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Firm Value and Risk Management in Credit Agreements

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by

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Neuchâtel, le 25 septembre 2014

Le doyen

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I dedicate this dissertation to my wife, Shadi and my son, Hirad.

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Summary:

In this dissertation, I analyze the proxies used in literature as the determinants of firm value to identify the core variables in modeling firm value. Using these variables, I evaluate the impact of interest rate derivatives on firm value. More specifically, I find that interest rate derivatives imposed in credit agreements has a positive impact on firm value in contrast to those used voluntarily for which the motive behind the use of derivatives is not clear for equity holders. The impact of systematic risk in placement structure of debt is also studied. I show that the impact of systematic risk on cost of debt is higher for public debts compared to those for private credit agreements. However, the emergence of loan secondary market diminishes this difference.

Keywords:

Firm value; interest rate; risk management; derivatives; hedging; agency conflicts; systematic risk; public debt; private debt; loan secondary market.

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Introduction

In this dissertation, I focus on the determinants of firm value. More specifically, I start by investigating the main determinants and core factors in modelling the "normal" value of the firm. I review papers published in major accounting, economic and finance journals that relate firm value to a set of determinants. Consistent with existing theories, this review reveals that profitability, risk, growth, payout policies and size are the main determinants of firm value. However, the proxies used for each factor is extremely diverse. Therefore, I apply Bayesian Information Criterion (BIC) to find variables with highest explanatory power. This analysis identifies six core variables for firm value. I also test the specification and power of the model based on these core variables by conducting a pseudo Mont Carlo simulation. The outcome of this research provides an in-depth understating of determinants of firm value as well as a baseline model to be applied in my research on the impact of risk management on firm value.

In chapter two, I study the interplay between the use of financial derivatives and firm value. I leverage my findings in my research on firm value and analyze the impact of the interest rate derivatives on firm value. Market frictions such as income tax, bankruptcy costs and access to the financial markets bolster potentials for value generation by risk management. For instance, risk management reduces the volatility of cash flows. As a result, it reduces the present value of tax liabilities when the tax function is convex and diminishes the probability of bankruptcy in unfavorable states of economy. Financial derivatives are one of the prevailing tools in risk management. International Swap and Derivative Association and Bank of International Settlement (BIS) frequently report a significant increase in the use of derivatives. For instance, according to BIS report, the notional value of interest rate derivatives increased from $3.3 trillion in 2000 to more than $35.6 trillion in 2009. However, these financial derivatives could be used for other purposes rather than risk management.

Stulz (1984) and Smith and Stulz (1985) argue that managers may hold derivative positions for their own advantage that might not be aligned with shareholders' interests. Consistent with this idea, there is evidence that some firms use financial instruments for speculation; see e.g., Faulkender (2005) and Géczy, Minton, and Schrand (2007). This agency conflict accounts for inconclusive result of researches on unconditional use of derivatives and firm value. Therefore, I turn my attention on the use of derivatives imposed by creditors on firm value. More specifically, I investigate the impact of interest rate protection covenants (IRPC) in syndicated loans on firm value. An IRPC clarifies the use of derivatives to both shareholders and bondholders for the purpose of risk management. Consequently, it alleviates the uncertainty in the motive behind the use of derivatives.

Using a panel of US firms exposed to interest rate risk between 1998 and 2007, I show that mandatory interest rate hedging has an economically large and statistically significant positive impact on firm value. This finding is robust to various competing hypotheses including the existence of additional covenants enhancing firm value, stricter corporate governance rules, and more intensive competition on the product market. To check the robustness of this result to a potential selection bias, I use a propensity score matching and my results are not altered. To reduce endogeneity concerns, I use the introduction of FAS133 rule as a natural experiment. This accounting rule imposes the disclosure of hedging policies, which reduces the ambiguity about interest rate derivatives usage. I find that, after the implementation of the rule, interest rate hedging has a positive impact on firm value. Finally, this analysis shows that this value is created by the relaxation of the financial constraint that allows a higher level of investment and, to a less extent, the reduction of cost of debt.

The outcome of this chapter motivates me to study the interplay between firm risk and debt structure. In fact, working on firms issued syndicated loans, I notice that a large portion of firms with investment grade rating finance their projects through private placement. The literature on the placement structure of debt posits information asymmetries as the main determinants of debt structure. In other word, private lenders are superior to public creditors in financing “information-problematic” firms (Carey, Post and Sharpe, 1998). However, information asymmetry is not an incentive for firms with investment grade rating. Several studies document the impact of systematic risks similar to those in equity price on cost of debt, e.g. Elton, Gruber, Agrawal, and Mann (2001). Since private creditors have a different investment horizon from that of public bond holders, I conjecture that private lenders have a distinct expectation for price of systematic risk compare to public lenders. As a result, in chapter three, I study the systematic risk of private and public borrowers in two groups of investment and speculative credit ratings. I also analyze the impact of emerging secondary loan market on the difference between systematic risk of public and private lenders.

To conclude, the results of my research on firm value complement the literature that examines the determinants of firm value. While most of the previous research considers the main determinants as control variables, I suggest which proxies really matter. I also provide novel empirical evidence of the impact of interest rate derivatives usage on firm value by comparing non-users, voluntary and mandatory users. It is also a step forward to an unbiased estimation of the influence of derivatives on firm value by focusing on derivatives usage imposed by creditors rather than that decided by managers alone. Last but not least, this research opens a new chapter in the debt structure literature by contrasting the price of systematic risk in private and public debt market. I also show that how secondary market diminishes the advantage of private lending in information asymmetry and controlling incentives.

Chapter 1: Which factors are important in firm valuation?

(In collaboration with Michel Dubois)

1.1 Introduction

Variables affecting firm value are of major interest for both corporate finance and asset pricing. A significant change in these variables, at a given point in time, allows the quantification of their real impact on firm value. Frequently, this identification consists of two steps: (a) the computation of cumulated abnormal stock returns around the event date (event studies) and (b) the estimation of a regression with cumulated abnormal returns as the dependent variable, the independent variables being the variable of interest and a set of controls that determine firm value. However, this identification strategy is feasible when the date and the magnitude of the change in the variable of interest are observable with a reasonable degree of accuracy; see, e.g., Kothari and Warner (2008). It also assumes that the event is not partially anticipated, which smooth the market reaction, and that wealth transfers between stockholders and creditors are absent. An alternative strategy consists in regressing Tobin's Q, a proxy for firm value, against the variable of interest[1] and a set of contemporaneous firm value determinants measured at equally spaced intervals. The former strategy has been employed routinely in finance and more generally, in economics, while the latter has been used more recently. It is popular for studying the impact of corporate governance, the structure of the board and specific manager's actions like the impact of derivatives usage, cash holding, corporate diversification and foreign listing.

In this paper, we study which variables are the core factors in firm valuation, whether the corresponding model is well specified and has power to detect changes in firm value when a specific variable of interest is added to the baseline model. We first identify the variables used in the literature. While there is a large consensus on the role of profitability, risk, growth, the

[1] The method can be accommodated easily when there are several variables of interest

payout policy and size as the main determinants of firm value, the proxies for these factors are extremely diverse. We examine which proxies explain firm value and, more importantly, exhibit a reliable sign. For that purpose, we follow a procedure similar to Frank and Goyal (2009). We collect the proxies of the core factors and select our baseline model with the Bayesian Information Criterion (BIC). This approach should help reduce the diversity of the control variables. Secondly, we evaluate the performance of this baseline model. Beyond the core factors, we aim at testing whether the model is well specified and has power to detect a variable of interest not already incorporated in the model. We explore these properties through pseudo Monte Carlo simulations.

We begin by reviewing papers published in major accounting, economic and finance journals that relate firm value to a set of determinants. We select empirical papers, published between 1995 and 2013[2], containing the following key words in the text: "Q ratio", "Tobin's Q", "firm value", "firm valuation" and "firm performance". Then, we retain exclusively those papers where Tobin's Q is the dependent variable. In total, we find fifty-two papers that match our requirements (fourty in finance journals, ten in accounting journals and two in economic journals). More specifically, their focus is on corporate governance (twenty-two papers), ownership structure (nine papers), followed by risk management (five papers), diversification, cross-listing and other corporate policies (sixteen papers).

These empirical papers typically study whether a variable of interest affects Tobin's Q after controlling for its main contemporaneous determinants (forty-nine papers). However, the comparison of their results is unreliable since most models do not share the same proxies for the control variables. For example, thirteen different proxies are used for profitability, twelve for risk, fifteen for growth, four for the payout policy and six for size. Note that industry, firm and

[2] These journals are: Accounting Review, Journal of Accounting and Economics, Journal of Accounting Research (accounting journals), American Economic Review, Journal of Political Economy, Quarterly Journal of Economics (economic journals), Journal of Finance, Journal of Financial Economics, Journal of Financial and Quantitative Analysis, and Review of Financial Studies (finance journals).

time fixed effects and their combinations are not counted, which renders the comparison of these models even more difficult.

Over the sample period (1963-2012), ten sub-samples and six sub-periods, our findings indicate that the explanatory power of the variables is not equal. We identify EBITDA / Total Assets, Market Leverage, CAPEX / Total Assets, R&D / Total Assets, Dividend / Total Assets and (the Log of) Total Assets as the core determinants of firm value in a model where we account for firm and industry-time fixed effects. In this model, standard errors are clustered by firm and industry-time. The adjusted R-square of the baseline model is twenty-three percent when the estimation is conducted over the sample period. The variance decomposition of Tobin's Q shows that twenty-two percent of the total variance is attributable to the determinants, forty-two percent to the firm fixed effect and six percent to the industry-time fixed effect. The sub-samples and the sub-periods that we examine demonstrate similar results with an adjusted R-square around twenty percent.

