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Faculté de Droit et des Sciences Economiques

Laboratoire d'Analyse et de Prospective Economiques (LAPE) EA1088

Thèse

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Présentée et soutenue publiquement par

Cécile CASTEUBLE

Le 07 Décembre 2015

Bank risk-return efficiency, ownership structure and bond pricing: Evidence from Western European listed banks.

Thèse dirigée par :

M. Philippe ROUS, Maître de conférences HDR à l'Université de Limoges

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JURY :

Rapporteurs :

- Mme Raphaëlle BELLANDO, Professeur à l'Université d'Orléans
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- Mme Laëtitia LEPETIT, Professeur à l'Université de Limoges
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« La faculté n'entend donner aucune approbation ni improbation aux opinions émises dans les thèses; elles doivent être considérées comme propres à leurs auteurs. »

To my beloved family.

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SUMMARY

GENERAL INTRODUCTION

Over the past decades, substantial changes have occurred in the European financial system. Technological advances have spurred financial innovations. The process of financial integration and deregulation has affected the organizational structure of markets, increasing banking consolidation and market shares of foreign banks. This financial development came along with an increase in prudential regulation. Taking into account the important role banking institutions play, their systemic importance and their tight interconnection with the real sector, banks are subject to more stringent regulations than non-financial firms. In addition to capital requirements, Basel II and Basel III accords were designed to encourage banks to exert sound practices and provide enhanced risk management.

Financial integration and deregulation enable new profit opportunities through decreasing costs, accessing new markets or expending access to capital. European integration has also fostered competition among financial institutions, which has had either positive or negative impacts on banks. On one hand, changes in the European banking industry have stressed the necessity for banks to expand and divert their activities in order to improve their performance relative to their peers (Goddard *et al.* (2007)): banks adjust their structures and their strategies to optimally respond to this new environment. On the other hand, following the financial globalization, the induced losses in market power may have resulted in reinforced moral hazard incentives and increased risk taking (Salas and Saurina (2003), Rajan (2005)). In the absence of an efficient risk management, this shift towards risk would increase the likelihood of financial crises (Mishkin (2005)). Overall in the new financial environment, the quality of banking risk management is assigned to play a preeminent role.

The evaluation and the management of risks are ones of the main functions of banking institutions. Risk management is the process by which banks' managers identify, assess and monitor banking risk. Risk management does not necessarily imply a decrease of the risk taken by banks: a lower risk may not be beneficial as it prevents managers investing in more profitable projects at the expense of shareholders wealth. On the contrary, a higher risk allows for more valuable projects but make banks more vulnerable. Consequently, the cost of taking on new risks that increases the bank's total risk should be traded off against the potential gain from taking the risk (Pyle (1997)). In that way, the purpose of risk management is to promote efficient risk-taking. A good management of risks will then lead to choose the risk-return couple that maximizes shareholders' wealth according to managers' appetite for risk and regulatory capital requirements (Stultz (2014)). Yet, all banks may not reach this objective.

A first factor likely to affect the success of risk management is directly attributable to managers' ability. This ability depends on managers' talent, knowledge, leadership etc... (see Demerjian *et al.* (2012)). More able managers are better to assess risks, to manage their portfolios, to identify the optimal amount of risk and to adopt the best practices in order to make an efficient use of risk-taking. Managers who suffer from a lack of expertise misallocate banking resources which can result in excessive risks if, for example, they allocate fewer personnel and resources to risk analysis and monitoring activities. Compared to their peers, banks that fail to turn risk-taking into optimal return are considered as risk-return inefficient according to a so-called measure of risk-return efficiency (DeYoung *et al.* (2001)).

In addition to managers' ability, banks' ownership structure may also influence the risk taking behavior of banks (Jensen and Meckling (1976), Saunders *et al.* (1990), Laeven and Levine (2008)) and affect the way risk is managed. When banks' franchise value is low[1], shareholders, who hold diversified portfolios and take the advantage of limited liability, have stronger incentives than non-shareholding managers to increase risk in order to maximize banks' value[2]. Indeed, without additional incentives, managers may be too risk-adverse to select these risky projects that potentially affect their invested wealth, human capital or reputation (Demsetz *et al.* (1997)). When the ownership is diffuse, the interests of bank managers may diverge from those of shareholders in terms of risk-taking. On the contrary, in the case of a concentrated ownership alike the European banking system, controlling shareholders, those with large ownership stakes, obtain an effective control of banks, the later exhibiting in this case a higher risk-taking behavior (Saunders *et al.* (1990)). According to Jensen and Meckling (1976), shareholders have strong incentive to engage in assets substitution after raising debt. Assets substitution is an investment strategy that involves changes in portfolio assets allocation in order to invest in excessively risky projects that promise very high payoff but with a very low probability of success. This risk-taking strategy increases the probability of bank failure (Keeley (1990)) and diverges from the risk-management incentive to avoid costly financial distress.

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[1] For example, banks' franchise value decreased after the wave of bank mergers and acquisitions that went along with the financial development of the European banking system (DeJonghe and Vander Vennet (2008)).

[2] On the contrary, a high franchise value limits banks' risk-taking incentives because the interest of shareholders and managers are likely to be aligned as they both suffer high costs associated with financial distress (Demsetz *et al.* (1997)).

Overall, even if banks' managers have a wide experience of risk management, they might fail in this exercise because of impaired managerial decisions or agency conflicts that may get banks into trouble[3]. Weak management in banking institutions may indeed have severe consequences such as an increased banking financial instability, which may impact the whole financial and economic systems. Altunbas *et al.* (2011) highlight that bank risks highly increased during the financial crisis, alongside the materialization of these risks, and banks' default risk has never been more credible than during this period. Banks' mismanagement of risk may be partly responsible for this situation. The huge accumulation of risks that subsequently materialized raises significant doubts to whether banks manage risk efficiently and gives even more incentives to study the quality of banks' risk management, especially during the financial crisis. Accordingly, the assessment and the analysis of banks' risk-return efficiency is the first objective of the thesis.

It is of particular interest for bank regulators to assess the quality of bank risk management in order to prevent a potential ensuing risk of insolvency and to improve banks' behavior[4]. However, regulators are not the only actors potentially interested in bank risk management. Bank mismanagement of risk is also likely to affect other banks' stakeholders such as, in particular, bondholders. Bondholders are mainly worried about the risk that the issuer will not be able to pay the interest and/or the principal of the bond, and thus the risk to lose their investment (Merton (1974)). Bondholders are then concerned about the risk of issuers' default. If they anticipate a high probability of failure, bondholders would require an appropriate default premium, increasing the cost of debt of banks. Theoretically, the risk premium required by bondholders to fully compensate for the expected losses should take into account, among others, the weak risk management. Empirically, the literature questions the accurateness of traditional default proxies and underlines their deficiency to fully explain the default risk premium contained in bond prices. For example, whereas they should be already integrated into the measure of default, the inclusion of accounting data (Demirovic *et al.* (2015)) or equity volatility (Campbell and Taksler (2003)) as determinants of the bond spread

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[3] According to Williams (2004), one of the management problems for European banks directly stems from managers' behavior. However, other factors are likely to affect positively or negatively the quality of risk management that are beyond managers' control such as an exogenous shock. Notice that the chance that a bad outcome takes place with an efficient risk-return project is small but increases with inefficient ones.

[4] For instance, on one hand, regulators may allow a greater flexibility for better-managed banks. On the other hand, banks with less ability to manage their risks may be penalized for taking higher risks in order to give them the incentives to improve their risk-return efficiency (DeYoung *et al.* (2001)).

in addition to a default measure brings incremental information in explaining the default risk premium. On these grounds, we investigate, as a second objective, whether the quality of bank management conveys additional information to default risk proxies.

More, bondholders are also concerned about the risk of wealth extraction and are directly affected when shareholders invest in high-risk projects that increase the probability of default on their debts without potential benefits (the asset substitution problem). This strategy stems from the existence of a conflict of interests between shareholders and debtholders. When the ownership is concentrated, bank managers and controlling shareholders have aligned incentives that diverge from the best interests of minority shareholders (Claessens *et al.* (1999, 2002)) but also from those of bondholders. Jensen and Meckling (1976) suggest that the potential conflict between shareholders and debtholders is reflected in terms of wealth expropriation and risk-shifting. While shareholders invest in these excessively risky projects, they shift the risk to bondholders. Indeed, shareholders benefit from upside returns when high-risk projects succeed and are protected from downside risk when those projects fail whereas, in that case, bondholders bear part of the cost. Anticipating such a behavior, bondholders require a higher premium that increases the bank cost of debt (Klock *et al.* (2005))[5]. More, this risk-shifting conflict of interest between shareholders and creditors may be strengthened if controlling shareholders hold control rights (the right to vote and therefore to control) in excess of cash-flow rights (the right to receive dividends) as in pyramid ownership structure[6]. They can achieve the control of a bank by committing low equity investment that allows them to extract wealth without bearing excessive costs. Boubakri and Gouma (2010) provide evidence for such a behavior during normal times for non-financial firms. However, the question of the impact of such agency costs on debt pricing in the specific case of banking institutions (and especially during distress times) is not addressed in the current literature; this will be the third and last objective of this thesis.

[5] This moral hazard problem of asset substitution by shareholders is more likely to occur since the reduction of banks' market power induced by the financial development and shareholders may be tempted to take on a higher risk to compensate for the lost profitability.

[6] A pyramid ownership structure is based on the fact that a firm is controlled by an ultimate owner who controls the firm through at least another corporation that it does not wholly control.

Structure of the thesis

According to the previous overview, we evaluate first the quality of banks' risk management. Second, we investigate whether bondholders price this quality of banks' risk management. Finally, we analyze the question of conflicts of interests between controlling shareholders and bondholders within banks' pyramids ownership structure.

More precisely, we aim at a contribution to the banking literature thanks to three empirical investigations on bank risk-return efficiency and bond pricing. Chapter 1 assesses and examines the relative efficiency of a homogeneous sample of European listed banks in terms of risk-return trade-off. Despite an abundant literature related to banks' efficiency, there are, at our knowledge, a very few attempts to evaluate bank risk-return efficiency of European banks. Chapter 2 investigates the determinants of bank bond spread and asks whether bank managerial ability, proxied by bank risk-return efficiency, improves the prediction of the default premium required by bondholders. Finally, Chapter 3 analyzes whether divergence between control rights and cash-flow rights of ultimate owners in pyramid ownership structure affects the pricing of banking bonds.

First, given the impact of banks' risk management in terms of financial stability, **Chapter 1** addresses, for a set of European banks, the matter of the empirical measurement and analysis of managerial efficiency defined as a risk-return trade-off. Changes that happened in the European banking industry let managers a greater freedom to allocate asset portfolios and to modify their strategies. They have incentives to operate more cost efficiently and/or to take on more risk to enhance their profitability. However, some banks are worse at risk-taking than others: they take additional risks that only increase their probability of experiencing financial distress and then may potentially threaten the safety of the financial system (DeYoung *et al.* (2001)). Most studies that have paid attention to bank efficiency in terms of cost or profit (Weill (2004, 2009), Altunbas *et al.* (2001a), Maudos *et al.* (2002)) disregard possible differences in managers' risk preferences (McAllister and McManus (1993)). Bank risk-return efficiency, as measured by Hughes *et al.* (1996), allows managers to trade return for a reduced risk and turns out to be a relevant proxy for the quality of bank risk management. To our knowledge, none of the studies that estimate bank efficiency with this method run comparisons across a large set of European banks or investigate whether this efficiency was affected by the financial crisis. We extend the established literature in this way.

Hence, to evaluate the performance of managers in terms of bank risk-taking practices, we assess the relative efficiency of banks' risk-return choices. The first step is to estimate each bank expected return and risk that directly and solely stem from the *ex-ante* portfolio choices made by bank managers. These *ex-ante* portfolio choices, which are distinct from realized ones, have to be disclosed. We borrow from Deaton and Muellbauer (1980) and Hughes *et al.* (1995) a methodology which enables this assessment of *ex-ante* portfolio choices. By means of a stochastic frontier model, we then assess precisely the relative bank risk-return efficiency. Beyond this assessment of bank risk-return efficiency, this chapter is devoted to four main issues. First, we confirm that some banks are inefficiently managed because of impaired managerial decisions and we take care to ensure that this result is robust. Second, we underline that the level of bank risk-return efficiency is relatively stable in the short term, whereas in the long term low performing banks are not condemned to remain inefficient. Third, we find some common characteristics for the most risk-return efficient banks by conducting mean equality tests. Fourth, we show that, when credit ratings do not account for potential public support, rating agencies assign a more attractive rating for the most risk-return efficient banks.

Second, the pricing of default risk has received much attention from regulators, supervisors and academics because they have strong interest to accurately measure it (Duffee (1999)). Investors such as bondholders are mainly worried about the risk that the issuer will not be able to pay the interest and/or the principal of the bond (Merton (1974)). They require a default premium to adequately compensate for the expected losses they may suffer. This premium is reflected in the bond spread defined as the difference between the bond yield to maturity at issuance and the yield of a same currency and maturity Treasury bond. To investigate how bondholders price the default risk, previous empirical studies model this premium by using commonly used credit default measures: credit or bank ratings (Elton *et al.* (2001), Sironi (2002), Sironi (2003), Pop (2006), Güntay and Hackbarth (2010)), market-based measures such as the distance to default (Tsuji (2005), Das *et al.* (2009), Demirovic *et al.* (2015)), and accounting-based ones like Z-Score (Balasubramnian and Cyree (2014), and Kavussanos and Tsouknidis (2014)). Although these approaches have delivered some important findings, the accurateness of these proxies to completely appreciate the default risk premium have been questioned (Jones *et al.* (1983), Das *et al.* (2009), Campbell and Taksler

(2003)). What arises from these studies is that, empirically, additional data bring incremental information in explaining the default premium.

From this perspective, **Chapter 2** investigates whether the assessment of the default premium required by bondholders can be improved by adding additional information, and, more specifically, the bank managerial ability measured as risk-return efficiency as a determinant. We test directly the effect of bank managerial ability on the bank bond spread, and we find that well-managed banks benefit from lower credit spread. We deepen our analysis by asking whether the impact of bank managerial ability on bond spread is the same during normal and distress times and on more restrictive subsets relating to ratings categories, payment ranks and maturities. The relationship holds whatever the studied period or bonds' characteristics. The results confirm that the default proxy does not entirely reflect the default premium, and we conclude that managerial ability is a determinant of bondholders' confidence in the measure of default risk.

Finally, some papers highlight that the cost of debt of banks can be influenced by additional factors beyond expected default (Elton *et al.* (2001)). Bliss (2001) underlines that while bond yields react to default risk, they may also be affected by other factors and considering bond yields as a basically measure of default risk is mistaken. Indeed, bondholders are also concerned about the risk of wealth extraction arising from agency problems (Klock *et al.* (2005)). The aforementioned agency problem between controlling shareholders and bondholders could even be accentuated in the case of pyramid ownership structure. This structure enables controlling shareholders to achieve control of a firm by committing low equity investment creating a divergence between control rights and cash-flow rights. Controlling shareholders have incentives to use their effective control rights to divert the upside gains for private benefits while leaving largely the costs of failure to bondholders. If bondholders anticipate that expropriation by controlling shareholders is likely to occur, they will require an additional premium when they price the debt.

The literature that empirically investigates the effect of controlling shareholders with excess control rights in the banking industry is scarce. Saghi-Zedek and Tarazi (2015) highlights that the divergence between ultimate owner's control and cash-flow rights affects bank profitability and risk in a different way during normal and distress times. Excess control rights are negatively associated with bank profitability and positively with risk before (2002-2006) and after (2009-2010) the financial crisis. On the contrary, excess control rights contribute to improve bank profitability and to reduce earnings volatility without impacting default risk during the financial crisis years (2007-2008). Boubakri and Ghouma (2010) examine the potential existence of conflicts between controlling shareholders and bondholders; they explore the effect of expropriation likelihood on firms' bond yield-spreads. They show that, in normal times, this expropriation by controlling shareholders affects bond yield-spreads, bondholders requiring a higher spread from firms controlled by an ultimate owner with excess control rights. However, during distress periods, controlling shareholders may change their behavior. As highlighted by Friedman *et al.* (2003)), firms that are subject to expropriation during upturns may profit from propping-up during downturns. Entrenched controlling shareholders may intervene to refund the failing firm in order to prevent all the firms inside the pyramid from financial distress and expropriate them in the future. If this mechanism is applied, bondholders may require a lower spread in turmoil compared to sound period.

Therefore, **Chapter 3** raises the question of the impact of such agency cost on debt pricing in the specific case of banking institutions as this issue is not addressed in the current literature and during distress times. The findings indicate that, before the crisis, the presence of excess control rights does not affect bank bond yield spread. On the contrary, during downturns, bondholders require a lower spread from banks controlled by an ultimate owner with excess control rights. Finally, we find that holders of secured or high rated bonds disregard the presence or the absence of excess control rights during both normal and distress times. On the contrary, holders of low rated and unsecured/subordinated bonds pay attention to excess control rights exclusively during distress times.

CHAPTER 1

Risk-return efficiency of European listed banks

1.1. Introduction

Over the last decades, the evolution of the European financial environment has led to technological innovations, banking deregulation and consolidation that favor financial integration and competition among banks (Goddard *et al.* (2007)). The several changes that happened in regulatory and supervisory policies let banks' managers greater freedom to allocate asset portfolios and encourage them to optimally adapt their strategies and enhance their efficiency (Chortareas *et al.* (2012)). Efficiency turns out to be a key factor for banks to stay competitive especially with the entry of new foreign competitors (Weill (2009)), a key determinant of bank failures that worry banking supervisors (Podpiera and Weill (2008)), and a policy objective of the European regulators to foster financial stability (European Central Bank (2006)). This context has renewed interest for regulators and policy-makers in identifying banks operating at low levels of efficiency which could affect the stability of the whole financial system.

The empirical measurement of efficiency in European banks has received wide attention from researchers. Management behavior is likely to play a large role in determining bank efficiency (Williams (2004)). The challenge to estimate bank efficiency stems in that case from the assessment of managers' production decisions. Most studies performed on a large set of European banks focused on either cost efficiency (e.g. Weill (2004, 2009), Chortareas *et al.* (2012)) and/or profit efficiency (e.g. Altunbas *et al.* (2001a), Maudos *et al.* (2002), Bos and Schmiedel (2007), Fiordelisi *et al.* (2011)). It should be noticed that cost and profit efficiency estimates assume that managers are risk-neutral. However, because of the specificity of banking activities, taking into account managers' risk preferences is essential to assess banks' efficiency. On one side, under the assumption of risk neutrality, banks operating with higher costs for a given bundle of outputs turn out to be inefficient compare to their peers *ceteris paribus*. On the other side, if banks are risk-adverse, these so-called inefficient banks may actually operate optimally according to their own level of risk adversity (McAllister and McManus (1993)). They increase their expenses to reduce their risk: they earn a lower profit but at a lower level of risk that reflects banks' risk aversion rather than inefficiency. Cost and profit efficiency measures may be misleading.

An extensive literature suggests that accounting for risk is important while analyzing managers' production decision-making and assessing bank efficiency[7]. Accordingly, Hughes and Moon (1995) and Hughes *et al.* (1995) suggest a function such as managers choose a most preferred production plan that maximize their utility: this model allows for the possibility that bank managers pursue alternative objectives, such as trading return for a reduced risk. The estimation of this model yields measures of bank expected return and risk from which Hughes *et al.* (1996) evaluate bank risk-return efficiency through a stochastic risk-return frontier[8]. To our knowledge, only two studies applied this method to the European context. On a sample of 113 French banks between 1993 and 1997, Petey (2004) examines the determinant of bank insolvency proxied by the risk-return efficiency measure. Koetter (2006) analyzes the stability of efficiency measures for a sample of universal German banks between 1993 and 2004.

The objective of this paper is to estimate and study the efficiency of a sample of European listed banks in terms of expected risk and return. While previous studies that apply the model of managerial utility maximization focused on a specific country, our sample covers 192 banks located in 16 European countries. The studied period, which goes from 2002 to 2011, encompasses the recent financial crisis. To our knowledge, there have been little attempts to investigate the effect of this financial instability on European bank efficiency (e.g. Alzubaidi and Bougheas (2012)).

To address the matter of European listed banks' efficiency, we focus on four issues. First, we aim to analyze why some banks do not belong to the efficient frontier. Is the sub-optimality of their expected risk-return choice mainly explained by inefficiency? Exogenous factors may also be responsible for these variations, so we have to ensure that the main reason is inefficiency. Results confirm the latest. Studies such as Bauer *et al.* (1998), Dietsch and Lozano-Vivas (2000), Lozano-Vivas *et al.* (2002) or Weill (2004) underline that efficiency measures can significantly vary across different empirical specifications, estimations and samples. We conclude in a different way: banks' ranking is not altered by the econometric choices relating to the methods or the estimation techniques of the efficient frontier.

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[7] See Hughes and Mester (2008) for a review of these studies.
[8] Studies such as Hughes (1999), Hughes *et al.* (2000), Hughes *et al.* (2001), DeYoung *et al.* (2001), Hua and Liu (2010) or Hughes and Mester (2013) also use this model to evaluate bank efficiency on the US market.

Second, we analyze the stability of bank efficiency in terms of level and ranking over time, along with the effect of the financial crisis. Is efficiency persistent over time? Do inefficient banks stay the same over the years? How the level of bank efficiency varies across the period? Does the financial crisis impact efficiency rankings? Our main results suggest that bank efficiency is stable, especially in the short term. Overall, a large part of most efficient banks tend to stay efficient over the whole period. We also notice that most of banks that under-performed before the financial crisis improve their efficiency in the post financial crisis period.

A third question involves the characteristics of banks according to their level of efficiency. The objective here is to identify the main features of the relatively (in)efficient banks in terms of balance-sheet structure, income statements and board constitution. Previous studies that investigate bank efficiency in terms of return and risk show for example that more efficient banks enjoy large branches networks (Hughes *et al.* (1996)), are well diversified and benefit from large scale economies (Hughes *et al.* (2001)), display better CAMEL ratings (DeYoung *et al.* (2001)) and credit ratings (Hua and Liu (2010)), experience lower borrowing costs and focus on lending activities (Petey (2004)). Even if this aforementioned literature underlines a few common characteristics for efficient banks, a typical profile does not stand out. We also reach such a result: we cannot highlight a typical profile. However, we do find that most efficient banks are more profitable; are less capitalized and focused on lending activity. They better perform in terms of operational costs and return. They are also less risky without being more solvent or bigger than others.

Our fourth and last issue aimed at the evaluation of efficiency by external actors such as rating agencies. The quality assessment of credit rating agencies is often blamed since the financial crisis (see Blöchlinger *et al.* (2012) or Hilscher and Wilson (2013)). We then wonder how rating agencies take into account the degree of efficiency of banks: do actually rating agencies assign lower ratings to less efficient banks? The level of banks' opaqueness may further alter their assessment of banks' efficiency as banks with worse management ability may be voluntarily opaque. Are inefficient banks considered as more opaque by the rating agencies and analysts? We conclude that (i) poorly managed banks tend to have downgraded ratings only when these rating do not account for a potential external support, and (ii) inefficient banks do not appear as more opaque.

The remainder of this paper is organized as follow. Section 2 describes the methodology to estimate bank efficiency while section 3 presents the data, sample and efficiency estimations. The quality of the efficiency measure is discussed in section 4. Section 5 investigates the stability of banks' efficiency over time as well as the impact of the financial crisis on rankings. Section 6 examines the possibility of differences between most and less efficient banks through balance-sheet indicators, income statements and board characteristics. Section 7 analyzes whether credit rating agencies take into account bank efficiency. Section 8 concludes.

1.2. Methodology

Before empirically estimating bank efficiency, we first present the method we employ.

1.2.1. Looking for a risk-return efficiency measure

Studies that estimate efficiency in the banking industry mainly focus on cost efficiency method (ability to choose inputs at minimized costs for a given level of outputs) and profit efficiency method (ability to choose inputs that maximize the profit for a given level of outputs). Cost or profit efficiencies are estimated by the bank's relative position to a best practice frontier (BPF). The distance to this BPF reflects the bank's ability to convert inputs as efficiently as possible into outputs compared to its peers. A bank will be considered as relatively less efficient than others if it is situated far from the BPF and this bank could reduce its costs by improving its suboptimal managerial choices, still producing a similar bundle of outputs. Doing so, the bank would get closer to the BPF.

Uncertainty is an essential aspect of the banking industry. However, the previous methods assume that bank managers are risk-neutral and, accordingly, most studies that estimate bank efficiency with these approaches do not consider the risk exposition associated with banks' production plans. For example, under the assumption of risk-neutrality, a bank operating with higher costs for a given bundle of outputs turns out to be inefficient compared to its peers *ceteris paribus*. But, a risk-adverse bank may adopt cost-intensive measures to reduce its risks, adjust upwards its level of capital to prevent default, allocate more resources to increase loan monitoring, accentuate the analysis of credits etc. All these expenses undertaken to reduce risk, that is to decrease the uncertainty of the return, may appear as cost inefficient whereas these choices may be optimal considering the bank's level of risk aversion. Hence, assuming that managers are risk-neutral can result in misleading estimates of bank efficiency. Consequently, cost/profit efficiency methods are subject to a misspecification that is counted as inefficiency. Adjusting the efficiency measurement by accounting for managers' risk aversion is necessary.

Some studies suggest to include the bank level of capital as an input into the cost or profit function while estimating cost or profit efficiency (see for instance Hughes and Mester (1993), McAllister and McManus (1993), Mester (1996), Hughes and Mester (1998), Hughes (1999), Altunbas *et al.* (2001b), Lozano-Vivas *et al.* (2002)). As a risk-adverse manager will prefer a higher level of capital, the latter variable indirectly reflects bank managers' risk preferences. Berger and Humphrey (1997) emphasize the importance of accounting for the level of capital when estimating cost or profit efficiency. As underlined by Hughes and Mester (1998), risk-adverse managers may not be willing to follow an objective of cost minimization (or profit maximization) if the level of capital which minimizes their costs implies an unacceptable degree of risk. They would rather trade profit for reduced risk. Consequently, a suitable estimation of bank efficiency would take manager's risk aversion into account.

As an alternative method, Hughes and Moon (1995)[9] developed a structural model based on the maximization of a utility function that incorporates bank managers' risk-preferences and allows for different objectives. Managers associate to each feasible production plan a conditional probability distribution of profit that is based on their beliefs about the probabilities of future economic states of the world and about how profits will be generated by different plans in these future economic states. The managerial utility function thus depicts managers' ranking of production plans. These rankings differ for each manager according to their objectives and risk preferences based on their subjective assessments of future economic states. A risk-adverse manager, whom objective is not to minimize cost/maximize profit, ranks production plans by considering both the expected profit and the variance of profit associated to each plan. This model integrates the special case of a risk-neutral manager who only ranks his plans according to their expected profits. The maximization of the utility function determines the highest-ranked production plan, i.e. the manager's most preferred one. From this model, the authors derive an expected return and the associated expected risk,

[9] This model is based on Hughes *et al.* (1995) following by Hughes *et al.* (1996) and Hughes *et al.* (2000) studies.

measured as the standard deviation of the expected return. This expected return reflects the *ex-ante* level of return on equity that a bank aims to reach for a given level of expected risk the bank is willing to take. Given these measures of expected return and risk, a best practice frontier is established in the risk-return space to finally estimate bank efficiency. Inefficient banks facing a non optimal risk-return trade-off may improve their risk-return management by either reducing their risk for a given level of expected return or increasing their return for a given level of expected risk.

1.2.2. Extracting bank expected return and risk

The evaluation of bank risk-return efficiency requires, at first, an accurate assessment of expected return and risk.

Following Hughes *et al.* (1995, 1996, 2000), we suppose that bank managers maximize a utility function that depends on the level of profit (π) and that takes into account their risk-aversion by considering a combination of bank inputs (x), conditional on the output vector (y), the vector of output prices (p), the risk-free rate (r), a measure of asset quality (n) and the level of bank's equity capital (k):

$$\underset{\pi,x}{\text{Max}}\ U\left(\pi, x \mid y, p, r, n, k\right) \tag{1.1.a}$$

The maximization of the utility function is subject to two constraints:

- the balanced budget: $p.y + m - w.x = p_\pi.\pi$ (1.1.b)

- the banking technology: $T(x, y, k) \leq 0$ (1.1.c)

where $p_\pi = 1/(1-t)$ is the price of a unit of after-tax profit in terms of before-tax profit with t the tax rate on profit, w the vector of input prices, and m the non-asset based income.

By solving this optimization problem, we obtain two parametric functions:

- the expected profit function: $\pi = \pi(y, n, v, m, k)$ (1.2.a)

- the input demand function: $x = x(y, n, v, m, k)$ (1.2.b)

where v is a price vector defined as $v = v(w, p, r, p_\pi)$.

Similarly, we can define the bank manager's problem as a dual expenditure minimization problem subject to a given utility level $\bar{U}$ and the banking technology:

$$\underset{\pi, x}{\text{Min}} \ w\,x + p_\pi\,\pi \tag{1.3.a}$$

subject to

$$U(\pi, x | y, p, r, n, k) = U \tag{1.3.b}$$

$$T(x, y, k) \leq 0 \tag{1.3.c}$$

Solving this problem leads to the input demand function:

$$x = x(y, n, v, k, U) \tag{1.4.a}$$

and to the expected profit function[10]:

$$\pi = \pi(y, n, v, k, U) \tag{1.4.b}$$

The expected level of expenditure (for this given utility level) is the sum of inputs remuneration plus profit before tax:

$$E(y, n, v, k, U) = w.x + p_\pi.\pi \tag{1.5}$$

From the budget equilibrium constraint, the level of expenditure is necessarily equal to:

$$\left[E(y, n, v, k, U) = w.x + p_\pi.\pi\right] = p.y + m \tag{1.6}$$

Functional forms for utility and banking technology are unknown. We thus approximate the expenditure function by using the Almost Ideal expenditure function developed by Deaton and Muellbauer (1980) and used in a similar way by DeYoung *et al.* (2001):

$$\text{Ln E} = \text{Ln P} + U\,\beta_0 \left(\prod_i y_i^{\beta_i}\right)\left(\prod_s w_s^{v_s}\right) p_\pi^{\ \mu}\ k^\kappa \tag{1.7}$$

Where LnP is defined as a linear combination of logarithms, squared logarithms and cross products of logarithms of the components of ($\tilde{p}$, y, w, p_π, r, n, k)[11]:

[10] This profit is not necessarily the maximum profit.

[11] As the number of coefficients to estimate is already important and to save on degrees of freedom, the output vector of price p is replaced by an index $\tilde{p} = \sum_i p_i y_i \Big/ \sum_j y_j$ which is the weighted average price of the outputs. i and j are indices which identify outputs and s and t refer to inputs. Notice that $\omega_{st} = \frac{1}{2}(\omega^*_{st} + \omega^*_{ts}) = \omega_{ts}$ and $\omega_{s\pi} = \frac{1}{2}(\omega^*_{s\pi} + \omega^*_{\pi s}) = \omega_{\pi s}$.

$$\begin{aligned}
\mathrm{Ln\,P} =& \alpha_0 + \alpha_p \mathrm{Ln}\,\tilde{p} + \sum_i \delta_i \mathrm{Ln}\,y_i + \sum_s \omega_s \mathrm{Ln}\,w_s + \eta_\pi \mathrm{Ln}\,p_\pi + \tau\,\mathrm{Ln}\,r + \nu\,\mathrm{Ln}\,n + \rho\,\mathrm{Ln}\,k + \frac{1}{2}\alpha_{pp}\left(\mathrm{Ln}\,\tilde{p}\right)^2 \\
&+ \frac{1}{2}\sum_i\sum_j \delta_{ij} \mathrm{Ln}\,y_i\,\mathrm{Ln}\,y_j + \frac{1}{2}\sum_s\sum_t \omega^*_{st} \mathrm{Ln}\,w_s\,\mathrm{Ln}\,w_t + \frac{1}{2}\eta_{\pi\pi}\left(\mathrm{Ln}\,p_\pi\right)^2 + \frac{1}{2}\tau_{rr}\left(\mathrm{Ln}\,r\right)^2 \\
&+ \frac{1}{2}\nu_{nn}\left(\mathrm{Ln}\,n\right)^2 + \frac{1}{2}\rho_{kk}\left(\mathrm{Ln}\,k\right)^2 + \sum_j \theta_{pj} \mathrm{Ln}\,\tilde{p}\,\mathrm{Ln}\,y_j + \sum_s \phi_{ps} \mathrm{Ln}\,\tilde{p}\,\mathrm{Ln}\,w_s \\
&+ \psi_{p\pi} \mathrm{Ln}\,\tilde{p}\,\mathrm{Ln}\,p_\pi + \psi_{pr} \mathrm{Ln}\,\tilde{p}\,\mathrm{Ln}\,r + \psi_{pn} \mathrm{Ln}\,\tilde{p}\,\mathrm{Ln}\,n + \psi_{pk} \mathrm{Ln}\,\tilde{p}\,\mathrm{Ln}\,k \\
&+ \sum_j\sum_s \gamma_{js}\,\mathrm{Ln}\,y_j\,\mathrm{Ln}\,w_s + \sum_j \gamma_{j\pi} \mathrm{Ln}\,y_j\,\mathrm{Ln}\,p_\pi + \sum_j \gamma_{jr} \mathrm{Ln}\,y_j\,\mathrm{Ln}\,r + \sum_j \gamma_{jn} \mathrm{Ln}\,y_j\,\mathrm{Ln}\,n + \sum_j \gamma_{jk} \mathrm{Ln}\,y_j\,\mathrm{Ln}\,k \\
&+ \omega_{\pi s}\,\mathrm{Ln}\,p_\pi\,\mathrm{Ln}\,w_s + \sum_s \omega_{sr} \mathrm{Ln}\,w_s\,\mathrm{Ln}\,r + \sum_s \omega_{sn} \mathrm{Ln}\,w_s\,\mathrm{Ln}\,n + \sum_s \omega_{sk} \mathrm{Ln}\,w_s\,\mathrm{Ln}\,k \\
&+ \eta_{\pi r}\,\mathrm{Ln}\,p_\pi\,\mathrm{Ln}\,r + \eta_{\pi n}\,\mathrm{Ln}\,p_\pi\,\mathrm{Ln}\,n + \eta_{\pi k}\,\mathrm{Ln}\,p_\pi\,\mathrm{Ln}\,k + \tau_{rn} \mathrm{Ln}\,r\,\mathrm{Ln}\,n + \tau_{rk} \mathrm{Ln}\,r\,\mathrm{Ln}\,k + \nu_{nk} \mathrm{Ln}\,n\,\mathrm{Ln}\,k
\end{aligned} \tag{1.8}$$

The coefficients of this log-linear combination of variables are parameters to be estimated. Using the Shephard's lemma, the partial derivative of $\mathrm{Ln\,E}$ subject to $\mathrm{Ln}\,w_s$ is equal to the expenditure share allocated to the inputs:

$$\frac{\partial \mathrm{Ln\,E}}{\partial \mathrm{Ln}\,w_s} = \frac{w_s\,x_s}{E(y,n,v,k,U^O)} = \frac{w_s\,x_s}{p.y+m} \tag{1.9}$$

Equally, the expenditure share allocated to the profit can be defined as:

$$\frac{\partial \mathrm{LnE}}{\partial \mathrm{Lnp}_\pi} = \frac{p_\pi.\pi}{E(y,n,v,k,U^O)} = \frac{p_\pi.\pi}{p.y+m} \tag{1.10}$$

Based on the expenditure functional form (1.8) and the inputs and profit share equations (1.9) and (1.10), the profit share S_π can be defined as:

$$\begin{aligned}
S_\pi = \frac{\partial \mathrm{LnE}}{\partial \mathrm{Lnp}_\pi} = \frac{p_\pi.\pi}{p.y+m} =& \eta_\pi + \eta_{\pi\pi}\,\mathrm{Ln}\,p_\pi + \psi_{p\pi} \mathrm{Ln}\,\tilde{p} + \sum_j \gamma_{j\pi}\,\mathrm{Ln}\,y_j + \sum_t \omega_{t\pi}\,\mathrm{Ln}\,w_t \\
&+ \eta_{\pi r}\,\mathrm{Ln}\,r + \eta_{\pi n}\,\mathrm{Ln}\,n + \eta_{\pi k}\,\mathrm{Ln}\,k + \mu\left(\mathrm{Ln}\left(p.y+m\right) - \mathrm{Ln\,P}\right)
\end{aligned} \tag{1.11}$$

and the expenditure share allocated to the input s is equal to:

$$\begin{aligned}
S_s = \frac{\partial \mathrm{Ln\,E}}{\partial \mathrm{Ln}\,w_s} = \frac{w_s\,x_s}{p.y+m} =& \omega_s + \sum_t \omega_{st}\,\mathrm{Ln}\,w_t + \phi_{ps} \mathrm{Ln}\,\tilde{p} + \sum_j \gamma_{js}\,\mathrm{Ln}\,y_j + \omega_{\pi s} \mathrm{Ln}\,p_\pi \\
&+ \omega_{sr}\,\mathrm{Ln}\,r + \omega_{sn}\,\mathrm{Ln}\,n + \omega_{sk}\,\mathrm{Ln}\,k + v_s\left(\mathrm{Ln}\left(p.y+m\right) - \mathrm{Ln\,P}\right)
\end{aligned} \tag{1.12}$$

At last, the hypothesized optimality of total equity (k) is granted by:

$$\rho+\rho_{kk}\,\text{Ln}\,k+\psi_{pk}\,\text{Ln}\,\tilde{p}+\sum_j\gamma_{jk}\,\text{Ln}\,y_j+\sum_s\omega_{sk}\,\text{Ln}\,w_s+\eta_{\pi k}\,\text{Ln}\,p_\pi+\tau_{rk}\,\text{Ln}\,r+\nu_{nk}\,\text{Ln}\,n \\ +\kappa\left(\text{Ln}\left(p.y+m\right)-\text{Ln}\,P\right)=0 \tag{1.13}$$

Some restrictions on parameters have to be considered: some coefficients have to be symmetric; homogeneity constraints on input and profit shares have to be respected, and these shares should sum up to 1. These restrictions are presented in Appendix 1.1.

