,725	14,728	14,728
Log pseudolikelihood	-117.38	-117.38	-117.29	-117.29	-114.99	-114.99
Gamma variance	1.0E-03	1.0E-03	1.0E-02	1.0E-02	3.0E-03	3.0E-03
Gamma variance SE	0.081	0.081	0.303	0.303	0.158	0.158
LR test	0.0E+00	0.0E+00	-3.0E-03	-3.0E-03	-2.0E-03	-2.0E-03
	0.500	*0.500*	*0.500*	*0.500*	*0.500*	*0.500*

For the description of the variables see Table 3.1. In Italics are reported the p values of the tests. Superscripts ***, ** and * denote statistical significance at the 1, 5 and 10 percent level, respectively. Unobserved hererogeneity (frailty) treated at observation level. The dependent variable is a dummy taking value 1 if a firm active at the end of time t-1 is in bankruptcy or liquidation or dissolved by the end of time t (t=2006,…,2009). DURAT, AGE, AGE2, SIZE and SIZE2 are in log terms. β are estimated coefficients. exp(β) represents hazard ratios: its values above 1 specify a greater probability of the event of interest occurs. LR test stands for likelihood ratio test: under the null hypothesis unobserved heterogeneity is negligible. DTIME2, DTIME3 and DTIME4 are dummy variables corresponding to survival years 2 to 4, specifying the duration dependence. Time-variant variables are included in duration models, excluding those retrived from survey data which refer to only a given year.

Appendix 3

Basic concepts in survival analysis

Both continuous and discrete durations models are grounded in diverse basic functions: cumulative density function *F(t)*, survivor function *S(t)*, probability density function *f(t)*, and hazard function *h(t)*. For all of these functions, *t* is the time during which someone (e.g. an individual, household, firm) could potentially experience a given transition.

The spell length of a firm is a realisation of a continuous random variable T with a cumulative density function – also called in the survival analysis literature as the failure function – that can be described as:

$$F(t) = \int_0^t f(r)dr = P(T \leq t) \tag{A3.7}$$

As a result, the Survivor function can be written as:

$$S(t) = 1 - F(t) = P(T > t) \tag{A3.8}$$

S(t) and *F(t)* are probabilities, so the Survivor function is bounded between zero and one and is a negative function of time (*t*). Hence, the probability density function, that may assume values greater than one since does not synthesize probabilities, can be represented by:

$$f(t) = \lim_{\Delta t \to 0} \frac{P(t \leq T \leq t + \Delta t)}{\Delta t} = \frac{\partial F(t)}{\partial t} = \frac{\partial S(t)}{\partial t} \tag{A3.9}$$

Where Δt represents an infinitesimal interval of time.

Therefore, the hazard function (or rate) can be formulated as:

$$\theta(t) = \lim_{\Delta t \to 0} \frac{P(t \leq T \leq t + \Delta t | T \geq t)}{\Delta t} = \frac{f(t)}{S(t)} \tag{A3.10}$$

In the continuous-time models, the hazard function (or rate) defines the probability of failing at time T conditional on having survived up to time *t* (Jenkins, 2005). However, since it concerns the exact time, the hazard rate does not summarise a probability and it is only assumed to be greater or equal to zero. Instead, in discrete-time models, the hazard rate assumes values between zero and one since it concerns a probability.

Let consider the interval $(a_{j-1}, a_j]$[108], the probability that the event (a transition from one state to another) occurs within this interval is:

$$h(a_j) = P(a_{j-1} < T \leq a_j | T > a_{j-1}) = 1 - \frac{S(a_j)}{S(a_{j-1})} \qquad (A3.11)$$

Hence, the interval hazard rate, $h(a_j)$, measures the probability that a spell ends during the interval j^{th}, conditional on surviving to the start of j^{th}interval (Jenkins, 2005).

Let assume a proportional hazards (PH) model in order to control for the impact of covariates on survivor and hazard functions:[109]

$$\theta(t, x_{i,t}) = \theta_0(t) exp^{\beta x_{i,t}} \qquad (A3.12)$$

where $x_{i,t}$ is the set of covariates, β represents the coefficients obtained by applying some estimation methods at time t; moreover, $\theta_0(t)$ is the baseline of the hazard function which synthesizes the pattern of duration dependence, assumed to be common to all firms. To identify the precise pattern of duration dependence in continuous-time models, many assumptions on the distribution of the baseline hazard are specified. By contrast, in discrete-time models, that have been derived from the continuous-time ones, the baseline hazard is without restrictions or unspecified.[110]

Discrete-time duration models

This section describes the Complementary log-log model, which has been implemented as a robustness check. Let consider banded data that consists of firms *(i)* and time *(t)*. Each firm might experience an event (i.e. is at risk of failure) indicated by a binary variable $y_{i,t}$. The probability of discrete hazard can be estimated as P($y_{i,t} = 1$). Therefore, the interval hazard function can be described as:

$$P(y_{i,t} = 1, x_{i,t}) = h(t, x_{i,t}) = 1 - \exp[-exp(x_{i,t}\beta + j_{t-t0})] \qquad (A3.13)$$

[108] The definition assumes that the intervals are of equal unit length (e.g. a month or a year) and positive integers could be used to label the intervals: $(a_{j-1}, a_j]$ for $a_j = 1; 2; 3 \ldots k - 1$, resulting that an interval notation *j* can be used. In such case, $(a_{j-1}, a_j]$ begins just after the date that identify the beginning and the end of the interval (a_{j-1}) and finishes just in the date marking end of a_j.