Fama and French (1998) propose an alternative dynamic panel data model that has been used in four papers; see Pinkowitz, Stulz and Williamson (2006), Dittmar and Mahrt-Smith (2007), and Frésard and Salva (2010). The core factors are profitability, risk, growth and dividends. This model departs from the previous specification by including lead-lag values of the core factors. The practical issue that arises is which model should be preferred. To answer this question, we proceed as follows. We estimate Fama and French (1998) model over the sample and six sub-periods. The R-square of this model is twenty percent, which is slightly lower than that of the baseline model. Since the baseline model, with the core contemporaneous determinants, and Fama and French (1998) model are non-nested, we use Vuong (1989) test to check which one (if any) dominates. Our results show that the baseline model should be preferred.

To examine the specification and the power of the baseline model, we proceed as follows. Based on the surveyed papers, we identify the characteristics of the variable of interest. Its effect on Tobin's Q is: (a) continuous, permanent and all firms are concerned, (b) the impact is permanent but it is firm-specific and (c) the treatment is reversible[3]. For (b) and (c) the number of treated firms varies across papers from ten to one hundred percent. In addition, the cross-sectional intensity of the treatment is constant (twenty-eight papers) or firm dependent (twenty-five papers)[4].

Second, we use pseudo Monte Carlo simulations. We draw five hundred firms in a given year and collect the core determinants for the current and the following seven years. We obtain an unbalanced panel data of five hundred firms over an eight-year period. Then, we generate a random variable of interest and estimate via OLS the baseline model (including the variable of interest) with firm and industry-time fixed effects. We estimate standard errors clustered at the firm level, at the firm and the industry-time levels (double clustering with analytical and a bootstrap estimate). This procedure is iterated five hundred times to generate the empirical distributions. Finally, we study whether the model is well specified and has power at the one, five and ten percent levels. Our benchmark is a model with firm fixed effect and standard errors clustered at the firm level.

Our results complement the literature that examines the determinants of firm value. While most of the previous research considers the main determinants as control variables, we suggest which proxies really matter. The spirit of our research is closely related to Bhojraj and Lee (2002). Two differences are noticeable. We use Tobin's Q as a proxy of firm value (instead of equity or enterprise value), a variable that has become standard in finance. We estimate the model appropriate fixed effects and standard errors adjustments. Our research is also related to

[3] The typical cases are (a) competition pressure or accounting transparency, (b) cross-listing in a foreign capital market and (c) derivatives usage since the firm can decide to hedge one year and not to hedge the next year, perhaps because the risk does not exist anymore.

[4] For instance, to study the impact of derivatives on firm value, the variable of interest can be binary (i.e., a firm is classified as derivatives user or non-user) or continuous (i.e., for every firm the hedging intensity is measured). Some papers use both variables in different specifications; see, e.g., Jin and Jorion (2006).

Fama and French (1998). The main advantage of our model is that it incorporates more observations without losing explanatory power when the performance of both models is compared on the same data set. In the context of panel data models examining the impact of both cross-sectional and time-series dependence, our contribution can be seen as an empirical application of recent techniques to a major topic in finance; see, e.g., Bertrand et al. (2004), Cameron, Gelbach and Miller (2008), Gow, Ormazabal and Taylor (2010) and Petersen (2009).

The structure of the paper is as follows. In the next section, we review how firm value and its determinants are measured in the literature. We also examine the sample characteristics and the estimation methods previously used. Section 1.3 reports the results of the variable selection process. In Section 1.4, we analyze the specification and the power of the model selected in the previous section and Section 1.5 concludes the paper.

1.2 The determinants of firm value

Discounting future cash flows is the classic approach to determine what a firm is worth. By making additional assumptions concerning earnings growth and the payout policy, analytical formulas are obtained. Empirical models, in a way or another, incorporate these core factors.

1.2.1. Defining Tobin's Q

Tobin's Q is the ratio of the market value of the firm to the replacement cost of its physical assets. As it is well known, the market price of debt and the replacement cost of the assets in place are difficult to estimate. However, Chung and Pruitt (1994), and Perfect and Wiles (1994) find a strong correlation between the market value of equity plus the book value of non-equity financial claims scaled by the book value of total assets, and proxies for Tobin's Q based on more complex methods; see, e.g., Lindenberg and Ross (1981), and Lang and Litzenberger (1989). Hence, most of the existing studies use their definition, which is easy to compute, and homogeneous among firms. We define Tobin's Q ratio as follows:

$$Q_{i,t} = \frac{MV_{i,t} + BV\ Assets_{i,t} - BV\ Equity_{i,t}}{BV\ Assets_{i,t}} \quad (1)$$

where *MV* is the market value of equity, *BV Assets* is the book value of assets and *BV Equity* is the book value of equity, *i* and *t* refer to firm *i* at fiscal year-end *t*. Due to the skewness of Tobin's Q ratio, we use Log of Q as the proxy of the firm value, a common practice in literature.

1.2.2. The determinants of firm value

From forty-nine papers in our survey, we summarize empirical Tobin's Q models as follows:

$$Q_{i,t} = \beta_0 + \beta_1 \mathbf{Prof_{i,t}} + \beta_2 \mathbf{Risk_{i,t}} + \beta_3 \mathbf{Growth_{i,t}} + \beta_4 \mathbf{Div_{i,t}} + \beta_5 \mathbf{Size_{i,t}} + \mu_i + \eta_t + \varepsilon_{it} \quad (2)$$

where $Q_{i,t}$ is (Log of) Tobin's Q, and $\mathbf{Prof_{i,t}}$, $\mathbf{Risk_{i,t}}$, $\mathbf{Growth_{i,t}}$, $\mathbf{Div_{i,t}}$ and $\mathbf{Size_{i,t}}$ are vectors of proxies for profitability, risk, growth, the payout policy and firm size. Firm, industry or country and time fixed effects are also frequently included.

Following Fama and French (1998), Dittmar and Mahrt-Smith (2007), Frésard and Salva (2010) or Pinkowitz, Stulz and Williamson (2006) estimate a model with the current level of these core variables and their two-year lead and lag changes. Lead variables are included because Tobin's Q contains the market value of equity. Hence, it incorporates expectations about the future value of accounting numbers. Lagged variables are also included to smooth (unusual) current values. Again, the core variables are profitability, risk, growth and the payout policy. With our notations, it can be written has follows:

$$Q_{i,t} = \beta_0^F + \beta_1^F \mathbf{Prof_{i,t}} + \beta_2^F \mathbf{Risk_{i,t}} + \beta_3^F \mathbf{Growth_{i,t}} + \beta_4^F \mathbf{Div_{i,t}} + \varepsilon_{it} \quad (3)$$

Interestingly, previous studies using this model retain the same proxies for the core factors[5]. Earnings before Extraordinary Items proxies for $\mathbf{Prof_{i,t}}$, Interest (rate) Expenses for $\mathbf{Risk_{i,t}}$, change in Total Assets and R&D Expenses for $\mathbf{Growth_{i,t}}$ and Common Dividends for $\mathbf{Div_{i,t}}$.

[5] Frésard and Salva (2009) add two variables, sales growth and the median of Q, plus a country fixed effect. We do not consider these variables in our specification.

Note that the lead market equity to book equity ratio is also added to capture growth options and that size is missing. While also missing in the original model, firm or country and time fixed effects have been included in two papers.

1.2.3. *Measuring the determinants of Tobin's Q*

1.2.3.1. Profitability and internal financing resources

Discounting models show that profitability is expected to be positively related to firm value. Fernandez (2013) states that cash flows should be preferred. As he put it: "Cash flow is a fact. Net income is just an opinion". He argues that net income figures are contaminated with accounting assumptions while cash flow is not. However, profitability ratios like Net Income, Income Before Extraordinary Items, EBIT, or EBITDA scaled by Total Assets, Sales, Tangible Assets or the Market Value of Equity represent the vast majority of the proxies in the surveyed papers. EBITDA/ Total Asset, the most frequent proxy for profitability, appears ten times, followed by ROA and Net Income / Total Asset (four times), and EBIT or EBITDA scaled by Sales (three times each).

1.2.3.2. Risk

The asset pricing literature states that the discounting rate increases with risk. Hence, everything else equal, a negative relation between risk and firm value should be observed. Systematic risk (market model Beta) is a classic proxy for risk (four times). The standard deviation of the residuals has also been used as a proxy for idiosyncratic risk; see, e.g., Fahlenbrach and Stulz (2009) and Gurun and Butler (2012). There are at least three concerns about these proxies: (a) they show a significant instability, (b) they are subject to the error in variables problem when used as independent variable, and (c) they are affected by infrequent trading. Leverage, particularly book leverage, computed as total debt over total assets, is the prevailed proxy for risk (twenty papers). Studies such as Welch (2004) underpin market leverage as a forward looking measure and book leverage as a backward accounting measure. However, Myers (1977) advocates book leverage as a measure for risk since debts are more supported by assets rather than equity. Long term debt instead of total debt, or scaling debt by equity, are alternative proxies. The volatility of stock return (four times), Altman's Z-Score and the distance to default (see Merton, 1974) are also used sporadically. Fama and French (1998) construct a proxy of financial risk based on interest payment instead of leverage with its two-year lead and lag data.

1.2.3.3. Growth

The relation between growth and firm value has two dimensions. The first component describes the dynamics of future earnings through the investment policy. The second component is the value of real options. Both are expected to be positively related to firm value. Proxies for growth are highly diverse but those based on CAPEX and R&D expenditures are the most frequent (twenty-six and twenty-three papers respectively). Myers (1977), and Smith and Watts (1992) argue about the impact of investment opportunities on firm value and introduce CAPEX as a proxy for investment. Morck and Yeung (1991) explain that CAPEX is a measure of tangible investment while R&D and Advertisement expenditures (not capitalized intangible investment) are proxies for growth options. Studies such as Maury and Pajuste (2005) use tangible assets as a proxy for investment growth. They argue that firms with lower tangible assets have higher intangibles with potential of generating cash flows. Barth and Clinch (1998) also show the positive correlation between firm value and intangible assets. The question is whether this proxy is interchangeable with R&D and Advertisement expenditures or whether both should be included. Measures based on sales, asset growth and depreciation of assets are other substitutes for growth (sixteen papers).