On the basis of the estimated coefficients vector $\hat{\beta}_t$ and the value of the different components of $Z_{b,t}=(p_{\pi_{b,t}},\tilde{p}_{b,t},y_{b,t},w_{b,t},r_{b,t},n_{b,t},k_{b,t},m_{b,t})$ relative to each date t and each bank b, we assess the expected profit share of bank b at date t as the estimated value of the profit share defined in (11), $S_\pi(\hat{\beta},Z_{b,t})$. From this expected profit share $S_\pi(\hat{\beta},Z_{b,t})$, we deduce the expected return on equity of bank b at time t:

$$ER_{b,t}=S_\pi(\hat{\beta}_t,Z_{b,t}).\frac{p_{b,t}.y_{b,t}+m_{b,t}}{k_{b,t}} \tag{1.14}$$

The relative risk is the estimated standard deviation of the expected return on equity. This risk is defined as:

$$RK_{b,t}=\left(\hat{X}_{b,t}\,\text{Var}\left(\hat{\beta}\right)\hat{X}'_{b,t}\right)^{1/2}\frac{p\,y_{b,t}+m_{b,t}}{k_{b,t}} \tag{1.15}$$

where $\hat{X}_{b,t}$ is the gradient of $S_\pi(\hat{\beta},Z_{b,t})$ valuated at point $Z_{b,t}$.

Finally, we can compute a risk-return couple for each bank at each date.

1.2.3. The risk-return frontier and the efficiency measure

To measure the relative risk-return efficiency of banks, we need a suitable layout of the so-called best practice frontier. This best practice frontier represents the optimal risk-return combinations. The shape of the BPF and the involved techniques for the estimation of this BPF have now to be stated. We can choose between two main methods[12] to estimate the BPF:

[12] See Bauer *et al.* (1998), Weill (2004) and Koetter *et al.* (2006) for a comparison of these techniques respectively on a set of US, European and German banks.

the Data Envelopment Analysis (DEA)[13] and the Stochastic Frontier Analysis (SFA)[14]. DEA is a (non parametric) linear programming method of envelopment of the risk/return combinations; the estimated envelope is assimilated to the BPF and the distance between risk/return combinations below the BPF and the envelope is imputed to inefficiency as a whole. On the contrary, the SFA approach of the BPF is a parametric one: the general shape of the BPF has to be chosen *a priori* and the parameters of this BPF are estimated under some distributional hypothesis. Moreover, the SFA approach breaks down the error term in two components: a pure stochastic element and the inefficiency component. The SFA method ensures that the resulting inefficiency measure is not biased by random disturbances while the DEA method may overestimate bank inefficiency by interpreting as an inefficient behavior what would result from a simple random shock. For this main reason, we will give advantage to the SFA approach and the DEA method will be used as a comparison.

Within the framework of this SFA approach, the risk/return frontier is specified as a production function for which the bank i produces some expected return $ER_{i,t}$ at time t on the basis of chosen risk $RK_{i,t}$. We then define the risk-return stochastic frontier on the basis of the Battese and Coelli (1992)[15] model:

$$ER_{i,t} = \alpha + \beta\, RK_{i,t} + \varepsilon_{i,t} \tag{1.16}$$

$$\text{with: } \varepsilon_{i,t} = \nu_{i,t} - u_{i,t}$$

The error term ε_{it}, which is time and bank-specific, is the sum of two components, $\nu_{i,t}$ and -$u_{i,t}$. The first one, $\nu_{i,t}$, is a two-sided random component which takes into account potential exogenous shocks which can impact the production function. It would be noticed that bank managers cannot be accountable for this random component from an inefficiency point of view. This first purely random component $\nu_{i,t}$ is assumed to be normally distributed with a zero mean and a variance $\sigma^2{}_v$:

$$\nu_{i,t} \sim N\ (0, \sigma_v)\,.$$

13 See Charnes *et al.* (1978) who were the first to introduce this method and Petey (2004) for an application of this method in a risk-return space.

14 See contemporaneous studies of Aigner *et al.* (1977), Battese and Corra (1977) and Meeusen and Van Den Broeck (1977).

15 The Battese and Coelli (1992) model uses maximum likelihood techniques to estimate a time-varying efficiency. We give advantage to this model because unlike previous ones, it relaxes the assumption that inefficiencies are constant through time (this hypothesis is hard to accept through many time periods (see Kumbhakar and Lovell (2000)).

The negative inefficiency component - $u_{i,t}$, is extracted from the left tail of a normal distribution with zero mean and variance $\sigma_u{}^2$:

$$u_{i,t} \sim N^+(0,\sigma_u)$$

The sample log-likelihood (see Battese and Coelli (1992)) is maximized relative to α, β, $(\sigma_v^2+\sigma_u{}^2)$ and a parameter γ which equals $\frac{\sigma_u{}^2}{(\sigma_v^2+\sigma_u{}^2)}$. γ is a measure of the relative contribution of the inefficiency component $u_{i,t}$ to the volatility of the whole $\varepsilon_{i,t}$.

At last, we infer the expected (conditional) $\hat{u}_{i,t}$ value for $u_{i,t}$ from the estimated $\hat{\varepsilon}_{i,t}$ and the conditional distribution of $u_{i,t}$ given $\varepsilon_{i,t}$. The managerial efficiency of bank *i* at time *t* is then computed as:

$$Efficiency_{it} = e^{-\hat{u}_{it}} \tag{1.17}$$

whose values lie between zero, for the less efficient banks, and one for the perfectly efficient ones.

We are now able to empirically compute a measure of bank's relative efficiency in terms of risk and return.

1.3. Empirical approach

In this section, we present the sample and the data used in this study as well as the variables used in order to estimate the risk-return efficiency.

1.3.1. Data and sample characteristics

Our study focuses on European listed[16] banks for which we have extracted consolidated financial statements from Fitch IBCA Bankscope database between 1998 and 2011. This

[16] We only include European listed (or delisted) banks to select an homogeneous sample of banks that allows us to estimate a common best-practice frontier and to extract a measure of each bank relative efficiency that is not affected by sample heterogeneity (Bos *et al.* (2009)). As robustness check, we still account for potential differences in environments among European countries by incorporating in the frontier equation a vector of

database reports annual balance sheets and income statements for 377 banks from the following countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom. As we are looking for systematic differences among banks characteristics, we do not impose a restriction on banks specialization and include either listed or delisted banks. For these banks, we also collect daily market data, necessary to compute market-based indicators, and board structure data from the Bloomberg database. To accurately estimate the annual frontier's parameters, a 5-year period of observations, [t-4; t], is required. We thus obtain a first risk-return frontier in 2002. By limiting the sample to banks for which we are able to estimate their efficiency for at least one year, and after cleaning bank production variables from outliers, we are left with a final sample of 192 banks from 2002 to 2011. This period includes the financial crisis, which goes from 2007 to 2009. See Appendix 1.2 for some general descriptive statistics of the sample.

Table 1.1 reports some general characteristics of our sample. The number of banks lightly varies among the first years. Yet, a large proportion of those 192 banks are present from 2007 to 2011. Italian (16%) and French (15%) banks are predominant[17] in our sample. Our set of banks is mainly composed of commercial banks (43%). It also includes cooperative banks (14%), bank holding companies (13%) and saving banks (12%). The set is composed of 143 listed banks and 49 delisted banks.

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variables that capture banks' country-specific environmental conditions (Dietsch and Lozano-Vivas (2000), Lozano-Vivas *et al.* (2002)).

[17] The low number of UK banks is due to a lack of data that prevent us to estimate risk-return efficiency for most of them.

Table 1.1: Distribution of banks

This table reports the distribution of the 192 banks by year, country and bank type.

By year	Number of banks (Number of listed)	Percentage
2002	76 (55)	7.59
2003	83 (61)	8.29
2004	81 (59)	8.09
2005	77 (57)	7.69
2006	78 (55)	7.79
2007	97 (77)	9.69
2008	123 (102)	12.29
2009	150 (117)	14.99
2010	147 (114)	14.69
2011	89 (74)	8.89
By country		
Austria	12 (8)	6.25
Belgium	2 (1)	1.04
Denmark	17 (10)	8.85
Finland	3 (3)	1.56
France	28 (20)	14.58
Germany	15 (10)	7.81
Greece	10 (9)	5.21
Ireland	4 (2)	2.08
Italy	30 (22)	15.63
Netherlands	6 (4)	3.13
Norway	19 (17)	9.90
Portugal	5 (3)	2.60
Spain	9 (6)	4.69
Sweden	7 (7)	3.65
Switzerland	14 (13)	7.29
United Kingdom	11 (8)	5.73
By type		
Commercial banks	82 (58)	42.71
Cooperative banks	26 (23)	13.54
Bank holding and bank holding companies	25 (21)	13.02
Saving banks	24 (20)	12.05
Investment banks	9 (6)	4.69
Real estate and mortgage banks	7 (7)	3.65
Other non-banking credit institutions	7 (6)	3.65
Private banking and asset mortgage companies	6 (3)	3.13
Specialized Governmental Credit Institution	6 (6)	3.13

1.3.2. Bank production variables

We assume that banks use three different inputs (x): x_1, the amount of fixed assets, x_2, the number of employees[18], and x_3, the sum of deposits[19], short term funding (i.e. total customer deposits, deposits from banks, other deposits and short term borrowings) and long term funding. Their prices are respectively w_1, other operating expenses to fixed assets, w_2, the amount of annual wages per employee, and w_3, interest expenses to the amount of deposits and borrowed funds. We include two outputs (y): y_1, the amount of gross loans, and y_2, the amount of other earnings assets. The related prices are respectively proxied by p_1, the ratio of interest income on loans to gross loans, and p_2, the sum of other interest income and net gains and losses on other activities to the amount of other earnings assets.

As a measure of assets quality, we consider the amount of loan loss provisions (n). We also include the amount of total equity (k). As non-asset based income, we consider the total of bank fees (m). To estimate the price of after tax-profit, we use countries' taxes on income, profits and capital gains (t) supplied by the World Bank Database. As a risk-free rate, we use the 3-month Treasury bond rate and, if not available, we consider the one with the shortest maturity available. A summary[20] and some descriptive statistics of these variables are presented in Appendix 1.3.

1.3.3. Estimating risk-return efficiency

In a first step, we estimate expected return and risk. We establish a demand system made of the profit share equation (eq. 1.11), the input share equation (eq. 1.12) and the equation that assesses the optimality of equity capital (eq. 1.13). Given the values of previous variables relative to each date and each bank, we estimate, for each year, the vector of the unknown coefficients of this system ($\hat{\beta}_t$), identical for all banks, by using nonlinear two-stage least squares over the 1998-2011 period. We then estimate an expected return and risk for each

[18] Bankscope does not provide the information each year for this variable. We assume that the number of employees is relatively stable over time. We can obtain a value for each year by interpolation and extrapolation using personal expenses, a highly correlated variable. To check whether this process affects the results, we estimate the expected return and risk on the original series of employees. Results remain the same.

[19] We follow the suggestion of Hughes and Mester (1993) to include bank deposits as an input of bank production.

[20] We remove the outliers of production variables. As robustness, we estimate the expected return and risk without dropping these outliers. We also use different risk-free rates or tax profit rates, include 3 outputs (derivatives and remaining earnings assets are associated with previous outputs), or finally use the OLS method to estimate the system. Overall the resulting measures are consistent with our main estimation.

bank and each year[21]. The expected return on equity (eq. 1.14) comes from the estimated profit share while risk is the standard deviation of the estimated return (eq. 1.15). These measures reflect what level of return managers can expect and the associated risk relative to their portfolio decisions.

In a second step we estimate the best-practice risk-return frontier which prevails for each year. To this end, expected return and risk variables have been rescaled with regard to their sample standard deviation as in Hughes *et al.* (1996) or DeYoung *et al.* (2001). The frontier equation is specified by equation 1.16. We estimate the frontier for each year based on a 5-year rolling window[22] to compute the yearly risk-return efficiency measure. Using a frontier estimated over the complete period would unsuitably suggest that the future information is known when we evaluate bank efficiency at time t[23]. Starting in 2002 and on the set of 192 banks, we estimate[24] the frontier parameter values by maximizing the log-likelihood associated to the model. Residuals $\hat{\varepsilon}_{i,t}$ are computed accordingly. Each estimated best-practice frontier is graphically represented in Appendix 1.4.

Finally the risk-return efficiency measure is estimated. As explained before, the residuals measure the distance from a risk-return combination to the best-practice frontier. This deviation from the optimal frontier may be due to mismanagement and/or an external positive or negative event[25]. The SFA model allows to disentangle suitably the residuals and isolates the inefficiency component, $\hat{u}_{i,t}$. The time dependent related efficiency score (eq. 1.17) varies in the range of 0 (the worst banks on an efficiency point of view) to 1 (the most efficient banks). This efficiency score is computed for each bank at each date over the 2002 – 2011 period.

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[21] We clean return and risk measures by removing some outliers' observations which wrongly drive the frontier estimate.
[22] For robustness check, we also compute a BPF_t computed using all the information available prior time *t*. We present it later.
[23] For robustness check, we estimate the efficiency relative to a single best practice frontier over the whole sample.
[24] We used the *SFA* function of the R - *FRONTIER* package to implement this estimation.
[25] In some cases, some risk-return points can overtake the frontier when random component of the error term cancels out (even exceeds) the inefficiency one.

1.4. Are there really inefficient banks?

The first objective of this section is to ensure that, at least, some banks are poorly managed, that is, there are some risk/return combinations which actually locate below the BPF because they are really inefficient. Furthermore, we wonder about the dispersion degree of the efficiency scores through banks. The second objective is then to check that the distribution of the efficiency measure is heterogeneous. At last, as efficiency scores have to be estimated, banks' ranking relative to these estimated scores may be influenced by our econometric choices related to the estimation method, the profile of the BPF or the estimation sample. Accordingly, we will test for the robustness of banks' efficiency ranking with regards to these econometric choices.

1.4.1. Does inefficiency matter?

Table 1.2 produces the estimates of each BPF_t, from t = 2002 to 2011. It should be reminded that the BPF, on the basis of which we assess bank inefficiency at time t, is estimated on a five-year sample [t-4, t]. Column 1 describes these samples. Column 2 gives the number of risk-return observations of the relevant sample. Column 3 provides the estimates of the efficient frontier parameters. Overall, the estimated frontier parameters are relatively stable over time: risk affects positively and significantly the expected return. This result is consistent with the theory suggesting that to reach a higher return, taking a higher risk is needed, regardless of the economic environment. We report in column 4 the estimated values of the variance of the inefficiency term while, in column 5, we focus on the parameter γ computed for each equation. This parameter is calculated as the ratio of the inefficiency component variance to the variance of the whole error term: this parameter γ measures the relative contribution of the inefficiency component to the total volatility i.e. the part of the deviation to the BPF due to banks' mismanagement. This parameter is significant for each frontier estimates with values between 0.47 and 0.75: inefficiency explains at least 50% of the sub-optimality of banks' expected risk-return choices. A large part of total volatility is then attributed to inefficiency. The stochastic part matters for at least 25%, which suggests that using a stochastic frontier method is relevant. Consequently, our results are in favor of the effectiveness of risk/return inefficiencies.

Table 1.2: Estimated frontiers

This table presents the estimates of each best practice frontiers from 2002 to 2011. ER is the expected return and RK, the risk. σ_u^2 is the variance of the inefficiency component. γ is defined as the ratio of the variance of the inefficiency term to the variance of the error term.

Years	Nb. Obs.	Frontier equation	σ_u^2	γ
1998 - 2002	180	$ER = 3.06^{***} + 0.06.RK$ (0.00) (0.41)	1.89^{***} (0.00)	0.75^{***} (0.00)
1999 - 2003	263	$ER = 2.94^{***} + 0.13^{**}.RK$ (0.00) (0.03)	1.66^{***} (0.00)	0.64^{***} (0.00)
2000 - 2004	344	$ER = 2.89^{***} + 0.16^{***}.RK$ (0.00) (0.00)	1.61^{***} (0.00)	0.62^{***} (0.00)
2001 - 2005	383	$ER = 2.81^{***} + 0.25^{***}RK$ (0.00) (0.00)	1.48^{***} (0.00)	0.57^{***} (0.00)
2002 - 2006	395	$ER = 2.91^{***} + 0.24^{***}.RK$ (0.00) (0.00)	1.45^{***} (0.00)	0.54^{***} (0.00)
2003 - 2007	416	$ER = 3.17^{***} + 0.19^{***}.RK$ (0.00) (0.00)	1.54^{***} (0.00)	0.58^{***} (0.00)
2004 - 2008	456	$ER = 3.24^{***} + 0.17^{***}.RK$ (0.00) (0.00)	1.84^{***} (0.00)	0.74^{***} (0.00)
2005 - 2009	525	$ER = 2.99^{***} + 0.20^{***}.RK$ (0.00) (0.00)	1.81^{***} (0.00)	0.73^{***} (0.00)
2006 - 2010	595	$ER = 2.67^{***} + 0.24^{***}.RK$ (0.00) (0.00)	1.41^{***} (0.00)	0.52^{***} (0.00)
2007 - 2011	606	$ER= 2.57^{***} + 0.20^{***}.RK$ (0.00) (0.00)	1.37^{***} (0.00)	0.47^{***} (0.00)

1.4.2. Distribution of the efficiency measure

Figure 1.1 represents the distribution of the efficiency measure over the whole period. Table 1.3, which reports the descriptive statistics of the efficiency measure on the same period, shows that the absolute range of the distribution is large as it goes from 0.022 to 0.841. However, there are a few observations in the left tail of the distribution. Most of observations (70%) are indeed located around the mean efficiency value, 0.506, and the relatively low standard deviation (0.135) supports this finding. These results give first insights to confirm that some banks lie further below the best practice frontier[26] and underline a relative difference in the efficiency of risk-return choices made by European banks. To go deeper in the description of the risk-return efficiency of European banks, we provide the mean efficiency scores for each country and bank type.

[26] A mean efficiency value close to one would suggest that the majority of banks is located near the best practice frontier.

Figure 1.1: Histogram of the efficiency measure

This figure shows the histogram of the efficiency measure on the whole sample.

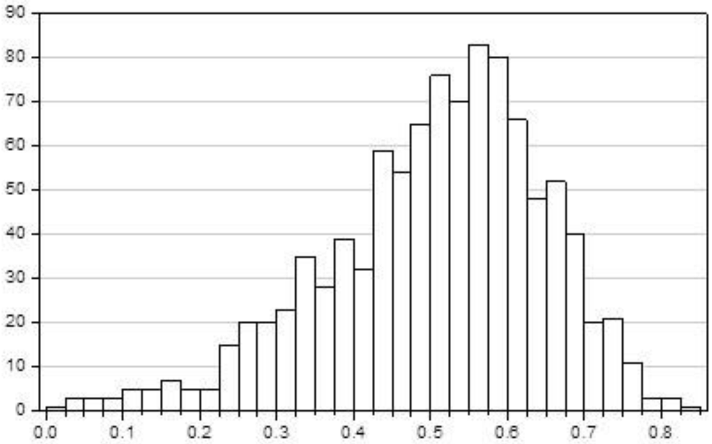


Table 1.3: Descriptive statistics of the efficiency measure

This table reports the main descriptive statistics of the efficiency measure on the whole sample.

	Efficiency measure
Mean	0.506
Median	0.525
Standard Deviation	0.143
Minimum	0.022
Maximum	0.841
Number of observations	1,001

Table 1.4 shows in the first part the distribution of efficiency by country. We perform a test of the null H0 "there is no differences in the average efficiency whatever the country". This test concludes in favor of the alternative: on average, efficiency is different across countries. Germany appears as the less performing country as regards to the mean of risk-return efficiency. A closer look actually shows a high dispersion which underlines different level of risk-return efficiency in the country.

We then focus on the relative performance of banks in terms of risk-return efficiency according to their specialization in the second part of Table 1.4. As banks are organized in a number of different ways, their efficiency may differ according to their ownership structure (Altunbas *et al.* (2001a)). Empirically, evidences are mixed. Studies on cost efficiency show that cooperative and saving banks have a cost efficiency advantage relative to commercial ones (see for instance Altunbas *et al.* (2001a), Weill (2004), Mamatzakis *et al.* (2008)). Petey (2004) underlines that cooperatives banks are better in their risk-return choices than savings banks which are in turn better than commercials ones. Subject to moral hazard incentives, private commercial banks tend to operate in the interests of their shareholders and might be expected to take greater risks than savings and cooperative banks. Because of their unconventional organizational design, savings and cooperative banks rely primarily on retail and small customers who have interests in keeping them safe and may exert a discipline by withdrawing funds with evidence of managerial inefficiency (Altunbas *et al.* (2001a)).

We perform a test of the null H0 "there is no differences in the average efficiency whatever the banks specialty" which concludes in favor of the alternative: on average, efficiency is different across different types of banks. This result confirms that banks' face a different level of risk-return efficiency according to their organizational forms. We conclude to a lower mean risk-return efficiency for commercial banks compared to saving ones but, contrary to the findings of Petey (2004), commercial and cooperative banks display a rather similar mean efficiency. This result is in line with the findings of Iannotta *et al.* (2007) who highlight that European mutual banks behave likewise private banks in terms of risk and operating costs because mutual banks become increasingly involved in the same range of activities of any private banks.

Table 1.4: Distribution of the efficiency measure

This table reports the distribution of the efficiency measure by country and bank type. T-stat is the Student statistic for H0: "the mean of efficiency is the same for all banks". ***indicate significance at the 1% level.

By country	N. of banks	Mean	Std. Dev.	Min	Max
Austria	12	0.472	0.120	0.152	0.664
Belgium	2	0.640	0.121	0.404	0.812
Denmark	17	0.487	0.110	0.200	0.656
Finland	3	0.533	0.101	0.373	0.710
France	28	0.460	0.128	0.062	0.842
Germany	15	0.398	0.186	0.022	0.788
Greece	10	0.521	0.133	0.222	0.734
Ireland	4	0.531	0.186	0.253	0.792
Italy	30	0.504	0.137	0.069	0.719
Netherlands	6	0.526	0.186	0.153	0.740
Norway	19	0.571	0.097	0.276	0.765
Portugal	5	0.592	0.115	0.266	0.761
Spain	9	0.574	0.104	0.354	0.779
Sweden	7	0.522	0.129	0.083	0.729
Switzerland	14	0.488	0.122	0.046	0.744
United Kingdom	11	0.538	0.166	0.077	0.802
	T-Stat	10.387***			

By type					
Commercial banks	82	0.506	0.148	0.038	0.813
Cooperative banks	26	0.492	0.106	0.242	0.762
Bank holding and bank holding companies	25	0.519	0.161	0.044	0.765
Saving banks	24	0.555	0.108	0.221	0.758
Investment banks	9	0.453	0.148	0.111	0.802
Real estate and mortgage banks	7	0.504	0.191	0.022	0.842
Other non-banking credit institutions	7	0.466	0.168	0.202	0.708
Private banking and asset mortgage companies	6	0.444	0.151	0.119	0.710
Specialized Governmental Credit Institution	6	0.498	0.076	0.345	0.664
	T-Stat	5.141***			

1.4.3. Are banks' rankings correlated across efficiency methods?

Efficiency measures may significantly vary according to different econometric alternatives. Correlatively, these econometric choices possibly impact banks' efficiency ranking. Hence, we now test for the robustness of our banks' efficiency ranking whatever are these econometric choices.

1.4.3.1. Stability relative to the frontier estimation

We check, at first, whether efficiency ranking is affected by the estimation of the BPF, i.e. we control for the choice we made to estimate a time dependent frontier based on a 5-year rolling window. We now compute the efficiency scores for each year relative to a single BPF computed on all available observations over the complete period 1998-2011 (see Koetter (2006), Petey (2004)). The induced banks' efficiency ranking is referred as "SINGLE" in tables 1.5 to 1.7. Also, we compute the efficiency scores for each year t relative to a BPF estimated on a growing sample of observations, i.e. a window [1998, t] and the relating ranking is "PAST" in tables 1.5 to 1.7.

1.4.3.2. Stability relative to the frontier specification

We check now for the neutrality of our linearity choice relating to the BPF design on banks' efficiency ranking. Papers such as Hughes *et al.* (1996) or DeYoung *et al.* (2001), assume that the risk-return frontier is not linear, underlying that risk positively affects bank expected return but at a decreasing rate. Accordingly, while remaining within the SFA methodology, we also estimate an alternative frontier specified as:

$$ER_{i,t} = \alpha + \beta_1 \, RK_{i,t} + \beta_2 \, RK^2_{i,t} + \varepsilon_{i,t} \qquad (1.18)$$

$$\text{with: } \varepsilon_{i,t} = v_{i,t} - u_{i,t}$$

The relevant ranking is referred as "NON-LINEAR" in tables 1.5 to 1.7.

1.4.3.3. Stability relative to the frontier model

Previous articles compare the SFA and the DEA approaches of the BPF (see Koetter *et al.* (2006) or Weill (2004)). Some of them give advantages to the DEA as such a method does not require any assumption about the functional form of the frontier or the error distribution. We then use, as an alternate choice, a DEA model to assess efficiency scores and "DEA" ranking in tables 1.5 to 1.7.

Until now, the estimation of the efficiency rests on some homogeneity hypothesis and we do not consider banks heterogeneity across countries or specialties. However, Mester (1997) underlines that banks could operate in different market or institutional contexts; in that way, the efficiency scores would be estimated on the basis of specific best-practice frontiers and not a common one. Consequently, we have to check whether our approach fits well across heterogeneous markets. To take into account heterogeneity, we estimate alternately the efficiency scores according to Battese and Coelli (1995)[27] and we use country dummies variables, bank size and a measure of each country's economic cycle to model the inefficiency error differently (HETEROGENEITY ranking in tables 1.5 to 1.7).

1.4.3.4. Comparison between efficiency methods

Table 1.5 gives the main descriptive statistics, the variance of the inefficiency component and the parameter γ[28] for each alternative econometric choice. Table 1.6 provides the results of tests of mean equality which compare the mean value of risk-return efficiency of the main method with those of alternative ones.

First, whatever the measure, the contribution of the inefficiency component is about 50 % of the total volatility of the error term. Regardless of the sample definition, the frontier estimation, specification or model, this parameter indicates that inefficiency always matters in our sample of banks.

Second, when the efficiency is estimated on a growing sample or when the efficient frontier is assumed to not be linear, tests of mean equality underline that both mean values of risk-return efficiency are similar with the main estimation. This result suggests that the efficiency measure is not affected either when the specification of the frontier is different or when we consider all the past information available at time t to compute the frontier.

Third, when we measure the risk-return efficiency relative to a single BPF computed on all the whole sample, results show a higher average efficiency. This estimation inherently assumes that *ex-post* information is known at time t and that the shape of the frontier is the same for each year. Presumably, this choice of a fixed frontier leads to overestimate the

[27] The Battese and Coelli (1995) model extends the Battese and Coelli (1992) one by expressing the one-sided inefficiency error component (u_{it}) as a linear function of explanatory variables that reflects banks and countries specific characteristics.
[28] To only get one value by measure, we compute the mean value of this parameter through years.

efficiency of banks because, although relatively stable, the shape of the frontier varies each year as we underlined in the main estimation.

Four, mean levels of efficiency turn out to be lower with the DEA method or when we account for heterogeneity. In the DEA method case, this result is in line with previous findings in literature. Studies generally find that nonparametric methods yields relatively low efficiencies scores compare to parametric ones (see Weill (2004) or Koetter *et al.* (2006) for a review of these studies). Indeed, this DEA approach tends to overestimate bank inefficiencies and dispersion in the data as it may falsely count as inefficiency, differences resulting from a random shock (Berger and Humphrey (1997)).

While we estimate alternately the efficiency scores taking into account heterogeneous environments, we suggest that some of the deviation from the best practice frontier may be due to heterogeneity across banking or environmental specificities. The resulting lower mean efficiency suggests that some deviations may be then identified as efficiency by the main method whereas they may actually reflect systematic differences. Accordingly, Bos *et al.* (2005) find that accounting for heterogeneity affects mean efficiency estimates leading notably to lower mean cost efficiency. Our result in terms of risk-return efficiency confirms this finding.

Table 1.5: Descriptive statistics for alternative methods of efficiency estimates

This table provides general descriptive statistics on alternative methods to estimate bank efficiency. σ_u^2 is the variance of the inefficiency component. γ is the part of the variance of the inefficiency term to the variance of the error term. We compute the mean value of this parameter through years. "SINGLE" is the efficiency ranking related to a unique frontier. "PAST" refers to an efficiency score estimated per year, with a frontier based on all the past available information. "NON-LINEAR" refers to the introduction of a squared risk term into the equation of the best practice frontier. "DEA" is the ranking involved by a DEA model. "HETEROGENEITY" takes into account countries' specificities, bank size and countries' business cycle.

	Mean	Min	Max	Std Dev	σ_u^2	Mean γ	N
A. Frontier estimation							
SINGLE	0.582	0.118	0.831	0.107	1.364	0.473	1,001
PAST	0.510	0.047	0.830	0.129	1.574	0.598	996
B. Frontier specification							
NON-LINEAR	0.507	0.040	0.835	0.132	1.586	0.627	996
C. Frontier model							
DEA	0.492	0.000	1.000	0.207	-	-	996
HETEROGENEITY	0.347	0.003	1.000	0.216	0.780	0.565	1,001

Table 1.6: Test of mean equality for alternative methods of efficiency estimates

This table compares the mean values of risk-return efficiency between our main measure and the alternate ones. "MAIN" refers to our baseline estimation of bank efficiency. "SINGLE" is the efficiency ranking related to a unique frontier. "PAST" refers to an efficiency score estimated per year, with a frontier based on all the past available information. "NON-LINEAR" refers to the introduction of a squared risk term into the equation of the best practice frontier. "DEA" is the ranking involved by a DEA model. "HETEROGENEITY" takes into account countries' specificities, bank size and countries' business cycle.

***,**,* indicate significance at the 1, 5, and 10 levels respectively. T-stat is the Student statistic for H0: "The mean value of efficiency is the same between our main measure and the alternate ones".

Alternative methods	T-Stat MAIN vs Alternative methods
SINGLE	13.54^{***}
PAST	0.665
NON-LINEAR	0.507
DEA	-1.75^{*}
HETEROGENEITY	-19.43^{***}

Despite a substantial amount of research, there is no consensus on the best method for measuring the efficient frontier (Bauer *et al.* (1998)). We cannot claim that one of the alternative measure prevails as the true level of banks' inefficiency cannot be observed. However, the efficiency measure derived from each approach should give consistent results in terms of banks' rank-order. Although efficiency levels may vary between alternative methods, these ones then should generate similar efficiency rankings of banks as they measure the same managerial ability. According to Bauer *et al.* (1998), if using alternative methods rank institutions differently then policy implications, conditional on the method employed, may be fragile. The stability of ranking of banks is then even more important for regulatory policy decisions than the absolute level of efficiency.

Hence, we test for the null of no correlation between our main ranking and the alternate ones involved by different econometric choices. Table 1.7 provides the Spearman's rank-order correlation between this main ranking ("MAIN") and the alternate ones over the whole period. All these rank correlations are positive and strongly significant. Efficiency rankings are quite similar across methods. Yet, this table further reveals that these rankings are slightly affected when we account for heterogeneity. Indeed, the inclusion of banking and environmental specificities leads to a decline of rank order correlation to 70% which suggests that a portion of banks are ranked differently.

Moreover, the statistically significant correlation of 0.82 between the main measure and the DEA method is particularly interesting. This result suggests that parametric and non parametric methods rank banks similarly according to their level of risk-return efficiency while previous studies mostly report an insignificant or very weak correlation (Ferrier and Lovell (1990)), Sheldon (1994), Bauer *et al.* (1998), Weill (2004), Koetter *et al.* (2006)). This result is thus in line with the few European studies which find that both SFA and DEA methods rank banks similarly e.g. Resti (1997) who focus on the cost-efficiency of Italian banks.

Overall, each method ranks banks approximately in the same order. Then we conclude in favor of the robustness of our main ranking as to the alternate econometric choices.

Table 1.7: Banks' efficiency ranking and econometric choices: some robustness checks

This table shows the rank-order correlation between our banks' efficiency main ranking and the alternate ones. "MAIN" refers to our baseline estimation of bank efficiency. "SINGLE" is the efficiency ranking related to a unique frontier. "PAST" refers to an efficiency score estimated per year, with a frontier based on all the past available information. "NON-LINEAR" refers to the introduction of a squared risk term into the equation of the best practice frontier. "DEA" is the ranking involved by a DEA model. "HETEROGENEITY" takes into account countries' specificities, bank size and countries' business cycle.

	MAIN
MAIN	1.00
SINGLE	0.89
PAST	0.99
NON-LINEAR	0.99
DEA	0.82
HETEROGENEITY	0.70

1.5. Is bank efficiency stable?

According to Bauer *et al.* (1998), a relative stability over time of banks' efficiency is needed for regulatory policy objectives. The financial crisis may have altered banks' efficiency ranking, and the ability of some banks to manage risk suitably may have been impacted by the turmoil. In this section, we determine the year-to-year stability of banks' efficiency ranking and analyze the evolution of efficiency through years to observe whether the less efficient (resp. most efficient) banks remain inefficient (efficient) before, during and after the financial crisis period.

1.5.1. Stability over time of banks' efficiency ranking

Table 1.8 provides the Spearman rank-order correlations between the efficiency rankings relative to each couple of years. In the short term, these correlations appear to be positive and significant. The rankings are highly correlated year-to-year and exhibit few changes from one year to another. This finding suggests that efficiency measure is quite stable in the short run. This is consistent with Koetter *et al.* (2006) which find a similar result in the case of German banks. In the same way, Berger and Humphrey (1997) highlight that efficiency is reasonably persistent. However, we observe a decline in correlation coefficients over time along with their significance. An efficient (inefficient) bank at time t is not necessarily efficient (inefficient) at t + k if k is large. These results suggest a change in banks' efficiency ranking in the long term, in particular after the financial crisis.

Table 1.8: Rank-order correlations of efficiency through years

This table produces the Spearman rank-order correlation of efficiency rankings between each couple of years, from 2002 to 2011.

***,**,* indicate significance at the 1%, 5%, and 10% levels respectively.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
2002	1.00									
2003	0.72***	1.00								
2004	0.64***	0.70***	1.00							
2005	0.39***	0.45***	0.76***	1.00						
2006	0.47***	0.30***	0.59***	0.71***	1.00					
2007	0.49***	0.64***	0.32***	0.44***	0.74***	1.00				
2008	0.53***	0.52***	0.36***	0.47***	0.67***	0.77***	1.00			
2009	0.42***	0.51***	0.35***	0.41***	0.50***	0.61***	0.79***	1.00		
2010	0.25*	0.35**	0.35***	0.54***	0.57***	0.59***	0.58***	0.65***	1.00	
2011	0.12	0.43**	0.10	-0.02	-0.15	0.32**	0.35**	0.70***	0.83***	1.00

1.5.2. Level of banks' efficiency before, during and after the financial crisis period

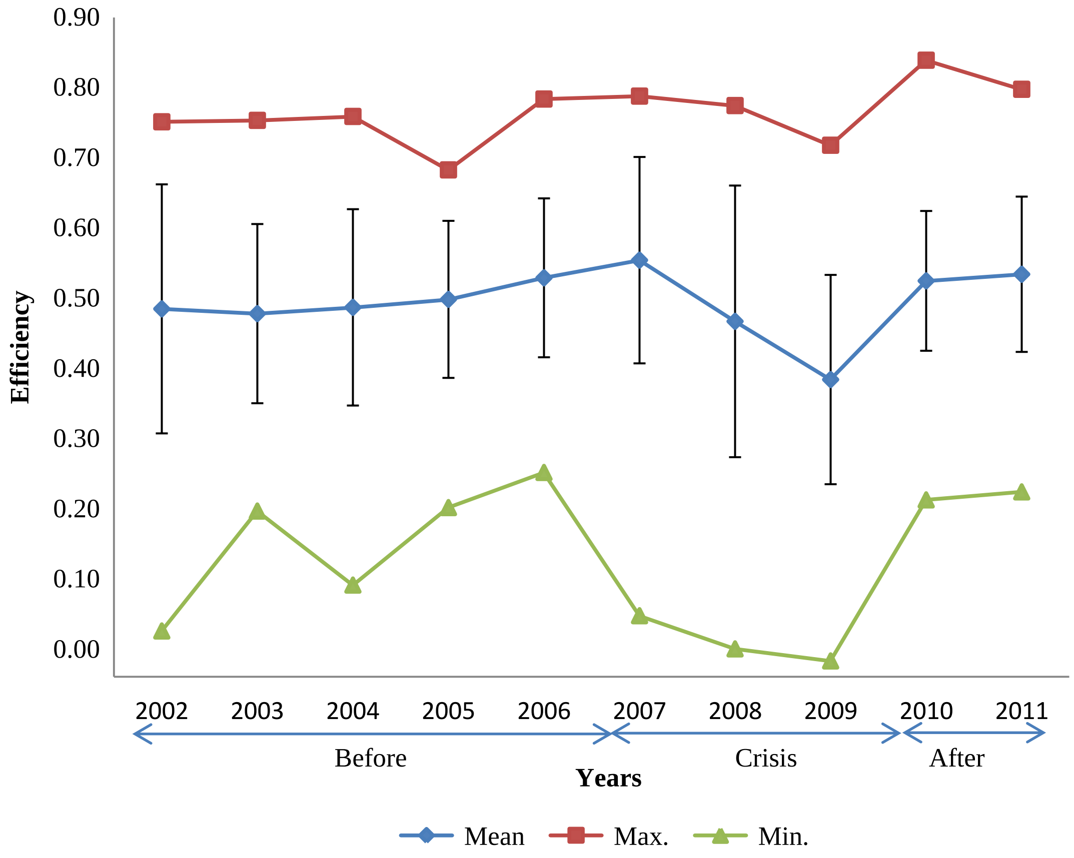
Figure 1.2 produces the evolution of efficiency through years. We distinguish 3 periods of time[29]: before the financial crisis (2002-2006), the financial crisis (2007-2009) and after the financial crisis (2010-2011). This graph confirms that efficiency level is relatively stable around the value of 0.50 before and after the financial crisis. However, during the financial crisis, the mean efficiency substantially decreased while the standard deviation increased. The spread between maximum and minimum is also much more important as some banks underperform during this period reaching a very low level of efficiency.