[109] In survival analysis, there are two key models: proportional hazards (PH) and accelerated failure time (AFT). See Jenkins (2005) for further insights.

[110] The discrete-time models derive from the continuous-time ones, in particular from the semi-parametric Cox (1975) PH approach. More in details, the continuous- and discrete-time models came from the maximum likelihood form, with the exception of Cox's model, which results from partial likelihood controlling for duration dependence (Zorn, 2000).

Where $x_{i,t}$ are described as in equations (A3.11) and the component of the interval(j_{t-t0}) specifies the spell length by using dummy variables. Specifically, t_0 indicates the first failure event and t-t_0 assesses the spell length from the first year until the current one.

Taking the log(-log(.)) transformation, I obtain:

$$cloglog(P) = cloglog(h_{i,t}) = \log[-\log(1 - h_{i,t})] = \tau_t + \beta' x_{i,t} \qquad (A3.14)$$

Where τ_t is the log of integrated hazard gauged over the interval (j_{t-t0}) and other factors are as described above. The Cloglog model allows to estimate coefficients accounting for the interval-censored and they can be interpreted as those obtained from the continuous-time model. However, τ_t cannot summarize the nature of the baseline hazard function that could imply, in this case, several shapes of the hazard function within each interval (Jenkins, 2005).[111]

The Cloglog model does not account for unobserved heterogeneity, which could imply a relevant bias in the estimation.[112] When incorporating unobserved heterogeneity, the standard Cloglog model in (A3.13) becomes:

$$cloglog[p(t, x|\beta, v)] = D(t) + \beta' x_{i,t} + u \qquad (A3.15)$$

Where u, alike to v, is a random variable (with zero mean and independent from t and X) representing an unobservable individual effect. D characterises the baseline hazard function.

Estimating the aforementioned expression requires to specify a distribution for the v, since each individual error term is unobserved, where the distribution is distinguished in terms of parameters, and the unconditional survivor function can be explicated in terms of this (Jenkins, 1995). For the discrete-time PH model, the Gamma distribution has been the most commonly used distribution. This application has been proposed by Meyer (1990) following the Prentice-Gloeckler (1978) model.[113] In order to capture unobserved heterogeneity, Meyer (1990) supposes that the unobservable attributes of an individual can be included in the hazard function assuming a multiplicative form based on a random variable. Thus, the error term is supposed to follow a Gamma distribution, with unit mean and variance σ^2 and independent of t and X. For Cloglog models, however,

[111] This model can be estimated in Stata by using the command *cloglog*.
[112] First, the degree of negative duration dependence in the hazard is over-estimated (i.e. the degree of positive duration dependence is under-estimates). This is the consequence of a selections process: firms which have a high unobserved random component are more likely to finish the spell early; so that, the sample of firms that survive is a selected sample with low random effect (v) which yields to lower hazard and, therefore, underestimation of the true hazard. Secondly, the proportionate response of the hazard to a variation in a given covariate decreases with time (i.e. β parameters give the interpretation of the constant impact in models without unobserved heterogeneity). Then, the coefficients of the explanatory variables are under-estimated (Jenkins, 2005).
[113] This model can be estimated using the built-in Stata program *pgmhaz8* implemented by Jenkins (1995).

it also usual to assume a Normal (Gaussian) distribution with mean zero for the frailty term (u).[114] In both cases, the null hypothesis of variance equal to zero can be tested in order to verify the presence of unobserved heterogeneity. Under the null, unobserved heterogeneity is negligible and the more appropriate estimated model should be that without individual unobserved heterogeneity.

[TABLES A3.1 – A3.3]

[114] Estimation can be done using Stata command *xtcloglog*.

TABLE A3.1 - Regression results for the French sample: marginal effects

	Probit	Logit	Cloglog
DURAT	-0.0136***	-0.0125***	-0.0104**
	0.004	*0.009*	*0.045*
AGE	0.7115***	0.7867***	0.8384***
	0.000	*0.000*	*0.000*
AGE2	-0.3354***	-0.3702***	-0.3943***
	0.000	*0.000*	*0.000*
SIZE	0.0568	0.0651	0.0605
	0.155	*0.158*	*0.247*
SIZE2	-0.0037	-0.0044	-0.0042
	0.112	*0.102*	*0.166*
LEV	0.0733***	0.0851***	0.0830***
	0.006	*0.005*	*0.009*
CASHFLOW	-0.4208***	-0.4422***	-0.4577***
	0.000	*0.000*	*0.000*
PRODU	-0.0017	-0.0008	0.004
	0.872	*0.952*	*0.799*
DEBTSUST	0.1363	0.1835	0.1554
	0.563	*0.462*	*0.549*
ZSCORE	-0.1332***	-0.1279***	-0.1327**
	0.000	*0.005*	*0.012*
Observations	2,519	2,519	2,519
Model test	223.19	211.48	286.69
	0.000	*0.000*	*0.000*
Log pseudolikelihood	-368.38	-363.90	-363.98
Pseudo R2	0.2363	0.2456	