1.2.3.4. Payout policy

There are several potential reasons why the payout policy should matter. As mentioned in Fama and French (1998), dividends could signal future profits or just be a smooth version of profits. In addition, dividend paying firms could face lower agency costs because less discretionary cash is available. Everything else equal, more dividends should enhance firm value.

The payout policy is captured through dividends scaled by sales, equities or assets, or with a dummy variable for dividend payments (six papers). Studies such as Lang and Stulz (1993) use this dummy as an indicator of access to the financial markets. Following Fazzari, Hubbard and Petersen (1988), they state that firms can cut dividend and invest the retained earnings. Therefore, a dividend paying firm has access to other financial resources for its investment. However, a firm may have a payout because it has no investment opportunities or because it is highly profitable. Fama and French (1998) use the level of dividend paid and state the tax disadvantage of dividends.

1.2.3.5. Size

As equation (2) shows, scaling market value with total assets, neutralizes the impact of size on firm value. Stigler (1963) demonstrates that size has no relation with the performance of the firm while Peltzman (1977) states that larger firms are more efficient. In his literature review, Mueller (2003) concludes that the relation between size and performance, particularly profitability, is ambiguous. Despite the above mentioned argument, size is frequently included as a determinant of firm value. Access to financial resources, industrial and geographical diversification, analysts' coverage and investors' visibility, are potential reasons explaining this relation. Therefore, firm size indirectly influence two main components of firm value, i.e. risk and growth options. Log of book value of assets (thirty papers), age (eleven papers), equities (seven papers), sales and tangible assets are the proxies for the firm size in the surveyed literature.

1.2.4. Estimation methods and sample characteristics

The models examined previously analyze panel data sets. Because some groups of observations have specific characteristics, fixed effects are introduced in the vast majority of the models (forty-five papers). Fixed effects have been considered separately or simultaneously along the following dimensions: time, firm, industry and country. Time and industry (seventeen papers) followed by time and firm (fifteen papers) are the most frequently used. Since firms do not change frequently from an industry to another, at least in the mid-term, firm and industry fixed effect are not used simultaneously. Hence, several studies use industry-adjusted variables (i.e. demeaned by industry). Also some studies introduce the average or median of the Q ratio into the model. However, Gormley and Matsa (2014) show that it generates serious biases in estimation. As they recommend, industry-year fixed effect ($\eta_{Industry,t}$) represents an interesting alternative since it captures the exposure of the industry to the business cycle and the competition within the industry. This type of fixed effect is absent from the previous literature.

Cross-sectional and time-series dependences are serious issue in panel data; see, e.g., Bertrand, Duflo and Mullainathan (2004), Petersen (2009) and Gow, Ormazabal and Taylor (2010). Positive autocorrelation or cross-correlation induces standard errors that are too small leading too frequently to the rejection of the null hypothesis (no impact of a variable of interest). In the early period of our survey, Fama-McBeth (1973) method was the most frequent method of estimation. Different solutions to correct for either cross-sectional or time-series dependence are proposed in the literature but do not perform well when both forms of dependence show up. Panel data models with parameters estimated through OLS with standard errors clustered at the firm level (eighteen papers), at the industry level (one paper) or at the country level (two papers) is now the standard method. More specifically, Petersen (2009) suggests that introducing firm fixed effect and clustering of the standard error at the firm level may be sufficient in some corporate finance applications. However, he clearly states that this pattern may not generalize and that […standard errors clustered by firm and time can be a useful robustness check]; see Petersen (2009, p. 473).

[Table 1.1]

In Table 1.1, we observe that the impact of the variable of interest on Tobin's Q is highly variable with a median of twelve percent. In fifteen papers, it is lower than ten percent, and above twenty percent in twenty-four (five papers show an average impact between ten and twenty percent). The standard errors clustered by firm are present in twelve papers while clustering by time is never considered. Therefore, the power of the corresponding models, i.e. their ability to reject the null when it is false, is questionable.

Concerning the sample, the typical panel has eight annual observations (median), for eight hundred firms (median). Most of the panels are unbalanced so that the number of observations has a median of 4200. Finally, the number of treated firms in sample varies from ten to one hundred percent.

1.3 Empirical Analysis

We extract annual data from the merged COMPUSTAT and CRSP database. The sample period starts in 1963 based on Fama and French (1992, p. 429) comments that COMPUSTAT is "tilted toward big historically successful firms" for the years before, and ends on 2012. Financial institutions and utility companies (SIC code starting with 6 and 49, respectively) are removed due to their special and regulated activities.

The variables are defined in the Appendix 1.A. They are winsorized left and right at one percent to reduce the impact of outliers on our tests. We eliminate Z-score from our analysis since it is a linear combination of other variables in the model. We follow the general practice in the literature that consists in replacing missing R&D and Advertisement expenditures with zero. To identify the core variables of the model, we conduct our tests on the sample over the 1963-2012 period, ten equal sub-samples where firms are selected randomly with replacement[6], and annual cross-sections. This data set allows us to observe the stability of the sign and the explanatory power of the variables.

1.3.1. Univariate analysis

We conduct a univariate analysis similar to that in Frank and Goyal (2009) between each variable and the Tobin's Q ratio. We compute the Pearson correlations and document how frequently they are statistically significant at the 1% (and 5%) level for negative and positive signs separately. This analysis gives a preliminary insight about the explanatory power of each variable and the stability of its corresponding sign.

[Table 1.2]

Table 1.2 shows the results. The first column is the correlation between each variable and firm value over the sample period. The next four columns show the proportion of correlations that are positive (respectively negative) and significant at the 1% and 5% (but not already significant at 1%) level in ten sub-samples. Column 6 to 9 report the proportion of correlation coefficients significant at the 1% and 5% (but not already significant at 1%) level for annual cross-sectional tests. The results indicate that the sign of pairwise correlations between the Q ratio and the proxies of profitability is not consistent. For instance, the negative correlation between ten profitability proxies and firm value is in contradiction with the theory. For nine of them, the correlation is more frequently negative than positive at the 1% level. Also in contradiction with the theory, measures of risk based on stock market prices (beta, idiosyncratic risk and volatility) are positively correlated with Q while, as expected, leverage proxies are

[6] To have a balanced distribution of firm-years in ten sub-samples, we randomly divide the sample at each year and index them from 1 to 10, randomly. Then we aggregate them all by index to have the final 10 random sub-samples.

negatively correlated with Q. Two proxies (three) of the payout policy, the dividend yield and the dividend dummy (equal to one for firms paying dividends), are negatively (positively) correlated with Q. Reassuringly, the signs of the correlation between Q and the proxies for growth are consistently positive. Despite the ambiguous correlation predicted by the theory, we also obtain a consistent negative correlation for size. These preliminary results show that proxies of the core factors should not be considered in isolation.

1.3.2. Selecting the determinants of Tobin's Q

Four model selection criteria have been employed in the literature: (a) Akaike Information Criterion (AIC, Akaike (1974)), (b) Bayesian Information Criterion (BIC, Schwartz (1978)), (c) Focused Information Criterion (FIC, Wei (1992) and (d) adjusted R^2 to evaluate the explanatory power of the variables in a model.[7] We use the BIC because of its popularity in literature; see e.g., Bossaert and Hillion (1999) and Frank and Goyal (2009). BIC is defined as:

$$BIC = -2 \times \text{log-likelihood} + p \times \log(n) \qquad (4)$$

where p is the number of variables in the model, and n the number of observations. Models with higher explanatory power generate a lower BIC. Given the high number of proxies, it is essential to remove those with low explanatory power.

[Table 1.3]

For that purpose, we follow Frank and Goyal (2009) recursive procedure. First, we estimate the model with all proxies. In Table 1.3, columns 1 and 2, we report the BIC (-417967) and the adjusted R-square (42%). We then remove the proxy (Growth Opportunities) with the lowest t-statistic and estimate the regression of this proxy on Q. The corresponding coefficient (0.001), t-stat (0.06) and R-square (0%) are presented in Columns 3 to 5. Then, the model is re-estimated without the proxy with the lowest t-stat (Growth Opportunities). On the second row

[7] Appendix A in Bossaerts and Hillion (1999) explains each of these criteria.

(dR&D / Total Assets), column 1, we observe a slight drop in the BIC from -417967 to -417979. This procedure is iterated until the bottom of the table. The lowest BIC (-616175) is obtained when R&D / Tangible and all the explanatory variables below in Table 1.3 are included. At this stage, we still have nineteen explanatory variables in the model.

To reduce further the number of variables, the procedure described above is also repeated for both the ten groups and annually. At each test, when the lowest BIC is reached, we record the variables in the model and compute the proportion of groups for which a specific proxy has a positive (negative) coefficient and presents in the minimum BIC model. The variables that show most frequently in the lowest BIC model are assigned as core factors in the model.

Interestingly, there is at least one proxy, and a maximum of two, representing each core factor in the model. These proxies are EBITDA / Total Assets and EBITDA / MV for profitability, Market Leverage for risk, CAPEX / Total Assets and R&D / Total Assets for growth, Dividend / Total Assets for the payout policy and, Log (Total Assets) and Log (Equity) for size. For each core factor, we retain the proxy that has the highest stability in terms of sign. Therefore, EBITDA / MV and Log (Equity) are eliminated. Note that we keep two proxies for growth since they represent two different dimensions, i.e. CAPEX / Total Assets and R&D / Total Assets. The proxies included in our final specification are those present in minimum BIC model at least 50% of our sub-samples periods (either the ten groups or the annual cross-sections). They have also a sign that is consistent with the theory. Finally, they do not switch sign in the annual cross-sections or over the sub-samples. These findings are consistent with the literature. As indicated, EBITDA / Total Assets and Log (Total Assets) are the most frequent proxies for profitability and size in the surveyed papers, respectively. R&D / Total Assets and CAPEX / Total Assets are also among the most frequently used as proxies for growth. However, market leverage and dividend / Total Assets are not standard variables in firm valuation models.