These assessments raise several questions about the evolution of banks' efficiency ranking through years and especially about the ranking of extreme performers. Do the most (less) efficient banks before the crisis period maintain their ranking during and after the crisis period? Symmetrically, did the most (less) efficient banks after the crisis period already belong to the most (less) efficient group before and during the financial crisis? Are the most (less) efficient banks during the crisis period over-performed (under-performed) on the other subsamples?

[29] According to the definition provided by the Bank of International Settlements, the financial crisis period goes from 2007 to 2009 (Bank of International Settlements (2010a)). We hence define the period ranging from 2002 to 2006 as before the financial crisis and the period ranging from 2010 to 2011 as after the financial crisis. Even if we mainly focus on the financial crisis because of its impact on the banking sector, the "after the financial crisis" period should not be assimilated to a sound period as the European debt crisis started to affect some of European countries from late 2009 (see Banque de France (2012)).

Figure 1.2: Mean efficiency per year

This figure shows the evolution of efficiency measure through the maximum value (■), the minimum value (▲) and the mean value (♦) for each year. Sticks around the mean curve represent the standard deviation of efficiency. Before refers to the 2002-2006 period, Crisis to the 2007-2009 period and After to the 2010-2011 period.



1.5.3. Did the financial crisis affect banks' efficiency ranking?

For each sub-period (before, during and after crisis), we compute the mean of the efficiency score for each bank. Then, for each sub-period, banks are ranked among the different deciles of the efficiency score distribution. The two first (resp. last) deciles identify the less (resp. most) efficient banks for a given sub-period[30]. We wonder now whether the most (or less) efficient banks match through the different sub-periods.

[30] We made the same investigation by either using banks located on the 10th decile or banks that belong to the 8th, 9th or 10th deciles. We apply the same logic for the group of the less efficient banks. Results are similar.

1.5.3.1. Re-distribution during and after the crisis of the most (less) efficient banks before the crisis period

Table 1.9 displays the re-distribution during and after the crisis period of those banks which were ranked as most (or less) efficient banks before the crisis period. On the upper (lower) part of the table, we focus on the group of most (less) efficient banks before the crisis period and investigate how these banks are ranked on the following periods.

This table shows that 50% of the most efficient banks before the crisis still belongs to the most efficient group during the crisis period. Equally, around 50% of the most efficient banks before the crisis are listed among the most efficient after the crisis period. Overall, a large part of banks formerly ranked in the top two deciles before the financial crisis are able to maintain their ranking on the following periods. But around 10% of banks that were previously best performers are re-ranked as less efficient after the crisis period. These banks experienced a decline in their relative level of efficiency through years so that they are now listed in the group of less efficient banks during the most recent period.

However, none of the less efficient banks before the crisis has been able to improve its ranking to integrate the group of the most efficient during and after the crisis. They manage to reach the 6th decile during the crisis and the 8th after. Yet, only 37% of the less efficient banks before the crisis are re-ranked in this same group after the crisis. A large part of the worst performing banks has been able to improve their ranking through time.

Table 1.9: Re-distribution during and after the crisis of most and less efficient banks before the crisis period

This table displays the re-distribution during the crisis period (2007-2009) and after (2010-2011) of the most and less efficient banks before the crisis period (2002-2006). For each sub-period, those banks which belong to the 9th and 10th deciles are considered as the most efficient whereas banks in the 1st and 2nd deciles are considered as the less efficient ones. The upper (lower) part of the table focuses on the group of most (less) efficient banks before the crisis period and indicates what percentage of this group of banks is re-located in each decile of the following periods.

Subsample: The 20% most efficient banks *before* the crisis period

		During the crisis	After the crisis
Less efficient	1st decile	0.00 %	10.53 %
	2nd decile	0.00 %	0.00 %
	3rd decile	0.00 %	0.00 %
	4th decile	15.00 %	5.26 %
	5th decile	0.00 %	10.53 %
	6th decile	5.00 %	5.26 %
	7th decile	10.00 %	15.79 %
	8th decile	20.00 %	5.26 %
Most efficient	9th decile	30.00 %*	26.32 %
	10th decile	20.00 %*	21.05 %

**These figures show that 50% (30%+20%) of the most efficient banks before the crisis period still belongs to the group of the most efficient banks during the crisis period.*

Subsample: The 20% less efficient banks *before* the crisis period

		During the crisis	After the crisis
Less efficient	1st decile	25.00%*	12.50%
	2nd decile	18.75%*	25.00%
	3rd decile	25.00%	12.50%
	4th decile	18.75%	18.75%
	5th decile	6.25%	12.50%
	6th decile	6.25%	6.25%
	7th decile	0.00%	6.25%
	8th decile	0.00%	6.25%
Most efficient	9th decile	0.00%	0.00%
	10th decile	0.00%	0.00%

**These figures show that 43.75% (25%+18.75%) of the less efficient banks before the crisis period still belongs to the group of the less efficient banks during the crisis period.*

1.5.3.2. Re-distribution before and after the crisis of the most and less efficient banks during the crisis period

Table 1.10 shows the re-distribution before and after the crisis period of the most and less efficient banks during the crisis period. On the upper (lower) part of the table, we focus on the group of most (less) efficient banks during the crisis period and investigate how these banks are ranked on the previous and following periods.

Half of the most efficient banks during the financial crisis are also identified as the most efficient ones before and after this period. Overall, the top performers in the crisis context were already well ranked before. Yet, after the crisis, the other half of most efficient banks during the crisis is spread all over subordinate deciles, and even 10% of these banks are downgraded towards the less efficient group (the first two deciles).

Most of worst performing banks during the crisis period belonged to the same low-ranked deciles before or after the crisis. However, 4% of them overturn completely their ranking after the crisis period.

Table 1.10: Re-distribution before and after the crisis of most and less efficient banks during the crisis period

This table displays the re-distribution before the crisis period (2002-2006) and after (2010-2011) of the most and less efficient banks during the crisis period (2007-2009). For each sub-period, those banks which belong to the 9th and 10th deciles are considered as the most efficient whereas banks in the 1st and 2nd deciles are considered as the less efficient ones. The upper (lower) part of the table focuses on the group of most (less) efficient banks before the crisis period and indicates what percentage of this group of banks is re-located in each decile of the previous and following periods.

Subsample: The 20% most efficient banks *during* the crisis period			
		Before the crisis	**After the crisis**
Less efficient	1st decile	0.00 %	6.45 %
	2nd decile	0.00 %	3.23 %
	3rd decile	9.09 %	3.23 %
	4th decile	0.00 %	3.23 %
	5th decile	9.09 %	3.23 %
	6th decile	18.18 %	9.68 %
	7th decile	9.09 %	6.45 %
	8th decile	9.09 %	12.90 %
Most efficient	9th decile	22.73 %*	19.35 %
	10th decile	22.73 %*	32.26 %

**These figures show that 45.46% (22.73%+22.73%) of the most efficient banks during the crisis were already identified as most efficient banks before the crisis period.*

Subsample: The 20% less efficient banks *during* the crisis period			
		Before the crisis	**After the crisis**
Less efficient	1st decile	42.86 %*	32.00 %
	2nd decile	7.14 %*	24.00 %
	3rd decile	7.14 %	12.00 %
	4th decile	21.43 %	0.00 %
	5th decile	7.14 %	12.00 %
	6th decile	0.00 %	8.00 %
	7th decile	0.00 %	8.00 %
	8th decile	14.29 %	0.00 %
Most efficient	9th decile	0.00 %	4.00 %
	10th decile	0.00 %	0.00 %

**These figures show that 50% (42.86%+7.14%) of the less efficient banks during the crisis were already identified as less efficient banks before the crisis period.*

1.5.3.3. Re-distribution before and during the crisis of the most and less efficient banks after the crisis period

Table 1.11 reports the re-distribution before and during the crisis period of the most and less efficient banks after the crisis period. On the upper (lower) part of the table, we focus on the group of most (less) efficient banks after the crisis period and investigate how these banks were ranked across previous periods.

We first wonder in which decile were previously located those banks which will be in the most efficient group after the crisis period. The results show that nearly 40% of them were ranked similarly before the crisis and, most importantly, 60% during the crisis. By considering the 8^{th} decile, 82% of the most efficient banks after the crisis were formerly ranked in the top three deciles during the crisis period. Overall, banks identified as the most efficient ones after the crisis period exhibited a comparable ranking during the crisis period.

Half of the less efficient banks after the crisis period are also listed as the less efficient ones on previous periods. The results also shows that, among the less efficient banks after the crisis, 15.38% and 11% were respectively belonging to the group of the most efficient banks before and during the crisis.

Table 1.11: Re-distribution before and during the crisis of most and less efficient banks after the crisis period

This table displays the re-distribution before the crisis period (2002-2006) and during (2007-2009) of the most and less efficient banks after the crisis period (2010-2011). For each sub-period, those banks which belong to the 9th and 10th deciles are considered as the most efficient whereas banks in the 1st and 2nd deciles are considered as the less efficient ones. The upper (lower) part of the table focuses on the group of most (less) efficient banks before the crisis period and indicates what percentage of this group of banks is re-located in each decile of the previous periods.

Subsample: The 20% most efficient banks *after* the crisis period

		Before the crisis	During the crisis
Less efficient	1st decile	0.00 %	0.00 %
	2nd decile	0.00 %	3.57 %
	3rd decile	9.09 %	0.00 %
	4th decile	9.09 %	0.00 %
	5th decile	4.55 %	3.57 %
	6th decile	13.64 %	3.57 %
	7th decile	4.55 %	7.14 %
	8th decile	18.18 %	25.00 %
Most efficient	9th decile	22.73 %*	32.14 %
	10th decile	18.18 %*	25.00 %

**These figures show that 40.91% (22.73%+18.18%) of the most efficient banks after the crisis were already identified as the most efficient banks before the crisis period.*

Subsample: The 20% less efficient banks *after* the crisis period

		Before the crisis	During the crisis
Less efficient	1st decile	23.08%*	25.93%
	2nd decile	23.08%*	25.93%
	3rd decile	7.69%	18.52%
	4th decile	15.38%	3.70%
	5th decile	0.00%	11.11%
	6th decile	0.00%	0.00%
	7th decile	0.00%	0.00%
	8th decile	15.38%	3.70%
Most efficient	9th decile	7.69%	3.70%
	10th decile	7.69%	7.41%

**These figures show that 46.16% (23.08%+23.08%) of the less efficient banks after the crisis were already identified as the less efficient banks before the crisis period.*

1.5.3.4. Summary

The findings highlight that a large part of most efficient banks tend to stay in this group over the three periods while a small part of them are re-ranked as less efficient over time. Likewise, less efficient banks during the crisis kept their ranking after, strengthening the result of a stability of banks' efficiency ranking for best and worst performers, especially in the short time. Nevertheless, a significant proportion of the less efficient banks at the beginning of the period improved their ranking later.

Overall, the results imply that efficiency is quite stable over time, but there is also a possibility of risk-return efficiency improvement. This suggests that in the long term, there is no fate at being inefficient.

1.6. Are there common banks' characteristics depending on their level of efficiency?

In this section, we try to determine the characteristics of efficient and inefficient banks in terms of activity, accounting or board structure indicators.

1.6.1. Activity, accounting and board structure indicators

1.6.1.1. Balance sheet and income statement indicators

The objective is to identify how bank efficiency varies with several aspects of bank balance-sheet and income statement. Empirical literature provides some evidences that bank efficiency is somehow related to bank's performance/profitability, level of capital, lending activities, size, risk-taking and solvency[31]. Appendix 1.5 presents the descriptive statistics of these variables and Appendix 1.7 provides their correlations table.

1.6.1.1.1. Performance and profitability

Previous studies that have explored the relationship between bank efficiency and performance/profitability mostly find that more efficient banks are more profitable (displaying a higher return on equity or return on assets) and better control their costs (with a lower costs ratio) (Casu and Girardone (2004)). For instance, profit efficiency allows to

[31] The accounting measures come from Bankscope Database and the market ones from Bloomberg Database.

evaluate the overall performance of a firm. A firm that is relatively profit efficient maximizes its profit with paying attention to both cost minimization and revenue maximization objectives (see Berger and Mester (1997)). Profit efficient banks turn out to be more profitable and would appear as better managed.

We then wonder whether more able managers in terms of risk-return efficiency are also more able to generate profits and to control their costs. To capture bank performance, we choose the cost to income ratio (CTIR) defined as the total of non-interest expenses to revenues. Profitability is measured by the return on average asset (ROA) that is the total operating income to total assets.

1.6.1.1.2. Capital

Previous studies highlight a positive relationship between bank efficiency and capital levels: more efficient banks tend to have higher capital ratios (Mester (1996), Kwan and Eisenbeis (1997), Fiordelisi *et al.* (2011)). Equity ratios, such as the equity to total asset ratio, reflect the degree to which shareholders have their own capital at risk in the bank and, therefore, their incentives to monitor bank management. Highly capitalized banks are then likely to be more efficient because they are more subject to shareholders' discipline (Eisenbeis *et al.* (1999), Casu and Girardone (2004)).

To account for capital adequacy and leverage, we respectively consider the ratio of Tier 1 capital divided by risk weighted assets (TIER1R) and the total equity to total asset ratio (EQTA).

1.6.1.1.3. Lending activities

Some papers highlight a relationship between banks lending activities and efficiency. On one hand, banks that are specialized in lending activities appear as more efficient as they have a comparative advantage in managing credit risk (Spong *et al.* (1995), Petey (2004), Casu and Girardone (2004)). On the other hand, banks may focus on traditional lending activities because managers are not able to diversify activities and fail to create new growth opportunities that make banks less efficient (Casu and Girardone (2004)). We then wonder whether the level of bank risk-return efficiency is related to the lending activities of banks.

To address this question we consider the level of loans proxied by the ratio of net loans to total assets (NLTA). We also use the ratio of net interest income to total operating income (NIIOPINC) that indicates the share of banks’ traditional revenue.

1.6.1.1.4. Size

Bank size is an important factor for banks that allows them to operate optimally by obtaining scale and scope economies. According to the literature the relationship between bank size and efficiency is ambiguous. First, more efficient banks are reported to be the largest ones; larger banks may choose product mixes that conduct to larger scope economies (Berger *et al.* (1993), Miller and Noulas (1996)). Second, more efficient banks may be the smallest ones; smaller banks are more focused on an specific activity that aware them some operational advantages and scale economies (De Young and Nolle (1996), Isik and Hassan (2002)). Studies such as Mester (1996) failed to find a relationship between bank size and efficiency.

We examine whether the level of risk-return efficiency is related to the size of the bank by measuring bank size as bank total assets (TA).

1.6.1.1.5. Risk

The empirical literature mostly provides evidences that less efficient banks are also riskier (Kwan and Eisenbeis (1997), Williams (2004), Fiordelisi *et al.* (2011)). Poorly managed banks tend to make bad loans (Berger and DeYoung (1997)). They face higher costs because of an inefficient control of their operating expenses and an inadequate credit monitoring that lead them to take higher risks to compensate for the lost returns. This negative link between efficiency and risk - taking is referred by Berger and DeYoung (1997) as "bad management" hypothesis. Altunbas *et al.* (2007) fail to find a negative relationship between efficiency and risk-taking and conclude that inefficient banks tend to take on less risks in the short term.

The objective is here to investigate whether the less (more) efficient banks in terms of expected risk-return have a level of effective risk higher (lower) than the one of more (less) efficient banks. We consider two indicators of banks risk-taking: credit risk, measured by banks' provisions with the ratio of loan loss provisions to net loans (LLPNL) and total bank risk (TRISK), proxied by the standard deviation of weekly bank stock returns computed on a moving window of 52 quoted weeks.

1.6.1.1.6. Solvency

Risk-return efficient banks should have a lower probability of experiencing financial distress (DeYoung *et al.* (2001), Petey (2004)). A relative risk-return inefficient bank fails to reach the optimal level of return and its level of risk-taking turns out to be excessive for its level of expected return. This excessive risk increases the level of bank default risk. Accordingly, we expect that more risk-return efficient banks make a better risk-return trade-off that lead them to be more solvent.

We measure bank solvency by using a market based Z-score (ZMKT) computed with a market measure of bank stock return and the previous total risk as (1 + average return) / TRISK.

1.6.1.2. Board structure indicators

In this section we wonder whether board structure in banks relates to risk-return efficiency. The board plays an important role in monitoring managers' behavior and decisions. Board members should have sufficient knowledge of the main bank's financial activities and independence to advise managers efficiently on strategy identification and implementation and to enable effective governance and oversight (Bank of International Settlements (2015)). Through internal risk governance mechanism, they would also monitor bank's managers risk-taking to ensure that the risk management is consistent with the strategy and policies approved by the board and bank's risk appetite (Minton *et al.* (2014)). Previous studies that investigate the impact of board structure[32] on bank performance or efficiency reveal that empirical evidences are mixed. Regarding bank board structure, we then focus on several indicators provided by Bloomberg Database[33]. Appendix 1.6 reports the descriptive statistics of these indicators and Appendix 1.8 the correlations between these variables.

1.6.1.2.1. Board size

A large strand of literature shows that more efficient banks are associated with smaller boards (e.g. Agoraki *et al.* (2010), Pathan and Faff (2013)). Directors in larger boards have limited incentives to monitor executive management (Jensen (1993)): the large size prevents them to meet frequently, increases decision-making problems, disagreement, communication and coordination costs (Lipton and Lorsch (1992)). In that case, we expect a negative relationship between bank efficiency and board size.

Another strand of literature finds that less efficient banks are associated with smaller board size (e.g. Tanna *et al.* (2011), Adams and Mehran (2012)). For instance, Adams and Mehran

[32] We do not test for gender diversity although the percentage of female directors on board may have a substantial impact on bank performance (Pathan et Faff (2013)) because of a lack of available data.

[33] Unfortunately, historical values for board indicators are only available from 2007 to 2011.

(2012) support a positive relation between bank board size and performance by providing evidence that boards need to be larger due to a more complex organizational structure, more M&A activities and consequently more directors with subsidiary directorships that facilitate the communication. In that case, we expect a positive relationship between bank efficiency and board size.

Finally, Andres and Vallelado (2008) find an inverted U-shaped relationship between board size and performance. Adding directors improves bank performance by providing better managers' monitoring and advising. However, when the number of directors reaches a high proportion, the bank performance decreases because of a lack of coordination and control as well as an increase in decision-making problems.

Thus, previous studies present mixed results. To investigate whether more risk-return efficient banks are associated with a large or small board or whether efficiency and board size are not related, we consider an indicator of the board size (SIZE) measured as the number of directors on the board.

1.6.1.2.2. Board composition

We wonder whether more risk-return efficient banks are associated with a different number of independent directors in their boards. Independent directors only have director relationship with the bank and do not have ties with managers. Previous empirical evidences about the relationship between independent directors and bank performance are ambiguous.

Banks should have independent directors which have the ability to exert sound judgment without being subject to the influence of managers or CEO (Bank of International Settlements (2015)). Independent directors face fewer conflicts of interests that prevent risky behavior of managers. Then, in order to promote their reputation, they may provide a better monitoring of managers and deliver good advices that increase the efficiency of banks (Fama and Jensen (1983)). In that case, efficient banks may be associated with more independent directors.

However, Minton *et al.* (2014) highlight that the presence of financial experts among independent boards lead to less efficient risk-taking behavior in US financial institutions during the 2007-2008 crisis. Accordingly, Erkens *et al.* (2012) and Aebi *et al.* (2012) find that financial firms with more independent directors perform worse during the crisis because, before the crisis they took excessive risks to maximize the shareholders wealth which turns out in costly and large losses during the crisis. More, although they bring their expert knowledge that may be beneficial to tackle management problems, they may lack of relevant bank-specific information (Adams and Ferreira (2007)). Also, a large number of independent directors prevent bank executives, who have the advantage to facilitate the communication between board directors and management, to join the board (Coles *et al.* (2008)). In that case, inefficient banks may be therefore associated with more independent directors.

More specifically, Andres and Vallelado (2008) underline that to improve bank performance, the board should be composed of an optimum combination of executive directors (who use their expert knowledge to advise) and independent directors (who use their independence to monitor) than excessively independent boards. Agoraki *et al.* (2010) conclude similarly: the impact on board composition on profit efficiency is non-linear.

In this study, we consider the board independence by an indicator (INDEPENDENT) that reflects the number of independent directors as defined by each bank's own criteria (for instance, it may represent the number of board directors' members that do not own shares in the bank).

1.6.1.2.3. Executives pay

Board directors set the level of executive/CEO pay which is in turn likely to affect the level of bank efficiency. Indeed previous studies highlight that higher pay to executive improves the efficiency of firms. For instance, Jensen and Murphy (1990) report a positive relationship between executive pay and firm performance. For bank executives, board directors attribute a managerial compensation that positively varies with the performance of the bank (Barro and Barro (1990)). The objective behind is to align executives' interests with those of bank and shareholders. Executives are sensitive and motivated by this higher pay associated with better bank performance and have more incentives to improve bank efficiency. Hence, efficient banks may be associated with higher executive pay.

On the contrary, some studies conclude that higher pay leads to worse firm performance. Board directors may fail to set an appropriate level of pay and executive may act in their own interest at the expense of bank performance (Crystal (1991) and Fahlenbrach and Stulz (2011)). In that case, efficient banks may be associated with lower executive pay.

We account for the level of executive pay by considering the total amount of salary the bank has paid to the executives (SALARIES).

1.6.1.2.4. Board age

We wonder whether there is a significant difference between the most and the least efficient banks in their average age of board directors. Older directors are more competent, they have important knowledge, they may benefit from greater and most valuable business experience that may be very helpful to tackle problems and advice managers. They are also more likely to avoid risky decisions because of a high degree of risk aversion. Banks with older board may achieve a higher performance (Francis *et al.* (2012)). Efficient banks may be those with older board directors.

However, older directors are less prone to pursue innovative and optimal strategies: they may not deal with new information and technology as easily as young directors. Directors' age is thus negatively related to firm performance (Nakano and Nguyen (2011)). We then expect that efficient banks to have younger directors.

To account for the age of board directors, we consider an indicator of the average age of board members (AGE).

1.6.1.2.5. CEO Turnover

A change in executive leadership is likely to affect firm performance. The CEO plays an important role in the firm strategy and its relative performance (Bertrand and Schoar (2003)). The probability of a forced turnover is negatively related to the CEO's performance (Jenter and Kanann (2006)). If the turnover is forced by the board, this reflects board's desire to change firm strategy. The board is dissatisfied with the existing CEO when for instance the current business strategy is performing poorly. The objective is then to identify, attract and hire a new CEO with better management skills in order to improve the strategy (see Clayton *e*t *al.* (2005)). Demerjian *et al.* (2012) find that replacing CEOs with more able managers improves firm management. Accordingly, forced turnovers of low-quality CEOs represent a positive news for shareholders (Kind and Schläpfer (2011)). In that case, the new CEO is expected to provide a better management: efficient banks are associated with high turnovers.

A CEO change may also result from a voluntary departure or retirement of the CEO (Clayton *et al.* (2005)). The board may also dismiss a well-performing CEO wishing to move in a direction and believes that this current CEO cannot perform the task. In both case, the board may hire a new CEO based on expected ability to continue or improve the firm's strategy. However, the ability of the new CEO may be lower from expected or from the one of the former CEO (Kind and Schläpfer (2011), Clayton *et al.* (2005)). If the turnover leads to an under-performer CEO, the performance should not be improved after the voluntary or forced departure of high-quality CEO (Demerjian *et al.* (2012)). In that case, we expect that efficient banks are associated with a low turnover.

Bank efficiency is likely to be affected by CEO's turnovers. Consequently, we measure the instability of executives members by the number of CEO's turnovers by year (TURNOVERS).

1.6.2. Profile of banks

We aim at extracting a typical profile for the less (most) efficient banks: we undertake tests of mean equality (t-test) on bank balance-sheet, income statement and board structure indicators. Each year, banks are ranked according to their efficiency scores. A bank is considered as less (most) efficient at time t if its efficiency score is in the first (last) two deciles D_{1t} and D_{2t} (resp. D_{9t} and D_{10t}) of the efficiency distribution at time t. Then we compute the mean of each accounting or board structure indicator 1/ for the only observations (i,t) which are in the two first deciles D_{1t}, D_{2t} whatever t ("low efficiency" observations) and 2/ for the only observations (i,t) which are in the two last deciles D_{9t}, D_{10t} whatever t ("high efficiency" observations). At last, for each indicator, we test for the null "the mean is the same for "low efficiency" and "high efficiency" observations" (T-Stat).

Table 1.12 provides the results of these t-tests for banks' balance sheet and income statement indicators and table 1.13 reports those for banks' board structure indicators. They highlight that low-graded (D_1, D_2) observations exhibit, on average, a poor performance in terms of cost to income and profitability, and a high level of capital. They are also less focused on lending activity and have lower traditional revenues than the most efficient ones. Less efficient banks are riskier either in terms of provisions or total risk. However, banks' size and solvency tend to be quite similar whatever the level of efficiency.

According to the board structure, we find that less efficient banks have larger boards. This result is in line with Agoraki *et al.* (2010) who find a negative correlation between board size and performance of European banks measured in terms of both cost and profit efficiency. We also find that the proportion of independent directors on the board is not significantly related to the bank efficiency. This result for European banks is similar to Adams and Mehran (2012) for US banks. Our result in terms of age of board directors is in line with Spong *et al.* (1995) who show that the level of bank efficiency is not related to the average age of board directors.

Finally, results underline that the level of bank risk-return efficiency is not related to the level of executive pay or to CEO turnovers.

Table 1.12: Test of mean equality for balance-sheet and income statement variables

This table compares the mean values of banks' balance-sheet and income statement indicators between "low efficiency" observations and "high efficiency" observations. Observation (i, t) is in the low (high) efficiency group if it was ranked in the first (last) two deciles of the efficiency distribution at time t, whatever t on the sample of 192 banks. CTIR is the cost to income ratio. ROA is the return on assets. TIER1R is the ratio of Tier 1 capital divided by risk weighted assets. EQTA is the ratio of equity to total assets. NLTA is the ratio of net loans to total assets. NIIOPINC is the ratio of net interest income to total operating income. TA is the bank's total assets expressed in billions Euros. LLPNL is the ratio of loan loss provisions to net loans. TRISK is the bank total risk defined as the standard deviation of weekly bank stock returns. ZSCORE is a market based Z-score. ***,**,* indicate significance at the 1, 5, and 10 levels respectively. T-stat is the Student statistic for H0: "The mean of the variable is the same between the two groups".

	Low efficiency	High efficiency	T-Stat Low vs High
CTIR	0.733	0.593	-6.124***
ROA	0.001	0.006	4.957***
TIER1R	0.124	0.092	-5.389***
EQTA	0.083	0.061	-4.157***
NLTA	0.449	0.668	10.495***
NIIOPINC	0.544	0.621	3.914***
TA	208.587	164.467	-1.172
LLPNL	0.014	0.007	-3.817***
TRISK	0.055	0.045	-2.826***
ZSCORE	28.917	29.023	0.053

Table 1.13: Test of mean equality for board structure variables

This table compares the mean values of banks' board structure indicators between "low efficiency" observations and "high efficiency" observations. Observation (i, t) is in the low (high) efficiency group if it was ranked in the first (last) two deciles of the efficiency distribution at time t, whatever t on the sample of 192 banks. SIZE is the number of directors on the board. AGE is the average age of the members of the board. SALARIES is the total amount of salary the bank has paid to the executives in thousands Euros. TURNOVERS is the number of CEO turnovers each year. INDEPENDENT is the number of independent directors in banks. ***,**,* indicate significance at the 1, 5, and 10 levels respectively. T-stat is the Student statistic for H0: "There are no differences in means of variables according to banks level of efficiency".

	Low efficiency	High efficiency	T-Stat Low vs High
SIZE	16.250	14.309	-2.023**
AGE	57.675	57.944	0.310
SALARIES	3,131.538	2,912.395	-0.396
TURNOVERS	0.286	0.214	-0.517
INDEPENDENT	9.516	8.346	-1.238

The previous analyze does not underline a specific profile for the most or the less efficient banks but some characteristics prevail. Most efficient banks enjoy higher expected return, return on assets and a better performance in terms of cost-to-income ratio. These banks make better risk-return choices that lead them to expect a higher return and lower operational costs. Banks that are more focused on lending activities or with fewer directors are the most efficient. Because they are more specialized, they are able to select more efficient strategies compare to more diversified banks. The most efficient banks are also less risky in terms of credit risk and total risk and also hold a lower level of capital. Finally, contrary to previous findings, we do not find evidence that these banks are more solvent or bigger than others.

1.7. Banks' efficiency, rating agencies and analyst views

1.7.1. Credit rating agencies

Credit rating agencies mainly evaluate banks' vulnerability to default and banks' ability to meet their financial obligations. The long-term credit rating provided by Fitch rating agency (FIR), the Issuer Rating provided by Moody's (MIR) as well as the long-term issuer credit rating provided by Standard & Poor's (SPIR) are traditional ratings and reflect the opinion of these agencies about the relative creditworthiness of banks accounting for potential external support[34]. Similarly Fitch bank individual rating (FBIR) and Moody's bank financial strength rating (MBFSR) evaluate banks intrinsic safety by assuming that they could not rely this on external support.

To assess banks' creditworthiness, rating agencies focus on several financial and non financial factors, both qualitative and quantitative, that may influence the bank's ability to repay their debts [35]. Hence, the rating process is not limited to an examination of financial measures. A proper assessment of credit quality also includes a review of the role and credibility of bank management in determining operational success (Standard and Poor's (2008)). We may wonder whether bank risk-return efficiency play a role in this rating process.

First, more risk-return efficient banks should have a lower probability of experiencing financial distress (DeYoung *et al.* (2001), Petey (2004)). Credit ratings may indirectly

[34] Ratings provided by Fitch, Moody's or Standard & Poor's rating agencies come from the Bloomberg database.
[35] See Standard and Poor's - About Credit Ratings - 2012

consider banks' efficiency through its impact on bank level of default. Hua and Liu (2010) conclude similarly. Second, skilled managers handle earnings more successfully and report higher quality earnings (Demerjian *et al.* (2013)). Earnings management matters in the rating process as credit rating deviations are associated with earnings management activities (Alissa *et al.* (2013)). Credit ratings may indirectly consider banks' efficiency through its impact on earnings management. More, as banks with less able managers provide less stable future outcomes, this may indicate an increased default risk that agencies should consider. Finally, Kuang and Qin (2013) find that rating agencies take into account managerial risk-taking incentives into their credit risk assessments and assign a lower rating for banks with high risk-taking incentives. The quality of risk management may be directly incorporated in the rating process[36]. In both case, we expect that rating agencies assign a lower rating to less efficient risk-takers.

The objective of this section is then to investigate whether less (more) efficient banks are associated with a worse (better) rating. To conduct this analysis, we convert Fitch, Moody's and S&P rating scales in cardinal values according to the correspondence (see Appendix 1.9). By definition, the safety of banks decreases when the numerical rating increases. We compute two synthetic numerical rating as the average of traditional ratings (RTGTRAD) and the average of strength/individual ratings (RTGSOL). Appendix 1.10 gives the main values of each rating including both RTGTRAD and RTGSOL according to the class of efficiency.

To investigate whether rating agencies assign a worse rating to the less efficient banks, we undertake a test of mean equality on these bank ratings. The objective is to test whether the mean of each rating differs between the subsamples of "low-efficiency" observations and "high-efficiency" ones[37].

Table 1.14 provides the results of these T-tests for each rating. We notice that there are no differences in the assignment of traditional ratings by Fitch, Moody's and Standard and Poor's. Banks exhibit quite similar ratings whatever their level of efficiency. While assigning banks' credit ratings, rating agencies seem only to care about the external support banks may

[36] According to the definition provided of ratings provided by Fitch agency, "[…] *these ratings were designed to assess a bank's exposure to, appetite for, and management of risk*". The quality of risk management should be directly included in the process rating and we may expect that risk-return efficient banks face a higher rating compared to less efficient banks. See Fitch Ratings - Definitions of Ratings and Other Forms of Opinion - 2013.

[37] To define the groups of high and low efficiency observations, we apply the same criteria as previously. The null for the T-tests assumes "no difference between the means of numerical ratings for the two classes of efficiency".

benefit. The mean tests for FBIR or MBFSR (and RTGSOL) confirm this result: when rating agencies do not consider the likelihood of a potential support, they unsurprisingly assign on average a higher (less attractive) numerical rating to low-efficiency banks compared to the others.

We can conclude that, with strength/individual ratings, credit rating agencies correctly incorporate the bank efficiency among their evaluation criteria and assign on average downgraded ratings for less efficient ones. However, traditional ratings seem to reflect the potential external support from which banks may benefit rather than their efficiency.

Table 1.14: Test of mean equality for ratings

This table compares the mean value of numerical ratings between the subsample of "low-efficiency" observations and the one of "high efficiency" observations. The observation (i,t) is in the low (high) efficiency class if the matching efficiency score is in the first (last) two deciles of the year t efficiency scores distribution. FIR and FBIR are respectively the long-term credit rating and the bank individual rating provided by Fitch. MIR and MBFSR are respectively the Issuer Rating and the Moody's bank financial strength rating provided by Moody's. SPIR is the long-term issuer credit rating provided by Standard & Poor's. RTGSOL is the mean value of MBFSR and FBIR while RTGTRAD is the mean value of FIR, MIR and SPIR. ***,**,* indicate significance at the 1, 5, and 10% levels respectively. T-stat is the Student statistic for H0: "There is no difference between the means of numerical ratings relating to the two relevant classes of efficiency".

	Low efficiency	High-efficiency	T-Stat Low vs High
FIR	5.68	5.35	-1.36
MIR	4.81	4.42	-0.96
SPIR	5.26	5.40	0.55
RTGTRAD	5.34	5.46	0.52
FBIR	6.92	5.05	-6.21***
MBFSR	7.77	6.37	-4.28***
RTGSOL	7.60	5.90	-6.00***

1.7.2. Bank opacity

Banks are inherently more opaque than other firms (Morgan (2002), Iannotta (2006)) and especially during distress periods (Flannery *et al.* (2013)). The opacity reflects the uncertainty with which outside investors accurately assess the fundamental value and financial condition of banks. Opacity may result when banks hide information to the market or when the information disclosed is not credible for investors (Jones *et al.* (2012)). Consequently, information asymmetries between bank and market investors reduces the effectiveness of market discipline (Jones *et al.* (2013)). We may wonder whether more efficient banks provide more public information to signal their better performance to the market and, hence, ask whether such banks are less opaque.

More performing banks may have incentives to increase the quality of the reported information as it reduces information asymmetry; investors can better assess their economic performance (Bharath *et al.* (2008)) and their cost of capital may decrease (Diamond and Verrecchia (1991)). Hirtle (2007) underlines that banks with better management are voluntarily less opaque and provide more detailed risk disclosure to signal their superior risk management ability. Managers of more efficient firms are likely to deliver less variable returns and higher earnings quality (Demerjian *et al.* (2013)). Akhigbe *et al.* (2013) confirm that better managed banks that enjoy higher profit efficiency are also more transparent. These studies tend to indicate that investors have less difficulties to evaluate more efficient banks as they seem to provide data which are more reliable. On the contrary, less performing banks may have incentives to understate their situation and are more likely to underreport financial losses (Gunther and Moore (2003), Huizinga and Laeven (2009)). These findings suggest that less efficient banks may have less incentive and/or ability to disclose reliable information about the quality of their management. The quality of the information they provide is weak and less credible for investors who face more difficulties in accurately assessing the financial situation of less efficient banks. Less efficient banks may appear as more opaque.

The objective of this section is then to investigate whether less (more) efficient banks are more (less) opaque. To measure the opacity of banking firms, studies focus on their assets' composition because of their inherent opacity (Morgan (2002), Jones *et al.* (2012)). In this study, we give advantage to measures of disagreements between either analysts or rating agencies as they are found to serve as a proxy for the information uncertainty associated with the opacity of banks.

First, bank opacity may lead to higher analyst earnings forecast error and increases the dispersion in analyst forecasts (Diether *et al.* (2002)). We then consider an opacity indicator based on analysts' standard deviation of earnings per share (EPSSTD) estimates. The volatility of EPS estimates captures the precision with which analysts assess earnings, a high volatility underlying a disagreement between analysts' estimates and, hence, increasing opacity.

Second, the relative opacity of banks may be assessed by using disagreement between rating agencies i.e. split ratings (Morgan (2002), Livingston *et al.* (2007), Jones *et al.* (2012)). We consider 4 splits based on previous credit ratings: FBIR-MBFSR, MIR-SPIR, FIR-SPIR, and FIR-MIR. Appendix 1.11 gives the mean values of split rating and EPS estimates for the different classes of efficiency.

We test whether there is a higher divergence between ratings and analyst consensus for the less efficient banks: as previously, we compute the mean of each opacity indicator for both class of efficiency (high, low) and we carry out T-test for the equality of means whatever the efficiency groups involved in the comparison.

Table 1.15 provides those tests. The results show that there is no significant divergence between split ratings for the low-efficiency observations by comparison with high-efficiency ones. Accordingly, the standard deviation of earnings per share estimates is on average the same whatever the degree of bank efficiency. More efficient banks are not less opaque than least efficient ones.

Table 1.15: Test of mean equality for split ratings and EPS forecast

This table compares the mean value of split-ratings and standard deviation of EPS estimates (EPSSTD) between the subsample of "low-efficiency" observations and the one of "high efficiency" observations. The observation (i,t) is in the low (high) efficiency class if the matching efficiency score is in the first (last) two deciles of the year t efficiency scores distribution. The split measures the divergence in absolute value between a couple of ratings. FIR and FBIR are respectively the long-term credit rating and the bank individual rating provided by Fitch. MIR and MBFSR are respectively the Issuer Rating and the Moody's bank financial strength rating provided by Moody's. SPIR is the long-term issuer credit rating provided by Standard & Poor's. EPSSTD is the standard deviation of earnings per share estimates. ***,**,* indicate significance at the 1, 5, and 10 levels respectively. T-stat is the Student statistic for H0: "There are no differences in means of variables according to banks level of efficiency".