For the description of the variables see Table 3.1. In Italics are reported the p values of the tests. Superscripts ***, ** and * denote statistical significance at the 1, 5 and 10 percent level, respectively. Standard errors (not reported) are robust to heteroskedasticity and autocorrelation. The dependent variable is a dummy taking value 1 if a firm active at the end of 2005 is in bankruptcy or liquidation or dissolved by the end of 2009. Country and sector dummies are always included but not reported. DURAT, AGE, AGE2, SIZE, SIZE2 and GDPP are in log terms.

TABLE A3.2 - Regression results for the Italian sample: marginal effects

	Probit	Logit	Cloglog
DURAT	-0.0131***	-0.0144***	-0.0144***
	0.000	*0.000*	*0.000*
AGE	0.2136**	0.1541	0.126
	0.017	*0.145*	*0.273*
AGE2	-0.0949**	-0.0677	-0.0545
	0.026	*0.176*	*0.317*
SIZE	0.1070***	0.0952***	0.0907***
	0.000	*0.000*	*0.000*
SIZE2	-0.0054***	-0.0047***	-0.0045***
	0.000	*0.000*	*0.000*
LEV	-0.0325**	-0.0250	-0.0230
	0.033	*0.189*	*0.244*
CASHFLOW	0.1526**	0.1807**	0.1886**
	0.020	*0.017*	*0.015*
PRODU	-0.0401***	-0.0394***	-0.0391***
	0.000	*0.000*	*0.000*
DEBTSUST	0.0396	-0.0259	-0.0573
	0.770	*0.880*	*0.752*
ZSCORE	-0.0455**	-0.0499*	-0.0519*
	0.018	*0.061*	*0.065*
Observations	3,976	3,976	3,976
Model test	1,471.21	3,417.13	19,671.25
	0.000	*0.000*	*0.000*
Log pseudolikelihood	-260.93	-259.31	-258.65
Pseudo R2	0.3271	0.3313	

For the description of the variables see Table 3.1. In Italics are reported the p values of the tests. Superscripts ***, ** and * denote statistical significance at the 1, 5 and 10 percent level, respectively. Standard errors (not reported) are robust to heteroskedasticity and autocorrelation. The dependent variable is a dummy taking value 1 if a firm active at the end of 2005 is in bankruptcy or liquidation or dissolved by the end of 2009. Country and sector dummies are always included but not reported. DURAT, AGE, AGE2, SIZE, SIZE2 and GDPP are in log terms.

TABLE A3.3 - Regression results for the Spanish sample: marginal effects

	Probit	Logit	Cloglog
DURAT	-0.0140***	-0.0141***	-0.0142***
	0.000	*0.000*	*0.000*
AGE	-0.0047	0.057	0.0827
	0.970	*0.654*	*0.530*
AGE2	0.0032	-0.0252	-0.0371
	0.958	*0.673*	*0.548*
SIZE	0.0673***	0.0688***	0.0659***
	0.001	*0.002*	*0.005*
SIZE2	-0.0032***	-0.0033***	-0.0031**
	0.003	*0.007*	*0.013*
LEV	0.0973***	0.1017***	0.1035***
	0.000	*0.000*	*0.000*
CASHFLOW	-0.1417***	-0.1460**	-0.1109*
	0.010	*0.032*	*0.080*
PRODU	-0.0100*	-0.0068	-0.0033
	0.056	*0.269*	*0.567*
DEBTSUST	0.0410	0.0736	0.1066
	0.745	*0.609*	*0.462*
ZSCORE	-0.0089	-0.0076	-0.0064
	0.477	*0.620*	*0.672*
Observations	4,947	4,947	4,947
Model test	216.19	222.59	255.29
	0.000	*0.000*	*0.000*
Log pseudolikelihood	-445.92	-445.36	-446.71
Pseudo R2	0.1723	0.1733	

For the description of the variables see Table 3.1. In Italics are reported the p values of the tests. Superscripts ***, ** and * denote statistical significance at the 1, 5 and 10 percent level, respectively. Standard errors (not reported) are robust to heteroskedasticity and autocorrelation. The dependent variable is a dummy taking value 1 if a firm active at the end of 2005 is in bankruptcy or liquidation or dissolved by the end of 2009. Country and sector dummies are always included but not reported. DURAT, AGE, AGE2, SIZE, SIZE2 and GDPP are in log terms.