1.3.3. Tobin's Q baseline model

From the set of proxies selected in the previous section, we start our regression analysis of the baseline model (hereafter "BL") by estimating equation (2) with firm and industry-time fixed effects. The t-statistics are adjusted for clustering at both firm and industry-time levels. Table 1.4, Panel A, displays results from OLS estimations of equation (2). Column 1 ("All") to 7, report the results of the 1963-2012 period and the subsequent six eight-year sub-periods.

[Table 1.4]

Looking at the impact of the core variables in column 1, we notice that all of them have the expected sign and are statistically significant at the 1% level. The subsequent columns provide a slightly different message. While three core variables (EBITDA / Assets, Market Leverage and CAPEX / Assets) have the expected sign and are statistically significant at 1%, the remaining ones (Log(Assets), Dividend / Assets and R&D / Assets) are not significant at the usual level in three sub-sample periods. The 1972-1979 period shows a core variable (R&D / Assets) with the wrong sign but is not significant. The R-square is 23.6% for the 1963-2012 period and is between 19.9% and 39.6% for the remaining sub-periods.

In Table 1.4, Panel B, we examine whether clustering standard errors at the firm level only changes our inference. In the first and the subsequent columns, we remark that t-stat are higher (standard errors are too small). The two-way clustering really matters in our model. In Table 1.4, Panel C, we estimate the model with firm and time (instead of industry-time) fixed effect and cluster standard errors at the firm level. Globally, the statistical inference that we draw from the coefficients and their related t-stats are similar to that of Panel B. However, the R-square decreases when the whole sample and the sub-periods are considered.

1.3.4. An alternative Tobin's Q (dynamic) model

As mentioned before, there is no variable selection for the Fama and French (1998) model (hereafter "FF"). We depart slightly from the original specification by introducing firm and industry-time fixed effects. As for the baseline model, standard errors are clustered at the firm and the industry-time level. To check the robustness of our results, we re-estimate the model with firm and time fixed effect with standard errors clustered at the firm level.

[Table 1.5]

In Table 1.5, Panel A, column 1, we report the results for the 1963-2012 sample period. All the coefficients have the expected signs and are significant at the 1% level. Similar results are obtained for the six sub-sample periods. Panel B and Panel C confirm these results. Two limitations of this specification are noticeable. First, the number of observations is 30% lower because lead/lag variables require at least five consecutive years to be computed and, second, the explanatory power (R-square) is always lower than that of the baseline model (-4% for the 1963-2012 sample period). To explore further this issue, we decompose the variance as suggested by Coles and Li (2011). To facilitate comparison, we estimate both models on the same sample, i.e. the one used to estimate FF.

[Figure 1.1]

The observed variables of the BL and FF explain respectively 23% and 19% of the total variance. This is consistent with BL having a higher adjusted R-square since there are more independent variables in FF. The contribution of the firm fixed effects is high for both models (42% and 48% respectively) while the industry-time fixed effect is of a lower magnitude (9% and 8% respectively). To summarize the pros and cons: (a) BL has a higher in-sample explanatory power, (b) BL does eliminate unnecessarily observations and, (c) FF has parameter estimates that are more consistent over time.

The last step of our analysis consists in comparing directly the performance of both models. Since they are non-nested (i.e., they do not share the same independent variables), we use the statistical test developed by Vuong (1989). This test compares the log-likelihood functions of both models. Under the null hypothesis (the log-likelihood functions are equal) the VMS statistics follows a standard normal:

$$VMS\left(FF,BL\right)=\frac{n^{-1}\sum_{i=1}^{n}\left[l_{i,FF}\left(\theta_{FF}\right)-l_{i,BL}\left(\theta_{BL}\right)\right]}{\left\{n^{-1}\sum_{i=1}^{N}\left[l_{i,FF}\left(\theta_{FF}\right)-l_{i,BL}\left(\theta_{BL}\right)\right]^{2}\right\}^{\frac{1}{2}}\Big/\sqrt{n}}\ \sim N\left(0,1\right) \quad (5)$$

where $l_{i,BL(FF)}\left(\theta_{BL(FF)}\right)$ is the log-likelihood of the observation i under BL (FF), and n the number of observations. A negative (positive) value of VMS indicates that BL (FF) should be preferred to FF (BL)

[Table 1.6]

Table 1.6 reports the value of the Vuong (1989) statistics (observed) and the related p-value for the whole sample and six sub-periods, and the ten groups. Over the whole sample, BL dominates and on the sub-periods BL is chosen three times, FF two times and two times the test is inconclusive at the critical level of 1%. For the ten groups, the Vuong statistics is always negative. Four and six (four) times it is significant at the 1% and 5% levels (inconclusive), respectively. To conclude our selection process, we choose BL because the sample is less affected to the survivorship bias, both models being comparable in terms of explanatory power.

1.4 Specification and power of the regression model

1.4.1. Description of the pseudo Monte Carlo simulations

To examine the specific impact of the variable of interest on our BL model, we rewrite the model as follows:

$$Q_{i,t}=\beta_0+\beta_1 Int_t+\mathbf{\Gamma}'\times\mathbf{F_t}+\mu_i+\eta_{Industry,t}+\varepsilon_{it} \quad (6)$$

where $Q_{i,t}$ is the (Log) of Tobin's Q, $Int_t\left(\beta_1\right)$ the variable of interest (coefficient of interest), $\mathbf{F_t}$ the core factors in BL, μ_i and $\eta_{Industry,t}$ the firm and industry-time fixed effects. Depending on the variable of interest, we distinguish two cases: (a) Int_t is a missing "continuous" variable in equation (6), and (b) Int_t is a treatment affecting some firms (treated) in the sample and leaving unaffected (controls) the remaining ones. The former case is the classic problem of the missing variable in a regression setting. The latter case is decomposed further based on whether the treatment is affecting specific firms: (b1) persistently after a common date but heterogeneously among firm-years ("Specific"), (b2) or constantly but reversible ("Reversible"). We do not explore settings in which the intensity of the treatment decays over time (e.g., autoregressive process AR(1) with a coefficient lower than 1).

1.4.1.1. Standard error estimation

As already shown in Section 1.3, standard error estimates have a strong tendency of being too small in our setting. Therefore, the null hypothesis is rejected too often. The potential corrections proposed in the literature are well known; see, e.g. Bertrand et al. (2004), Petersen (2009) and Gow et al. (2010). We use three different methods to estimate the standard errors. Our benchmark is the OLS standard errors without any adjustment. This benchmark is compared one-way clustered standard errors (firm level), two-way clustered standard errors (firm and the industry-time level), and the bootstrapped one- and two-way clustered standard errors as suggested by Cameron et al. (2008).

1.4.1.2. The specification and the power of the baseline model

- Specification

To test whether the variable of interest has any impact on Tobin's Q, we use Model (3). The null hypothesis is $H_0 : \beta_1 = 0 \, vs \beta_1 \neq 0$. If the model is well specified, we should not reject the null in this setting. Therefore, to test the specification of the model, we generate 500 random panels, estimate the regression model for each panel and test whether we reject the null at 1%, 5% and 10% (α) significant level. The model is conservative if we reject the null lower than 500α times and anticonservative if we reject the null more than 500α. The control variables in our model is potentially skewd. This skewness increases the probability of Type I error in our test. Barber, Lyon, and Tsai (1999) address similar concern and refer to Sutton's (1993) statement: "[Bootstrap] should be preferred to the t-test when the parent distribution is asymmetrical, because it reduces the probability of type I error in cases where the t-test has an inflated type I error rate and it is more powerful in other situations.". Hence, we estimate the probability of rejection on both sides of the distribution.

More specifically, to generate a panel, we randomly choose a year *t* between 1963 and 2005. On year *t*, we randomly choose 500 firms with replacement. To calibrate our simulations with the surveyed research, we explore additional dimensions. We select an eight-year panel data from year *t* to *t+7*. This panel length corresponds to the median of the surveyed papers; see Table 1.1. Some firms may not exist for the whole period. As a result, our panels are unbalanced. We conduct our tests for each type of treatments separately. For "Reversible" treatment, at each iteration, after generating panel from a randomly chosen year and firms, we assign *Treatment = 1* to random firm-years in our sample. We conduct separate tests when 20%, 40% and 60% of firm-years in the panel are treated. For "Continuous" variable, at each iteration we generate random numbers from a normal distribution with zero mean and variance equal to 1%, 2.5% and 5% of the variance of the Log (Q) in our randomly generated panel. These marginal variances are in line with those of control variables in our model. Last, for "Specific" treatments, we generate random numbers with similar procedure explained for "Continuous" treatments. Then, we assign these numbers to random firms after a random year in the period of the panel. This test is repeated for different portion of treated firms, i.e. 20%, 40% and 60% of the firms in each panel.

- Power

We turn our attention to the power of the model (Type II). We follow the methodology applied in Barber et al. (1999). For "Reversible" and "Specific" treatments, after generating the panel, we manipulate firm value by artificially adding ±20%, ±15%, ±10%, and ±5% of the firm values for treated firms. For "Continuous" treatment, we add ±20%, ±15%, ±10%, and ±5% of Int_t to Log (Q) as abnormal firm values. Similar to specification test, we focus on the coefficient of the variable of interest and test the null hypothesis of $\beta_1 \leq 0$ $(\beta_1 \geq 0)$ for negative (positive) abnormal firm values at 1%, 5% and 10% (α) statistical significance levels. The rejection rate of the null gives the power test.

For both specification and power tests, we run the model with firm and industry-time fixed effects and estimate the standard error of the coefficients robust to heteroskedasticity and autocorrelation clustered at firm level. We also estimate the model with firm and industry-time clusters. Bootstrapping with 200 times resampling is also conducted for these tests. Finally, we estimate the model with random effects and clustering at firm level.