	Low-efficiency	High-efficiency	T-Stat Low vs High
MIR -SPIR	1.09	1.23	0.97
FIR - SPIR	0.80	0.73	-0.60
FIR - MIR	1.11	0.85	-1.61
FBIR - MBFSR	1.32	1.54	1.29
EPSSTD	0.65	0.53	-0.62

1.8. Conclusion

This paper estimates and studies the efficiency of a sample of European listed banks in terms of expected risk and return between 2002 and 2011. More specifically, the objective is to investigate the stability of efficiency through estimation methods and through time, to examine the characteristics of less and more efficient banks and to check whether external actors correctly incorporate bank efficiency into their analysis. To this end, by using a stochastic frontier, we estimate bank risk-return efficiency i.e. the relative efficiency of banks' risk-return choices accounting for managers' risk aversion. None of the studies that estimate bank efficiency with this method run comparisons across a large set of European banks or investigate whether this efficiency was affected by the financial crisis. We extend the established literature in these ways.

After providing econometrical evidences that some European banks are inefficiently managed, a comparison between our measure and alternative methods highlights the robustness of banks' rankings. The study of efficiency stability through time yields two important results. First, bank efficiency is stable over time, especially in the short term where banks' rankings mostly stay the same year-to-year. Second, most of efficient banks were not adversely affected by the financial crisis while the less performing ones have tended to improve their efficiency in the long run. The analysis of banks' activity, accounting and board structure indicators underlines that some common characteristics prevail for risk-return efficient banks: they are specialized on traditional banking activity (i.e. lending); they are less capitalized; they better perform in terms of return and operational costs; and they are less risky without being more solvent or bigger than others. Also, while assigning banks' credit ratings, rating agencies seem only to care about the external support banks may benefit whereas their strength/individual ratings correctly incorporate bank efficiency. Finally, we conclude that less efficient banks are not more opaque than efficient ones.

APPENDICES

Appendix 1.1: Restrictions on system parameters

Some conditions may be imposed on the parameters to guaranty symmetry on some coefficients, homogeneity of share equations and that the sum of input and profit share equations equals 1.

1. **Symmetry restrictions**

- **S1**: $\delta_{ji} = \delta_{ij}\ \forall i,j$
- **S2**: $\omega_{\pi s} = \omega_{s\pi} \forall s$
- **S3**: $\omega_{is} = \omega_{si} \forall s,i$

2. **Homogeneity restrictions**

   a. *Homogeneity of degree 1 of the expenditure function:*

- **H1**: $\alpha_p + \sum_s \omega_s + \eta_\pi + \tau = 1$
- **H2**: $\sum_s v_s + \mu = 0$
- **H3**: $\frac{1}{2}\alpha_{pp} + \frac{1}{2}\eta_{\pi\pi} + \eta_{\pi r} + \frac{1}{2}\tau_{rr} + \sum_s \phi_{ps} + \psi_{pr} + \psi_{p\pi} + \frac{1}{2}\sum_s\sum_t \omega_{st} + \frac{1}{2}\sum_s \omega_{\pi s} + \frac{1}{2}\sum_s \omega_{s\pi} + \sum_s \omega_{sr} = 0$

   b. *Homogeneity of degree 0 for input and profit shares:*

- **H4**: $\alpha_{pp} + \sum_s \phi_{ps} + \psi_{p\pi} + \psi_{pr} = 0$
- **H5**: $\sum_t \omega_{st} + \sum_s \phi_{ps} + \omega_{s\pi} + \omega_{sr} = 0$
- **H6**: $\eta_{\pi\pi} + \psi_{p\pi} + \sum_s \omega_{\pi s} + \eta_{\pi r} = 0$
- **H7**: $\tau_{rr} + \psi_{pr} + \sum_s \omega_{sr} + \eta_{\pi r} = 0$
- **H8**: $\psi_{pk} + \sum_s \omega_{sk} + \eta_{\pi k} + \tau_{rk} = 0$
- **H9**: $\psi_{pn} + \sum_s \omega_{sn} + \eta_{\pi n} + \tau_{rn} = 0$
- **H10**: $\theta_{pj} + \sum_s \gamma_{js} + \gamma_{j\pi} + \gamma_{jr} = 0\ \ \forall j$

3. **Adding-up restrictions**

The sum of inputs and profit shares must be equals to 1: $\frac{p_\pi \pi}{p.y + m} + \sum_s \frac{w_s x_s}{p.y + m} = 1$. This condition requires:

- **A1**: $\sum_s \omega_s + \eta_\pi = 1$

And that all these sums are equal to 0:

- **A2**: $\omega_{s\pi} + \sum_t \omega_{st} = 0\ \ \forall s$
- **A3**: $\psi_{p\pi} + \sum_s \phi_{ps} = 0$
- **A4**: $\gamma_{j\pi} + \sum_s \gamma_{js} = 0\ \ \ \forall j$
- **A5**: $\eta_{\pi\pi} + \sum_s \omega_{\pi s} = 0$
- **A6**: $\eta_{\pi r} + \sum_s \omega_{sr} = 0$
- **A7**: $\eta_{\pi n} + \sum_s \omega_{sn} = 0$
- **A8**: $\eta_{\pi k} + \sum_s \omega_{sk} = 0$
- **A9**: $\mu + \sum_s v_s = 0$

To assess the previous model, we then impose S1-S3, A1-A8.

Note that A9 is equivalent to H2 so we do not include both. Among the homogeneity constraints, we impose H1, H3-H10. H7 can be simplify as $\tau_{rr} + \psi_{pr} = 0$ as we impose $\eta_{\pi r} + \sum_s \omega_{sr} = 0$ (A6).

Appendix 1.2: Table A1 - General descriptive statistics of the final sample

This table provides general descriptive statistics on some financial variables. TA is the bank's total assets. ROA is the return on assets. LEVERAGE is the ratio of total liabilities to total equity. NLTA is the ratio of net loans to total assets. DEPTA is the ratio of total deposits to total assets. NPLNL is the ratio of nonperforming loans to net loans. LLPNL is the ratio of loan loss provisions to net loans. All variables are in percentages except TA which is in billions Euros.

	TA	ROA	LEVERAGE	NLTA	DEPTA	NPLNL	LLPNL
Mean	159.06	0.41	17.34	61.10	62.77	2.77	0.86
Median	20.66	0.55	15.39	65.25	63.33	2.16	0.49
Standard Deviation	348.89	1.08	9.46	20.84	16.34	2.56	1.42
Minimum	0.07	-9.61	1.28	1.38	1.73	0.04	0.00
Maximum	2,202.42	4.23	69.01	97.44	94.08	13.73	18.48

Appendix 1.3: Table A2 - Definitions and descriptive statistics of the variables involved in the AIDS model

Variables	Description	Mean	Std. Dev.	Max.	Min.
y1*	*Gross loans* [1]	47,721.55	104,000.00	768,000.00	0.066
y2	*Other earnings assets*[1]	46,292.15	150,000.00	1,760,000.00	0.005
p1*	*Interest income on loans / Gross loans*	0.079	0.254	5.835	0.000
p2*	*(Other interest income + Net gains (losses) on trading and derivatives + Net gains and losses on other securities + Net gains (losses) on assets at FV through income statement + Net insurance income + Other operating income) / Other earnings assets*	0.305	1.370	19.793	0.000
p̃ *	*Weighted average of output prices*	0.056	0.040	0.490	0.004
x1	*Fixed assets* [1]	785.42	2,166.42	26,858.00	0.00
x2*	*Employees* [2]	12,324.20	29,821.43	331,458.00	60.00
x3*	*Deposits and borrowed funds*[1]	70,415.33	167,000.00	1,340,000.00	0.000

Table A2 (Continued)

Variables	Description	Mean	Std. Dev.	Max.	Min.
w1*	*Other Operating Expenses / Fixed assets*	3.533	8.658	98.667	0.012
w2*	*Personal Expenses / Employees*[3]	95.600	98.925	2,066.78	0.735
w3*	*(Interest Expense on Customer Deposits + Other interest expense) / Deposits*	0.040	0.055	1.000	0.000
Part1	*Share of physical capital*	0.171	0.119	1.805	0.001
Part2	*Share of labor*	0.198	0.099	0.961	0.014
Part3	*Share of deposits*	0.454	0.191	1.363	0.000
Partπ	*Share of profit before tax*	0.176	0.155	0.803	-1.340
$p_\pi.\pi$	*Profit before tax* [1]	954.65	2,579.09	26,512.05	-17,798.58
p.y + m	*Expected revenue* [1]	6,035.73	12,647.44	109,000.00	3.89
n*	*Loan loss provision* [1]	404.06	1,348.3	18.549.00	0.00
m*	*Non asset based income -Fees* [1]	738.00	1,859.00	18,489.27	0.00
k*	*Total equity* [1]	4,555.20	11,272.64	139,000.00	0.70
r	*Specific country's Treasury bond within a 3-month time maturity*[4]				
t	*Specific country's taxes on income, profits and capital gains (% of revenue)*[5]				

*: These variables are cleaned by removing extreme observations.

1: In billions of Euros.

2: In number of people. This series is completed by interpolation and extrapolation using a highly correlated variable: personal expenses.

3: In thousands Euros per year, per employees.

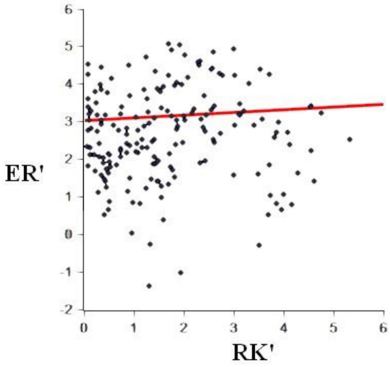
4: If the 3-month is not available, we select the one with the shortest maturity.

5: Source: WorldDataBank

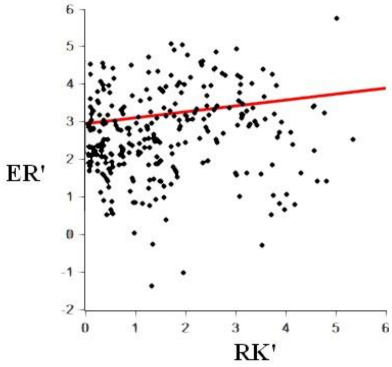
Appendix 1.4: Figures A1 - Best practice frontier per year

These figures represent, for each year, the relevant BPF. ER’ and RK’ are respectively the expected return and risk, rescaled by their standard deviation**.**

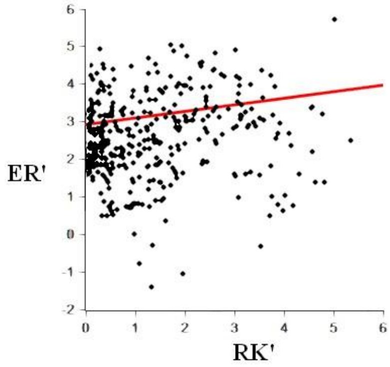
Year - 2002



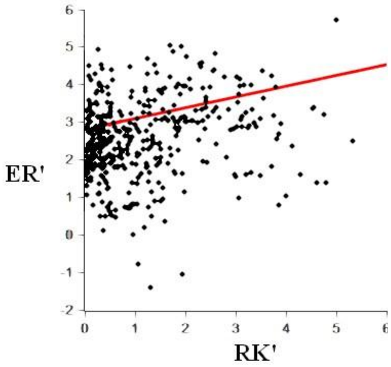
Year - 2003



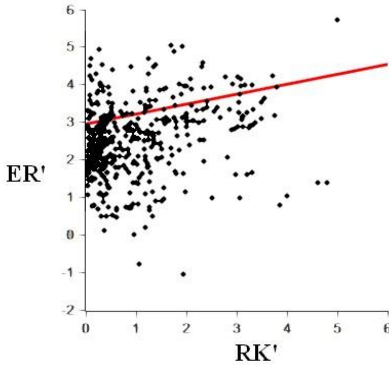
Year - 2004



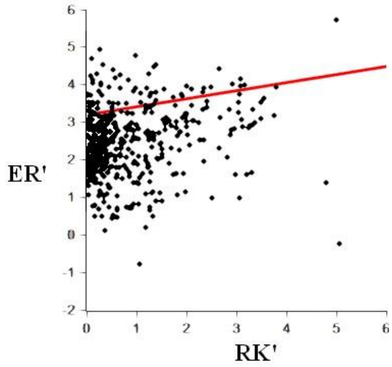
Year - 2005



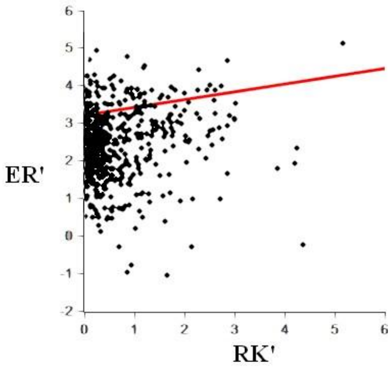
Year - 2006



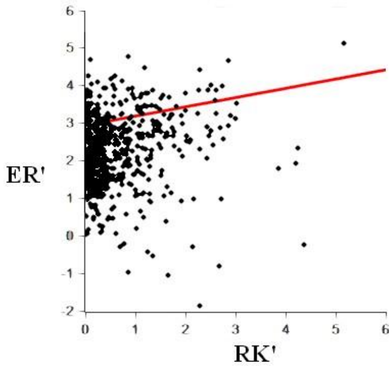
Year - 2007



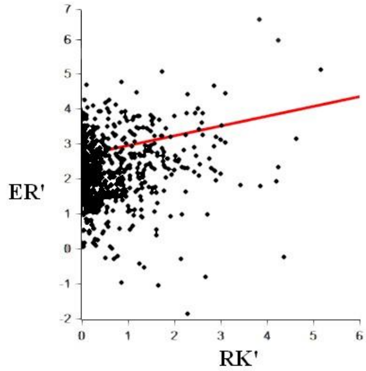
Year - 2008



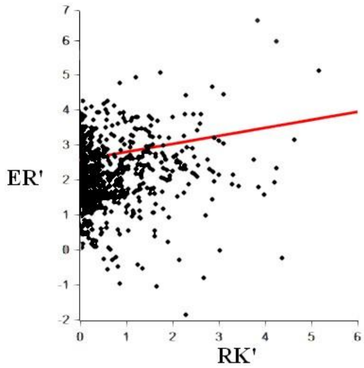
Year - 2009



Year - 2010



Year - 2011



Appendix 1.5: Table A3 - General descriptive statistics of balance-sheet and income statement indicators

This table provides general descriptive statistics on indicators of banks' balance-sheet and income statement. EFFICIENCY is the measure of bank efficiency. CTIR is the cost to income ratio. ROA is the return on assets. TIER1R the ratio of Tier 1 capital divided by risk weighted assets. EQTA is the ratio of equity to total assets. NLTA is the ratio of net loans to total assets. NIIOPINC is the ratio of net interest income to total operating income. TA is the bank's total assets expressed in billions Euros. LLPNL is the ratio of loan loss provisions to net loans. TRISK is the bank total risk defined as the standard deviation of weekly bank stock returns. ZSCORE is a market based Z-score.

	Mean	Median	Standard Deviation	Minimum	Maximum
CTIR	0.633	0.609	0.189	0.166	1.948
ROA	0.004	0.005	0.011	-0.096	0.042
TIER1R	0.101	0.090	0.045	0.043	0.490
EQTA	0.073	0.065	0.042	0.015	0.483
NLTA	0.611	0.653	0.208	0.014	0.974
NIIOPINC	0.598	0.618	0.179	0.019	0.986
TA	159.057	20.656	348.887	0.075	2,202.423
LLPNL	0.009	0.005	0.014	0.000	0.185
TRISK	0.046	0.038	0.030	0.002	0.254
ZSCORE	31.905	27.001	23.419	1.075	258.334

Appendix 1.6: Table A4 - General descriptive statistics of board indicators

This table provides general descriptive statistics on indicators of banks' board structure. SIZE is the number of directors on the board. AGE is the average age of the members of the board. SALARIES is the total amount of salary the bank has paid to the executives in thousands Euros. TURNOVERS is the number of CEO turnovers each year. INDEPENDENT is the number of independent directors in banks.

	Mean	Median	Standard Deviation	Minimum	Maximum
SIZE	15.219	15.000	4.823	6.000	31.000
AGE	57.508	57.265	3.270	50.300	68.670
SALARIES	2,468.653	2,020.930	2,092.386	0.207	10,753.000
TURNOVERS	0.221	0.000	0.478	0.000	2.000
INDEPENDENT	8.830	9.000	4.253	2.000	23.000

Appendix 1.7: Table A5 - Correlation between bank efficiency and balance-sheet and income statement indicators

This table provides the correlation between bank efficiency and the indicators of banks' balance-sheet and income statement. EFFICIENCY is the measure of bank efficiency. CTIR is the cost to income ratio. ROA is the return on assets. TIER1R the ratio of Tier 1 capital divided by risk weighted assets. EQTA is the ratio of equity to total assets. NLTA is the ratio of net loans to total assets. NIIOPINC is the ratio of net interest income to total operating income. TA is the bank's total assets. LLPNL is the ratio of loan loss provisions to net loans. TRISK is the bank total risk defined as the standard deviation of weekly bank stock returns. ZSCORE is a market based Z-score.

	EFFICIENCY	CTIR	ROA	TIER1R	EQTA	NLTA	TA	NIIOPINC	LLPNL	ZSCORE	TRISK
EFFICIENCY	1.00										
CTIR	-0.25***	1.00									
ROA	0.22***	-0.42***	1.00								
TIER1R	-0.22***	0.20***	0.06*	1.00							
EQTA	-0.14***	0.02	0.11***	0.56***	1.00						
NLTA	0.37***	-0.33***	0.04	-0.22***	0.06*	1.00					
NIIOPINC	0.15***	-0.22***	-0.16***	-0.17***	-0.22***	0.60***	-0.14***				
TA	-0.04	0.06*	-0.04	-0.07**	-0.32***	-0.39***	1.00	1.00			
LLPNL	-0.21***	0.24***	-0.54***	0.09**	0.03	-0.10***	-0.02	0.11***	1.00		
TRISK	-0.24***	0.16***	-0.28***	0.13***	-0.07**	-0.17***	0.18***	0.04	0.40***	-0.63***	
ZSCORE	0.05	-0.13***	0.17***	-0.09**	0.02	0.17***	-0.13***	0.03	-0.22***	1.00	1.00

Appendix 1.8: Table A6 - Correlation between bank efficiency and board structure indicators

This table provides the correlation between bank efficiency and the indicators of banks' board structure. EFFICIENCY is the measure of bank efficiency. SIZE is the number of directors on the board. AGE is the average age of the members of the board. SALARIES is the total amount of salary the bank has paid to the executives. TURNOVERS is the number of CEO turnovers each year. INDEPENDENT is the number of independent directors in banks.

	EFFICIENCY	SIZE	AGE	SALARIES	CHANGES	INDEPENDENT
EFFICIENCY	1.00					
SIZE	-0.07	1.00				
AGE	0.02	0.16**	1.00			
SALARIES	-0.03	0.40***	0.47***	1.00		
TURNOVERS	-0.08	-0.00	-0.08	-0.05	1.00	
INDEPENDENT	-0.07	0.41***	0.23***	0.38***	0.17*	1.00

Appendix 1.9: Table A7 - Ratings scales

These tables indicate the numerical scale for credit ratings of Moody's, Fitch and Standards & Poor's (see Ronn and Verma (1987)). FIR and FBIR are respectively the long-term credit rating and the bank individual rating provided by Fitch. MIR and MBFSR are respectively the Issuer Rating and the Moody's bank financial strength rating provided by Moody's. SPIR is the long-term issuer credit rating provided by Standard & Poor's.

Traditional credit rating

Cardinal value	MIR	FIR	SPIR
1	Aaa	AAA	AAA
2	Aa1	AA+	AA+
3	Aa2	AA	AA
4	Aa3	AA-	AA-
5	A1	A+	A+
6	A2	A	A
7	A3	A-	A-
8	Baa1	BBB+	BBB+
9	Baa2	BBB	BBB
10	Baa3	BBB-	BBB-
11	Ba1	BB+	BB+
12	Ba2	BB	BB
13	Ba3	BB-	BB-
14	B1	B+	B+
15	B2	B	B
16	B3	B-	B-
17	Caa1	CCC+	CCC+
18	Caa2	CCC	CCC
19	Caa3	CCC-	CCC-
20	Ca	CC	CC
21	C	C	C
22	D	D	D

Financial strength rating

Cardinal value	MBFSR
1	A
2	A-
3	B+
4	B
5	B-
6	C+
7	C
8	C-
9	D+
10	D
11	D-
12	E+
13	E

Cardinal value	FBIR
1	A
2,5	A/B
4	B
5,5	B/C
7	C
8,5	C/D
10	D
11,5	D/E
13	E

Appendix 1.10: Table A8 - Ratings by efficiency classes

This table provides the mean of numerical ratings for each class of efficiency. FIR and FBIR are respectively the long-term credit rating and the bank individual rating provided by Fitch. MIR and MBFSR are respectively the Issuer Rating and the Moody's bank financial strength rating provided by Moody's. SPIR is the long-term issuer credit rating provided by Standard & Poor's. RTGOL is the mean of FBIR and MBFSR and RTGTRAD is the mean of MIR, SPIR and FIR.

Efficiency	FBIR	MBFSR	RTGSOL	FIR	MIR	SPIR	RTGTRAD
[0-0.1[	6.25	7.57	7.18	4.86	4.00	5.00	4.57
[0.1-0.2[	9.50	8.17	8.46	5.62	4.20	5.67	5.61
[0.2-0.3[	7.23	7.84	7.57	5.50	4.69	5.44	5.42
[0.3-0.4[	6.39	7.63	7.37	5.96	4.54	4.74	5.22
[0.4-0.5[	5.68	6.84	6.51	5.67	5.20	5.13	5.21
[0.5-0.6[	5.50	6.55	6.17	5.87	5.10	5.61	5.72
[0.6-0.7[	5.27	6.51	6.06	5.61	4.73	5.64	5.76
[0.7-0.8[	4.54	5.77	5.33	4.81	3.82	5.15	4.92
[0.8-0.9]	6.00	7.00	6.31	5.00	4.50	5.00	5.08
All	5.63	6.73	6.37	5.65	4.79	5.35	5.48

Appendix 1.11: Table A9 - Split ratings and EPS estimates by efficiency classes

This table provides the value of split ratings and standard deviation of EPS estimates (EPSSTD) for each class of efficiency. The split measure the divergence in absolute value between two ratings. FIR and FBIR are respectively the long-term credit rating and the bank individual rating provided by Fitch. MIR and MBFSR are respectively the Issuer Rating and the Moody's bank financial strength rating provided by Moody's. SPIR is the long-term issuer credit rating provided by Standard & Poor's.

	Split ratings				EPSSTD
Efficiency	FBIR - MBFSR	MIR - SPIR	FIR - SPIR	FIR - MIR	
[0-0.1[	2.08	1.67	0.43	1.17	0.53
[0.1-0.2[	2.50	1.50	1.00	0.75	0.45
[0.2-0.3[	1.57	1.00	0.57	1.08	1.41
[0.3-0.4[	1.11	0.78	0.68	0.91	0.44
[0.4-0.5[	1.22	1.06	0.75	0.58	0.78
[0.5-0.6[	1.39	0.90	0.58	0.53	0.66
[0.6-0.7[	1.44	1.18	0.71	0.76	0.42
[0.7-0.8[	1.37	1.39	0.67	1.05	0.35
[0.8-0.9]	1.25	2.00	0.33	1.50	-
All	1.39	1.06	0.66	0.75	0.59

CHAPTER 2

Do bank bondholders price banks' ability to manage risk/return?

This chapter refers to the working paper entitled "Do bank bondholders price banks' ability to manage risk/return" (Casteuble, Nys, Rous (2015)).

2.1. Introduction

The literature on credit bond spreads shows that default risk proxies are not sufficient to explain the default premium: bondholders need to use additional financial content to explain its level. The purpose of this paper is to investigate whether, in the banking industry characterized by its opaqueness, the quality of bank management conveys additional information in explaining the pricing of the default premium of bond spreads.

Common credit default measures used in the empirical literature to estimate the default risk premium are of three kinds: credit or bank ratings (Elton *et al.* (2001), Sironi (2002), Sironi (2003), Pop (2006), Güntay and Hackbarth (2010)), market-based measures such as the distance to default (Tsuji (2005), Das *et al.* (2009), Demirovic *et al.* (2015)), and accounting-based ones like Z-Score (Balasubramnian and Cyree (2014), and Kavussanos and Tsouknidis (2014)). Studies have been conducted to assess the accurateness of these proxies. Bharath and Shumway (2008) find that the Merton distance to default model is outperformed by a "naïve" alternative of the model. Du and Suo (2007) find a similar result as a simple reduced form model outperforms the structural model of Merton (1974). But they also show that adding the firm's equity value as an explanatory variable greatly raises the valuation of credit risk.

In line with this later result, some studies show that considering additional information improves the determination of the default risk premium. Benos and Papanastasopoulos (2007) find, on a set of North American firms, that default risk measurement is better explained by adding to the distance to default metric accounting measures such as liquidity, profitability, leverage and capital structure variables. Das *et al.* (2009), while studying CDS spreads, show that the prediction of default is improved using both market and accounting information. Campbell and Taksler (2003) conclude that adding equity volatility to credit ratings better explain US bond spreads. Likewise Demirovic *et al.* (2015) find that accounting data, such as profitability, liquidity and leverage ratios, add relevant information in explaining the credit spread of US firms. If theoretically securities prices contain all the information necessary to predict default, practically accounting data bring incremental information value in explaining the default premium, and are thus relevant to debt holders. Comparable evidences are found by Iannotta *et al.* (2013): when the debt market grows more opaque, the information content of ratings is poorer and bond investors rely more on additional information. And precisely the banking market is identified by its opaqueness. Morgan (2002), for the US industry, and Iannotta (2006), for the European industry, shows that split ratings at the issuance of bonds are larger for banking firms than for non-banking firms: in other words the banking industry is more opaque than other markets. Thus, investigating whether bondholders consider additional information to price the default premium is particularly relevant in the banking context.

We therefore ask in this paper whether the assessment of the default premium required by bondholders can be improved by adding additional information, and more specifically bank managerial ability as a determinant. Bank managerial ability can be defined as manager's talent, reputation, willingness, or technical skills. We hypothesize that this may have a direct impact on bond spreads by improving the perception of default premium. Some papers show that debt holders take an interest in the way firms are managed when they price their debt. For example, Donelson *et al.* (2015) find, in a survey answered by 492 bank lenders, that respondents value management as an important factor in deciding whether to extend commercial credit, even before leverage and financial condition. Ashbaugh-Skaife *et al.* (2006) show that weak governance implies worse credit ratings, which leads to a higher debt financing cost for firms. Both studies conclude that previous ones undervalue the potential direct effect of management on the cost of debt as they mainly focus on issue characteristics and issuer risk attributes. The originality of our paper is to investigate whether bank managerial ability is a relevant determinant of the cost of bank bonds.

Managerial ability is difficult to assess empirically. Demerjian *et al.* (2012) introduce a new measure of managerial ability based on firm managers' relative efficiency to generate revenue. In the context of the banking industry, we rather estimate risk-return efficiency scores as computed by DeYoung *et al.* (2001): first these scores, unlike profit and cost efficiency scores, take into account the risk induced by banking activities, and second the method allows us to only capture the part of efficiency that is solely attributable to the manager action[38]. We consider these scores as a measure of bank managerial ability (BMA afterwards) in terms of risk-return. Using a set of 192 European listed banks, we first estimate bank revenue and risk.

[38] In their paper, DeYoung *et al.* (2001), compute risk-return efficiency scores that come from the ex-ante portfolio choices made by risk-averse bank managers. They use a stochastic best practice frontier that allows eliminating the influence of chance and exogenous effects on efficiency measure. They finally use these scores to examine how CAMEL ratings reflect bank level of risk - taken and risk - taking efficiency.

Then we assess the level of managerial ability for each bank as the distance of the bank to the best practice frontier, determined by a stochastic frontier model. We then test the impact of bank managerial ability on bond pricing using a sample of 1,924 bonds issued by 67 European listed banks between 2002 and 2011. More specifically we aim to study if an increase in the quality of the bank's management will decrease bank credit spread. We deepen our analysis by considering distress and sound episodes, and then by studying whether different bond factors can alter the bond spread-BMA relationship.

Our analysis yields several key findings. Well-managed banks benefit from lower credit spread while controlling for issue and issuer characteristics. This result is robust to different specifications of the spread equation, to different proxies of default risk and different measures of managerial ability. There are two explanations for these findings. First, as the coefficient of managerial ability is significant as well as the default risk one, it corroborates previous findings that this default risk variable cannot explain entirely the default premium. Second, bank managerial ability can be seen as a measure that reflects the premium required by bondholders from less capable banks. These have less able managers to take optimal decisions, their choices are unsure. This makes bondholders less secure about the reliability of banks' level of default and its resulting proxy. Facing uncertainty about the actual default level, bondholders require a premium which depends on the degree of confidence they have in the measure of the level of default. We also consider the pricing of bond spread before and during the financial crisis. Our results confirm that bank managerial ability is an important determinant as bondholders price it during the two periods, sound and distress, whereas the default risk proxy is only considered during the turmoil. A deeper analysis actually shows that the relationship between bank managerial ability and bank bond spread holds on more restrictive subsets relating to ratings categories, secured or subordinated bonds and different bond maturities. Our findings have potential policy implications in the market discipline field. They highlight that bondholders monitoring is effective and supervisors could rely on bond spreads to detect bank managerial shortcomings.

The remainder of the paper proceeds as follows. Section 2 announces our hypotheses and describes data and sample. Section 3 provides the methodology to calculate the proxy of managerial ability. Section 4 specifies the bond spread equation and variables. Section 5 presents and discusses our results. Section 6 is devoted to some robustness checks. Section 7 concludes.

2.2. Hypotheses, data, sample and summary statistics

2.2.1. Hypotheses

This paper is based on the literature that suggests that the default risk premium required by bondholders is misspecified. Because of a lack of accurateness in the measure of proxies commonly used, adding information may improve the determination of the default risk premium. Given that default risk proxies cannot explain entirely the default premium, we make the hypothesis that bank managerial ability is also a determinant of the cost of debt. Some recent studies (see Ashbaugh-Skaife *et al.* (2006) and Donelson *et al.* (2015)) conclude that the potential effect of management on the cost of debt has not been properly taken into account, previous studies mainly focus on issue characteristics and issuer risk attributes. In line with these studies, we aim to investigate whether bank managerial ability impacts the spread charged by bondholders. More precisely we ask if bondholders price bank managerial ability by requiring a premium through the yield spread depending specifically on the degree of managers' competence no matter the level of the default risk proxy.

H1: Bank managerial ability directly impacts the level of the spread paid by banks on their debt on the primary market.

We then deepen our analysis by considering whether the recent financial crisis has modified the pricing of bonds: was the managerial ability a determinant of bond spreads before the financial crisis, or has this context led investors to more carefully take it into account. The troubled context of this period has raised banks' failures and default probability. According to Chiu *et al.* (2015), default risks significantly increased during this period. More, the financial crisis also increased the possibility of mispricing risk. Indeed, Flannery *et al.* (2013) indicate that during the financial crisis, banks have become more opaque and outside investors more uncertain about banks' solvency. This opaqueness creates uncertainty about how market actors evaluate banks' probability of default. We thus assume that bondholders are more sensitive to components of the default risk premium during the distress period, in other words we expect that, during this period, bank managerial ability and default measures have a significantly superior effect.

H2: Bondholders' sensitivity to bank managerial ability increases during the recent financial crisis.

Finally, our last hypothesis aims to analyze whether the impact of bank managerial ability remains the same depending on bond characteristics. Güntay and Hackbarth (2010) underline the increasing sensitivity of creditors when credit quality declines whereas their behavior remains the same whatever the maturity of bonds. Pop (2006) shows that subordinated creditors are more sensitive than senior ones to the risk profile of bank issuers. We hence expect that the bondholders' sensitivity to bank managerial ability depends on bonds' rating, payment rank and maturity. As the default probability increases with investment horizon, holders of bonds with long maturities should be more exposed in case of issuer's failure. Similarly, holders of bonds with downgraded ratings and holders of subordinated or unsecured bonds face a lower debt quality and a higher probability of default. Consequently, those investors should be more concerned about the bank managerial ability and the BMA-spread relationship should be strengthen in those cases.

H3: Bondholders' sensitivity to bank managerial ability increases when bonds are subordinated/unsecured, face downgraded ratings or long maturities.

2.2.2. Data and sample

To test these hypotheses, we focus on European publicly traded banks[39], for which we have extracted financial statement from FitchIBCA Bankscope database between 1998 and 2011. By limiting the sample to banks that provide information on variables needed to compute the measure of bank managerial ability for at least one year, we are left with a sample of 192 banks.

Among them, we identify 92 banks within Bloomberg database that have issued 4,791 bonds on the primary[40] market satisfying the following criteria: standard bonds issued between 2002[41] and 2011 with fixed coupon rate, no-early redemption (bullet) and no option features

[39] We restrain the sample to European listed banks to obtain an homogeneous sample of banks that allows us to estimate a common best-practice frontier and to extract a measure of each bank relative efficiency that is not affected by sample heterogeneity (Bos *et al.* (2009)). As robustness check, we account for potential differences in environments among European countries by incorporating variables in the frontier equation that capture banks' country-specific environmental conditions (Dietsch and Lozano-Vivas (2000), Lozano-Vivas *et al.* (2002)). Results remain unchanged.

[40] We use primary market data to get up-to-date ratings that reflect bond default risk at issue date. These ratings have been converted in cardinal values as shown in Appendix 2.1.

[41] We choose to collect bonds from 2002 and not 1998 because we need 4 years of information to estimate the bank managerial ability measure i.e. the first observation is established in 2002 (computed on a 1998-2002 time sample). More, by choosing 2002, we eliminate the DotCom bubble effect that happens in 2001, which could affect results.

(non-callable, non-putable, non-sinkable and non-convertible). We indifferently include matured and non-matured bonds. These bonds are secured, unsecured or subordinated. They have to be rated at the immediate neighborhood of issuance by, at least, one credit rating agency (Moody's, Standards & Poors or Fitch). We only keep bonds for which we have an annual coupon rate and exclude issues with a very short maturity and perpetual bonds that do not have a maturity date in order to calculate a spread. Each bond spread is computed as the difference between the bond yield at issuance and the implicit yield of a same currency and a same maturity Treasury bond. When the bond maturity does not match the maturity of the risk free rate benchmark, the yield of this one is interpolated, for a given maturity, as in Sironi (2003). For bonds issued in Euros, we take the country of the issuer as benchmark. Detailed information about issues such as issue date, maturity, amount issued, currency coupon rate, ratings by the three main rating agencies have also been collected.

The sample of bonds was restricted by data availability. We drop observations with no measure of bank managerial ability available at the issue date[42] (2,616 bonds) and bonds for which the control variables in the bond spread equation are not available (241 bonds). Our sample includes the recent sovereign debt crisis; during this period government bond yields from PIGS countries (Portugal, Italy, Greece and Spain) cannot be considered as a good proxy of the risk free rate. We thus omit 10 bonds issued in 2011 by Italian, Portuguese or Irish banks for which we observe a highly negative bond spread[43]. We end up with a final sample of 1,924 bonds issued by 67 European banks over the 2002-2011 period. This dataset is used to estimate the spread equation. See Appendix 2.2 for a description of the sample by year, country and rating categories.

Table 2.1 provides a distribution of banks and issues by country. We notice that most of the issues are German (1,018 out of 1,924). Most of British issues were deleted during the sample selection as for most issuers we cannot assess bank managerial ability. Table 2.2 presents some general descriptive statistics at the bank level.

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[42] In the first step, we keep banks for which we are able to measure bank managerial ability for at least one year. However, at the bond level, it is not necessary that all these banks have a measure available for all years and that explain the reason why we drop some bonds.

[43] As criteria, we choose to only keep bonds for which the related spread is superior to -500 basis points. For robustness, we estimate a spread equation with these 10 bonds or without the years of the sovereign debt crisis. Results are robust. We also compute a spread relative to the same risk - free rate for all bonds, the German government bond yield, and proceed to the estimation of the bond spread equation. We find very similar results.

Table 2.1: Distribution of banks and issues by country

Countries	Banks*	Sample	
		Issuers	Issues
Austria	12	5	89
Belgium	2	-	-
Britain	11	4	17
Denmark	17	2	12
Finland	3	1	14
France	28	7	193
Germany	15	9	1,018
Greece	10	1	1
Ireland	4	4	107
Italy	30	13	200
Netherlands	6	2	4
Norway	19	4	6
Portugal	5	3	15
Spain	9	7	125
Sweden	7	4	121
Switzerland	14	1	2
Total	192	67	1,924

*European listed banks available in Bankscope for which we have the required data to compute the measure of bank managerial ability.

Table 2.2: Descriptive Statistics for the 67 issuing banks

All variables are expressed in percentage except for TA, which is in billion Euros. TA is banks' total assets. ROA is the return on assets. ROAE is the return on average equity. EQTA is the ratio of total equity to total assets. NLTA is the ratio of net loans to total assets. TCR is the risk-based total capital ratio. TIER1R is the risk-based Tier 1 capital ratio. LLPNL is the ratio of loan loss provision to net loans.

	TA	ROA	ROAE	EQTA	NLTA	TCR	TIER1R	LLPNL
Mean	507.00	0.19	4.40	4.28	50.43	12.28	8.91	0.72
Median	275.00	0.22	6.29	3.57	57.57	11.82	8.20	0.60
St. Dev.	504.00	0.53	12.24	1.91	17.59	2.31	2.43	0.58
Maximum	2,200.00	1.59	34.06	12.05	88.27	22.40	18.90	6.97
Minimum	5.13	-7.00	-129.58	1.45	10.33	8.00	4.30	0.01

2.3. A risk-return measure of bank managerial ability

At each date, bank managers assign subjective probabilities to different future economic states. As managerial skills or competences differ, this assignment depends on their relative expertise in processing the available information and some banks are better than others to infer an optimal productive strategy. Consequently, the risk-return couple of the best banks would be located on a so-called best practice frontier (BPF) whereas it would be located under for the others. We argue that the relative distance from a given risk-return couple to the frontier is an acceptable measure for the actual bank managerial ability only if the involved risk-return measures are *expected* ones. Indeed, *realized* ones are influenced not only by past production choices but also by random events that have occurred and that are beyond managers control. Consequently, the estimation of bank managerial ability requires, at first, an accurate assessment of expected return and risk that result only from bank production choices, second, a satisfactory layout of the BPF, and third, a measure of the distance from each observation to this BPF.