1.4.2. Results

Table 1.7 reports the results of specification tests for "Reversible" treatments. The numbers in the table show the percentage of rejection of the null at corresponding statistical significance levels of 1%, 5% and 10%. As indicated in the table, the model is anticonservative when 20% of the firms are treated. It might be the result of high number of zero values for treatments that generates a strong autocorrelation for this variable. This autocorrelation results in underestimation of the standard errors for variable of interest. In this context, we observe that the additional layer of clustering at industry-time level improves the performance of the model but not significantly. Bootstrapped resampling exacerbates the underestimation of the standard errors for this type of treatment. Last, we observe that the performance of the random effect model is identical to fixed effect in specification tests. Moreover, our results reveal that increasing the number of treated firms significantly improves the performance of the model. The model is almost well specified when 40% of firms are treated and is almost conservative when the number of treated firms is 60%. In fact, for higher number of treated firms, we have less clustered zero values and consequently less autocorrelation in variable of interests. When the number of treated firms are increased, the advantage of double clustering vanishes. Similar to previous results, there is no improvement in the results in bootstrap and random effect models. Result show that when the number of treated firms are low and the impact of treatment is constant, researchers should be cautious in interpreting the results in which the null hypothesis could be rejected based on the nature of the data rather than the economic impact of the treatment.

[Table 1.7]

Results of power test of the model for “Reversible” treatments are reported in Table 1.8. As demonstrated in the table, when Log (Q) is increased or decreased 10% or more, the model identifies the abnormal firm values in 100% of the tests. For 5% abnormal firm values, the model still performs well in more than 80% of the tests. Similar to results for specification test, there is no significant difference in the performance of the model when we apply double clustering, bootstrap or random effects in our model.

[Table 1.8]

Furthermore, we conduct our tests for “Continuous” variable of interests. Specification tests are reported in Table 1.9. Compared to “Reversible” treatment, we observe a significant improvement in the model specification which is well specified when the variance of the variable of interest is 1% of that of Log (Q). The model becomes more conservative when the marginal variance increases to 2.5% and 5%. It is natural since we have an increase in standard deviation of coefficient and consequently less rejection. We should note that the simulated variable of interest does not have autocorrelation in this test that explains the improvement in specification tests compare to “Reversible” treatments. Similar to previous test, increasing the layer of clustering as well as bootstrap and random effect do not improve the performance of the model for “Continuous” variable of interest.

[Table 1.9]

In Table 1.10, we report the results for power test of the model. Similar to specification test, we conduct our analysis with different variance of variable of interest, i.e. 1%, 2.5% and 5% of variance of the Log (Q) as well as different level of abnormal Q. In all tests, the model rejects the null hypothesis. In summary, this model can explain the impact of continuous variables of interest (without autocorrelation) on firm value with high reliability and confidence.

[Table 1.10]

In the last step, we estimate the model for “Specific” treatments. Our test varies in two dimensions in this step. We conduct our test on different portion of treated firms – i.e. 20%, 40% and 60% of the firms – with variances of variable of interest equal to 1%, 2.5% and 5% of the Log (Q). Results of specification tests are presented in Table 1.11. Independent from portion of treated firms, an increase in variance of the variable of interest improves the performance of the model. In terms of portion of treated firms, the model is almost well specified when 20% of firms are treated. When this portion increases to 40% and 60%, we observe that the model becomes more conservative. Similar to previous tests, double clustering, bootstrap or random effect do not improve the specification of the model.

[Table 1.11]

In terms of power of the model, we report the results for portion of firms treated for 20%, 40% and 60% in Panels A to C in Table 1.12 respectively. As presented, in all three portion of treated firms, the power of the model increases when the abnormal treatment of the firm value decreases. This trend looks counterintuitive at first glance. However, the variance of the variable of interest explains this trend. In fact, abnormal values are applied exclusively to treated firms. It means that the impact of the marginal increase on the variance of variable is larger than its impact on its average value. It results in the increase of standard error of estimates and consequently the model fails to identify the abnormal increase. Based on this explanation, we should observe an increase in the power of the model when the portion of treated firms increases. As reported in Tables B and C, when the portion of treated firms increases to 40% and 60%, the performance of the model increases significantly. At the limit, when all firms are treated, we have a continuous treatment in which the model identifies abnormal Qs in all tests, as reported in Table 1.10. Consistent to previous results, double clustering, bootstrap and random effect models do not show any improvement in performance of the model. Overall, researchers should interpret the results of "Specific" treatments in panels cautiously when the variance of the variable of interest is significantly lower than that of firm value.

[Table 1.12.A]

[Table 1.12.B]

[Table 1.12.C]

1.5 Conclusion

Firm value theories describe profitability, risk and growth options as the main elements of firm value. In this study, we review several papers in firm value literature. We identify proxies used for the profitability, risk and growth separately. We also find that the majority of studies evaluate the impact of dichotomy variables in firm value. These dichotomy variables are generally random over firms and time ("Reversible" treatments) but there are also researches work on variables persistent for specific firms after a certain date ("Specific" treatment). Using all proxies used in reviewed papers, we apply Bayesian Information Criterion (BIC) methodology and identify Log (assets), EBITDA / Total Assets, market leverage, CAPEX / Total Assets, R&D / Total Assets, and Dividend / Total Assets as the core factors in firm value.

We test the power and specification of the model based on these variables. Our tests reveal that when the variable of interest is "Continuous" without autocorrelation, the specification and power of the model is ideal. In "Reversible" treatments, the specification of the model is sensitive to the portion of treated firms due to its impact on the autocorrelation in non-treated firms. This sensitivity does not exist for power of the model. Alternatively, the power of the model is sensitive to the magnitude of the abnormal firm values. In particular, the power of the model significantly reduces when the abnormal firm value is lower than 5% in absolute values. For "Specific" treatment, the performance changes over two dimensions. The specification, improves when the variance of the variable of interest increases. When the portion of treated firms is 20%, the power of the model is highly sensitive to the magnitude of the abnormal firm value. This sensitivity diminishes when the portion of treated firms increases to 40% and 60%. In summary, researchers can rely on the result of the model for "Continuous" treatment with low autocorrelation for testing the hypothesis. However, the results should be cautiously interpreted when treatments are not continuous. The portion of treated firms as well as the variance of the treatment should be taken into consideration for interpretation of the results.

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Appendix 1.A: Description of variables

Variable	Description	Compustat
Advertisement	Advertisement expense	item 45
Age	Number of year since the appearance at COMPUSTAT	
Asset growth	Total assets divided by total assets of previous years minus one	item 6
Beta250	CAPM Beta calculated over last 250 daily returns	
Beta36	CAPM Beta calculated over last 36 monthly returns	
Beta60	CAPM Beta calculated over last 60 monthly returns	
Book leverage (ltd)	Long term debt divided by total assets	item 9 / item 6
Book leverage(total)	Long term debt plus debt in current liabilities divided by total assets	(item 9 + item 34) / item 6
Equity	Book value of equity	item 60
CAPEX	Capital expenditure	item 128
CAPEX proxy	One year change in property, plants and equipment's plus depreciation	Δ(item 8+ item 14)
Dividend	Common Dividend	item 21
Dividend yield	Dividend divided by market value of equity	item 21/(item 199×item 25)
E	Income before extraordinary items + interest expense + noncash charges	item 18 + 15 + 50 + 51
EBIT	Earnings before interest and tax:	item 178
EBITDA	Earnings before interest, tax and depreciation:	item 13
FCF	EBITDA - tax - interest expense - common and preferred shares dividends	item 13 -16 - 35 - 15 - 19 - 21

Appendix 1.A - *Continued*

Variable	Description	Compustat
Idiosyncratic volatility (all)	Standard deviation of residuals in market model for all daily returns since appearance in CRPS	
Idiosyncratic volatility (250)	Standard deviation of residuals in market model for the last 250 daily returns	
Idiosyncratic volatility (60)	Standard deviation of residuals in market model for the last 60 monthly returns	
Interest	Interest expense	item 15
Market leverage	Long term debt plus debt in current liabilities divided by MV	item 9 + item 34) / (item199 × item 25 item 6 - item 60)
MV	Market value of equity plus total assets minus book value of equity	item 199× item 25 +item 6-item 60
Net income		item 172
Net income before extraordinary		item 18
PPE (Tangible assets)	Property, plant and equipment	item 8
R&D	Research and development expense:	item 46
Return volatility	Standard deviation of return over last 60 monthly returns (minimum 24 months)	
ROA	Operating income before depreciation plus the decrease in receivables, the decrease in inventory, the increase in current liabilities, and the decrease in other current assets. This measure is divided by the average of beginning and ending-year book value of total assets.	(item 13+ item 2+ item 3 item 72+ item 68)/ item 6
ROE	Net income before extraordinary items divided by MV	item 18 / (item199 × item 25 +item 6 - item 60)
Sales		item 12
Sales growth	Increase in sales from 2-year before in percentage	
Sales growth dummy	Equal one if sales growth is higher than the medina of the industry (2-digit SIC)	
Sales/total assets		item 12 / item 6
Z-score	Altman Z-Score	(1.2×item 179+1.4×item 36+ 3.3×item 178+ 0.999×item 12) / item 6

Figure 1.1: Variance decomposition

This Figure shows the variance decomposition of Firm fixed-effect, Industry-time fixed-effect and control variables in the baseline and Fama and French (1998) models.

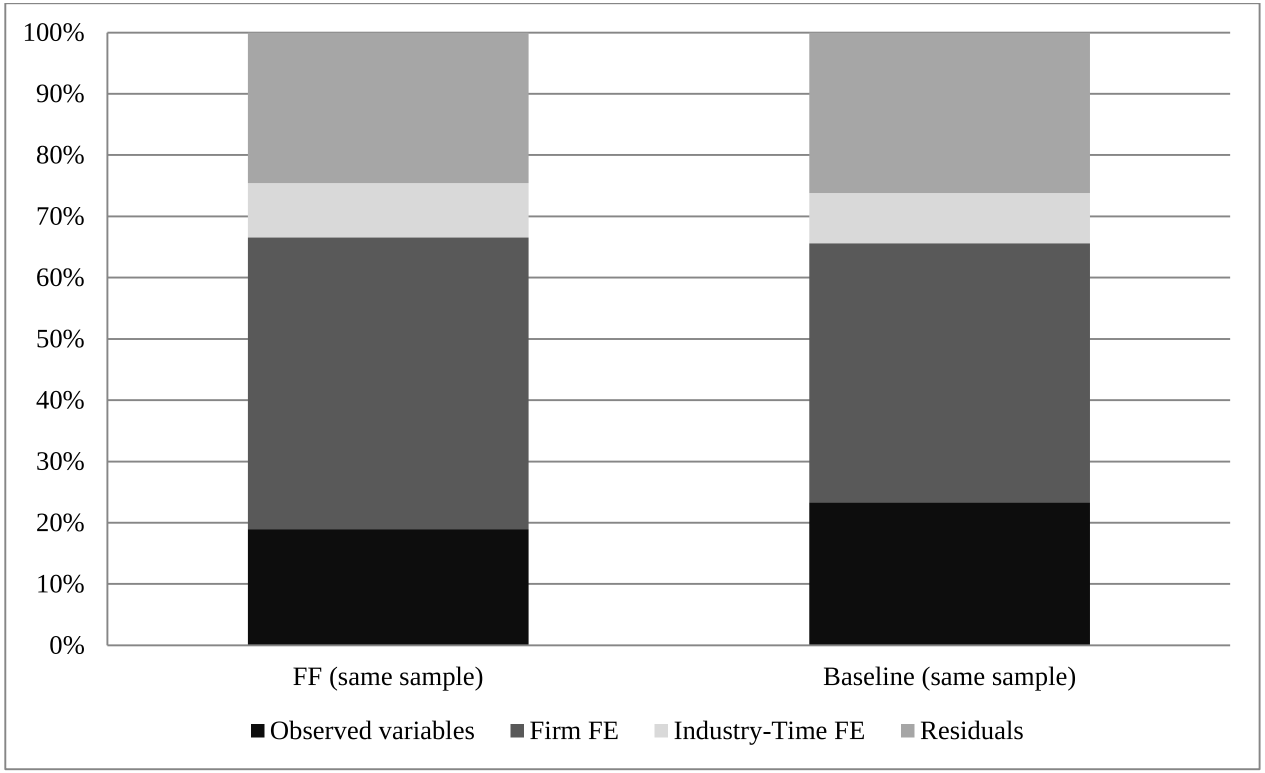

Table 1.1: Variables of Interest in the literature on Firm Value

This table lists the main characteristics of the surveyed papers. Columns 1 to 3 describe the publication (authors, year and journal); Column 4 to 7 describe the area of research, the nature of the variable of interest (binary versus continuous) and the type of treatment (Specific or Reversible). Column 8 reports the impact of the corresponding variable of interest on Tobin's Q and column 9 is its statistical significance. Finally, Columns 10 to 13 present the fixed effects and Column 14, the standard error adjustments (if any).

Publication			Variable of Interest			Sample			Impact		Fixed effect and clustering				
Author(s)	Date	Journal	Area	Binary	Type	#obs.	#treated	#years	%	sig	Time	Ind.	Firm	Country	Clustering
			Corporate Governance												
Adams and Ferreira	2009	JFE	Board structure	No	-	9300		8	7%	***	X		X		Firm
Agrawal and Knoeber	1996	JFQA	Corporate governance	No	Reversible	400		1	9%	*					
Ahern and Dittmar	2012	QJE	Change in Board	No	-	2700		8	12%	***	X		X		Firm
Baek, Kang and Park	2004	JFE	Corporate governance	Yes	Reversible	650	150	13	6%			X			
Bebchuck and Cohen	2005	JFE	Entrenched boards	Yes	Reversible	4200	2500	4	20%	***	X				
Black and Kim	2012	JFE	Board structure	Yes	Specific	3700	500	24	1%	**	X	X	X		Firm
Dey	2008	JAR	Governance	No	-	150		2	11%	**					
Dittmar and Mahrt.	2007	JFE	Governance	Yes	Reversible	2700	350	14	28%	***	X		X		
Evans et al.	2010	JAR	CEO turnover	Yes	Reversible	350	150	4	22%	***	X	X			Firm
Faleye	2007	JFE	Entrenchment manager	Yes	Reversible	12400	6200	8	10%	***	X	X			
Fauver et al.	2003	JFQA	Investors protection	Yes	Specific	28800	2000	5	5%	**	X			X	
Fich and Shivdasani	2006	JOF	Busy boards	Yes	Reversible	3400	1750	7	4%	***	X				
Gompers et al.	2003	QJE	Governance	No	-	4600		4	18%	**					
Hope and Thomas	2008	JAR	Firm disclosure	No	-	2150		5	5%	**	X	X			
Lang et al.	2004	JAR	Firm control	No	-	2500		1	10%	**		X		X	
Lang et al.	2012	JAR	Transparency	No	-	77000		14	16%	***	X	X	X	X	
Masulis et al.	2012	JAE	Foreign directors	Yes	Reversible	10000	1250	9	14%	***	X	X	X		Firm
Oxelheim and Randoy	2003	JBF	Foreign board member	Yes	Specific	650	100	3	15%	**	X	X			
Palia	2001	RFS	Manager compensation	No	Reversible	3250		13	0.6%		X		X		
Ringaert and Thomas	2012	JAR	Insider trading	Yes	-	450	250	2	21%	***		X			Firm
Yermack	1996	JFE	Small board	No	-	3450		8	20%	***	X	X			
Zhao and Chen	2008	AR	Staggered board	Yes	Reversible	4300	2650	7	9%	**	X	X			Firm

Table 1.1 - *Continued*

Publication			Variable of Interest			Sample			Impact		Fixed effect and clustering				
Author(s)	Date	Journal	Area	Binary	Type	#obs.	#treated	#years	%	sig	Time	Ind.	Firm	Country	Clustering
			Ownership Structure												
Anderson and Reeb	2003	JOF	Family ownership	Yes	Reversible	2700	950	8	14%	***	X	X			Industry
Cronqvist and Nilsson	2003	JFQA	Minority shareholders	No	-	1300		7	18%	***	X		X		
Fahlenbrach	2009	JFQA	Founder-CEO	Yes	Specific	14000	1450	11	18%	***	X		X		Firm
Fahlenbrach and Stulz	2009	JFE	Manager ownership	No	-	21500		18	5%	***	X		X		Firm
King and Segal	2008	RFS	Ownership structure	Yes	Specific	7050	1900	18	22%	***	X	X			
Laeven and Levine	2007	RFS	Ownership structure	No	-	1650		1	18%	**		X		X	Country
Lemmon and Lins	2003	JOF	Ownership structure	Yes	Reversible	800	200	1	10%	**		X			
Villalonga and Amit	2006	JFE	Family ownership	Yes	Specific	2800	1050	7	13%	**	X	X			Firm
Woidtke	2002	JFE	Institutional investors	No	-	1750		5	26%	***	X				

Table 1.1 - *Continued*

Publication			Variable of Interest			Sample			Impact		Fixed effect and clustering				
Author(s)	Date	Journal	Area	Binary	Type	#obs.	#treated	#years	%	sig	Time	Ind.	Firm	Country	Clustering
			Firm Policies												
Allayannis and Weston	2001	RFS	Risk management	Yes	Reversible	2050	750	6	5%	**	X	X			Firm
Bartram et al.	2011	JFQA	Risk Management	Yes	Reversible	2100	1200	2	18%	**		X		X	
Billett and Mauer	2003	RFS	Financing Constraints	No	Reversible	4200		9	8%	***	X		X		
Campa and Kedia	2002	JOF	Diversification	Yes	Reversible	58900	17000	19	6%	***	X		X		Firm
Daines	2001	JFE	Bankruptcy law	Yes	Specific	39000	19000	16	14%	***	X		X		
Daske et al.	2008	JAR	IFRS	Yes	Specific	106000	35000	5	7%	**					
Denis, Denis and Yost	2002	JOF	Diversification	Yes	Specific	33500	13500	14	19%	***					
Durnev et al.	2004	JOF	Capital Budgeting	No	-	16700		5	28%	***		X			
Fama and French	1998	JOF	Tax	No	Reversible	66700		28	N/A						
Fang, Noe and Tice	2009	JFE	Stock liquidity	No	Reversible	8300		6	28%	***	X	X			Firm
Fauver and Naranjo	2010	JFQA	Risk management	Yes	Reversible	11000	5450	10	8%	***	X				
Fresard and Salva	2010	JFE	Cross-listing and cash	Yes	Specific	60000	7000	17	15%	**	X			X	Country
Gozzi et al.	2008	JFE	Internationalization	Yes	Specific	67000	7000	12	11%	***	X			X	
Gurun and Butler	2012	JOF	Advertising	No	Reversible	3000		5	5%	***	X	X			Firm
Jin and Jorion	2006	JOF	Risk management	Yes	Reversible	350	150	4	1%		X				Firm
Lang et al.	2003	JAR	Cross listing	No	-	2500		1	12%	***		X		X	
Mansi and Reeb	2002	JOF	Diversification	Yes	Specific	18900	6500	12	5%	***					
Nguyen and Swanson	2009	JFQA	Firm characteristics	No	Reversible	48200		23	N/A						
Opler and Titman	1994	JOF	Financial distress	No	Reversible	47000	1400	20	10%	***					
Perez-gonzalez and Yun	2013	JOF	Risk management	No	Reversible	5500		18	11%	***	X		X		Firm
Pinkowitz et al.	2006	JOF	Cash and Dividend	No	Reversible	30000		16	N/A						
Rountree et al.	2008	JFE	Smooth performance	No	Reversible	12000		3	15%	***	X			X	Firm

Table 1.2: Univariate Analysis

This table reports the Pearson correlations between firm value and the proxies of the core factors. In Column 1, these correlations are calculated for the whole sample. We calculate the correlation on ten equal random sub-samples (columns 2 to 5) and annually separately (columns 6 to 9). The percentage of correlations that are positive or negative and statistically significant at the 1% (or at 5% but not at 1%) level are shown in columns 2 (3) and 4 (5) respectively. The description of variables is available in the Appendix.