We first disclose return and risk for bank *b* at time *t* from a microeconomic grounded Almost Ideal Demand System AIDS[44] as described in DeYoung *et al.* (2001). Previous studies underline the importance of accounting for managers' risk preferences while estimating the bank portfolio production plan as risk influences their investment strategies. The AIDS approach hypothesizes that risk adverse bank managers have the possibility to trade return for a reduced risk. Managers maximize their own utility function, for given output prices and quantities. Equally, this managers' utility-maximization problem can be considered as a dual one: managers minimize an expenditure function, for given prices and utility level, to determine expected profit and input quantities, subject to technological and income equilibrium constraints. The solution of this dual problem results in a preferred expenditure function for the given prices, outputs, and utility level. The generalized functional form of this preferred expenditure function is similar to DeYoung *et al.* (2001). Using the Shephard's lemma, system of partial derivatives equations of the expenditure function are defined i.e. profit and inputs shares. The coefficients of this system are estimated on a moving window. Then, from the estimated profit share, we deduce the return on equity of the bank. Risk is finally computed as the standard deviation of this return.

[44] See Deaton and Muellbauer (1980).

Second, with these measures of bank expected risk and return, we are able to compute the best practice frontier. We can choose between two main methods to estimate this BPF: the Data Envelopment Analysis (DEA) and the Stochastic Frontier Analysis (SFA). The efficiency measure resulting from the DEA method incorporates management characteristics but also unidentified factors (firm-specific or environmental) that may aid or hinder manager's activity. Even if purging the DEA efficiency measure from firm - specific, industry and time factors potentially allow to attribute the unexplained portion of firm efficiency/residual to management (see Demerjian *et al.* (2012)), the SFA method saves this additional step.

Then, we follow DeYoung *et al.* (2001) and use a stochastic model (SFA); the DEA one will be only used as robustness check. This method breaks down the distance to the BPF in two components, a pure inefficiency part and a stochastic one, avoiding interpreting as inefficiency what would be actually a random shock. The time-dependant BPF relies on the estimated return (*ER*) and risk (*RK*)[45] 1998-2011 time series. As in Hughes *et al.* (1996) and DeYoung *et al.* (2001), these risk and return measures are standardized relative to their respective standard deviations. The BPF pattern depends on a Battese and Coelli (1992)[46] model for which:

$$ER_{i,t} = \alpha + \beta\, RK_{i,t} + \varepsilon_{i,t} \qquad (2.1)$$
$$\text{with: } \varepsilon_{i,t} = \nu_{i,t} - u_{i,t}$$

As in a productive efficiency model, the risk of bank *i* at time *t* is considered as an input and the return as the induced output.

The bank and time specific error term $\varepsilon_{i,t}$ is made up of two independent components: (i) a first usual statistical noise $\nu_{i,t}$ which is hypothesized to be a normal two-sided term; and (ii) a

[45] We clean ER and RK, by removing extreme observations. More, as robustness check, we compute several different measures of risk and expected return to guarantee that our measures are robust. We alternately choose different measures of the risk-free rate, of tax rate on profit, estimate the system parameters with the least square method, add an output in the model and not remove extreme value. We establish a significant Spearman rank-order correlation between all these measures and conclude that our results are robust. All these results are available upon request.

[46] The Battese and Coelli (1992) model uses maximum likelihood techniques to estimate a time-varying efficiency. We give advantage to this model because unlike previous ones, it relaxes the assumption that inefficiencies are constant through time (this hypothesis is hard to accept through many time periods (see Kumbhakar and Lovell (2000)).

one-sided negative second one ($- u_{i,t}$) which depends on the manager relative ability to select an efficient risk-return combination:

$$\nu_{i,t} \sim N(0, \sigma_\nu)$$
$$u_{i,t} \sim N^+(0, \sigma)$$

Only the second component depends on bank managerial ability. When assessing managerial ability at time *t*, we refer to a time dependent BPF_t which is based on a 5-year [t-4, t] rolling window. On the set of 192 banks, for each date *t*, parameter values (α, β, σ, σ_ν) are estimated by maximizing the log-likelihood[47] associated to the model on the relevant period, [t-4, t], starting on t = 2002. Residuals $\hat{\varepsilon}_{i,t}$ are computed accordingly[48]. Appendix 2.3 presents the estimates of each BPF_t, from t = 2002 to 2011. Appendix 2.4 shows the last BPF (2011), which is based on the 2007-2011 period[49].

At last, we make use of the conditional distribution of $u_{i,t}$ given $\varepsilon_{i,t}$ to infer the expected (conditional) $\hat{u}_{i,t}$ value for $u_{i,t}$ given $\hat{\varepsilon}_{i,t}$; the estimated measure for bank *i* managerial ability at time *t* is computed as:

$$BMA_{it} = e^{-\hat{u}_{it}} \quad (2.2)$$

whose values lie between zero (harmful ability) and 1 (the risk-return combination locates on the relevant BPF_t). Appendix 2.5 presents the mean value of BMA through years.

47 We used the *SFA* function of the R - *FRONTIER* package to implement this estimation.

48 For robustness check, we also compute a BPF_t computed using all the information available prior time *t*. Results are available upon request.

49 It can be noticed that some risk-return observations can overtake the *BPF*: such an event occurs if the pure-noise component of the error term cancels out the inefficiency one and the over performing bank benefits from a positive random event.

2.4. Variables and model specification

We investigate whether the quality of bank management affects the bond spread level and thus improves the explanation of default premium.

The baseline spread equation is:

$$\begin{aligned} SPREAD_j = {} & \beta_0 + \beta_1 RISK_j + \beta_2 BMA_{i(j)t(j)} \\ & + \beta_3 LIQUIDITY_j + \beta_4 TAX_j \\ & + \beta_5 SIZE_{i(j)t(j)} + \beta_6 MATURITY_j + \beta_7 SUBD_j + \beta_8 CRISIS_{t(j)} + \beta_9 LAMBDA_j \\ & + \sum_c \alpha_c DCO^c_{c(j)} + \sum_m \theta_r DCU^m_{m(j)} + \varepsilon_j \end{aligned} \tag{2.3}$$

where *j* denotes the individual bond (*j* = 1, 2, ..., 1,924), *i* denotes the bank that issues the bond (i = 1, 2, ..., 67), *t(j)* denotes the date of issuance of the bond *j*, *c(j)* denotes the country in which the bank is located, *m(j)* denotes the currency in which the bond has been issued, DCO is a vector of countries dummy variables, DCU is a vector of currencies dummy variables and ε_j is the error term.

2.4.1. The dependent variable

The dependent variable is SPREAD, that is the difference, in basis points, between the bond yield to maturity at issuance and the yield of a same currency and maturity Treasury Bond. When the time to maturity differs, we interpolate the government bond yield to match with the bank bond yield to maturity before calculating the spread. When the bond is issued in Euros, we choose the country of the issuing bank as benchmark.

2.4.2. The default premium

The default premium is required by bondholders to compensate for the bank likelihood of failure and directly affects the level of bond spread. In this paper, we assume that this default premium is made of two components: RISK, which is a common measure of the default risk of the issuing banks, and BMA, the bank managerial ability measure.

The RISK variable is proxied by issue ratings. These ratings are assigned at issuance by the Fitch, Moody's or Standard & Poors agencies to the single issue. We converted them into cardinal values as shown in Appendix 2.1. If several agencies rate bonds at issuance, we use the average rating. If only one of them rates the issue, we consider the rating of this particular agency. We consider issue ratings[50] as the main default risk measure for several reasons. First, on the primary market, issue ratings are essential: they reflect the bank's credit quality near the time of issuance whereas others proxies do not have this time accuracy. Second, by using publicly and private information, through quantitative and qualitative analyses, rating agencies provide a rating of the bond which reflects their synthetic opinion about bank's default probability and also its recovery rate. Credit ratings are relevant as banks' credit risk quality measure. Third, this proxy is commonly used in the bond spread literature. Papers such as Houweling *et al.* (2005) underline the importance of bond ratings in the determination of the bond spread and support the evidence of a tight relationship between the bond spread and ratings. Finally, we expect that default risk increases with a higher default probability and/or a lower expected recovery rate, that is when the credit rating gets worse, the bond spread should increase.

However, a few studies (such as Bliss (2001), Campbell and Taksler (2003) or Iannotta *et al.* (2013)) suggest that bond ratings are not enough to capture the default premium and underline the importance of including additional information to improve the measure of the default premium. To this end and consistent with our first hypothesis, we introduce bank managerial ability as a determinant of the default premium required by bondholders to improve its assessment: an improvement in the quality of the management should result in a significant decrease of the bond spread. We thus expect a negative relationship between the spread and BMA.

2.4.3. Control variables

Previous studies underline the importance of tax and liquidity effects as they prove to be significant non-risk default determinants (see Elton *et al.* (2001), Longstaff *et al.* (2004) or Houweling *et al.* (2005)). When bond liquidity increases, the bond spread decreases. However we cannot assert that large issues are the most liquid. In theory, large issues should benefit from lower information costs and should be easily traded and more liquid. This should lead to a negative effect on bond spread. However McGinty (2001) and Iannotta *et al.* (2013) show that some large issues are illiquid and poorly traded. Thus, bondholders may require a higher

[50] Other specifications of the default risk variable are considered in robustness section.

spread from large issues. This could lead to a positive effect on bond spread. Hence, the effect of the issue amount in terms of liquidity is unclear. We expect that the bond spread includes a tax-related component. Bank bonds are subject to country taxes whereas government bonds are not. Investors who choose bonds with a high coupon rate will pay higher taxes on each coupon compared to bonds with a low coupon rate. The formers have a larger tax burden and are at tax disadvantage. The size of the tax component is then proportional to the coupon rate of the bonds. Thus, a high coupon rate is less desirable and bondholders should be compensated by a higher spread. We expect that this variable positively impacts the bond spread. To consider both liquidity and tax effects, we include respectively these two variables: AMOUNT, the natural logarithm of the issue amount (expressed in Euros) and TAX, the coupon rate.

In addition to these two variables, we include other bond-level variables as determinants of bond spread. MATURITY is the time between the issuance and the maturity of the issue (expressed in years). As the probability of default increases with investment horizon, we expect a positive sign. SUBD is a dummy that equals 1 if the bond is subordinated, and 0 otherwise. This dummy differentiates bonds depending on their status in case of default. Subordinated debt holders should be more sensitive to the default risk as they are repaid after senior ones. They anticipate consequently higher losses for a given default risk. Thus, we predict a positive coefficient.

We also introduce control variables that are found in the literature to affect the bond spread. SIZE is the natural logarithm of bank total assets. We control for the influence of the size on bond spreads for two reasons. First, the too-big-to-fail effect makes bondholders believe that regulators will act to prevent failure or compensate investors in case of bank difficulties. Second, large banks present more diversified assets in their portfolio and then have a lower specific risk than small banks. In both cases, we expect a negative coefficient. CRISIS is a dummy that equals 1 if the issuance date occurs during the distress period, from July 2007 to the end of 2011, 0 otherwise. According to previous studies, the yield spread is more sensitive to bank risk during the financial crisis, and we expect a positive sign. LAMBDA is the inverse of a Mills' ratio. Covitz *et al.* (2004) show that estimates of the bond spread equation are most likely contaminated by a selection bias: the bank issuance choice may be conditional to the spread predicted by the bank. We control for this possible selection bias with an Heckman (1979) correction[51] and we accordingly introduce this variable in the spread equation.

We finally include a set of currency and country dummies[52] to control for differences across issues related to economic situations, cross-country institutional differences or liquidity that may affect bond pricing.

Table 2.3 is the correlation matrix[53]. Table 2.4 provides some general descriptive statistics of the variables.

[51] Results of this estimation are shown in Appendix 2.6.

[52] We drop one of each to avoid colinearity issue. We also estimate the spread equation without currency and country dummies in robustness checks.

[53] As MATURITY and TAX exhibit a high degree of correlation, we alternately estimate the spread equation without one of them as robustness. Main results are not altered.

Table 2.3: Correlation matrix

RISK is the average issue rating, BMA is the proxy of bank managerial ability. AMOUNT is the natural logarithm of amount of issue in Euros. TAX is the coupon rate. SIZE is the natural logarithm of the issuing bank's total assets. MATURITY is the number of years between the issue and the redemption date. SUBD is a dummy variable that equals one if the issuing debt is subordinated, and zero otherwise. The dummy CRISIS equals 1 if the issuance date occurs during the distress period, from July 2007 to the end of 2011, and 0 otherwise. ***. **. * indicate significance at the 1%, 5%, and 10% levels respectively.

	RISK	BMA	AMOUNT	TAX	SIZE	MATURITY	SUBD	CRISIS
RISK	1.00							
BMA	0.04	1.00						
AMOUNT	-0.17***	0.22***	1.00					
TAX	0.16***	0.12***	0.00	1.00				
SIZE	-0.04*	-0.26***	-0.05**	0.02	1.00			
MATURITY	-0.01	-0.02	0.05**	0.35***	0.07***	1.00		
SUBD	0.22***	0.04	0.09***	0.34***	0.04**	0.41***	1.00	
CRISIS	0.15***	0.14***	-0.16***	-0.12***	-0.08***	-0.04	-0.03	1.00

Table 2.4: Descriptive statistics of the variables

SPREAD is the difference in basis points between the bond yield at issuance and the yield of a same currency and maturity treasury bond, RISK is the average issue rating. BMA is the proxy of bank managerial ability, AMOUNT is the natural logarithm of amount of issue in Euros. TAX is the coupon rate. SIZE is the natural logarithm of the issuing bank's total assets. MATURITY is the number of years between the issue and the redemption date. SUBD is a dummy variable that equals one if the issuing debt is subordinated, and zero otherwise. The dummy CRISIS equals 1 if the issuance date occurs during the distress period, from July 2007 to the end of 2011, and 0 otherwise.

	SPREAD	RISK	BMA	AMOUNT	TAX	SIZE	MATURITY	SUBD	CRISIS
Mean	58.25	3.71	0.46	18.28	3.44	19.52	4.85	0.04	0.49
Median	39.96	4.00	0.49	18.42	3.39	19.39	4.00	0.00	0.00
St. Dev.	70.10	1.88	0.15	2.07	1.32	1.11	3.15	0.20	0.50
Maximum	469.76	11.00	0.79	24.32	8.75	21.51	30.00	1.00	1.00
Minimum	-212.56	1.00	0.04	11.99	0.01	15.42	0.08	0.00	0.00

2.5. Empirical results

2.5.1. Effect of bank managerial ability on bond spreads

We first undertake some mean and variance tests. Table 2.5 reports the mean and the standard deviation of the spread according to the level of each right hand side variable of the equation.

We split the sample into two sub-samples: (*i*) below or above the median for the following variables (BMA, RISK, SIZE, AMOUNT, MATURITY and TAX), (*ii*) before or during the distress period, and (*iii*) according to whether the issue is subordinated or not. We then test for the equality of the means of SPREAD (T-test) and for the equality of the variances (F-test).

The objective here is to check whether the mean and the standard deviation of the spread differ across the sub-samples tested. If we consider the t-test in the case of the BMA variable, we make two subsamples: the first one (HBMA) identifies the bonds issued by the well-managed banks that is with a BMA superior to the median value. The second sub-sample (LBMA) includes bonds from banks which have a BMA inferior or equal to the median value. We then calculate the mean of the spread for each subset: $\overline{\text{Spread}}_{\text{HBMA}}$ and $\overline{\text{Spread}}_{\text{LBMA}}$, and we test for:

$$\begin{cases} \text{H0: } \overline{\text{Spread}}_{\text{HBMA}} = \overline{\text{Spread}}_{\text{LBMA}} \\ \text{versus H1: } \overline{\text{Spread}}_{\text{HBMA}} \neq \overline{\text{Spread}}_{\text{LBMA}} \end{cases}$$

In order to have consistent results, we expect to reject the null hypothesis, which is the case. The procedure is similar for the F-test.

We find that the mean spread and dispersion differ between better and worse managed banks. Those that are the worse managed are penalized. The average spread is higher for badly-rated bonds, illiquid bonds, subordinated bonds, long maturities bonds that have been issued during the financial crisis, and bonds with high coupon rate. The mean spread test does not show a significant difference depending on the size of the issuers.

Table 2.5: Bond spread and issue characteristics

RISK is the average issues ratings. BMA is the proxy of bank managerial ability. AMOUNT is the natural logarithm of amount of issue in Euros. TAX is the coupon rate, SIZE is the natural logarithm of the issuing bank's total assets. MATURITY is the number of years between the issue and the redemption date. SUBD is a dummy variable that equals to one if the issuing debt is subordinated, and zero otherwise. The dummy CRISIS equals 1 if the issuance date occurs during the distress period, from July 2007 to the end of 2011, and 0 otherwise. We split the whole sample into two equally sized sub-samples: below or above the median for the following variables (BMA, RISK, SIZE, AMOUNT, MATURITY and TAX)[54]; before or during the distress period and according to whether the issue is subordinated or not. We then test for the equality of the means of SPREAD (T-test) and variances (F-test)

***, **, * indicate significance at the 1%, 5%, and 10% levels respectively.
T-stat is the Student statistic for H0: "the mean of the spread is the same on the two subsamples".
F-stat is the Fisher statistic for H0: "the standard deviation of the spread is the same on the two subsamples".

Variables	Subsets	Nb of issues	Mean Spread	T-stat	Std. Dev. Spread	F-stat
BMA	[Q1-Q50[	962	67.37	(-5.75)***	73.70	(1.28)***
	[Q50-Q100]	962	49.13		65.09	
RISK	[Q1-Q50]	1,200	52.38	(4.79)***	65.84	(1.32)***
	]Q50-Q100]	724	67.99		75.70	
AMOUNT	[Q1-Q50[	889	52.09	(3.58)***	67.63	(1.12)*
	[Q50-Q100]	1,035	63.54		71.78	
TAX	[Q1-Q50[	962	39.45	(12.20)***	60.12	(1.53)***
	[Q50-Q100]	962	77.05		74.25	
SIZE	[Q1-Q50[	962	56.57	(1.05)	64.41	(1.36)***
	[Q50-Q100]	962	59.94		75.37	
MATURITY	[Q1-Q50]	979	54.51	(-2.38)***	65.17	(1.31)***
	]Q50-Q100]	945	62.13		74.71	
SUBD	Yes	87	133.59	(-10.54)***	79.83	(1.39)***
	Now	1,837	54.68		67.58	
CRISIS	Before	949	19.11	(28.93)***	40.11	(3.22)***
	During	975	96.35		72.06	

[54] Even using the median value, we do not necessarily obtain the same number of observations in each sub-sample. Indeed, for some variables, the median value is taken by a multitude of observations. For example, in the case of the risk variable, 357 bonds have a rating equal to 4, the median value. This represents 18% of the sample. We decided to affect the median value either to the superior or the inferior sub-sample in order to try to balance each subset.

We then estimate the coefficients of the spread model using OLS and robust variance-covariance matrix for these estimated coefficients. Column 1 in Table 2.6 reports the results of this estimation.

Coefficients of both RISK and BMA appear to be highly significant: worst rated and managed banks pay a larger spread. A lower bond rating reflects a higher probability of default, which conveys a higher yield spread. A decrease in the BMA measure reveals a decline in the bank managerial ability for which bondholders require a higher spread. A one standard deviation improvement of BMA (0.15) decreases the bond spread by 7.85 basis points[55].

BMA appears to be a determinant of the bond spread in addition to the risk variable. We suggest two explanations for such a finding. First, Leverty and Grace (2012) find that inefficient management leads to a higher likelihood of failure. Firms controlled by less capable managers are more likely to become insolvent. Thus, while the effect of managerial ability on bank default risk should be fully incorporated by bond ratings, we observe a direct effect on bond spreads which tends to confirm that the default proxy does not entirely reflect the default premium. Second, Demerjian *et al.* (2013) find that managerial ability has a positive impact on bank disclosure policies and financial reporting quality[56] which leads to lower bank opacity. Moreover, as shown by Bharath *et al.* (2008)[57], when the quality of the reported information increases, investors can better assess the economic performance of firms. Therefore banks with more capable managers provide data that are more reliable. The default measure is more faithful for performing banks. Bondholders are thus less confident about the default measure of banks with low level of managerial ability because of their lack of disclosure and their less stable behavior. They require a higher spread to compensate for this uncertainty, whatever the level of default, which is captured by the bank managerial ability measure.

[55] The economic effect of improving BMA by one standard deviation on bond spread is computed as: $0.15 \times -52.32 \approx -7.85$

[56] They show that superior managers have a better judgment and knowledge about their films leading to higher quality earnings, which accurately reflect companies' current operating performance.

[57] They measure the degree of discretionary accounting choices made by firms. Banks have difficulties to estimate future operating cash flows of borrowers using financial statements in the case of firms with large abnormal operating accruals, that is abnormal deviations between earnings and operating cash flow. A high level of abnormal operating accruals reveals a poor accounting quality which results in higher loan spread.

The coefficient of AMOUNT is positive and significant. Bondholders require a higher spread from larger amounts. We suggest two explanations for this finding. On one hand, this result may imply that larger bonds are illiquid. It is consistent with previous results such as McGinty (2001) and, more recently, Iannotta *et al.* (2013) who suggest that some large bonds are actually poorly traded. In that case, the bond spread increases because the high amount of the bond decreases its liquidity. On the other hand, a bank that issues larger bonds increases its level of debt but, at the same time, its probability of missing ongoing debt payments. According to structural models, a firm is assumed to default when the value of its liabilities exceed the value of its assets (Black and Scholes (1973) and Merton (1974)). Accordingly, when a bank issue a new debt, its level of liabilities increases and this bank is more likely to reach the condition for default. This effect is even stronger than the amount of bond is large. Holders of larger bonds are then exposed to a higher risk to lose their investment and may also require an higher spread for this reason.

The positive and significant sign associated with TAX points out that bondholders require a tax premium. These results confirm empirical findings (see Elton *et al.* (2001), Longstaff *et al.* (2004), Driessen (2005) or Houweling *et al.* (2005)). The MATURITY coefficient is negative and significant. Bondholders seem to charge a higher spread for bonds with shorter maturity. A deeper analysis of bondholders' behavior before and during the financial crisis might explain this result. The SUBD dummy is positive and significant: subordinated debt holders require a higher spread for the higher risk they bear (see Pop (2006)).

The coefficients of the other control variables are consistent with the literature. The sign of the SIZE variable is negative and significant. This suggests that large issuers benefit from diversification or from an implicit guarantee discount on the yield spread (see Flannery and Sorescu (1996) or Balasubramnian and Cyree (2011)). The bond spread is significantly higher during the recent financial crisis (starting in mid-2007) as shown by the positive and significant coefficient associated to the CRISIS variable. The 2007-2009 financial crisis led to an increase in the bond premium required by investors (see Gilchrist and Zakrajšek (2011)). The inverse of the Mills' ratio (LAMBDA) presents a significant coefficient, we thus need to take into account the sample selection bias in our study (see Covitz *et al.* (2004)). In summary, our results suggest that, when we control for observable issue characteristics and issuer fundamentals, bondholders *directly* price bank managerial ability.

2.5.2. Financial crisis effect on the pricing of managerial ability

According to our hypothesis 2, we ask whether the behavior of bondholders is the same depending on the economic situation. We further look into our analysis by considering two sub-periods: before and during the recent financial crisis. The first period stretches from 2002 to the end of the second quarter of 2007. The financial crisis goes from the third quarter of 2007 to the end of 2011. Appendix 2.7 reports the number of issues and the average spread for the whole period and for each sub-period. This table also provides breakdowns by payment rank, maturity groups, coupon rate groups, credit rating groups and whether or not there is a disagreement between rating agencies. Nearly the same number of bonds is issued during both periods: 949 during the sound period and 975 during the stressed one. However, the number of issuers is quite different: during the distress period, 58 banks have issued bonds while only 20 one of them has issued bonds during the sound period[58].

We estimate coefficients of the spread model presented in equation 2.3 for both periods. Columns 2 and 3 of Table 2.6 report the results for the sound and distress periods.

The financial crisis has influenced the way bondholders price debt. Before the distress period, bondholders only price bank managerial ability. The default risk proxy is not significant. However, during the financial crisis, both default risk proxy and bank managerial ability are priced by bondholders. Bondholders have become sensitive to the risk measure. We can also observe that they are more sensitive to bank managers' ability as the coefficient relative to the BMA variable is higher during the distress period. Improving BMA of one standard deviation results in a reduction of 4.19 basis points of the spread during the sound period while decreasing the spread by 14.88 basis points during the turmoil. The increase of the default probability and uncertainty during the financial crisis has led bondholders to be particularly attentive in the pricing of the default premium. Our results suggest that bondholders have increased their monitoring during the difficult time.

The effect of the amount of issue is different depending on the sub-samples periods. While it matters during the sound period, it becomes non significant during the distress period. The tax

[58] The financial crisis led many banks to adjust their funding models towards more stable and more traditional sources.

premium appears to be a determinant of the bond spread in both periods. Bank size and payment rank matter during the sound period, bond maturity and payment rank during the financial crisis. The coefficient of bond maturity appears to be negative and significant only during the financial crisis. Given the liquidity problems faced by banks during the period considered (see the average amount of issues in Appendix 2.2), our result might be explained by a strong demand of liquidity with short maturities (2007, 2008, and 2009 are characterized by the lowest average maturities over the period studied) while demand for longer maturities is lessen.

Table 2.6: Bond spread equations: whole, sound and distress periods

This table reports the estimates of equation 2.3 where SPREAD is the difference in basis points between the bond yield at issuance and the yield of a same currency and maturity treasury bond, RISK is the average issue rating, BMA is the proxy of bank managerial ability. AMOUNT is the natural logarithm of amount of issue in Euros. TAX is the coupon rate. SIZE is the natural logarithm of the issuing bank's total assets. MATURITY is the number of years between the issue and the redemption date. SUBD is a dummy variable that equals one if the issuing debt is subordinated, and zero otherwise. The dummy CRISIS equals 1 if the issuance date occurs during the distress period, from the July 2nd 2007 to the end of 2011, 0 otherwise. LAMBDA is the inverse of the Mills' ratio. ***, **, * indicate significance at the 1%, 5%, and 10% levels respectively. Country and currency dummies are present in each equation.

	Whole	Sound	Distress
	(1)	(2)	(3)
RISK (α)	4.528***	0.891	8.032***
	(7.26)	*(1.38)*	*(7.65)*
BMA (β)	-52.330***	-27.982***	-99.223***
	(-5.20)	*(-2.79)*	*(-5.18)*
AMOUNT	1.578**	2.075***	0.658
	(2.25)	*(3.52)*	*(0.54)*
TAX	18.878***	17.997***	21.252***
	(11.36)	*(6.57)*	*(9.25)*
SIZE	-5.739***	-7.859***	-4.159
	(-3.33)	*(-5.63)*	*(-1.42)*
MATURITY	-1.719***	-0.471	-3.028***
	(-3.77)	*(-0.68)*	*(-4.62)*
SUBD	34.842***	16.340**	52.186***
	(5.03)	*(2.09)*	*(5.67)*
CRISIS	67.681***	-	-
	(22.78)	-	-
LAMBDA	-48.441**	-64.621***	-21.546
	(-2.17)	*(-4.30)*	*(-0.78)*
CONSTANT	51.430	87.677**	102.111*
	(1.34)	*(2.48)*	*(1.77)*
Obs.	1,924	949	975
Adjusted R^2	0.550	0.356	0.415
F	64.395	18.480	21.357

2.5.3. Factors affecting the relationship between managerial ability and bond spread

To further our analysis, we investigate whether the grade of credit ratings, bond maturity and payment rank strengthen or weaken the relationship between managerial ability and bond spread.
For each category, we estimate coefficients of the spread model.

2.5.3.1. Credit Ratings

In columns 1 to 3, we report subsample equations for three rating categories: respectively high (AAA), medium (between AA+ and AA-) and low (between A+ and BB+) rating levels. Table 2.7 reports the results of these estimations.

For each of the three subsamples, the BMA coefficient is negative and significant as for the whole sample. Whatever the level of default risk, bondholders require a higher spread for impaired management. Moreover our results show that for bonds rated A+ to BB+ investors are more sensitive to managerial ability than for those with better ratings. The coefficient assigned to this variable is more than twice the one of bonds with a rating above A+.

We observe that the coefficient of the default risk proxy is positive and significant only for bonds with a default risk belonging to the low rated category: we can foresee that the default risk proxy matters only for these bonds as this category presents the most disparity among the ratings.

Table 2.7: Bond spread equations: credit rating categories

This table reports the estimates of equation 2.3 on subsample for respectively high (AAA), medium (between AA+ and AA-) and low (between A+ and BB+) rating levels. SPREAD is the dependent variable defined as the difference in basis points between the bond yield at issuance and the yield of a same currency and maturity treasury bond, RISK is the average issue rating, BMA is the proxy of bank managerial ability. AMOUNT is the natural logarithm of amount of issue in Euros. TAX is the coupon rate. SIZE is the natural logarithm of the issuing bank's total assets. MATURITY is the number of years between the issue and the redemption date. SUBD is a dummy variable that equals one if the issuing debt is subordinated, and zero otherwise. The dummy CRISIS equals 1 if the issuance date occurs during the distress period, from the July 2nd 2007 to the end of 2011, 0 otherwise. LAMBDA is the inverse of the Mills' ratio. ***, **, * indicate significance at the 1%, 5%, and 10% levels respectively. Country and currency dummies are present in each equation.

	[AAA]	[AA+ ; AA-]	[A+ ; BB+]
	(1)	(2)	(3)
RISK (α)	-1.076	1.949	7.873**
	(-0.12)	*(0.69)*	*(2.22)*
BMA (β)	-46.214***	-43.053**	-106.198***
	(-3.10)	*(-2.49)*	*(-5.80)*
AMOUNT	0.650	1.622*	2.436
	(0.44)	*(1.67)*	*(1.48)*
TAX	10.386***	21.628***	22.934***
	(6.61)	*(7.67)*	*(7.22)*
SIZE	-13.072***	-3.098	-15.320***
	(-3.50)	*(-0.91)*	*(-4.04)*
MATURITY	-2.960***	-0.498	-2.617***
	(-4.32)	*(-0.63)*	*(-2.95)*
SUBD	-	27.280**	29.879***
	-	*(2.28)*	*(3.36)*
CRISIS	43.585***	74.174***	68.283***
	(9.14)	*(14.61)*	*(11.19)*
LAMBDA	-120.977***	-54.831	-91.514***
	(-3.67)	*(-0.91)*	*(-2.67)*
CONSTANT	259.876***	-9.373	213.854**
	(3.66)	*(-0.12)*	*(2.47)*
Obs.	461	894	569
Adjusted R^2	0.555	0.560	0.630
F	25.927	32.549	31.209

2.5.3.2. Payment Rank

In columns 1 and 2 of Table 2.8, we report subsample estimates for respectively secured bonds and unsecured / subordinated bonds.

Results are in line with our previous ones: the BMA coefficient is negative and significant for both categories whereas the pricing of the default risk proxy is effective only for unsecured / subordinated bonds. The coefficient estimates of most control variables are statistically significant for both categories and have the same signs as those we find in our baseline results. Bondholders price managerial ability whatever the payment rank of bonds.

Our findings are in line with those of Bliss and Flannery (2000) and Pop (2006): subordinated bondholders are particularly sensitive to bank default risk, and their monitoring is more effective.

Table 2.8: Bond spread equations: payment rank categories

This table reports the estimates of equation 2.3 on subsample for respectively secured bonds and unsecured or subordinated bonds. SPREAD is the dependent variable defined as the difference in basis points between the bond yield at issuance and the yield of a same currency and maturity treasury bond, RISK is the average issue rating, BMA is the proxy of bank managerial ability. AMOUNT is the natural logarithm of amount of issue in Euros. TAX is the coupon rate. SIZE is the natural logarithm of the issuing bank's total assets. MATURITY is the number of years between the issue and the redemption date. SUBD is a dummy variable that equals one if the issuing debt is subordinated, and zero otherwise. The dummy CRISIS equals 1 if the issuance date occurs during the distress period, from the July 2nd 2007 to the end of 2011, 0 otherwise. LAMBDA is the inverse of the Mills' ratio. ***, **, * indicate significance at the 1%, 5%, and 10% levels respectively. Country and currency dummies are present in each equation.

	Secured	Unsecured / Subordinated
	(1)	(2)
RISK (α)	-1.060	5.729***
	(-0.45)	*(4.29)*
BMA (β)	-67.874***	-53.868***
	(-3.45)	*(-4.31)*
AMOUNT	-0.393	1.376*
	(-0.26)	*(1.66)*
TAX	16.389***	19.572***
	(5.21)	*(10.02)*
SIZE	-13.320***	-5.410**
	(-3.33)	*(-2.48)*
MATURITY	-2.152***	-1.569***
	(-2.89)	*(-2.76)*
SUBD	35.713***	31.210***
	(6.25)	*(4.49)*
CRISIS	-1.060	80.480***
	(-0.45)	*(20.56)*
LAMBDA	-115.883***	-32.085
	(-2.64)	*(-1.23)*
CONSTANT	276.396***	33.070
	(3.31)	*(0.65)*
Obs.	586	1,338
Adjusted R^2	0.358	0.596
F	16.548	55.726

2.5.3.3. Maturity

In Table 2.9 reports the estimates for the maturity effect. Instead of making two subgroups we opt here for the use of interaction terms[59]. We create a dummy HM which equals 1 if the maturity is higher than 4 years (the median maturity), 0 otherwise. We interact this term with both RISK and BMA. The δ coefficient, relative to the interacted variable BMA*HM, is not significant but the sum β + δ remains significantly negative: the effect of BMA on the spread does not depend on the maturity of the bond. Furthermore, our results show that bondholders sensitivity to the default risk proxy is stronger for long maturities: bondholders require a higher default risk premium for long-term bonds (see Güntay and Hackbarth (2010)).

[59] Results are similar if we proceed by sub-samples (available upon request).

Table 2.9: Bond spread equations: maturity effect

This table reports the estimates of equation 2.3 where SPREAD is the difference in basis points between the bond yield at issuance and the yield of a same currency and maturity treasury bond, RISK is the average issue rating, BMA is the proxy of bank managerial ability. AMOUNT is the natural logarithm of amount of issue in Euros. TAX is the coupon rate. SIZE is the natural logarithm of the issuing bank's total assets. SUBD is a dummy variable that equals one if the issuing debt is subordinated, and zero otherwise. The dummy CRISIS equals 1 if the issuance date occurs during the distress period, from the July 2nd 2007 to the end of 2011, 0 otherwise. LAMBDA is the inverse of the Mills' ratio. HM is dummy which equals 1 if maturity is higher than 4 years (median maturity), 0 otherwise. T-statistics are shown in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% levels respectively. Country and currency dummies are present in each equation.

	SPREAD
RISK (α)	3.243***
	(4.07)
BMA (β)	-42.955***
	(-3.70)
AMOUNT	1.714**
	(2.41)
TAX	17.856***
	(11.31)
SIZE	-6.359***
	(-3.61)
SUBD	24.467***
	(3.45)
CRISIS	68.194***
	(22.80)
LAMBDA	-51.88**
	(-2.24)
CONSTANT	58.90
	(1.52)
RISK x HM (γ)	3.373***
	(2.88)
BMA x HM (δ)	-16.051
	(-1.03)
HM	-8.562
	(-1.01)
Obs.	1,924
Adjusted R^2	0.547
F	60.678
test for $\alpha + \gamma = 0$	6.61***
test for $\beta + \delta = 0$	-59.00***

2.6. Robustness checks

Our results indicate evidences that managerial ability is a determinant of the bond spread. We undertake robustness checks relative to the bank managerial ability variable, and the relationship between this variable and the bond spread. Estimations are reported in Appendices 2.8 to 2.10.

2.6.1. Spread equation and sample robustness

We first perform several robustness checks related to the spread regression model. We estimate the spread equation: (i) excluding the managerial ability measure to test for the marginal explanatory power of this variable, (ii) excluding LAMBDA, the inverse of the Mills' ratio, which can potentially drive results, (iii) excluding the TAX variable, (iv) excluding the MATURITY variable, (v) excluding country and currency dummies, (vi) calculating a bond spread using an identical benchmark for all bonds, the German Government Yield, and (vii) excluding years of the sovereign debt crisis i.e. 2010 and 2011. These estimations are available in Appendix 2.8.

Compared to column (i) in Table A7 of Appendix 2.8, the *adjusted* R-squared of column (1) in Table 2.6 is higher due to the inclusion of bank managerial ability. This confirms that the introduction of bank managerial ability matters into the determination of bond spread.

Second, the insertion of both TAX and MATURITY variables into the spread equation does not affect the main relationships.

Third, excluding country and currency dummies (vi) affect the SIZE variable whose coefficient is no longer significant. This result is consistent with our findings in univariate mean tests and underlines the necessity to control for country and currency effects.

Finally, our results are also robust to the choice of benchmark to compute the bond spread (vii) and to the time period (viii).

2.6.2. Managerial ability robustness

We then undertake robustness checks related to the measure of the bank managerial ability. Results can be found in Appendix 2.9. We try five different proxies for the measure of BMA: (i) BMA1 is computed using a Battese and Coelli (1995) model that includes environmental variables[60] as suggested by Dietsch and Lozano-Vivas (2000), (ii) BMA2 is obtained by using a data envelopment method (DEA) as Demerjian *et al.* (2012), (iii) BMA3 is estimated through the same technical estimation as BMA except we assume that investors refer to the very past information, and consequently the BPF is estimated using the whole information since 1998, the window for the estimation of the different annual frontiers is thus [1998, t], (iv) BMA4 is calculated with the introduction of a non linear term, the squared risk term, into the frontier[61] as suggested by DeYoung *et al.* (2001), and (v) BMA5 is estimated using a single BPF computed over the complete period 1998-2011 assuming that investors hold *ex-post* information.