	All	Ten random sub-samples				Annual cross-section			
	Corr.	% pos. at 1%	% pos. at 5%	% neg. at 1%	% neg. at 5%	% pos. at 1%	% pos. at 5%	% neg. at 1%	% neg. at 5%
Profitability									
EBIT / Total Assets	-0.033	0%	0%	90%	10%	40%	4%	30%	6%
EBIT / Sales	-0.180	0%	0%	100%	0%	18%	0%	70%	0%
EBITDA / Total Assets	-0.018	0%	0%	60%	20%	44%	4%	26%	2%
EBITDA / MV	-0.183	0%	0%	100%	0%	4%	0%	90%	0%
EBITDA / Sales	-0.182	0%	0%	100%	0%	24%	0%	70%	0%
EBITDA / Tangible Assets	-0.066	0%	0%	100%	0%	34%	0%	56%	2%
FCF / Total Assets	-0.086	0%	0%	100%	0%	32%	0%	60%	4%
Net income / Total Assets	-0.065	0%	0%	100%	0%	36%	0%	48%	0%
E / Sales	-0.085	0%	0%	100%	0%	36%	0%	50%	2%
dE / Total Assets	0.100	100%	0%	0%	0%	90%	4%	0%	0%
ROA	-0.002	10%	0%	0%	10%	54%	6%	18%	8%
ROE	0.026	100%	0%	0%	0%	46%	8%	22%	2%
Risk									
Beta250	0.144	80%	0%	0%	0%	64%	0%	18%	2%
Beta36	0.162	90%	0%	0%	0%	69%	0%	13%	2%
Beta60	0.115	80%	0%	0%	0%	57%	0%	17%	3%
Book leverage (ltd)	-0.175	0%	0%	100%	0%	0%	0%	96%	2%
Book leverage (total)	-0.211	0%	0%	100%	0%	0%	0%	98%	0%
Idiosyncratic risk (all daily)	0.151	90%	0%	0%	0%	72%	0%	4%	8%
Idiosyncratic risk (250)	0.188	100%	0%	0%	0%	78%	0%	4%	6%
Idiosyncratic risk (60)	0.129	100%	0%	0%	0%	70%	0%	3%	7%

Table 1.2 - *Continued*

	All	Ten random sub-samples				Annual cross-section			
	Corr.	% pos. at 1%	% pos. at 5%	% neg. at 1%	% neg. at 5%	% pos. at 1%	% pos. at 5%	% neg. at 1%	% neg. at 5%
Risk									
Interest / Total Assets	-0.154	0%	0%	100%	0%	0%	0%	94%	0%
dInterest / Total Assets	-0.021	0%	0%	60%	20%	24%	6%	18%	12%
Total Debt / BV Equity	-0.095	0%	0%	100%	0%	2%	0%	80%	2%
Market leverage	-0.458	0%	0%	100%	0%	0%	0%	100%	0%
Return volatility	0.192	100%	0%	0%	0%	74%	2%	6%	2%
Growth									
Advertis. / Tangible Assets	0.008	60%	0%	0%	0%	46%	10%	0%	0%
Advertis. / Total Assets	0.056	100%	0%	0%	0%	78%	6%	4%	2%
Advertisement / Sales	0.090	100%	0%	0%	0%	80%	8%	0%	0%
Asset growth	0.131	100%	0%	0%	0%	96%	2%	0%	0%
CAPEX / Total Assets	0.125	100%	0%	0%	0%	94%	6%	0%	0%
CAPEX / PPE	0.019	70%	10%	0%	0%	70%	4%	0%	0%
CAPEX / Sales	0.126	100%	0%	0%	0%	92%	0%	0%	0%
CAPEX Proxy	0.126	100%	0%	0%	0%	98%	2%	0%	0%
Growth Opportunities	0.105	100%	0%	0%	0%	72%	0%	0%	2%
PPE / Total Assets	-0.093	0%	0%	100%	0%	10%	4%	62%	6%
PPE / Sales	0.020	60%	30%	0%	0%	32%	6%	16%	8%
R&D / Total Assets	0.323	100%	0%	0%	0%	100%	0%	0%	0%
dR&D / Total Assets	0.151	100%	0%	0%	0%	92%	6%	0%	2%
R&D / Sales	0.256	100%	0%	0%	0%	100%	0%	0%	0%
R&D / Tangible Assets	0.272	100%	0%	0%	0%	100%	0%	0%	0%
Sales / Total Assets	0.03	80%	0%	0%	0%	12%	0%	0%	0%
Sales growth	0.205	100%	0%	0%	0%	100%	0%	0%	0%
Sales growth dummy	0.07	20%	0%	0%	0%	18%	0%	0%	0%

Table 1.2 - *Continued*

	All	Ten random sub-samples				Annual cross-section			
	Corr.	% pos. at 1%	% pos. at 5%	% neg. at 1%	% neg. at 5%	% pos. at 1%	% pos. at 5%	% neg. at 1%	% neg. at 5%
Payout policy									
Dividend / Total Assets	0.107	100%	0%	0%	0%	90%	0%	2%	0%
Dividend / BV Equity	0.055	100%	0%	0%	0%	66%	8%	10%	2%
Dividend dummy	-0.160	0%	0%	100%	0%	6%	4%	70%	6%
Dividend Yield	-0.233	0%	0%	100%	0%	0%	0%	100%	0%
dDividend / Total Assets	0.124	100%	0%	0%	0%	98%	0%	0%	0%
Size									
Log (Age)	-0.163	0%	0%	100%	0%	6%	6%	84%	0%
Log (Total Assets)	-0.137	0%	0%	100%	0%	6%	2%	80%	6%
Log (Equity)	-0.073	0%	0%	100%	0%	10%	2%	72%	2%
Log (PPE)	-0.131	0%	0%	100%	0%	8%	0%	76%	2%
Log (Sales)	-0.119	0%	0%	100%	0%	4%	0%	78%	2%

Table 1.3: Bayesian Information Criterion (BIC) Analysis

This table reports the results of Bayesian Information Criterion (BIC) analysis explained in the text. Starting with all the variables in the model, variables are ranked from the lowest to the highest in terms of the explanatory power in the model. Description of variables is available in the Appendix.

	BIC	Cum. R^2	Coef.	t-stat	Own R^2	Ten groups		Cross-section	
						Pos.	Neg.	Pos.	Neg.
Growth Opportunities	-417967	0.42	0.001	0.06	0.00	0.00%	0.00%	0.00%	0.00%
dR&D / Total Assets	-417979	0.42	0.001	0.08	0.00	0.00%	0.00%	0.00%	0.00%
dDividend / Total Assets	-417990	0.42	0.005	0.17	0.01	0.00%	0.00%	0.00%	0.00%
Growth dummy	-418010	0.42	0.001	0.08	0.00	0.00%	0.00%	0.00%	0.00%
EBITDA / Tangible Assets	-418419	0.37	0.000	-0.21	0.01	0.00%	0.00%	0.00%	0.00%
Beta60	-418422	0.37	0.001	0.17	0.00	0.00%	0.00%	0.00%	0.00%
Beta250	-418431	0.37	0.000	0.22	0.00	0.00%	0.00%	0.00%	0.00%
EBIT / Sales	-418442	0.37	-0.003	-0.35	0.00	0.00%	0.00%	0.00%	0.00%
EBITDA / Sales	-418452	0.37	0.001	0.43	0.00	0.00%	0.00%	0.00%	0.00%
Dividend dummy	-418461	0.37	-0.001	-0.58	0.00	0.00%	0.00%	0.00%	8.00%
Beta36	-418470	0.37	0.001	0.98	0.00	0.00%	0.00%	0.00%	0.00%
ROA	-418472	0.37	0.002	0.61	0.00	0.00%	0.00%	0.00%	0.00%
Log (PPE)	-418483	0.37	-0.001	-0.62	0.02	0.00%	6.00%	0.00%	0.00%
Book leverage (ltd)	-418491	0.36	-0.003	-0.67	0.01	0.00%	0.00%	0.00%	0.00%
CAPEX / PPE	-418501	0.36	0.016	0.83	0.00	0.00%	0.00%	0.00%	0.00%
dE / Total Assets	-418508	0.36	-0.003	-0.88	0.02	0.00%	0.00%	0.00%	0.00%
Dividend / BV Equity	-418708	0.36	0.027	0.92	0.01	0.00%	0.00%	0.00%	0.00%
FCF / Total Assets	-418712	0.36	0.007	0.92	0.01	0.00%	0.00%	0.00%	0.00%
Advertisement / Total Assets	-474653	0.36	-0.016	-0.46	0.00	0.00%	0.00%	0.00%	0.00%
Advertisement / Sales	-474664	0.36	0.010	0.41	0.00	0.00%	0.00%	0.00%	0.00%
EBIT / Total Assets	-474674	0.36	0.009	0.62	0.04	11.00%	0.00%	6.00%	0.00%
Idiosyncratic risk (60)	-474677	0.36	0.002	1.01	0.00	0.00%	0.00%	0.00%	0.00%
Sales / Total Assets	-474685	0.36	0.001	0.77	0.05	0.00%	0.00%	0.00%	0.00%
Idiosyncratic risk (all daily)	-474694	0.36	0.004	0.85	0.00	0.00%	0.00%	0.00%	0.00%
Idiosyncratic risk (250)	-474710	0.36	0.002	1.11	0.00	0.00%	0.00%	0.00%	0.00%
Log (Age)	-520485	0.36	0.003	0.36	0.02	0.00%	17.00%	0.00%	44.00%
CAPEX Proxy	-520497	0.36	-0.005	-1.33	0.02	0.00%	0.00%	0.00%	0.00%
R&D / Sales	-533733	0.36	0.005	1.19	0.00	0.00%	0.00%	0.00%	0.00%