We can notice that when we use the DEA method (BMA2), the coefficient associated to bank managerial ability is no longer significant. This result may be a consequence of the use of the DEA method. Indeed, this nonparametric method cannot disentangle random error from inefficiency in the error term and is not able to provide an accurate measure of managerial ability. For the other proxies (BMA1, BMA3, BMA4, BMA5), results remain mostly the same.

2.6.3. Risk robustness

Finally, we replicate the estimations by replacing the default proxy (the rating bond) by 5 different proxies also commonly used in the literature to measure the effect of the default premium on bond spreads. Results can be found in Appendix 2.10.

First, we consider the distance to default (DD). We use the same formula as Crosbie and Bohn (2003) with a maturity of one year and daily series of equity market value. The daily series of debt are interpolated from annual ones using a cubic spline. The volatility of equity is measured as the standard deviation of the daily return multiplied by $\sqrt{252}$. The risk-free interest rate is the 12-month Euribor whatever the country. All relevant series come from Bloomberg. A higher distance to default is associated with a lower probability of failure (see Demirovic *et al.* (2015)). Second, we use a market based and accounting Z-score. The market based Z-score (ZMKT) is computed using market measures of bank stock return and risk, the

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[60] The Battese and Coelli (1995) model extends the Battese and Coelli (1992) one by expressing the one-sided inefficiency error component (u_{it}) as a linear function of explanatory variables that reflects countries specific characteristics. We include the density of population, the domestic credit provided by financial sector and the GDP per capita relative to each countries (extracted from respectively Eurostat and the Worldbank).

[61] The frontier equation is then $ER_{it} = \alpha + \beta RK_{it} + \gamma RK^2_{it} + \varepsilon_{it}$.

later is defined as the standard deviation of weekly bank stock returns computed on a moving window of 52 quoted weeks [t-51, t]. The accounting based Z-score (ZROA) equals the return on assets plus the capital asset ratio divided by the standard deviation of asset returns. A 3-year moving window is used to estimate standard deviations for each bank each year (see Cubillas *et al.* (2012) or Balasubramnian and Cyree (2014)). A higher Z-score indicates that a bank is more stable and less prone to default.

Third, we use two different kind of bank ratings: RTGTRAD, the average of the Fitch, Moody's and Standard and Poor's issuer ratings and RTSOL, the average of bank individual / financial ratings (see Sironi (2003)). The former strength ratings are different from traditional issuer ratings as they exclude a potential influence of a safety net effect; in this respect, they reflect the intrinsic financial condition of banks. These ratings measures are built using the rating scales in Appendix 2.1. With the exception of RTSOL, for which the coefficient appears to be not significant, results remain unchanged whatever the risk proxy.

2.7. Conclusion

This paper investigates the relationship between bank managerial ability and bond spread. We provide evidence that banks with better capable managers have significantly lower spread. This finding is robust to the inclusion of bank and issue-specific characteristics, common control variables, splitting of the sample and alternative econometric specifications. The impact of bank managerial ability on bond spread is significant. Disregarding management effects while studying bond spread determinants leads to a misspecification of the default risk component. We find evidence that bank bondholders take into account the quality of bank management in terms of risk and return when they price debt.

Our findings also suggest that the quality of bank management is a determinant of bondholders' confidence in the measure of default risk. Unskilled managers are less able to make efficient choices and provide information which reflects inaccurately their true default probability. The actual level of default is then more uncertain for inadequately managed banks and bondholders require a higher spread to compensate for this uncertainty, whatever the current level of default. Our findings have potential policy implications in the market discipline field. They highlight that bondholders' monitoring is effective, and enhance the quality of market signals which correctly reflects banks' default profile.

APPENDICES

Appendix 2.1: Table A1 - Ratings scales

These tables indicate the numerical scale for credit ratings (see Ronn and Verma (1987)). As traditional credit ratings we use Moody's Issuer Rating, Fitch Long Term Issuer Default Rating, and Standard & Poor's Issuer Credit Rating. The strength ratings are only Moody's Bank Financial Strength Rating (MBFSR) and Fitch's Bank Individual Rating (FBIR) as Standard & Poor's agency does not provide a solidity rating.

Traditional credit rating: Issuers and Issues

Cardinal value	Moody's	Fitch	S&P
1	Aaa	AAA	AAA
2	Aa1	AA+	AA+
3	Aa2	AA	AA
4	Aa3	AA-	AA-
5	A1	A+	A+
6	A2	A	A
7	A3	A-	A-
8	Baa1	BBB+	BBB+
9	Baa2	BBB	BBB
10	Baa3	BBB-	BBB-
11	Ba1	BB+	BB+
12	Ba2	BB	BB
13	Ba3	BB-	BB-
14	B1	B+	B+
15	B2	B	B
16	B3	B-	B-
17	Caa1	CCC+	CCC+
18	Caa2	CCC	CCC
19	Caa3	CCC-	CCC-
20	Ca	CC	CC
21	C	C	C
22	D	D	D

Financial strength rating: Issuers

Cardinal value	MBFSR	Cardinal value	FBIR
1	A	1	A
2	A-		
		2,5	A/B
3	B+		
4	B	4	B
5	B-		
		5,5	B/C
6	C+		
7	C	7	C
8	C-		
		8,5	C/D
9	D+		
10	D	10	D
11	D-		
		11,5	D/E
12	E+		
13	E	13	E

Appendix 2.2: Table A2 - Distribution and sample descriptive statistics of issues by year, rating, and country categories.

Subd indicates whether the issue is subordinated or not. Spread is the difference in basis points between bond yield at issuance and the yield of a same currency and maturity treasury bond. Maturity is the number of years between the issue and the redemption date. Bond rating, traditional and solidity bank ratings are the average rating of issues and banks respectively according to the rating scale (see Appendix 2.1). BMA is the proxy for bank managerial ability.

	Issues Nb. (Banks)	Subd	Spread		Maturity (years)	Amount (€ million)	Bond Rating	Traditional Bank Rating	Solidity Bank Rating	BMA
			Mean	S.d.						
By year										
2002	94 (16)	14	24.68	39.69	5.16	344.51	3.63	4.76	5.67	0.41
2003	133 (18)	8	34.05	60.34	5.38	207.17	4.47	5.62	6.98	0.38
2004	252 (22)	7	9.71	30.64	4.83	166.21	4.13	5.36	6.12	0.46
2005	207 (20)	1	11.54	32.25	4.93	259.38	3.59	5.67	6.04	0.51
2006	146 (22)	6	27.28	40.14	4.52	405.47	4.33	5.44	5.09	0.53
2007	185 (20)	4	36.18	39.00	3.82	1,487.32	3.74	4.73	4.96	0.61
2008	180 (32)	14	110.98	78.47	4.52	669.46	3.40	4.63	5.59	0.43
2009	261 (35)	8	120.42	67.59	4.28	667.57	3.16	4.83	6.55	0.38
2010	319 (45)	17	76.30	58.53	5.73	788.98	3.37	5.52	7.42	0.41
2011	147 (26)	8	95.11	91.04	5.23	631.58	3.98	6.10	6.47	0.54
By rating										
AAA/Aaa	461	0	44.50	49.16	5.10	531.39	1.00	5.82	6.69	0.48
AA+/Aa1	146	0	60.55	76.82	4.03	792.72	2.00	4.93	6.44	0.36
AA/Aa2	236	2	80.91	76.20	4.72	1,290.73	3.00	4.00	4.92	0.47
AA-/Aa3	512	28	51.53	72.01	5.03	514.26	4.00	4.65	5.76	0.44
A+/A1	225	21	73.27	64.92	4.88	645.68	5.00	5.50	6.43	0.50
A/A2	258	17	46.98	68.76	4.47	170.85	6.00	6.16	6.62	0.49
A-/A3	70	13	107.71	97.38	5.18	142.38	7.00	6.74	7.71	0.42
BBB+/Baa1	12	4	66.69	110.27	5.92	84.8	8.00	6.59	7.41	0.47

Table A.2 (Continued)

BBB/Baa2	3	2	77.82	129.30	6.45	33.67	9.00	7.94	6.92	0.50
BBB-/Baa3	0	0	-	-	-	-	10.00	-	-	-
BB+/Ba1	1	0	72.60	-	5.00	70.35	11.00	11.00	8.50	0.64
By country										
Austria	89 (5)	1	68.34	54.73	5.79	136.57	3.54	6.01	7.57	053
Britain	17 (4)	2	232.17	118.44	7.67	1,150.56	5.22	4.76	4.33	0.55
Denmark	12 (2)	0	69.30	29.44	2.89	742.50	1.67	5.50	9.83	0.37
Finland	14 (1)	2	94.38	91.80	4.99	1,604.64	3.71	3.71	5.14	0.50
France	193 (7)	30	98.44	73.74	4.70	1,381.01	3.59	3.52	4.65	0.43
Germany	1,018 (9)	20	35.17	51.13	4.65	210.81	3.73	5.55	6.57	0.41
Greece	1 (1)	0	22.20	-	7.00	1,500.00	1.00	8.00	6.25	0.63
Ireland	107 (4)	0	68.53	82.30	2.74	1,108.46	3.80	5.22	5.93	0.64
Italy	200 (13)	25	69.77	81.91	5.81	836.83	4.91	5.98	6.39	0.51
Netherlands	4 (2)	0	110.15	84.22	8.00	1,018.75	5.08	4.00	-	0.59
Norway	6 (4)	0	36.34	24.43	3.33	275.00	5.16	6.25	6.62	0.64
Portugal	15 (3)	0	83.50	93.97	4.68	845.33	2.74	5.92	6.18	0.59
Spain	125 (7)	3	62.16	67.31	5.89	1,194.05	2.17	4.87	4.88	0.60
Sweden	121 (4)	4	114.93	62.31	4.66	1,065.44	3.39	4.59	5.84	0.46
Switzerland	2 (1)	0	102.50	115.17	3.99	425.00	3.42	4.33	5.25	0.33
TOTAL	**1,924**	**87**	**58.26**	**70.11**	**4.85**	**586.87**	**3.71**	**5.27**	**6.21**	**0.46**

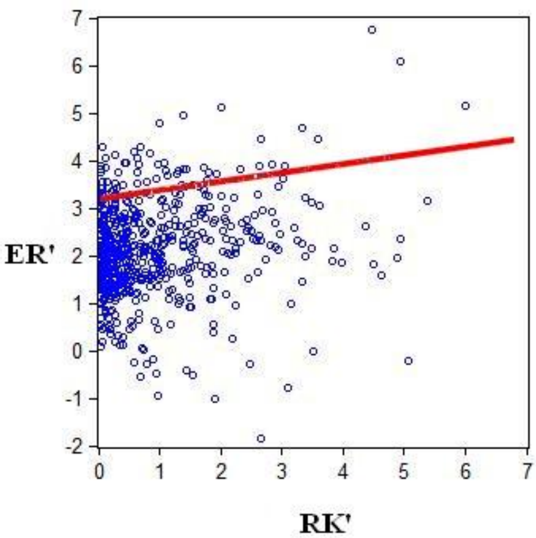
Appendix 2.3: Table A3 - Summary of stochastic frontier estimated parameters

ER is the estimated bank return and RK is the bank risk. P-values are shown in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels respectively. γ is equal to $\sigma^2 / (\sigma_v^2 + \sigma^2)$ and σ^2 is the variance of the inefficiency component $u_{i,t}$.

Years	Frontier equation	Nb. Obs.	Log Likelihood	Mean Efficiency	γ	σ^2
1998 - 2002	$ER = 3.06^{***} + 0.06.RK$ (0.00) (0.41)	180	-252.63	0.4753	0.75*** (0.00)	1.89*** (0.00)
1999 - 2003	$ER = 2.94^{***} + 0.13^{**}.RK$ (0.00) (0.03)	263	-369.58	0.5143	0.64*** (0.00)	1.66*** (0.00)
2000 – 2004	$ER = 2.89^{***} + 0.16^{***}.RK$ (0.00) (0.00)	344	-482.81	0.5234	0.62*** (0.00)	1.61*** (0.00)
2001 - 2005	$ER = 2.81^{***} + 0.25^{***}RK$ (0.00) (0.00)	383	-530.64	0.5466	0.57*** (0.00)	1.48*** (0.00)
2002 - 2006	$ER = 2.91^{***} + 0.24^{***}.RK$ (0.00) (0.00)	395	-548.51	0.5544	0.54*** (0.00)	1.45*** (0.00)
2003 - 2007	$ER = 3.17^{***} + 0.19^{***}.RK$ (0.00) (0.00)	416	-582.18	0.5370	0.58*** (0.00)	1.54*** (0.00)
2004 - 2008	$ER = 3.24^{***} + 0.17^{***}.RK$ (0.00) (0.00)	456	-635.84	0.4815	0.74*** (0.00)	1.84*** (0.00)
2005 - 2009	$ER = 2.99^{***} + 0.20^{***}.RK$ (0.00) (0.00)	525	-730.63	0.4867	0.73*** (0.00)	1.81*** (0.00)
2006 - 2010	$ER = 2.67^{***} + 0.24^{***}.RK$ (0.00) (0.00)	595	-828.10	0.5668	0.52*** (0.00)	1.41*** (0.00)
2007 - 2011	$ER = 2.57^{***} + 0.20^{***}.RK$ (0.00) (0.00)	606	-848.34	0.5851	0.47*** (0.00)	1.37*** (0.00)

Appendix 2.4: Figure A1 - The last estimated frontier over the period 2007 – 2011

ER' is the estimated bank return and RK' is the bank risk.



Appendix 2.5: Table A4 - Mean return, risk and bank managerial ability measure for the 192 banks

ER is the estimated bank return, RK is the bank risk and BMA is the measure of bank managerial ability.

Years	Return (ER)	Risk (RK)	BMA
2002	0.18	0.41	0.52
2003	0.16	0.39	0.50
2004	0.15	0.25	0.50
2005	0.14	0.23	0.51
2006	0.15	0.27	0.54
2007	0.16	0.23	0.57
2008	0.15	0.31	0.49
2009	0.11	0.20	0.41
2010	0.12	0.34	0.54
2011	0.11	0.35	0.55
Total	0.14	0.32	0.51

Appendix 2.6: Table A5 - Issuance decision model

Our model of issuance decision is:

$$DISSUE_{it} = \alpha_0 + \alpha_1\, NPLNL_{it} + \alpha_2\, VIX_{it} + \alpha_3\, UNEMPL_{it} + \alpha_4\, LNTA_{it} + \alpha_5\, EQTA_{it} + \varepsilon_{it} \qquad (2.4)$$

DISSUE is a dummy that equals 1 if bank *i* decides to issue a new bond at time *t* and 0 otherwise. NPLNL is the non-performing loans to net loans ratio. VIX is an index of market volatility. UNEMPL is the unemployment rate relative to each country. LNTA is the natural logarithm of bank total assets. EQTA is the equity total assets ratio. The previous probit equation is estimated on a sample including both issuing and non-issuing banks. From the involved residuals, we compute LAMBDA, the inverse of the Mills' ratio according to Heckman (1979) .

Z-statistics are shown in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% levels respectively.

	DISSUE
NPLNL	0.253
	(0.16)
VIX	0.02^{***}
	(2.63)
UNEMPL	-0.06^{***}
	(-4.40)
LNTA	0.81^{***}
	(19.08)
EQTA	-11.13^{***}
	(-8.36)
Obs.	5,295
Mc Fadden R²	0.705
LR Statistic	2.099^{***}

Appendix 2.7: Table A6 - Descriptive statistics by issue characteristics over all periods

The table reports the number of observations and the mean spread (in parentheses) for the whole, distress and sound periods. The distress period goes from July 2007 to the end of 2011 whereas the sound period goes from 2002 to the end of June 2007. It also provides breakdowns by payment rank, maturity groups, coupon rate groups, credit rating groups and whether or not there is a disagreement between rating agencies.

	Whole Sample	Distress Sample	Sound Sample
Number of issuers	67	58	38
Number of issues	1,924 (58.26)	975 (96.35)	949 (19.12)
Payment Rank			
Secured	586 (37.08)	271 (60.79)	315 (16.68)
Unsecured	1251 (62.94)	653 (104.50)	598 (17.55)
Subordinated	87 (133.59)	51 (180.90)	36 (66.57)
Maturity			
Short (< 5 years)	1,296 (55.95)	646 (97.66)	650 (14.51)
Medium (5 - 15 years)	602 (62.70)	318 (94.04)	284 (27.60)
Long (15 - 30 years)	26 (70.25)	11 (86.50)	15 (58.32)
Coupon			
0-2%	223 (29.14)	118 (64.82)	105 (-10.95)
2-4%	1,015 (45.37)	450 (86.49)	565 (12.62)
4-6%	621 (78.21)	362 (106.22)	259 (39.07)
6-10%	65 (168.63)	45 (198.21)	20 (102.06)
Bond Rating			
AAA	461 (44.50)	276 (66.36)	185 (11.89)
[AA+;AA-]	894 (60.76)	451 (103.98)	443 (16.75)
[A+;BB+]	569 (65.47)	248 (115.85)	321 (26.55)
Split Rating			
0	1,217 (52.27)	644 (84.50)	573 (16.04)
1	707 (68.57)	331 (119.41)	376 (23.81)

Appendix 2.8: Table A7 - Different specifications of the bond spread equation and sample

This table reports estimations of different specifications for equation 2.3 where SPREAD is the difference in basis points between the bond yield at issuance and the yield of a same currency and maturity treasury bond. RISK is the average issue rating. BMA is the proxy of bank managerial ability. AMOUNT is the natural logarithm of amount of issue in Euros. TAX is the coupon rate. SIZE is the natural logarithm of the issuing bank's total assets. MATURITY is the number of years between the issue and the redemption date. SUBD is a dummy variable that equals one if the issuing debt is subordinated, and zero otherwise. The dummy CRISIS equals 1 if issuance occurs during the distress period, from July 2007 to the end of 2011, and 0 otherwise. LAMBDA is the inverse of the Mills' ratio. For estimation (vi), we use a bond spread using a same benchmark for all bonds, the German Government Yield. For estimation (vii), we exclude years of the sovereign debt crisis i.e. 2010 and 2011. T-statistics are shown in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% levels respectively.

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
RISK	4.554***	4.344***	6.523***	4.947***	4.75***	6.974***	3.523***
	(7.23)	*(7.02)*	*(9.99)*	*(7.96)*	*(7.07)*	*(7.04)*	*(5.06)*
BMA	-	-49.544***	-36.386***	-49.178***	-38.63***	-63.521***	-65.94***
	-	*(-4.97)*	*(-3.46)*	*(-4.92)*	*(-4.06)*	*(-4.40)*	*(-5.97)*
AMOUNT	1.246*	1.641**	1.805**	1.533**	3.46***	3.518***	2.045***
	(1.76)	*(2.33)*	*(2.40)*	*(2.16)*	*(5.95)*	*(3.30)*	*(2.76)*
TAX	18.199***	18.968***	-	17.441***	16.24***	35.261***	14.69***
	(11.03)	*(11.44)*	-	*(11.33)*	*(11.58)*	*(9.55)*	*(7.68)*
SIZE	-4.013**	-2.686**	-6.261***	-6.232***	-1.29	3.690	-6.180***
	(-2.37)	*(-2.39)*	*(-3.37)*	*(-3.57)*	*(-0.63)*	*(1.64)*	*(2.76)*
MATURITY	-1.527***	-1.741***	0.338	-	-1.88***	-4.325***	-0.734
	(-3.33)	*(-3.83)*	*(0.70)*	-	*(-4.15)*	*(-4.49)*	*(-1.32)*
SUBD	34.263***	35.612***	53.744***	26.702***	38.42***	31.817***	30.24***
	(4.89)	*(5.14)*	*(6.81)*	*(3.85)*	*(5.46)*	*(3.26)*	*(3.72)*
CRISIS	73.178***	67.187***	75.948***	68.986***	71.06***	87.521***	71.36***
	(27.41)	*(22.54)*	*(26.57)*	*(23.44)*	*(26.96)*	*(20.26)*	*(18.34)*
LAMBDA	-34.620	-	-58.955**	-50.217**	-32.11	61.296**	-59.12**
	(-1.60)	-	*(-2.29)*	*(-2.20)*	*(-1.12)*	*(2.01)*	*(-2.47)*
CONSTANT	1.389	-11.162	92.519**	55.395	-63.07	-216.939***	70.927
	(0.04)	*(-0.41)*	*(2.27)*	*(1.42)*	*(-1.51)*	*(-4.01)*	*(1.55)*
Country Dummies	YES	YES	YES	YES	NO	YES	YES
Currency Dummies	YES	YES	YES	YES	NO	YES	YES
Obs.	1,924	1,924	1,924	1,924	1,924	1,977	1,458
R^2	0.551	0.557	0.494	0.554	0.450	0.679	0.598
Adjusted R^2	0.542	0.548	0.485	0.546	0.447	0.673	0.588
F	64.226	65.842	51.235	65.137	174.123	110.825	58.796

Appendix 2.9: Table A8 - BMA robustness

This table reports the estimation of equation 2.3 (OLS with robust error term) where SPREAD is the difference in basis points between the bond yield at issuance and the yield of a same currency and maturity treasury bond. RISK is the average issues ratings. BMA is the proxy of bank managerial ability. AMOUNT is the natural logarithm of amount of issue in Euros. TAX is the coupon rate. SIZE is the natural logarithm of the issuing bank's total assets. MATURITY is the number of years between the issue and the redemption date. SUBD is a dummy variable that equals one if the issuing debt is subordinated, and zero otherwise. The dummy CRISIS equals 1 if issuance occurs during the distress period, from July 2007 to the end of 2011, and 0 otherwise. LAMBDA is the inverse of the Mills' ratio. HM is dummy that equals 1 if the maturity of the issue is higher than 4 years, the median, 0 otherwise. BMA1 is assessed with a Battese and Coelli (1995) model that includes environmental variables. BMA2 is obtained by using a data envelopment method. BMA3 is estimated by assuming that investors refer to the very past information. BMA4 is measured with the introduction of a non-linear term, the squared risk term, in the equation of the best practice frontier. BMA5 is estimated using a single BPF computed over the complete period 1998-2011. T-statistics are shown in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% levels respectively.

	BMA1	BMA2	BMA3	BMA4	BMA5
RISK	5.019***	4.484***	4.516***	4.499***	4.534***
	(7.77)	*(7.04)*	*(7.22)*	*(7.18)*	*(7.21)*
BMA	-61.572***	-9.761	-51.173***	-43.239***	-40.592***
	(-6.24)	*(-1.39)*	*(-4.85)*	*(-4.46)*	*(-3.30)*
AMOUNT	1.348*	1.300*	1.559**	1.543**	1.434**
	(1.76)	*(1.84)*	*(2.22)*	*(2.19)*	*(2.05)*
TAX	17.548***	18.331***	18.707***	18.664***	18.458***
	(9.92)	*(11.04)*	*(11.29)*	*(11.27)*	*(11.15)*
SIZE	-4.114**	-4.509***	-5.707***	-5.771***	-5.335***
	(-2.28)	*(-2.63)*	*(-3.31)*	*(-3.32)*	*(-3.09)*
MATURITY	-2.080***	-1.568***	-1.683***	-1.672***	-1.628***
	(-4.21)	*(-3.41)*	*(-3.70)*	*(-3.67)*	*(-3.56)*
SUBD	41.876***	34.452***	34.857***	34.631***	34.564***
	(5.32)	*(4.92)*	*(5.02)*	*(4.98)*	*(4.94)*
CRISIS	73.791***	71.899***	69.150***	70.453***	70.048***
	(25.17)	*(24.56)*	*(24.09)*	*(25.20)*	*(23.96)*
LAMBDA	-32.108	-38.929*	-47.554**	-47.078**	-44.268**
	(-1.40)	*(-1.77)*	*(-2.13)*	*(-2.11)*	*(-1.99)*
CONSTANT	27.412	14.586	51.109	48.613	45.664
	(0.68)	*(0.38)*	*(1.33)*	*(1.26)*	*(1.16)*
Country Dummies	YES	YES	YES	YES	YES
Currency Dummies	YES	YES	YES	YES	YES
Obs.	1,610	1,924	1,924	1,924	1,924
R^2	0.577	0.551	0.557	0.556	0.553
Adjusted R^2	0.567	0.542	0.548	0.547	0.545
F	57.854	62.579	64.058	63.783	63.174

Appendix 2.10: Table A9 - Risk robustness

This table reports the estimates of some alternate specifications for equation 2.3 where SPREAD is the difference in basis points between the bond yield at issuance and the yield of a same currency and maturity treasury bond,. RISK is the average issues ratings. BMA is the proxy of bank managerial ability. AMOUNT is the natural logarithm of amount of issue in Euros. TAX is the coupon rate. SIZE is the natural logarithm of the issuing bank's total assets. MATURITY is the number of years between the issue and the redemption date. SUBD is a dummy variable that equals one if the issuing debt is subordinated, and zero otherwise. The dummy CRISIS equals 1 if the issuance date occurs during the distress period, from July 2007 to the end of 2011, and 0 otherwise. LAMBDA is the inverse of the Mills' ratio. DD is the distance to default. ZMKT is a market based Z-score and ZROA an accounting based one. RTGTRAD, the average of the Fitch, Moody's and Standard and Poor's issuer rating and RTSOL, the average of bank individual / financial ratings. T-statistics are shown in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% levels respectively.

	DD	ZROA	ZMKT	RTGTRAD	RTGSOL
RISK	-6.137***	-0.053***	-0.314***	2.989**	0.910
	(-6.81)	*(-2.82)*	*(-3.85)*	*(2.04)*	*(0.90)*
BMA	-48.094***	-40.567***	-59.184***	-54.009***	-53.130***
	(-2.89)	*(-3.56)*	*(-5.54)*	*(-5.38)*	*(-5.01)*
AMOUNT	-1.118	0.900	0.462	0.703	0.937
	(-1.16)	*(1.26)*	*(0.63)*	*(1.01)*	*(1.38)*
TAX	24.872***	20.951***	20.832***	19.975***	20.084***
	(10.30)	*(12.41)*	*(12.02)*	*(12.13)*	*(11.99)*
SIZE	-3.619	-6.076***	-6.531***	-3.241	-5.376***
	(-1.56)	*(-3.46)*	*(-3.69)*	*(-1.61)*	*(-2.98)*
MATURITY	-1.658***	-2.174***	-2.057***	-2.060***	-1.996***
	(-2.59)	*(-4.72)*	*(-4.35)*	*(-4.51)*	*(-4.32)*
SUBD	45.733***	42.251***	42.679***	44.462***	43.188***
	(4.87)	*(6.08)*	*(6.16)*	*(6.40)*	*(6.16)*
CRISIS	53.116***	63.167***	62.489***	62.899***	62.959***
	(13.01)	*(22.05)*	*(19.84)*	*(21.82)*	*(20.93)*
LAMBDA	-19.950	-37.169*	-31.807	-19.229	-32.335
	(-0.70)	*(-1.78)*	*(-1.50)*	*(-0.91)*	*(-1.51)*
CONSTANT	73.488	81.454**	112.211***	9.548	64.743
	(1.47)	*(2.11)*	*(2.73)*	*(0.21)*	*(1.47)*
Country Dummies	YES	YES	YES	YES	YES
Currency Dummies	YES	YES	YES	YES	YES
Obs.	1,205	1,921	1,807	1,905	1,892
R^2	0.551	0.550	0.558	0.550	0.548
Adjusted R^2	0.537	0.541	0.549	0.542	0.539
F	38.702	62.150	60.306	61.796	62.388

CHAPTER 3

Control rights versus cash-flow rights, banks' shareholders and bondholders conflicts: Evidence from the 2007 - 2010 crisis

This chapter refers to the working paper entitled "Control rights versus cash-flow rights, banks' shareholders and bondholders conflicts: Evidence from the 2007 - 2010 crisis " (Casteuble and Saghi-Zedek (2015)).

3.1. Introduction

A substantial amount of research addresses the financial implications of the divergence between control rights (i.e., the right to vote and hence to control) and cash-flow rights (i.e., the right to receive dividends) of ultimate owners. Such a divergence between both rights, commonly referred to as excess control rights, arises mainly from the use of pyramidal[62] ownership structures, as prevalent in Asia and Europe. Pyramids enable controlling owners to achieve control of a firm by committing low equity investment while maintaining tight control of the firm, accentuating the agency conflicts between controlling shareholders and minority shareholders. Overall, during normal times, the literature finds that the presence of excess control rights negatively affects firm value and performance in general (Claessens *et al.* (2002)) and, more specifically it decreases banks' profitability but also increases their risk and insolvency (Azofra and Santamaría (2011), Saghi-Zedek and Tarazi (2015)).

The objective of this paper is to focus on the conflicts of interests between shareholders and debtholders within pyramids in the case of banking firms. More specifically, we examine the effect of the divergence between control rights and cash-flow rights of ultimate owners in pyramids on the costs of borrowing of European banks and how this effect might be different during sound periods and distress periods.

Conflicts of interests between controlling shareholders and debtholders arise from moral hazard and risk-shifting induced by limited liability. Limited liability provides shareholders the incentives to divert wealth at the expense of debtholders by increasing asset risk and leverage, and creates the option value of equity (Merton (1974)). For instance, controlling shareholders can extract wealth from debtholders by investing in new projects that are riskier than those currently held in the firm's portfolio. Shareholders capture most of the gains when high-risk projects succeed, while debtholders bear part of the costs when those high-risk projects fail (Jensen and Meckling (1976)). This moral hazard could be even more severe when controlling shareholders hold control rights in excess of cash-flow rights: the divergence between both rights may provide extra risk-taking incentives to controlling shareholders because they are able to use their effective control rights to divert the upside gains for private benefits while leaving the costs of failure to debtholders. Anticipating such

[62] A pyramid is a multilayer ownership structure where an ultimate owner holds a firm through at least another corporation.

incentives, debtholders could ask for higher rents, leading to higher costs of debt capital. Empirically, Boubakri and Ghouma (2010) provide evidence for such a conflict of interests during normal times. Using a sample of non-financial firms during the 1992-2004 period, the authors find that the divergence between control and cash-flow rights is associated with higher bond spreads. However, the question of whether such conflicts of interests are present in the specific case of banking firms and especially during distress times is not addressed in the current literature.

Banks are more opaque and more complex than other institutions (Morgan (2002)) and the nature of their assets influence their opaqueness (Flannery *et al.* (2004)). Unlike non-financial firms, banks are highly leveraged and benefit from external implicit and explicit supports and guarantees such as deposit insurance and too-big-to-fail policy. Taken all together, these features could either exacerbate or attenuate the conflicts of interests between shareholders and debtholders observed in the case of non-financial firms. For instance, the presence of safety net guarantees may weaken the debtholders' incentives to discipline the bank by charging a risk premium proportionate to the bank's risk level. In this case, debtholders may not charge a higher premium from banks controlled by shareholders with excess control rights. Alternatively, bank opaqueness and high leverage may provide a freer play to the risk-shifting incentives of shareholders with excess control rights. Specifically, these shareholders can distort banks behavior by forcing them to lend at more favorable terms to other corporations wherein they have higher cash-flow rights (La Porta *et al.* (2003)). They could also push banks to lend to related firms merely to sustain them, without necessarily requiring guarantees or by collecting collateral but of bad quality. This related lending could weaken the value of collateral, which in turn reduces the recovery rates in the event of default, increasing the loss of debtholders. Under such conditions, just like for non-financial firms, debtholders could charge higher premiums for banks controlled by shareholders with excess control rights.

Moreover, the effect of excess control rights on the cost of debt capital -especially in the banking industry- could be different across sound periods and distress periods. A crisis represents a shock (Friedman *et al.* (2003)) that may trigger a change in the behavior of shareholders with excess control rights, possibly shaping the pricing imposed by debtholders. Consistent with the expropriation view (Johnson *et al.* (2000), Mitton (2002), Baek *et al.* (2004)), a crisis shock could provide shareholders with excess control rights, extra risk-shifting incentives to be able to divert resources for their own benefits. The rationale behind such incentives is to compensate for the losses they might suffer in their other firms due to bad economic conditions, allowing them to smooth their revenues across good and bad times. In addition, the market view postulates that investors may pay less attention to weak governance during economic upturns, but they are likely to take it more into consideration during crisis periods (Rajan and Zingales (1998)). Assuming that debtholders anticipate such a behavior, they will require even a higher premium than they charge during a sound period, resulting in a higher cost of debt capital.

Alternatively, according to the propping up view (Friedman *et al.* (2003)), shareholders with excess control rights may be willing to transfer even their private funds to their failing firms/banks among the pyramid to prevent them from distress during downturns. This propping up behavior is justified by the fact that those controlling shareholders can reap valuable earnings in the future, mainly from profit stealing, and therefore want to keep those entities in business and prevent their failure to be able to extract such opportunities in the future.

More precisely, in this paper we use data on ultimate ownership of 89 publicly traded banks established in 16 Western European countries[63] over the 2002-2010 period to test the effect of excess control rights on the cost of debt capital and how this effect might differ across normal times and distress times. We capture the cost of debt capital using bank bond yield spreads, i.e. the difference between bank bond yields and the risk-free rate. As an exogenous shock, we consider the distress period from the third quarter of 2007 to 2010 which is characterized by two subsequent events: the global financial crisis and the European sovereign debt crisis triggered late 2009.[64] Our sound period then ranges from 2002 to the second quarter of 2007.

By controlling for issuer and bonds characteristics, the results show that while bondholders disregarded the presence of excess control rights during the sound period of 2002 - Q2 2007, they required a lower spread from banks controlled by shareholders with excess control rights during the distress period of Q3 2007 - 2010. These results are consistent with the view that

[63] We focus on European countries because the presence of excess control rights is known to be more prevalent in these countries than in other countries, for instance, the U.S. (La Porta *et al.* (1998)).

[64] According to the definition provided by the Bank of International Settlements, the financial crisis period is from July 2007 to March 2009 (Bank of International Settlements (2010a)). Moreover, the timeline provided by the Banque de France (2012) outlines that the European debt crisis started to affect some of European countries (the GIPS countries comprising Greece, Ireland, Portugal and Spain) from late 2009. We hence define the period ranging from the third quarter of 2007 to 2010 as our distress period.

during good times investors and specially bondholders do not care about deficiencies in governance schemes and that they do react only during bad times. Particularly, our results show that bondholders anticipate the occurrence of the profit-sharing among all firms within pyramids which prevent the bank failure and, as a consequence, they charge a lower premium for banks controlled by shareholders with excess control rights compared to their peers during distress times. Our results are robust to alternative measures of ownership and risk as well as to the definition of the crisis period.

Beyond this main analysis, we take a step forward and examine whether some bonds characteristics affect the behavior of bondholders. More precisely, we test whether the link between excess control rights and bond yield spreads depends on bonds ratings (i.e., high versus low ratings[65]) and their payment rank (i.e., unsecured/subordinated bonds versus secured bonds). Holders of bonds with downgraded ratings and holders of unsecured/subordinated bonds face a lower debt quality and a higher probability of default and, as a consequence, they should be more concerned about weaknesses in governance schemes. We hence expect the link between excess control rights and bond yield spreads to be more pronounced in these two cases. Coherently and consistent with this prediction, we find that bondholders charge a lower premium to banks controlled by shareholders with excess control rights only when they hold subordinated/unsecured bonds and bonds with low ratings. Holders of secured and high rated bonds do not price excess control rights either in sound or in distress periods.

This paper contributes to the literature in several directions. First, our study extends the paper of Boubakri and Ghouma (2010) in two ways. While Boubakri and Ghouma (2010) address the conflicts of interests between controlling shareholders and bondholders in non-banking firms during normal times, our paper analyzes the same conflicts in the specific case of banking firms by concomitantly considering normal times and distress times. To our knowledge, this is the first study that builds a bridge between controlling shareholders and bondholders in pyramids for banks. Unlike the findings of Boubakri and Ghouma (2010), by focusing on banking firms we find that bondholders do not care about bank governance weaknesses during normal times. Furthermore, by considering a crisis period, our results reveal a negative association between excess control rights and bond yield spreads, implying

[65] In this paper, we consider bonds with high ratings if they are rated at issuance between Aaa and Aa2 for Moodys or AAA and AA for Fitch and Standards & Poor's, and bonds with low ratings if the grade is equal to or lower than Aa3 for Moodys and AA- for the other rating agencies.

that bondholders perceive banks controlled by shareholders with excess control rights as safer. This suggests that while the presence of excess control rights in non-financial firms conveys a bad signal for bondholders, its presence for banks is perceived as good news. This is potentially because bondholders are aware that bankruptcy costs inside a pyramid are higher for banks than for non-financial firms. Indeed, if banks fail all connected firms within the same pyramid may be negatively affected since they need to find other lending-banks outside the pyramid with potentially less favorable terms. Anticipating such bankruptcy costs, bondholders are almost certain that ultimate owners will intervene to bail out these banks and therefore require lower premiums for such banks.[66]

Second, our study contributes to the various papers that attempt to explain differences in performance of banks during the 2008 turmoil by factors related to governance schemes.[67] Among these, the paper of Saghi-Zedek and Tarazi (2015) shows that European banks controlled by shareholders with excess control rights underperform during sound periods but outperform other banks during distress times. The results of our paper then corroborate those findings and provide a new channel to explain why these banks outperform other banks during crisis periods: they experience a lower cost of debt financing.

Finally, our paper contributes to the post crisis debate on bank governance and market discipline. We show that bondholders perceive banks controlled by shareholders with excess control rights as safer because they benefit from strong links and interconnections within pyramids which prevent them from failure. Even though these banks are not necessarily too big to benefit from safety net guarantees and too-big-to-fail policies, bondholders do not price them during normal times and require lower premiums from such banks during distress times. This result suggests that not only the safety net guarantees and too-big-to-fail policies affect the effectiveness of market discipline but also interconnectedness of banks within complex ownership structures. Our findings are therefore consistent with the worries of the Basel Committee on Banking Supervision (Bank of International Settlements (2010b)) regarding governance mechanisms within complex ownership structures and recommending more disclosure of banking institutions' ownership.

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[66] Besides the paper of Boubakri and Ghouma (2010), another strand of the literature investigates whether cross-variations in bond yield spreads can be explained by differences in governance mechanisms (see, e.g., Bhojraj and Sengupta (2003), Klock *et al.* (2005)). While these studies have mainly focused on the conflicts between managers and debtholders in non-financial firms, in our work we pay attention to banking firms and consider the conflicts between controlling shareholders and bondholders in complex ownership structures.

[67] See for instance Gropp and Köhler (2010); Fahlenbrach and Stulz (2011); Aebi *et al.* (2012); Beltratti and Stulz (2012); Erkens *et al.* (2012).

The rest of the paper is structured as follows. In Section 2, we describe the data and the empirical method. Section 3 presents the sample characteristics and some univariate analysis. In Section 4, we discuss the econometric results. Section 5 reports the robustness checks and Section 6 concludes the paper.

3.2. Data and model specification

Before describing our variables and the model, we present our sample.

3.2.1. Sample

Our sample consists of publicly traded 89 banks (either commercial or not) headquartered in 16 Western European countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.[68] The sample period is from 2002 to 2010 which covers the sound and the distress periods. We obtain annual accounting data from Bankscope database. For each bank, we use consolidated statements. To collect ownership information of the sampled banks, we mostly use Bankscope and Amadeus databases and complete missing ownership information from annual reports disclosed on websites. We collect daily market data necessary to compute market-based risk indicators and data on bond issues and other related details such as issue date, maturity, amount issued, currency, coupon rates, and credit ratings from the Bloomberg database.

We identify 114 publicly traded banks for which Bankscope reports information on the main accounting variables. We eliminate extreme observations on main financial variables as well as banks with discontinuously traded stocks and end up with a sample of 94 banks. These banks issued on the primary market 3,260 bonds that satisfy the following criteria: bonds with (i) fixed and annualized coupon rate, (ii) no-early redemption (bullet), (iii) no option features (non-callable, non-putable, non-sinkable and non-convertible), and (vi) bonds rated at the immediate neighborhood of issuance by at least one credit rating agency (Moody's, Standards and Poors, or Fitch). Among these bonds, we exclude those for which a risk-free rate benchmark is not available to calculate bond yield spreads such as bonds with a very short

[68] We do not include Luxembourg because no bank provides data consistent with the criteria we use to define our cleaned sample.

maturity,[69] perpetual bonds and so forth. After eliminating extreme observations for the spread variable (1% lowest and highest values), we end up with a final sample of 2,800 bonds issued by 89 banks over the 2002-2010 period, including secured, unsecured and subordinated bonds, either matured or not (see Appendix 3.1 for some general descriptive statistics of the sample banks).

3.2.2. Presentation of variables

We now define our dependent variable reflecting bank bond yield spreads, our ownership variable of interest (excess control rights) and the different control variables introduced in our regressions. Statistics and other details on all the variables used in our regressions are reported in Table 3.1.

3.2.2.1. Bond yield spreads

We define bond yield spreads as the difference between the bank bond yield at issuance and the implicit yield at the same issue date and of a same currency and maturity Treasury Bond. In the case of bonds issued in Euros, we take the issuer's country as a benchmark. Whenever the time to maturity differs between the bank and the Treasury bonds, we interpolate the maturity of the risk-free rate benchmark to match it with the maturity of the bank bond yield before assessing spreads. To allow for easier comparison across countries and for robustness considerations, we also compute bank bond spreads by subtracting the yield on German government bonds from banks bond yields at issuance (i.e., we use a common risk-free rate as a benchmark).[70]

3.2.2.2. Building control chains and measuring excess control rights

Our variable of interest is excess control rights. This is a proxy of bank ownership which is defined as the difference between control and cash-flow rights of the largest ultimate owner. Excess control rights could arise from the use of dual class shares (i.e., shares with superior voting rights) and/or from the use of pyramids (indirect control chains). Because Bankscope and Amadeus only provide information on control rights, we focus on excess control rights

[69] We exclude bonds with maturity lower than three months. This is because the corresponding risk-free rate of most countries included in our study is not provided, making interpolation impossible to compute a bond yield spread.

[70] Results, not reported but available on request, are similar to those obtained using a domestic Treasury bond for each country.

arising from the use of pyramids and ignore the use of dual class shares which, in any case, is not a serious shortcoming of our study since prior studies find that the use of dual class shares is not widespread (Faccio and Lang (2002); Azofra and Santamaría (2011)).

To measure excess control rights, as a first step we trace indirect control chains among pyramids in order to isolate the ultimate controlling owners for each bank. Indirect control chains imply the presence of at least one corporation, between the bank and the ultimate owner, who holds a pre-established minimum percentage of shares (i.e., a control threshold). We set this control threshold to 10% since previous studies on both banks (Caprio *et al.* (2007), Laeven and Levine (2009)) and non-financial firms (La Porta *et al.* (1999), Laeven and Levine (2008)) consider that 10% of control rights are enough to have an effective control over a firm.[71] According to this threshold, we classify banks among two categories. We consider as widely held, banks for which ownership is dispersed among small shareholders (i.e., no shareholder holds at least 10% of control rights). We consider as controlled, banks for which at least one shareholder has control rights that sum up to 10% or more. In the latter case, we analyze the ownership structure of each identified shareholder. If this is not controlled by another shareholder (such as an individual, a family or a state), we consider him to be the ultimate controlling owner of the bank. However, if the identified shareholder is controlled by another corporation (e.g., a bank, a financial company and so on), we go deeper in tracing the control chain and repeat the process to identify their owners, the owners of their owners until we reach the ultimate owner of the bank. To build these control chains, we collect data on direct ownership from Bankscope that we complete with information from annual reports reported on banks' websites and from Amadeus when shareholders at intermediate levels of indirect control chains are non-banking institutions. Because ownership structure is at some extent stable over time (La Porta *et al.* (1999), Laeven and Levine (2009)) and both databases (i.e., Bankscope and Amadeus) update ownership information only every 18 months, we do not collect ownership for each year. Prior to the financial crisis, we build banks' control chains for the years 2004 and 2006.[72] We also build control chains for the year 2010 to capture potential changes in ownership structure that may have come especially from government intervention during the financial crisis.

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[71] As a robustness check, we also consider a 20% threshold. Our results, not reported but available on request, are insensitive to the control threshold we use.
[72] Our starting point for ownership is 2004 instead of 2002 because Bankscope and Amadeus do not provide information on the types of shareholders before 2004.

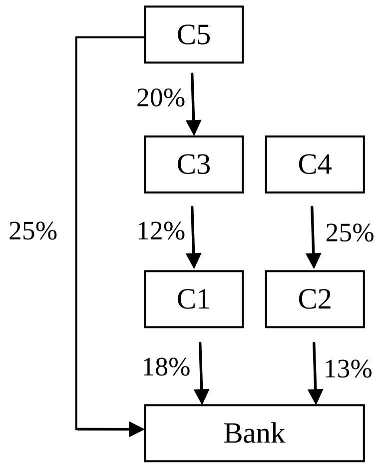
As a second step, we identify ultimate owners of banks and assess control rights and cash-flow rights to compute excess control rights. We classify the identified ultimate owners into five categories: a bank (Bank); a manager, an individual or a family (Family); a state or a public authority (State); a financial company, an insurance company, a pension fund or a mutual fund (Institutional); or a foundation (Foundation). An ultimate owner can hold a bank directly and/or indirectly. Direct rights (control and cash-flow rights) are the stake directly held by the ultimate controlling shareholder in the bank. According to the last link principle method proposed by La Porta *et al.* (1999), we define indirect control rights as the ownership stake held directly in the bank by the first intermediate corporation in the control chain. Indirect cash-flow rights are defined as the product of ownership stakes held indirectly by each corporation along the control chain. By summing direct and indirect rights held in the bank, we obtain aggregate control rights (CR) and aggregate cash-flow rights (CFR) of the ultimate owner. Aggregate control and cash-flow rights are set equal to zero for widely held banks. In the case of banks with several ultimate owners, we consider the one with the highest control rights.

Finally, we measure excess control rights using two proxies: a continuous variable (ExcessControl) defined as the difference between control and cash-flow rights, and a binary variable [d(ExcessControl)] which is equal to one if the control rights are greater than the cash-flow rights, and zero otherwise. We then classify the sampled banks into two groups: banks without excess control rights (Absence of Excess Control Rights) and banks with excess control rights (Presence of Excess Control Rights). We classify a bank as without excess control rights if it is controlled by an ultimate owner with equal control and cash-flow rights or if it is widely held. We consider a bank as with excess control rights if it is controlled by an ultimate owner with greater control than cash-flow rights.

To illustrate how we compute excess control rights within pyramids, Figure 3.1 provides an example of a control chain for a bank. We assume that this bank has two ultimate owners: C4 and C5. According to the considered control threshold, C5 is identified as the largest ultimate controlling owner of the bank. Direct control and cash-flow rights of C5 are equal to 25%. In addition to his direct rights, C5 holds the bank indirectly through two intermediate corporations C1 and C3. His indirect cash-flow rights are equal to 0.4% (20% x 12% x 18%) and his indirect control rights are equal to 18% (i.e., the percentage of ownership stake held by C1 which is the closest corporation to the bank in the control chain). Aggregate control and cash-flow rights are then equal to 43 % (18% + 25%) and 25.4% (0.4% + 25%), respectively. Finally, the difference between aggregate control rights and aggregate cash-flow rights (i.e., ExcessControl) is 17.57% (43% - 25.4%).

Figure 3.1: Example of a control chain

This figure reports an example of a control chain of a bank to explain the calculation of excess control rights. C denotes a corporation in each box. Arrows are ownership stakes held by each corporation either in the bank or in intermediate corporations along the control chain. CR and CFR are respectively the aggregate (sum of direct and indirect) control and cash-flow rights of the two identified ultimate controlling shareholders of the bank: C4 and C5. Direct rights, either control or cash-flow rights, are the ownership stake directly held by the ultimate owner in the bank. According to the last link principle method proposed by (La Porta *et al.*, 1999), indirect control rights of the ultimate owner is the percentage of shares held in the first layer of the control chain. Indirect cash-flow rights are the product of ownership stakes held indirectly along the chain. We define excess control rights (ExcessControl) as the difference between control and cash-flow rights.



CR (C5) = 25% + 18% = 43%
CFR (C5) = 18% x 12% x 20% +25%= 25.43%
ExcessControl (C5) = 43% - 25.43% = 17.57%

CR (C4) = 13%
CFR (C4) = 25% x 13% = 3.25%
ExcessControl (C4) = 13% - 3.25% = 9.75%

3.2.2.3. Risk and Control variables

Because bank risk-taking increases the likelihood of default, bondholders require a higher premium from riskier banks, leading to higher bond yield spreads (e.g., Elton *et al.* (2001), Krishnan *et al.* (2005), Driessen (2005)). As a proxy for bank risk, we include TotalRisk measured by the standard deviation of weekly bank stock returns computed on a moving window of 52 quoted weeks[73]. Campbell and Taksler (2003) provide evidences that this measure of stock return volatility is an important determinant of bond yield spread. They

[73] In addition to TotalRisk, we initially include the ratio of total equity to total assets (EQTA) as a proxy for default. However, the results (available upon request) show that EQTA is not significant. Hence, we include in our regressions only the TotalRisk variable as a proxy for bank risk.

report a strong positive effect of this volatility on the cost of debt. They first argue that a firm with more volatile equity is more likely to reach the boundary condition for default. Second, this proxy is a measure of firm's total risk that reflects both idiosyncratic and market risk and captures continuous and recent information that are not yet reflected in credit ratings or accounting data but which are particularly relevant for bondholders. Empirically, the total risk then matters at least as much as credit rating as a determinant of bond yield spread (its explanation being even better when they are considering together). Because of a lack of consensus in empirical studies about the accurate proxy to use as determinant of bond risk premium, we consider alternative proxies of bank risk for robustness considerations. Results remain unchanged.

We also include in our estimations a set of control variables which are expected to affect bank bond yield spreads. As a proxy for bank profitability, we include the return on average assets defined as net income divided by average total assets (ROAA). Bank profitability should affect the level of bond spreads even if the sign is a priori unclear (Flannery and Sorescu, 1996). On the one hand, higher values of ROAA indicate greater performance for banks, i.e. a good management of risk-taking. This should negatively affect spreads required by bondholders (Evanoff *et al.* (2011), Jagtiani *et al.* (2002)). On the other hand, a higher profitability goes along with a higher risk which risk-averse bondholders may dislike and then require higher spreads. We expect a positive sign in the latter case (Sironi (2003)).

We include the natural logarithm of bank total assets [Log(Assets)] to account for bank size. Large banks benefit from implicit guaranties, have greater ability to diversify their activities and are generally safer than small banks and, as a consequence, they are expected to have lower spreads (Balasubramnian and Cyree (2011)). We hence expect a negative coefficient on the variable Log(Assets).

Previous literature underlines the importance of liquidity for bondholders. Liquid bonds are more often traded, their information and transaction costs are lower compared to illiquid ones and bondholders are more prone to require lower spreads from issuers of liquid bonds. Many empirical papers consider the issued amount of bonds as a proxy of their liquidity (see Houweling *et al.* (2005) for a short review of these studies). We follow them by including Ln(Issuance), the natural logarithm of the issue, as a spread determinant. The existing results are inconclusive as both negative and positive coefficients are observed. Morgan and Stiroh (2001) and Sironi (2002) highlight that the amount of issue negatively affects bond yield spreads, reflecting a possible liquidity benefit on larger issues. On the contrary, McGinty (2001) shows that large bonds are not necessarily the most liquid and, consistent with Sironi (2003) and Iannotta *et al.* (2013), finds that large issues are associated with higher spreads.

Besides, we introduce in our regressions the Maturity variable which is defined as the difference between the issuance and maturity dates. Bond yield spreads should increase with the increase of the investment horizon and, as a consequence, we expect a positive link between the bond maturity and its spread (Morgan and Stiroh (1999)).

Finally, we introduce in our regressions a set of dummy variables. We include a dummy [d(Subordinated/Unsecured)] which takes a value of one if the bond is subordinated or unsecured, and zero otherwise. Holders of such bonds are repaid after senior bondholders. As they anticipate higher losses for a given default risk than others, subordinated/unsecured bondholders may require a higher premium (Pop (2006)). Accordingly, we predict a positive coefficient on the variable d(Subordinated/Unsecured). To account for differences across issues such as economic conditions and cross-country institutional factors, we also introduce a set of currency and country dummies.

Table 3.1: Variables definition and summary statistics

Variable	Definition	Source	Mean	Median	Standard deviation	Minimum	Maximum	Number of observations
Spread	Difference between the bond yield at issuance and the yield of a same currency and maturity Treasury Bond.	Bloomberg	0.581	0.397	0.654	-1.380	4.062	2,800
ExcessControl	Difference between control and cash-flow rights (%).	Bankscope, Amadeus and annual Reports	2.254	0.000	8.055	0.000	63.900	2,800
d(ExcessControl)	Dummy equal to one if control rights are greater than cash flow rights, and zero otherwise.	Bankscope, Amadeus and annual Reports	0.113	0	0.316	0	1	2,800
d(Crisis)	Dummy equal to one if the observation is from the Q3 2007 to 2010, and zero otherwise.	Bloomberg	0.446	0	0.497	0	1	2,800
TotalRisk	Standard deviation of weekly bank stock returns computed on a moving window of 52 quoted weeks (%).	Bloomberg	5.358	3.900	3.759	0.761	25.425	2,800
ROAA	Return on average assets defined as the ratio of net income to average total assets (%).	Bankscope	0.302	0.280	0.460	-2.420	2.230	2,800
Log(Assets)	Natural logarithm of bank total assets (thousands of Euros).	Bankscope	19.398	19.273	1.100	13.912	21.674	2,800
Log(Issuance)	Natural logarithm of the issuance amount (in Euros).	Bloomberg	18.300	18.421	2.019	11.995	24.437	2,800
Maturity	Number of years between the bond issue date and redemption (in years).	Bloomberg	4.763	4.000	3.439	0.504	30.001	2,800
d(Subordinated/Unsecured)	Dummy equal to one if the bond is either subordinated or unsecured, and zero otherwise.	Bloomberg	0.735	0	0.441	0	1	2,800

3.2.3. Model specification

We aim to investigate the effect of excess control rights on bank bond yield spreads, and more specifically how this effect differs according to the state of the banking system and the economy as a whole. The distress period of 2007-2010, which includes the global financial crisis of 2007-2008 and the European sovereign debt crisis (late 2009), enables us to look for differential effects of excess control rights on bank bond yield spreads depending on economic conditions. To differentiate sound and distress periods, we define a dummy variable d(Crisis) which takes a value of one if the observation is from the Q3 2007 to 2010, and zero otherwise.[74] To test whether bondholders differently price bank governance, as measured by excess control rights, during sound and distress periods we allow for differential effects across both periods by interacting the dummy variable d(Crisis) with our ownership variable of interest ExcessControl. We hence specify the following model:

$$\begin{aligned}\text{Spread}_{j(it)} = [\alpha_1 + \alpha_2\, \text{d(Crisis)}_t]\text{ExcessControl}_{it} + \alpha_3\, \text{d(Crisis)}_t + \alpha_4 \text{TotalRisk}_{it} \\ + \beta' X + \alpha_0 + \omega'\, \text{d}(Country)_i + \varphi'\, \text{d}(Currency)_{j(it)} + \varepsilon_{j(it)}\end{aligned} \quad (3.1)$$

where Spread_j is the dependent variable measuring bank bond yield spreads for bond j issued by bank i at time t; $\text{ExcessControl}_{it}$ corresponds to excess control rights defined as the difference between control and cash-flow rights of the largest ultimate owner of the issuing bank i at time t; TotalRisk_{it} is the risk of the issuing bank i at time t; X is a vector of the aforementioned control variables: ROAA, Log(Assets), Ln(Issuance), Maturity and d(Subordinated/Unsecured);[75] d(Country) and d(Currency), respectively, denote vectors of country and currency dummies; and ε is the error term.

The coefficient α_1 measures the effect of the shareholder's excess control rights (ExcessControl) on bank bond yield spreads during the pre-crisis period 2002 – Q2 2007. As explained before, the literature on non-financial firms (Boubakri and Ghouma (2010)) highlights that bondholders perceive controlling shareholders with excess control rights as a potential risk and therefore they charge higher spreads from firms controlled via excess control rights. If such a behavior also applies to banking firms, we expect the coefficient α_1 to be positive and significant. Alternatively, previous studies (Rajan and Zingales (1998)) argue

[74] To identify our distress period, we follow the definitions provided by the Bank of International Settlements (2010b) and the Banque de France (2012).

[75] Appendix 3.2 shows the correlation coefficients among the key explanatory variables used in our regressions. Overall, the correlation coefficients are low.

that market participants in general and bondholders in particular may pay less attention to weak governance during upturns. In the banking sector, this bondholders' behavior may occur because market discipline is further weakened as banks are highly regulated and benefit from implicit safety net guarantees. In this case we predict the coefficient α_1 to be non-significant. Hence, the effect of excess control rights on bank bond yield spreads is a priori unpredictable and depends on the prevailing bondholders' behavior: the coefficient α_1 should be either significant and positive or non-significant.

The parameter $\alpha_1 + \alpha_2$ measures the effect of the shareholder's excess control rights (ExcessControl) on bank bond yield spreads during the distress period ranging from the third quarter of 2007 to 2010. The sign of the coefficient α_2 is also unclear. According to the expropriation hypothesis (e.g., Johnson *et al.* (2000)), entrenched controlling shareholders increase their propensity to expropriate during downturns. The rationale behind such a behavior is to compensate for the losses they are enduring in other firms, allowing them to smooth their revenues across sound and distress periods. In this case, we expect the coefficient α_2 to be positive and significant meaning that, during crisis periods, bondholders require higher spreads from banks controlled via excess control rights than from other banks. However, according to the propping up view (Friedman *et al.* (2003)), entrenched controlling shareholders may intervene during downturns to keep the failing bank in business and exploit its profits in the future. They can either bring their private funds or transfer funds from other related firms under their control. Bondholders anticipating such a behavior may charge lower spreads for banks controlled by shareholders with excess control rights. In this case, we expect the coefficient α_2 to be negative and significant.

3.3. Sample characteristics and univariate analysis

In this section, we first present the general characteristics of our sample. Then, as a first check, we analyze the relationship between excess control rights and bond yield spreads by simply conducting mean tests.

3.3.1. Sample characteristics and ownership pattern

We report in Table 3.2 some general and ownership characteristics of our sample.[76] The number of issuances is quiet evenly distributed across years (Panel A of Table 3.2). The number of bond issues is also equally distributed across sound (2002 – Q2 2007) and distress (Q3 2007 – 2010) periods: around 50% of the bonds are issued during each period. However, the number of issuers slightly differs according to the period: on average, 37 banks have issued bonds during the sound period while the number of issuers grows up to 51 banks during the crisis period. This highlights that banks of our sample go frequently to the bond market even if most of them issued bonds during the crisis period. The table (Panels B-D) also shows that German banks (48%) and commercial banks (62%) are predominantly the bond issuers in our sample and that issues are principally unsecured (69%). Furthermore, the table (Panel E) indicates that banks of our sample have mainly issued more than one bond during the whole period. Indeed, only 11 of the sample banks issued one bond between 2002 and 2010 whereas more than 50% of the banks issued at least 10 bonds over the same period.

To better emphasis the sample characteristics, we also look into the distribution of bond issues according to the bank ownership structure. Our data set indicates that 2,484 bonds were issued by banks without excess control rights whereas 316 bonds relate to banks controlled by a shareholder with excess control rights. Panel F of Table 3.2 shows that out of the 2,484 bonds issued by banks without excess control rights, 923 bonds were issued by widely held banks. Banks controlled by other banking entities and those controlled by institutional investors are the predominant bond issuers in our sample: they issued 623 and 502 bonds over the sample period, respectively. Banks controlled by states, industrial companies, and foundations are also frequent bond issuers. However, the table reveals that bonds are less often issued by banks controlled by families: they issued only 63 bonds over the whole period, of which 51 were issued by banks without excess control rights and 12 bonds relate to banks with excess control rights. A deeper look to the descriptive statistics shows that in the presence of excess control rights family-controlled banks did not at all issue bonds during the crisis period, potentially because they substantially increased their equity to total assets ratio during the financial crisis of 2007-2008 (Saghi-Zedek and Tarazi (2015)).

[76] We undertake a similar analysis for both sub-samples of banks with and without excess control rights. The results, not reported here but available on request, show almost a similar pattern as for the whole sample.

Table 3.2: Distribution of banks and bond issues

This table reports the distribution of banks and bonds issues by year (Panel A), country (Panel B), bank type (Panel C), payment rank (Panel D), frequency of issues (Panel E), and ownership type (Panel F). We differentiate the sample banks according to the type of their ultimate owner: a bank (Bank); a manager, an individual or a family (Family); a state or a public authority (State); a financial company, an insurance company, a pension fund or a mutual fund (Institutional); or a foundation (Foundation). Widely Held refers to banks that are widely held, i.e. banks with no controlling shareholders.

Panel A: Distribution of banks and bonds by year				
Year	Number of banks	Number of issues	Percentage	Cumulative
2002	32	212	7.57	7.57
2003	34	277	9.89	17.46
2004	34	292	10.43	27.89
2005	41	297	10.61	38.50
2006	43	254	9.07	47.57
2007	49	361	12.89	60.46
2008	50	341	12.18	72.64
2009	55	478	17.07	89.71
2010	50	288	10.29	100.00
Panel B: Distribution of banks and bonds by country				
Austria	4	183	6.54	6.54
Belgium	1	2	0.07	6.61
Denmark	3	109	3.89	10.50
Finland	1	16	0.57	11.07
France	9	222	7.93	19.00
Germany	10	1,342	47.93	66.93
Greece	1	1	0.04	66.96
Ireland	5	238	8.50	75.46
Italy	15	271	9.68	85.14
Netherlands	4	9	0.32	85.46
Norway	6	15	0.54	86.00
Portugal	3	22	0.79	86.79
Spain	8	110	3.93	90.71
Sweden	4	147	5.25	95.96
Switzerland	5	28	1.00	96.96
United Kingdom	10	85	3.04	100.00
Panel C: Distribution of banks and bonds by banks type				
Commercial banks	44	1,742	62.21	62.21
Cooperative banks	9	72	2.57	64.79
Saving banks	6	61	2.18	2.18
Bank holding and bank holding companies	14	242	8.64	75.61
Investment banks	5	135	4.82	80.43
Real estate and mortgage banks	4	516	18.43	98.86
Other non-banking credit institutions	7	32	1.14	100.00

Table 3.2 (continued)

Panel D: Distribution of banks and bonds by issue payment rank				
Unsecured	82	1932	69.00	69.00
Secured	34	742	26.50	95.50
Subordinated	35	126	4.50	100.00
Panel E: Distribution of banks and bonds by the frequency of issues				
Frequency of issues				
1	10		11.24	11.24
2	8		8.99	20.22
3	4		4.49	24.72
4	4		4.49	29.21
5	6		6.74	35.96
6	2		2.25	38.20
7	7		7.87	46.07
8	1		1.12	47.19
9	2		2.25	49.44
10	4		4.49	73.03
[11, 20]	17		19.10	73.03
[21, 30]	6		6.74	79.78
[31, 40]	1		1.12	80.90
[41, 50]	3		3.37	84.27
[51, 100]	5		5.62	89.89
[101, 465]	9		10.11	100.00
Panel F: Distribution of banks and bonds by ownership type				
Bank	15	623	22.25	22.25
Family	5	63	2.25	24.50
State	12	272	9.71	34.21
Institutional	23	502	17.93	52.14
Industry	9	231	8.25	60.39
Foundation	6	186	6.64	67.04
Widely Held	43	923	32.96	100.00

3.3.2. Excess control rights and bank bond yield spreads: univariate mean tests

We compare bond yield spreads in the absence and in the presence of excess control rights across sound and distress periods by conducting a test for the equality of means (t-test). The results are reported in Table 3.3. Overall, the table shows that the mean of bond yield spreads has substantially increased during the crisis period either in the absence or in the presence of excess control rights: the bond yield spreads mean is almost five times greater during the crisis period compared to the sound period. The results also show that during the sound period, on average, the bond spread is not significantly different in the absence and in the presence of excess control rights: bondholders seem to disregard the presence of excess control rights during sound periods. However, during the crisis period banks with excess control rights display lower bond spreads than banks without excess control rights. This result suggests that bondholders perceive banks controlled by shareholders with excess control rights as safer than other banks and, as a consequence, they require a lower bond spread for those banks during crisis periods.

Table 3.3: Bond spreads by excess control rights, on average, across sound and crisis periods

This table reports the mean of bond spreads during sound and crisis periods for the subsamples of banks with and without excess control rights. We consider a bank as with excess control rights if this bank is controlled by an ultimate shareholder with control rights greater than cash-flow rights. We consider a bank as without excess control rights if this bank is widely held or controlled by an ultimate shareholder with identical control and cash-flow rights. T-statistics test for the null hypothesis: "bond spread is not different between banks with or without excess control rights during sound and crisis periods". ***, ** and * indicate significance respectively at the 1%, 5% and 10% levels.

	Number of issues	Mean Spreads	T-statistics
Sound period (2002 - Q2 2007)	1,552	0.253	
Presence of excess control rights	144	0.235	0.508
Absence of excess control rights	1,408	0.252	
Crisis period (Q3 2007 - 2010)	1,248	0.989	
Presence of excess control rights	172	0.892	2.080**
Absence of excess control rights	1,076	1.005	

3.4. Results

We first examine the relationship between excess control rights and bank bond yield spreads across sound and distress periods. We then go deeper and analyze whether some bond features affect this relationship.

3.4.1. Effect of excess control rights on bank bond yield spreads

We estimate the coefficients of Eq. (3.1) using the Ordinary Least Square (OLS) method with robust standard errors. The estimation results are reported in Table 3.4. The two first columns report the results on the effect of the presence of excess control rights on bank bond yield spreads over the whole period. The two last columns include an interaction variable to differentiate its effect across sound and distress periods. We alternatively use the continuous (columns 1 and 3) and binary (columns 2 and 4) variables to capture the presence of excess control rights.[77]

The results reported in regressions (3) and (4) show that before the crisis, bondholders pay less attention to bank governance: the coefficient α_1 associated to our ownership variable is not statistically significant. Our results also indicate that the effect of the divergence between control and cash-flow rights is significantly different during sound and distress periods: α_2 is negative and significant in both regressions. Specifically, the Wald test indicates that the coefficient associated to the continuous measure of excess control rights (column 3) is negative and significant at the 1% level, suggesting that the divergence between control and cash-flow rights is associated with a lower cost of debt financing during the crisis period. Similarly, estimates from column 4 show that the average bond yield spreads of banks controlled by a shareholder with excess control rights [d(ExcessControl)=1] is significantly lower than the average bond yield spreads of banks without excess control rights [d(ExcessControl)=0] during the crisis period: the coefficient estimates associated with both dummies are respectively 0.571 and 0.687. Furthermore, the t-test (not reported in the table) indicates that the difference between these two coefficients (i.e., 0.571 and 0.687) is significantly different from zero. Overall, the results suggest that banks controlled by a

[77] The standard deviation for the excess control rights variable on the whole sample is 8.05 which seems quite enough to accurately test our hypotheses. But nevertheless, to ensure that our results are not affected by the prevalence of bonds issued by banks without excess control rights (2,484 against 316 for banks controlled by shareholders with excess control rights), we perform our regressions using a continuous variable along with a binary variable to capture the presence of excess control rights.

shareholder with excess control rights experienced a lower cost of debt financing during the distress period of Q3 2007-2010[78]. This result is consistent with the propping up view under which banks controlled via excess control rights might benefit from private support from their ultimate controlling shareholders or their related-firms within the pyramid during a crisis, reducing their probability of failure. Bondholders anticipating such incentives charge lower spreads for banks controlled by these shareholders.

Regarding the other variables, most of them, either related to issuer or issue characteristics, are significant with the expected signs. Coherently, bondholders price bank risk and require higher spreads form riskier banks. The coefficient on the binary variable d(Crisis) shows an increase in bank bond yield spreads suggesting that bondholders charge higher spreads during downturns. As predicted, the results also indicate lower spreads for larger banks. Consistent with the findings of Sironi (2003) and Iannotta *et al.* (2013), larger issue amounts are associated with higher spreads. Coherently, Maturity and the binary variable d(Subordinated/Unsecured) also enter the regressions positively and significantly.

[78] This result is in line with the findings of Saghi-Zedek and Tarazi (2015) during the 2007-2008 financial crisis. Whereas a larger divergence between ultimate shareholders' control and cash-flow rights is associated with higher default risk and lower performance before the crisis period, during this crisis period such a divergence has contributed to enhance banks' performance and no longer affects banks' default risk. Banks with ultimate shareholders with excess control rights appear as safer during turmoil and bondholders should accordingly require a lower yield spread.

Table 3.4: Excess control rights and bank bond spreads

This table shows the Ordinary Least Square estimation results on the effect of excess control rights on bank bond spreads (Eq. (3.1)) for a sample of 2,800 bonds issued by 89 banks over the 2002-2010 period. In all the regressions, the dependent variable is bank bond spreads defined as the difference between the bank bond yield at issuance and the yield of a same currency and maturity Treasury Bond. We use two proxies of bank ownership: a continuous variable (ExcessControl) defined as the difference between control and cash-flow rights of the largest ultimate owner; and a binary variable [d(ExcessControl)] equal to one if the issuing bank is controlled by a shareholder with greater control than cash-flow rights, and zero otherwise. d(Crisis) is a dummy variable equal to one if the bond is issued during the period Q3 2007 - 2010, and zero otherwise. TotalRisk is a proxy of bank risk defined as the standard deviation of weekly bank stock returns computed on a moving window of 52 quoted weeks. ROAA is the return on average assets defined as the ratio of net income to average total assets. Log(Assets) is the natural logarithm of bank total assets. Log(Issuance) is the natural logarithm of the issuance amount. Maturity is the number of years between the bond issue date and redemption. d(Subordinated/Unsecured) is a dummy equal to one if the bond is either subordinated or unsecured, and zero otherwise.

T-statistics are shown in parentheses. ***, ** and * indicate significance respectively at the 1%, 5% and 10% levels. Wald tests are performed to test the significance of some coefficients.

	(1)	(2)	(3)	(4)
Ownership variable	ExcessControl	d(ExcessControl)	ExcessControl	d(ExcessControl)
Ownership variable (α_1)	-0.003**	-0.063*	0.002	0.002
	(-2.21)	(-1.86)	(1.11)	(0.06)
Ownership variable x d(Crisis) (α_2)	-	-	-0.008***	-0.118**
	-	-	(-3.11)	(-2.08)
d(Crisis) (α_3)	0.675***	0.671***	0.694***	0.687***
	(28.33)	(28.37)	(27.95)	(26.87)
TotalRisk	0.029***	0.029***	0.028***	0.029***
	(7.52)	(7.63)	(7.49)	(7.63)
ROAA	-0.046	-0.043	-0.052*	-0.044
	(-1.48)	(-1.38)	(-1.68)	(-1.43)
Log(Assets)	-0.034***	-0.031***	-0.032***	-0.032***
	(-3.16)	(-2.92)	(-3.05)	(-3.01)
Ln(Issuance)	0.025***	0.025***	0.025***	0.026***
	(4.12)	(4.17)	(4.15)	(4.24)
Maturity	0.027***	0.027***	0.027***	0.027***
	(6.34)	(6.36)	(6.28)	(6.33)
d(Subordinated/Unsecured)	0.231***	0.231***	0.228***	0.229***
	(10.15)	(10.15)	(10.02)	(10.09)
Constant	0.047	-0.014	0.017	-0.007
	(0.20)	(-0.06)	(0.07)	(-0.03)
Currency dummies	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes
Number of observations	2,800	2,800	2,800	2,800
R-Square	0.482	0.481	0.484	0.482
Adjusted R-Square	0.475	0.474	0.477	0.474
Wald tests				
$\alpha_1 + \alpha_2$	-	-	-0.006***	-0.116***
p-value	-	-	(0.001)	(0.014)
$\alpha_1 + \alpha_2 + \alpha_3$	-	-	-	0.571***
p-value	-	-	-	(0.000)

3.4.2. Effect of excess control rights on bank bond yield spreads: a deeper investigation

Our main results show that banks controlled by shareholders with excess control rights experienced relatively lower spreads compared to their peers during the distress period. A potential explanation for such a finding is that bondholders regard strong links among shareholders within pyramids as a cushion against bank failure and therefore require lower spreads from such controlled banks. However, all bondholders are not identically concerned about bank default. More precisely, because holders of unsecured and subordinated bonds bear most of the costs in the event of default, they should pay more attention to weaknesses in bank governance during downturns compared to holders of secured bonds. Similarly, bonds with low ratings are perceived by rating agencies as more likely to default and, as a consequence, holders of such bonds should be more sensitive to deficiencies in bank governance. We hence expect our previous result to be mainly effective as long as unsecured and subordinated bonds are concerned as well as in the case of bonds with downgraded ratings. Our aim herein is then to test whether bonds' ratings (high versus low ratings) and bonds' payment rank (subordinated and unsecured bonds versus secured bonds) affect the incentives of bondholders to price the presence of excess control rights.[79]

Consequently, we split the sample of bonds into subsamples according to their ratings and payment ranks.[80] To test the effect of bond ratings, we classify bonds as high rated if they are rated at issuance between Aaa and Aa2 for Moodys or AAA and AA for Fitch and Standards & Poor's, and as low rated if the grade is equal to or lower than Aa3 for Moodys and AA- for the other rating agencies. To capture the effect of the payment rank, we separate the sample of bonds into two subsamples: unsecured and subordinated bonds versus secured bonds.

Overall, the results reported in Table 3.5 show that before the crisis bondholders do not price

[79] We also would like to test whether the effect of excess control rights on bank bond spreads depends on the ownership type. The risk of expropriation of minority shareholders relates to the ownership type as previous literature highlights that this may occurs to a large extent by families who have an increased incentive to expropriate (see Claessens *et al.* (1999), Villalonga and Amit (2006)). More specifically, family-controlled banks are likely to be benefit from support from their ultimate owners during distress times (Saghi-Zedek and Tarazi (2015)) and, as a consequence, we expect that the link between control rights and bond spreads to be more pronounced in family-controlled banks. However, as explained before, in our specific case family-controlled banks did not issue bonds during the distress period, making such investigations impossible.

[80] For simplicity, we perform our regressions on subsamples of bonds instead of augmenting Eq. (3.1) using interaction terms.

bank governance, as measured by excess control rights, regardless of the bonds characteristics. This is consistent with the view that during upturns investors are less concerned about deficiencies in bank governance. Coherently, the results also show that the negative association between excess control rights and bond yield spreads during the crisis period is only relevant for low rated as well as unsecured and subordinated bonds. This result suggests that bondholders who face a lower quality of debt and therefore a higher default risk (i.e., holders of downgraded, subordinated and unsecured bonds) price excess control rights during distress periods. More precisely, bondholders charge a lower cost of debt during the crisis period when issuers of these bonds are banks controlled by shareholders with excess control rights. Bondholders perceive those banks as less likely to fail as they enjoy strong links inside their pyramid ownership structure and may benefit from the support of ultimate owners or other related-firms during distress periods. Otherwise, just like before the crisis, holders of secured bonds and bonds with upgraded ratings do not take into account the bank ownership structure, as measured by excess control rights, when they fix the bond premium.

Table 3.5: Excess control rights and bank bond spreads - Rating and Payment Rank categories

This table shows the Ordinary Least Square estimation results on the effect of excess control rights on bank bond spreads (Eq. (3.1)) for sub-samples of rating and payment rank categories over the 2002-2010 period. We classify bonds according to their payment ranks into secured bonds (Secured) and subordinated or unsecured (Subordinated/Unsecured). To capture the effect of rating categories, bonds are classified as high rated (High Rating) if they are rated at issuance between Aaa and Aa2 for Moodys or between AAA and AA for Fitch and Standards & Poor's. We consider them as low rated (Low Rating) when the grade is equal to or lower than Aa3 for Moodys and AA- for Fitch and Standards & Poor's. In all the regressions, the dependent variable is bank bond spreads defined as the difference between the bank bond yield at issuance and the yield of a same currency and maturity Treasury Bond. We use two proxies of bank ownership: a continuous variable (ExcessControl) defined as the difference between control and cash-flow rights of the largest ultimate owner; and a binary variable [d(ExcessControl)] equal to one if the issuing bank is controlled by a shareholder with greater control than cash-flow rights, and zero otherwise. d(Crisis) is a dummy variable equal to one if the bond is issued during the period Q3 2007 - 2010, and zero otherwise. TotalRisk is a proxy of bank risk defined as the standard deviation of weekly bank stock returns computed on a moving window of 52 quoted weeks. ROAA is the return on average assets defined as the ratio of net income to average total assets. Log(Assets) is the natural logarithm of bank total assets. Log(Issuance) is the natural logarithm of the issuance amount. Maturity is the number of years between bond issue date and redemption. d(Subordinated/Unsecured) is a dummy equal to one if the bond is either subordinated or unsecured, and zero otherwise.

T-statistics are shown in parentheses. ***, ** and * indicate significance respectively at the 1%, 5% and 10% levels. Wald tests are performed to test the significance of some coefficients.

	Payment Rank				Credit Ratings			
	Subordinated / Unsecured		Secured		High Rating		Low Rating	
Ownership variable	ExcessControl	d(ExcessControl)	ExcessControl	d(ExcessControl)	ExcessControl	d(ExcessControl)	ExcessControl	d(ExcessControl)
Ownership variable (α_1)	0.003	0.030	-0.002	-0.017	-0.002	-0.018	0.004	0.023
	(1.48)	(0.67)	(-0.27)	(-0.30)	(-0.74)	(-0.35)	(1.59)	(0.42)
Ownership variable x d(Crisis)	-0.009***	-0.137**	-0.001	-0.024	-0.001	-0.044	-0.012***	-0.231**
	(-2.92)	(-1.97)	(-0.06)	(-0.28)	(-0.26)	(-0.73)	(-3.04)	(-1.99)
d(Crisis) (α_3)	0.762***	0.754***	0.470***	0.463***	0.560***	0.561***	0.799***	0.788***
	(21.45)	(20.50)	(15.56)	(15.14)	(16.95)	(16.65)	(20.16)	(19.28)
TotalRisk	0.029***	0.030***	0.007	0.006	0.021***	0.021***	0.032***	0.033***
	(5.74)	(6.03)	(1.07)	(0.95)	(4.57)	(4.62)	(5.52)	(5.75)
ROAA	-0.050	-0.037	-0.138***	-0.139***	-0.027	-0.026	-0.206***	-0.185***
	(-1.18)	(-0.88)	(-3.41)	(-3.43)	(-0.71)	(-0.68)	(-4.22)	(-3.84)
Log(Assets)	-0.049***	-0.048***	-0.037*	-0.039**	0.039**	0.041**	-0.066***	-0.067***
	(-4.03)	(-4.01)	(-1.84)	(-2.00)	(2.22)	(2.32)	(-5.26)	(-5.34)
Ln(Issuance)	0.029***	0.030***	-0.016	-0.016	-0.007	-0.007	0.059***	0.061***
	(4.15)	(4.32)	(-1.47)	(-1.53)	(-0.76)	(-0.72)	(7.78)	(8.10)
Maturity	0.034***	0.034***	0.007	0.007	0.007*	0.008*	0.039***	0.040***
	(6.24)	(6.33)	(1.13)	(1.11)	(1.69)	(1.70)	(5.96)	(6.16)

Table 3.5 (continued)

d(Subordinated/Unsecured)	-	-	-	-	0.051	0.048	0.294***	0.299***
	-	-	-	-	(1.08)	(1.02)	(5.38)	(5.45)
Constant	0.423	0.393	1.128***	1.172***	-0.588	-0.635*	-0.093	-0.115
	(1.54)	(1.44)	(2.66)	(2.86)	(-1.61)	(-1.72)	(-0.29)	(-0.37)
Currency dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	2,058	2,058	742	742	1,188	1,188	1,612	1,612
R-Square	0.497	0.494	0.419	0.418	0.487	0.486	0.565	0.561
Adjusted R-Square	0.487	0.485	0.400	0.399	0.471	0.470	0.554	0.550
Wald tests								
$\alpha_1 + \alpha_2$	-0.006**	-0.107*	-0.003	-0.040	-0.003*	-0.063	-0.009***	-0.207**
p-value	(0.013)	(0.080)	(0.211)	(0.541)	(0.070)	(0.185)	(0.008)	(0.042)
$\alpha_1 + \alpha_2 + \alpha_3$		0.647***		0.423***		0.498***		0.581***
p-value		(0.000)		(0.000)		(0.000)		(0.000)

To summarize (see Table 3.6 for a summary of results), we find that the presence of excess control rights matters for bondholders but differently across sound and distress periods. Holders of secured or high rated bonds disregard the bank governance quality (as measured by the presence and the absence of excess control rights) during both normal times and distress times. However, holders of low rated and unsecured/subordinated bonds pay attention to deficiencies in bank governance schemes only during distress times. Particularly, they charge a lower premium for banks controlled by shareholders with excess control rights. These bondholders perceive the interconnectedness of shareholders among pyramids as a potential safety cushion against bank failure and therefore charge a lower premium from such controlled banks.

Table 3.6: Summary of the results

This table presents a summary of the results. We classify bonds according to their payment ranks into secured bonds (Secured) and subordinated or unsecured (Subordinated/Unsecured). To capture the effect of rating categories, bonds are classified as high rated (High Rating) if they are rated at issuance between Aaa and Aa2 for Moodys or between AAA and AA for Fitch and Standards & Poor's. We consider them as low rated (Low Rating) when the grade is equal to or lower than Aa3 for Moody's and AA- for Fitch and Standards & Poor's.

	PaymentRanks		Bond Ratings	
	Secured	Subordinated / Unsecured	High Rating	Low Rating
Sound period (2002 - Q2 2007)	0	0	0	0
Distress period (Q3 2007 - 2010)	0	-	0	-

3.5. Robustness checks

In this section, we perform several regressions to examine the robustness of our findings in subsection 4.1.[81] The results are presented in the Appendices.

First, to ensure that our coefficients estimates do not suffer from the bias of omitted variables, we augment the model reported in Eq. (3.1) by some additional variables. In addition to premiums required for default factors, bondholders could also charge a tax premium (Elton *et al.* (2001)). We capture such a premium by introducing the coupon rate (Coupon). Since we focus on the primary market and because most of the bonds in our sample are issued and

[81] We also check the robustness of the results obtained in subsection 3.4.2. The results, available upon request, indicate that our main conclusions remain unchanged.

redeemed at par, the coupon rate is already the main component of the Spread variable. Hence, in our specific case including the coupon rate in the set of control variables may not bring additional information. But nevertheless, to be consistent with previous studies we ensure that our results are not driven by the omission of the coupon rate. Moreover, because the decision of banks to issue bonds depends on their probability of default and overall on the costs and the benefits related to debt issuance, riskier banks may be more reluctant to issue bonds (Covitz *et al.* (2004)). We control for this potential sample selection bias by including the inverse of the Mill's ratio (Mills) in the model (Eq. (3.1)).[82] In both cases, the results reported in Appendix 3.3 remain unchanged.

Second, because bank risk is the main determinant of bond yield spreads, we use alternative measures (accounting or market-based) for the risk variable instead of TotalRisk that we include in our equation until now: (i) the distance to default,[83] (ii) the accounting based Z-Score defined as the return on assets plus the ratio of equity to total assets, divided by the standard deviation of the return on assets, (iii) the bond rating at issuance date defined as the best rating attributed by one of the three rating agencies, and (iv) the ratio of bank loan loss reserves to total loans. Our results, reported in Appendix 3.5, remain mostly the same whatever the measure we include.

Third, to disentangle the effect of excess control rights on bond yield spreads across sound and distress periods, we perform regressions separately on the two subsamples of distress and sound periods instead of using interaction terms as in Eq. (3.1). This check leads to similar conclusions (see Appendix 3.6).

Finally, until now, our distress period, which ranges from Q3 2007 to 2010, includes both the financial crisis and the beginning of the sovereign debt crisis. To ensure that the sovereign debt crisis during which bond yield spreads and Treasury Bonds were affected did not drive our results, we consider an alternative measure of the crisis period. We now exclude the Q2 2009 – 2010 period from our sample and focus on the acute financial crisis period which ranges from Q32007 to Q12009. The results yield similar conclusions (see Appendix 3.7).

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[82] See Appendix 3.4 for more details about the estimation of this variable.

[83] We compute the distance to default using both accounting and market variables: (i) debt of one year maturity defined as the annual total assets minus annual total equity and interpolated using the cubic spline method, (ii) daily market value of equity and (iii) the one year interbank risk-free rate. We measure the volatility of equity as the standard deviation of the daily stock returns multiplied by $\sqrt{252}$. All data come from Bloomberg database.

3.6. Conclusion

The objective of this study is to empirically test whether the presence of ultimate shareholders with excess control rights in pyramids affects banks bond yield spreads and whether this effect is different across sound and distress periods. For this purpose, we use a sample of 2,800 bonds issued by 89 publicly listed banks based in 16 Western European countries during the 2002-2010 period.

Our results indicate that, before the crisis, the presence of excess control rights does not affect banks bond yield spreads. However, our results also show that bank governance does matter for bondholders during downturns: the divergence between control and cash-flow rights was significantly associated with lower banks bond yield spreads during the distress period of Q3 2007-2010. A deeper investigation reveals that such an effect is only prevalent in the case of bonds with downgraded ratings and subordinated/unsecured bonds. On the whole, our results show that while bondholders disregard bank governance, as measured by the presence and the absence of excess control rights, during normal times, they take it into consideration during downturns.

Overall, we show that ownership structure and specifically the divergence between control and cash-flow rights does matter in explaining differences in banks bond yield spreads during crisis periods. Our findings suggest that bondholders perceive banks controlled by shareholders with excess control rights as safer and require from such banks lower premiums, possibly because they enjoy strong links and interconnections within pyramids which prevent them from failure. From a policy point of view, this finding suggests that besides the safety net guarantees and too-big-to-fail policies, interconnectedness of banks within complex ownership structures may also affect the effectiveness of market discipline. More disclosure on complex ownership structure of banks following the suggestions of the Basel Committee on Banking Supervision (Bank of International Settlements (2010b)) are therefore encouraged.

APPENDICES

Appendix 3.1: Table A1 - General descriptive statistics of the final sample over the 2002-2010 period

This table provides general descriptive statistics on some financial variables. Assets is the bank's total assets. ROAA is the return on average assets. LEVERAGE is the ratio of total liabilities to total equity. NLTA is the ratio of net loans to total assets. NPLNL is the ratio of nonperforming loans to net loans. LLPNL is the ratio of loan loss provisions to net loans. All variables are in percentages except Assets which is in billions Euros.

	Assets	ROAA	LEVERAGE	NLTA	NPLNL	LLPNL
Mean	443.013	0.302	27.715	52.899	2.479	0.661
Median	234.582	0.280	26.954	57.660	2.096	0.543
Standard Deviation	469.909	0.456	13.829	17.053	1.580	0.578
Minimum	1.101	-2.420	4.684	0.630	0.007	0.000
Maximum	2,586.701	2.230	125.000	91.530	9.505	5.073

Appendix 3.2: Table A2 - Correlations table

ExcessControl is the difference between control and cash-flow rights. d(ExcessControl) is a binary variable equal to one if the issuing bank is controlled by a shareholder with excess control rights, and zero otherwise. d(Crisis) is a dummy variable equal to one if the bond is issued during the period Q3 2007 - 2010, and zero otherwise. TotalRisk is a proxy of bank risk defined as the standard deviation of weekly bank stock returns computed on a moving window of 52 quoted weeks. ROAA is the return on average assets defined as the ratio of net income to average total assets. Log(Assets) is the natural logarithm of bank total assets. Log(Issuance) is the natural logarithm of the issuance amount. Maturity is the number of years between the bond issue date and redemption. d(Subordinated/Unsecured) is a dummy equal to one if the bond is either subordinated or unsecured, and zero otherwise. ***, ** and * indicate significance respectively at the 1%, 5% and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ExcessControl (1)	1.000								
d(ExcessControl) (2)	0.785***	1.000							
d(Crisis) (3)	0.105***	0.071***	1.000						
TotalRisk(4)	0.006	-0.024	0.424***	1.000					
ROAA (5)	-0.045**	0.034*	-0.162***	-0.331***	1.000				
Log(Assets) (6)	-0.030	-0.009	0.144***	0.123***	-0.193***	1.000			
Log(Issuance) (7)	0.068***	0.119***	0.116***	-0.033*	0.078***	-0.016	1.000		
Maturity (8)	-0.048**	-0.029	0.008	-0.052***	0.067***	0.037*	0.038**	1.000	
d(Subordinated/Unsecured) (9)	0.074***	0.081***	0.058***	0.121***	0.116***	0.003*	-0.025	-0.094***	1.000

Appendix 3.3: Table A3 - Excess control rights and bank bond spreads: alternative specifications of the bond spread equation

This table shows the Ordinary Least Square estimation results on the effect of excess control rights on bank bond spreads for a sample of banks over the 2002-2010 period. For robustness, we add some control variables to the baseline bond spreads equation: the bond coupon rate and/or the inverse of the Mill's ratio to control for a potential selection bias. In all the regressions, the dependent variable is bank bond spreads defined as the difference between the bank bond yield at issuance and the yield of a same currency and maturity Treasury Bond. We use two proxies of bank ownership: a continuous variable (ExcessControl) defined as the difference between control and cash-flow rights of the largest ultimate owner; and a binary variable [d(ExcessControl)] equal to one if the issuing bank is controlled by a shareholder with greater control than cash-flow rights, and zero otherwise. d(Crisis) is a dummy variable equal to one if the bond is issued during the period Q3 2007 - 2010, and zero otherwise. TotalRisk is a proxy of bank risk defined as the standard deviation of weekly bank stock returns computed on a moving window of 52 quoted weeks. ROAA is the return on average assets defined as the ratio of net income to average total assets. Log(Assets) is the natural logarithm of bank total assets. Log(Issuance) is the natural logarithm of the issuance amount. Maturity is the number of years between the bond issue date and redemption. d(Subordinated/Unsecured) is a dummy equal to one if the bond is either subordinated or unsecured, and zero otherwise.

T-statistics are shown in parentheses. ***, ** and * indicate significance respectively at the 1%, 5% and 10% levels. Wald tests are performed to test the significance of some coefficients.

Ownership Variable		ExcessControl			d(ExcessControl)	
Ownership Variable (α_1)	0.000	0.002	-0.000	-0.046	-0.022	-0.065
	(0.10)	(0.74)	(-0.01)	(-1.13)	(-0.49)	(-1.43)
Ownership Variable x d(Crisis) (α_2)	-0.007***	-0.008***	-0.007**	-0.082	-0.117*	-0.072
	(-2.87)	(-2.86)	(-2.54)	(-1.49)	(-1.95)	(-1.22)
d(Crisis) (α_3)	0.617***	0.730***	0.645***	0.606***	0.721***	0.630***
	(25.24)	(27.36)	(24.47)	(23.88)	(26.40)	(23.24)
TotalRisk	0.036***	0.025***	0.036***	0.037***	0.025***	0.037***
	(10.02)	(6.26)	(9.46)	(10.17)	(6.38)	(9.60)
ROAA	-0.032	-0.065*	0.000	-0.023	-0.059	0.008
	(-1.10)	(-1.69)	(0.01)	(-0.80)	(-1.53)	(0.23)
Log(Assets)	-0.037***	-0.050***	-0.039**	-0.035***	-0.045**	-0.033**
	(-3.99)	(-2.73)	(-2.40)	(-3.76)	(-2.51)	(-2.05)
Ln(Issuance)	0.020***	0.024***	0.019***	0.021***	0.025***	0.020***
	(3.63)	(3.89)	(3.24)	(3.74)	(3.97)	(3.33)
Maturity	0.006	0.029***	0.006	0.006	0.030***	0.006
	(1.31)	(6.28)	(1.27)	(1.40)	(6.30)	(1.32)
d(Subordinated/Unsecured)	0.176***	0.266***	0.177***	0.178***	0.266***	0.177***
	(8.24)	(9.82)	(6.98)	(8.33)	(9.82)	(6.98)

Table A3 (Continued)

Coupon	0.173***	-	0.180***	0.172***	-	0.179***
	(12.49)	-	(14.25)	(12.41)	-	(14.13)
Mills	-	0.025	0.204	-	0.073	0.261
	-	(0.09)	(0.84)	-	(0.26)	(1.11)
Constant	-0.280	0.329	-0.264	-0.333	0.231	-0.391
	(-1.28)	(0.86)	(-0.75)	(-1.52)	(0.61)	(-1.13)
Currency dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	2,800	2,482	2,482	2,800	2,482	2,482
R-Square	0.551	0.490	0.556	0.548	0.487	0.553
Adjusted R-Square	0.544	0.481	0.548	0.541	0.478	0.545
Wald tests						
$\alpha_1 + \alpha_2$	-0.007***	-0.007***	-0.007***	-0.128***	-0.138***	-0.138***
p-value	(0.000)	(0.001)	(0.000)	(0.003)	(0.004)	(0.002)
$\alpha_1 + \alpha_2 + \alpha_3$				0.477***	0.582***	0.493***
p-value				(0.000)	(0.000)	(0.000)

Appendix 3.4: Table A4 - Bond issue decision model and the inverse of Mills ratio

Based on a set of all listed European banks (issuing or not) which includes our 89 banks, we estimate banks' probability to issue bonds over the 2002 - 2010 period using this probit equation:

$$d(Issue)_{it} = \alpha_0 + \alpha_1\ NPLNL_{it} + \alpha_2\ VIX_{it} + \alpha_3\ UNEMPL_{it} + \alpha_4\ Log(Assets)_{it} + \alpha_4\ EQTA_{it} + \varepsilon_{it} \qquad (3.2)$$

where d(Issue) is a dummy equal to one if bank i decides to issue a new bond at time t, and zero otherwise. The set of explanatory variables includes: the ratio of non-performing loans to net loans (NPLNL); an index of market volatility (VIX); the country's unemployment rate (UNEMPL); the natural logarithm of bank total assets (Log(Assets)) and finally the ratio of equity to total assets (EQTA). We extract the inverse of Mills' ratio from the residuals of the estimation results of Eq.(2).

Z-Statistics are shown in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% levels respectively.

	d(Issue)
NPLNL	0.253
	(0.162)
VIX	0.019***
	(2.628)
UNEMPL	-0.057***
	(-4.409)
Log(Assets)	0.815***
	(19.083)
EQTA	-11.131***
	(-8.360)
Number of observations	5,295
Mc Fadden R²	0.705
Likelihood Ratio Statistic	2.099***

Appendix 3.5: Table A5 - Excess control rights and bank bond spreads: alternative measures of risk

This table shows the Ordinary Least Square estimation results on the effect of excess control rights on bank bond spreads (Eq. (3.1)) for a sample of bonds over the 2002-2010 period. For robustness considerations, we use alternative measures of bank risk: the bank distance to default (DD); accounting-based Z-score (ZScore) measured as the return on assets plus the equity to total assets ratio, all divided by the standard deviation of the return on assets; the bond rating at issuance date defined as the best rating attributed by one of the three rating agencies (Rating), and the ratio of loan loss reserves to total loans (LLR). In all the regressions, the dependent variable is bank bond spreads defined as the difference between the bank bond yield at issuance and the yield of a same currency and maturity Treasury Bond. We use two proxies of bank ownership: a continuous variable (ExcessControl) defined as the difference between control and cash-flow rights of the largest ultimate owner; and a binary variable [d(ExcessControl)] equal to one if the issuing bank is controlled by a shareholder with greater control than cash-flow rights, and zero otherwise. d(Crisis) is a dummy variable equal to one if the bond is issued during the period Q3 2007 - 2010, and zero otherwise. ROAA is the return on average assets defined as the ratio of net income to average total assets. Log(Assets) is the natural logarithm of bank total assets. Log(Issuance) is the natural logarithm of the issuance amount. Maturity is the number of years between the bond issue date and redemption. d(Subordinated/Unsecured) is a dummy equal to one if the bond is either subordinated or unsecured, and zero otherwise.

T-statistics are shown in parentheses. ***, ** and * indicate significance respectively at the 1%, 5% and 10% levels. Wald tests are performed to test the significance of some coefficients.

Ownership Variable	ExcessControl				d(ExcessControl)			
Risk variable	DD	ZScore	Rating	LLR	DD	ZScore	Rating	LLR
Ownership Variable (α_1)	-0.000	0.002	0.001	0.001	-0.038	-0.023	0.010	-0.027
	(-0.20)	(0.79)	(0.59)	(0.46)	(-0.79)	(-0.58)	(0.27)	(-0.62)
Ownership Variable x d(Crisis) (α_2)	-0.008***	-0.009***	-0.008***	-0.008***	-0.143**	-0.127**	-0.171***	-0.111*
	(-2.65)	(-3.36)	(-3.23)	(-2.84)	(-1.97)	(-2.23)	(-3.06)	(-1.89)
d(Crisis)	0.702***	0.738***	0.791***	0.757***	0.688***	0.730***	0.789***	0.750***
	(21.58)	(30.75)	(33.23)	(30.90)	(20.50)	(29.31)	(31.85)	(29.73)
Risk variable	-0.050***	-0.001***	0.108***	0.008	-0.051***	-0.001***	0.107***	0.012
	(-6.92)	(-5.57)	(11.77)	(0.87)	(-6.97)	(-5.51)	(11.73)	(1.35)
ROAA	-0.072*	-0.141***	-0.160***	-0.170***	-0.059	-0.134***	-0.153***	-0.159***
	(-1.84)	(-4.48)	(-5.49)	(-4.63)	(-1.50)	(-4.27)	(-5.26)	(-4.37)
Log(Assets)	-0.045***	-0.031***	0.002	-0.030***	-0.044***	-0.029***	0.004	-0.028**
	(-2.95)	(-2.85)	(0.25)	(-2.69)	(-2.90)	(-2.73)	(0.39)	(-2.47)
Ln(Issuance)	0.023***	0.027***	0.032***	0.025***	0.025***	0.027***	0.033***	0.025***
	(2.80)	(4.32)	(5.59)	(3.95)	(2.96)	(4.40)	(5.80)	(4.04)
Maturity	0.025***	0.026***	0.023***	0.026***	0.025***	0.026***	0.023***	0.027***
	(4.58)	(5.99)	(5.40)	(5.88)	(4.67)	(6.04)	(5.46)	(5.89)

Table A5 (Continued)

d(Subordinated/Unsecured)	0.199***	0.255***	-0.129***	0.272***	0.206***	0.257***	-0.127***	0.273***
	(5.24)	(11.28)	(-3.39)	(11.37)	(5.45)	(11.39)	(-3.35)	(11.42)
Constant	0.651**	0.113	-0.835***	0.062	0.600*	0.075	-0.888***	-0.007
	(2.05)	(0.47)	(-3.66)	(0.24)	(1.90)	(0.31)	(-3.90)	(-0.03)
Currency dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	1,586	2,788	2,777	2,647	1,586	2,788	2,777	2,647
R-Square	0.452	0.476	0.505	0.474	0.448	0.473	0.503	0.471
Adjusted R-Square	0.439	0.468	0.497	0.466	0.434	0.465	0.495	0.463
Wald tests								
$\alpha_1 + \alpha_2$	-0.008***	-0.007***	-0.007***	-0.007***	-0.182***	-0.150***	- 0.161***	-0.138***
p-value	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.002)	(0.001)	(0.004)
$\alpha_1 + \alpha_2 + \alpha_3$					0.506***	0.580***	0.628***	0.613***
p-value					(0.000)	(0.000)	(0.000)	(0.000)

Appendix 3.6: Table A6 - Excess control rights and bank bond spreads: regressions on subsamples

This table shows the Ordinary Least Square estimation results on the effect of excess control rights on bank bond spreads for a subsample of bonds issued during the sound period (2002 - Q2 2007) and a sub-sample of bonds issued during the crisis period (Q3 2007 - 2010). In all the regressions, the dependent variable is bank bond spreads defined as the difference between the bank bond yield at issuance and the yield of a same currency and maturity Treasury Bond. We use two proxies of bank ownership: a continuous variable (ExcessControl) defined as the difference between control and cash-flow rights of the largest ultimate owner; and a binary variable [d(ExcessControl)] equal to one if the issuing bank is controlled by a shareholder with greater control than cash-flow rights, and zero otherwise. TotalRisk is a proxy of bank risk defined as the standard deviation of weekly bank stock returns computed on a moving window of 52 quoted weeks. ROAA is the return on average assets defined as the ratio of net income to average total assets. Log(Assets) is the natural logarithm of bank total assets. Log(Issuance) is the natural logarithm of the issuance amount. Maturity is the number of years between the bond issue date and redemption. d(Subordinated/Unsecured) is a dummy equal to one if the bond is either subordinated or unsecured, and zero otherwise.

T-statistics are shown in parentheses. *** , ** and * indicate significance respectively at the 1%, 5% and 10% levels.

Ownership Variable	ExcessControl		d(ExcessControl)	
Sample period	Sound period	Crisis period	Sound period	Crisis period
Ownership Variable	0.002	-0.007***	-0.033	-0.126**
	(1.01)	(-3.96)	(-0.77)	(-2.35)
TotalRisk	0.027***	0.025***	0.028***	0.025***
	(3.38)	(5.68)	(3.45)	(5.87)
ROAA	0.003	-0.120**	0.006	-0.102**
	(0.10)	(-2.29)	(0.20)	(-1.99)
Log(Assets)	-0.040***	-0.061***	-0.042***	-0.056***
	(-4.61)	(-2.91)	(-4.66)	(-2.62)
Ln(Issuance)	0.024***	0.012	0.024***	0.014
	(3.81)	(1.23)	(3.76)	(1.39)
Maturity	0.044***	0.008	0.044***	0.008
	(7.44)	(1.38)	(7.46)	(1.46)
d(Subordinated/Unsecured)	0.104***	0.431***	0.105***	0.430***
	(4.54)	(9.83)	(4.60)	(9.79)
Constant	0.162	1.549***	0.192	1.391***
	(0.64)	(3.62)	(0.75)	(3.25)
Currency dummies	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes
Number of observations	1,552	1,248	1,552	1,248
R-Square	0.287	0.309	0.286	0.302
Adjusted R-Square	0.270	0.288	0.270	0.281

Appendix 3.7: Table A7 - Excess control rights and bank bond spreads: alternative measures for the crisis period

This table shows the Ordinary Least Square estimation results on the effect of excess control rights on bank bond spreads (Eq. (3.1)) for a sample of bonds issued between 2002 and Q1 2009. In all the regressions, the dependent variable is bank bond spreads defined as the difference between the bank bond yield at issuance and the yield of a same currency and maturity Treasury Bond. We use two proxies of bank ownership: a continuous variable (ExcessControl) defined as the difference between control and cash-flow rights of the largest ultimate owner; and a binary variable [d(ExcessControl)] equal to one if the issuing bank is controlled by a shareholder with greater control than cash-flow rights, and zero otherwise. d(Crisis) is a dummy variable equal to one if the bond is issued between Q3 2007 and Q1 2009, and zero otherwise. TotalRisk is a proxy of bank risk defined as the standard deviation of weekly bank stock returns computed on a moving window of 52 quoted weeks. ROAA is the return on average assets defined as the ratio of net income to average total assets. Log(Assets) is the natural logarithm of bank total assets. Log(Issuance) is the natural logarithm of the issuance amount. Maturity is the number of years between the bond issue date and redemption. d(Subordinated/Unsecured) is a dummy equal to one if the bond is either subordinated or unsecured, and zero otherwise.

T-statistics are shown in parentheses. ***, ** and * indicate significance respectively at the 1%, 5% and 10% levels. Wald tests are performed to test the significance of some coefficients.

Ownership Variable	ExcessControl	d(ExcessControl)
Ownership Variable (α_1)	0.002	-0.004
	(1.20)	(-0.09)
Ownership Variable x d(Crisis) (α_2)	-0.008***	-0.140*
	(-2.82)	(-1.94)
d(Crisis) (α_3)	0.762***	0.758***
	(24.12)	(22.88)
TotalRisk	0.024***	0.025***
	(4.06)	(4.11)
ROAA	-0.039	-0.034
	(-1.12)	(-0.97)
Log(Assets)	-0.031***	-0.032***
	(-2.79)	(-2.82)
Ln(Issuance)	0.020***	0.021***
	(2.84)	(2.94)
Maturity	0.037***	0.037***
	(7.61)	(7.71)
d(Subordinated/Unsecured)	0.168***	0.169***
	(6.97)	(7.03)
Constant	0.095	0.088
	(0.35)	(0.33)
Currency Dummies	Yes	Yes
Country Dummies	Yes	Yes
Number of observations	2,171	2,171
R-Square	0.467	0.465
Adjusted R-Square	0.457	0.455
Wald tests		
$\alpha_1 + \alpha_2$	-0.005***	-0.143**
p-value	(0.004)	(0.021)
$\alpha_1 + \alpha_2 + \alpha_3$	-	0.614***
p-value	-	(0.000)

GENERAL CONCLUSION

Over the last decades, European banks have been affected by various changes that have occurred in the banking industry. The processes of deregulation, financial integration and innovation led to a transformation in banking activities and ownership structure that altered banks' risk-taking behavior by notably increasing their incentives to take risks. The financial development has exacerbated banks' financial fragility while the probability that this fragility adversely impacts the whole economy has increased. As financial market expanded, the place and role of banks have been strengthened in the economy. Ensuring their financial stability to prevent their failure is thus one of the main objectives of prudential regulation. Banks' risk management plays a preeminent role to insure this objective. However, weak managerial skills or agency conflicts are likely to affect the way banks are dealing with risks. Because banks' bondholders are mainly concerned about banks' default risk, they may be directly impacted by the potential risk of insolvency ensuing from mismanagement. Hence, the new financial context has raised the debate on banks' quality of risk management and ownership structure, among which, their effects on bondholders' behavior.

From this perspective, the aim of this thesis is therefore to assess the quality of banks' risk management and to investigate how this quality and the effect of excess control rights of ultimate controlling shareholders affect the pricing of banking bonds. This conclusion summarizes the main findings and contributions of the three previous chapters.

The purpose of the first chapter is to evaluate and to analyze the efficiency of banks while they manage their risks. To this end, we employ a structural model of production to estimate the expected return and risk that directly and exclusively stem from the *ex-ante* portfolio choices made by managers of a sample of 192 European banks. Using a stochastic frontier model, we produce the best-practice risk-return frontier and compute each bank's risk-return efficiency by its distance from this frontier. The study shows that some banks operate at relatively low levels of efficiency, not solely because their management is potentially affected by a negative exogenous factor, but especially because they have an impaired ability to manage their risk-taking. We take care to ensure that this result is robust to different econometric choices relative to the estimation techniques of the best practice frontier. We then perform a statistical analysis to emphasize the stability of banks' ranking through times. We infer from this analysis that the level of bank efficiency is relatively stable in the short term. In the long term, a large part of the most efficient banks were not adversely affected by the financial crisis while low performing banks are not condemned to remain inefficient. We then conduct mean equality tests to highlight some common characteristics for the most risk-return efficient banks. These banks are specialized on lending activities, are less capitalized. They better perform in terms of return and operational costs, and they are less risky without being more solvent, less opaque or bigger than less efficient ones. At last, when credit ratings do not account for potential extern support, we show that rating agencies assign a better rating for the most risk-return efficient banks.

The second chapter of this thesis rests directly on the findings of the first one and examines the role that banks' quality of risk management can play in the pricing of banking bonds. More precisely, on a sample of 1,924 bonds issued by European listed banks, we investigate whether the default premium required by bondholders is partly explained by the risk-return efficiency measure. We consider the risk-return efficiency measure as a proxy of bank managerial ability in terms of risk-return trade-off. Because of a lack of accurateness in traditional default risk proxies, we assume that adding this variable improves the explanation of the default risk premium. Our investigation effectively claims that bondholders require a higher yield spread when the bank managerial ability decreases, confirming the intuition that the default risk premium cannot be entirely explained by traditional default risk proxies. The quality of banks' risk management turns out to be a relevant determinant of this premium. Bondholders tend to be less confident about the default measure of banks with low level of managerial ability. The premium for risk mismanagement may be considered as a premium that bondholders require to compensate for the lack of confidence they have in the measure of the effective level of bank default. More, the global financial crisis provides a timely case to explore how the effect of bank managerial ability on bank bond spread might differ depending on the soundness of the banking industry. We thus deepen our analysis and investigate whether bondholders' pricing behavior is the same during the turmoil than before. We find that their incentive to account for banks' managerial ability while pricing their debt have been strengthened during this period. Overall, we conclude that bondholders increase their monitoring and become more sensitive to this component when the banks' default probability increases.

The third chapter deals with the agency problem between controlling shareholders and bondholders. Ultimate owners with control rights in excess of cash-flow ones could threaten the interests of minority shareholders as well as those of bondholders essentially by undertaking projects that increase the likelihood of bankruptcy. We then assume that the divergence between control and cash-flow rights of the ultimate owner influences bondholders' pricing behavior. Specifically, we examine whether the presence of ultimate shareholders with excess control rights in pyramids affects bank bond yield spread and whether this effect is different across sound and distress periods. During normal times, one may think that controlling shareholders use their effective control rights to divert gains to themselves, leaving the cost of failure to bondholders, which in turn require a higher spread. Our results do not support this intuition as we find that the presence of excess control rights does not affect bank bond yield spread during this period. This result highlights that bondholders pay less attention to bank governance and confirms the finding of the previous chapter: bondholders are less willing to monitor banks during upturns. On the contrary, we find that banks controlled by a shareholder with excess control rights experienced a lower cost of debt financing during the financial crisis period. Such a result is consistent with the propping-up view: entrenched controlling shareholders intervene to refund banks in order to prevent all the firms in the pyramid from financial distress. Anticipating such a behavior, bondholders require a lower spread compared to sound periods for banks controlled by shareholders with excess control rights. For deeper insights, we also test whether bond ratings and payment rank affect the incentives of bondholders to price the presence of excess control rights. This investigation underlines that the impact of controlling shareholders on bank bond spread is only significant when banks experience a high default risk. Indeed, the results remain unchanged for the sound period and the negative effect of excess control rights on the bond spread during the crisis period is only significant for low rated as well as unsecured and subordinated bonds.

Overall, this thesis highlights several challenges for banking institutions and supervisors. First, our result that some European banks are inefficient to manage their risk optimally supports the need for a prompt monitoring of banks' ability to manage optimally the risk-return trade-offs. We may wonder whether supervisors correctly take into account such ability when aiming to discipline banks. Consequently, this thesis raises some questions regarding the ability of bank supervisors to differentiate between banks according to their efficiency at risk-taking and their incentives to discourage inefficient risk-taking in this context.

Second, as the results confirm that the quality of risk management is a determinant of bond spread, this thesis brings evidences that bondholders accurately monitor banks and this finding turns out to be a key element for banks' supervisors who may use the information contained in bond yield spread as a signal to indirectly discipline banks. Banks should anticipate this reaction and should have even more incentives to improve their risk management.

Finally, the previous results suggest that bondholders do not consider the divergence between control rights and cash-flow rights of ultimate owners during upturns and even consider banks controlled by shareholders with excess control rights as safer during the financial crisis as they benefit from strong interconnections within their pyramid structure. These findings raise the question of the effectiveness of bondholders' discipline in presence of complex ownership structure and support the need for banks' supervisors and regulators to recommend more disclosure of banking institutions' ownership.

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TABLE OF CONTENTS

ABSTRACT

This thesis consists of three empirical essays with an emphasis on bank risk-return efficiency and bond pricing. Chapter 1 aims at a better understanding of the quality of banks' risk management by providing, for a set of European listed banks, a measure of each bank's relative efficiency in terms of risk-return trade-off. We show that the level of bank risk-return efficiency is quite stable in the short term, whereas in the long term low performing banks are not condemned to remain inefficient. We also identify some common characteristics for the most risk-return efficient banks, which are assigned, by rating agencies, a more attractive financial strength rating. In chapter 2, we investigate the determinants of bank bond spread and we show that bank managerial ability, proxied by bank risk-return efficiency, improves the explanation of the default premium required by bondholders. Our results underline that standard default risk measures do not entirely reflect the default premium and banks' managerial ability turns out to be a determinant of bondholders' confidence in the measure of the effective level of bank default. Chapter 3 examines the effect of divergence between control rights and cash-flow rights of ultimate owners in pyramid ownership structure on the pricing of banking bonds. Whereas before the financial crisis such a divergence does not affect bank bond yield spread, during downturns bondholders require a lower spread from banks controlled by an ultimate owner with excess control rights. The investigation on more restrictive subsets underlines that this result is only significant when banks experience a high level of default risk.

Keywords: [European Banks, Risk-Return Efficiency, Bond Spread, Excess Control Rights]

RESUMÉ

Cette thèse est construite autour de trois essais empiriques centrés sur l'efficience rendement risque des banques européennes cotées et sur la tarification des obligations qu'elles émettent. Avec le premier essai, on mesure l'aptitude relative des banques à choisir efficacement le couple rendement / risque. On montre que cette aptitude relative est stable, surtout à court terme et que les banques les plus efficaces dans leurs choix rendement / risque partagent des caractéristiques communes et bénéficient d'une notation de solidité plus avantageuse. Le second essai apporte la preuve que l'introduction de cette mesure d'efficience du choix rendement / risque améliore de manière sensible l'explication de la prime de défaut qu'exigent les investisseurs sur les obligations émises par les banques et que les mesures traditionnelles du risque de défaut ne captent pas à elles seules l'intégralité de la prime de défaut. En outre, la capacité des banques à gérer efficacement le couple rendement / risque s'avère être un élément déterminant de la confiance que mettent les détenteurs d'obligations dans la mesure du risque effectif de défaut des banques. Avec le dernier essai on traite des conséquences d'une éventuelle divergence entre droits de contrôle et droits pécuniaires des actionnaires ultimes des banques sur la tarification des obligations qu'elles émettent. Si les obligataires ne semblent pas sensibles à une telle divergence avant la crise financière, les résultats montrent en revanche qu'ils le deviennent pendant la crise en exigeant un spread d'autant moins élevé que cette divergence est plus prononcée. Il est intéressant de noter que ce résultat ne tient que lorsque les banques font face à un risque de défaut élevé.

Mots clés: [Banques Européennes, Efficience Rendement-Risque, Spread Obligataire, Divergence entre droits de contrôle et droits pécuniaires]