Table 1.3 - *Continued*

	BIC	Cum. R^2	Coef.	t-stat	Own R^2	Ten groups		Cross-section	
						Pos.	Neg.	Pos.	Neg.
dInterest / Total Assets	-533731	0.36	-0.033	-1.43	0.00	0.00%	0.00%	0.00%	0.00%
Return volatility	-533735	0.36	0.024	1.67	0.00	0.00%	0.00%	0.00%	0.00%
Sales growth	-586111	0.36	0.004	-0.11	0.00	0.00%	0.00%	0.00%	0.00%
Adver. / Tangible Assets	-586123	0.36	0.000	-1.72	0.00	0.00%	0.00%	0.00%	0.00%
CAPEX / Sales	-586134	0.36	0.006	2.45	0.00	0.00%	0.00%	0.00%	0.00%
Asset growth (dAT)	-586104	0.36	0.003	2.78	0.02	0.00%	0.00%	0.00%	0.00%
R&D / Tangible Assets	-616175	0.36	0.002	2.41	0.00	0.00%	0.00%	0.00%	0.00%
PPE / Sales	-585531	0.35	-0.006	-3.25	0.00	0.00%	0.00%	0.00%	0.00%
PPE / Total Assets	-585197	0.35	0.007	1.77	0.00	0.00%	0.00%	0.00%	0.00%
Log (Sales)	-588991	0.35	-0.011	-3.89	0.01	0.00%	0.00%	0.00%	9.00%
Net income / Total Assets	-588181	0.35	-0.035	-3.8	0.02	0.00%	0.00%	0.00%	0.00%
Leverage (over BV Equity)	-588213	0.35	-0.002	-4.09	0.00	0.00%	0.00%	0.00%	0.00%
R&D / Total Assets	-588100	0.35	0.004	5.06	0.03	20.00%	0.00%	91.00%	0.00%
Log (Equity)	-584014	0.35	-0.008	-6.53	0.01	0.00%	0.00%	0.00%	18.00%
Dividend yield	-582159	0.35	0.314	6.87	0.02	0.00%	0.00%	0.00%	0.00%
Dividend / Total Assets	-576648	0.35	-0.073	-4.67	0.03	46.00%	0.00%	16.00%	0.00%
CAPEX / Total Assets	-576439	0.34	0.013	7.15	0.03	80.00%	0.00%	9.00%	0.00%
Interest / Total Assets	-575680	0.34	0.300	7.86	0.01	0.00%	0.00%	0.00%	0.00%
E / Sales	-575370	0.34	-0.159	-8.04	0.02	0.00%	0.00%	0.00%	0.00%
ROE	-575074	0.34	0.110	6.34	0.04	0.00%	0.00%	0.00%	0.00%
EBITDA / MV	-575015	0.34	-0.062	-6.39	0.00	0.00%	29.00%	0.00%	11.00%
EBITDA / Total Assets	-574760	0.34	0.034	5.78	0.05	66.00%	0.00%	4.00%	0.00%
Book leverage (total)	-574715	0.34	0.204	10.85	0.01	0.00%	0.00%	0.00%	0.00%
Market leverage	-573588	0.34	-0.092	-9.94	0.17	0.00%	100.00%	0.00%	100.00%
Log (Total Assets)	-571767	0.31	-0.940	-15.03	0.02	0.00%	51.00%	0.00%	28.00%

Table 1.4: Tobin's Q baseline model

This table reports the result of the baseline model. The variables are defined in Appendix 1. In Panel A, the model is estimated with firm and industry-time fixed effect and the standard errors are clustered at the firm and the industry-time level. In Panel B, the model is estimated with firm and industry-time fixed effect and the standard errors are clustered at the firm level. In Panel C, the model is estimated with firm and time fixed effect and the standard errors are clustered at the firm level.

	All	1963-1971	1972-1979	1980-1987	1988-1995	1996-2003	2004-2012
	Panel A: Firm and industry-time fixed effect, firm and industry-time clustering						
Log (Assets)	-0.047***	0.019	-0.033***	-0.093***	-0.042***	-0.096***	-0.119***
	[14.27]	[1.26]	[2.79]	[9.83]	[4.65]	[11.88]	[12.50]
Dividend/Asset	1.403***	0.727	0.12	0.135	0.950***	1.103***	1.197***
	[11.71]	[1.35]	[0.32]	[0.44]	[4.88]	[4.74]	[7.93]
EBITDA/Asset	0.540***	1.043***	0.608***	0.432***	0.392***	0.562***	0.519***
	[26.69]	[11.64]	[11.56]	[11.80]	[9.70]	[16.11]	[11.35]
Market Leverage	-1.015***	-1.229***	-0.644***	-0.924***	-1.200***	-1.223***	-0.994***
	[67.65]	[23.22]	[20.02]	[30.23]	[34.03]	[39.63]	[29.61]
R&D/Asset	0.803***	0.043	-0.04	0.724***	0.512***	0.349***	0.637***
	[12.31]	[0.14]	[0.14]	[4.01]	[3.85]	[3.22]	[4.56]
CAPEX/Asset	0.753***	0.374***	0.567***	0.602***	0.612***	0.562***	0.520***
	[30.72]	[6.89]	[13.03]	[13.16]	[11.50]	[9.29]	[7.74]
# of observations	250172	19657	32209	41719	47180	58181	49702
Adjusted R^2	0.236	0.396	0.253	0.261	0.199	0.227	0.238

Table 1.4 – *Continued*

	All	1963-1971	1972-1979	1980-1987	1988-1995	1996-2003	2004-2012
	Panel B: Firm and industry-time fixed effect, firm clustering						
Log (Assets)	-0.047***	0.019*	-0.033***	-0.093***	-0.042***	-0.096***	-0.119***
	[29.26]	[1.95]	[4.10]	[14.23]	[6.72]	[16.51]	[19.12]
Dividend/Asset	1.403***	0.727**	0.12	0.135	0.950***	1.103***	1.197***
	[20.86]	[2.32]	[0.45]	[0.62]	[6.37]	[6.00]	[10.14]
EBITDA/Asset	0.540***	1.043***	0.608***	0.432***	0.392***	0.562***	0.519***
	[42.64]	[15.76]	[15.68]	[15.01]	[13.09]	[20.96]	[16.96]
Market Leverage	-1.015***	-1.229***	-0.644***	-0.924***	-1.200***	-1.223***	-0.994***
	[129.31]	[36.87]	[29.37]	[42.94]	[50.72]	[56.72]	[43.10]
R&D/Asset	0.803***	0.043	-0.04	0.724***	0.512***	0.349***	0.637***
	[18.70]	[0.20]	[0.17]	[5.40]	[4.82]	[4.03]	[6.32]
CAPEX/Asset	0.753***	0.374***	0.567***	0.602***	0.612***	0.562***	0.520***
	[42.70]	[8.77]	[15.91]	[16.22]	[14.47]	[11.55]	[9.84]
# of observations	250172	19657	32209	41719	47180	58181	49702
Adjusted R^2	0.236	0.396	0.253	0.261	0.199	0.227	0.238
	Panel C: Firm and time fixed effect, firm clustering						
Log (Assets)	-0.036***	0.055***	-0.075***	-0.086***	-0.027***	-0.113***	-0.178***
	[17.26]	[5.46]	[9.60]	[11.67]	[3.85]	[16.88]	[21.80]
Dividend/Asset	1.181***	0.538	-0.42	-0.122	0.945***	1.334***	0.734***
	[9.81]	[1.07]	[1.11]	[0.46]	[5.30]	[6.22]	[4.99]
EBITDA/Asset	0.499***	1.057***	0.330***	0.422***	0.386***	0.661***	0.569***
	[26.17]	[11.80]	[6.85]	[12.83]	[10.82]	[20.34]	[12.94]
Market Leverage	-1.278***	-1.779***	-1.141***	-1.169***	-1.337***	-1.388***	-1.346***
	[90.65]	[37.27]	[40.51]	[43.29]	[43.97]	[50.98]	[44.11]
R&D/Asset	0.612***	-1.096***	-0.427	0.631***	0.454***	0.119	0.092
	[9.65]	[3.89]	[1.46]	[3.84]	[3.85]	[1.17]	[0.66]
CAPEX/Asset	0.714***	0.473***	0.580***	0.718***	0.545***	0.692***	0.501***
	[29.85]	[8.98]	[13.42]	[17.07]	[11.47]	[13.03]	[8.11]
# of observations	248182	19247	31575	40356	45312	56575	48645
Adjusted R^2	0.211	0.38	0.236	0.238	0.191	0.204	0.223

Table 1.5: Fama and French's model for Tobin's Q

This table reports the results for the Fama and French (1998) model. The variables are defined in Appendix 1. In Panel A, the model is estimated with firm and industry-time fixed effect and the standard errors are clustered at the firm and industry-time level. In Panel B, the model is estimated with firm and industry-time fixed effect and the standard errors are clustered at the firm level. In Panel C, the model is estimated with firm and time fixed effect and the standard errors are clustered at the firm level.

Panel A: Firm and industry-time fixed effect, firm and industry-time clustering

	All	1963-1971	1972-1979	1980-1987	1988-1995	1996-2003	2004-2012
E	0.117***	1.603***	0.590***	0.446***	0.08	0.297***	0.227**
	[2.28]	[3.75]	[3.65]	[3.08]	[1.34]	[4.94]	[2.48]
dE	0.237***	0.164	0.240**	0.031	0.181***	0.184***	0.215***
	[7.57]	[0.66]	[2.34]	[0.62]	[3.83]	[5.88]	[2.80]
dE2	0.096***	0.314**	0.394***	0.197***	0.086***	0.116**	0.092
	[3.57]	[2.30]	[4.87]	[3.06]	[2.69]	[2.44]	[1.53]
dAT	0.169***	0.268***	0.164***	0.102***	0.116***	0.138***	0.130***
	[15.65]	[7.69]	[7.60]	[4.05]	[9.92]	[5.50]	[9.47]
dAT2	0.275***	0.276***	0.247***	0.253***	0.236***	0.257***	0.281***
	[19.28]	[9.25]	[4.07]	[13.62]	[16.61]	[12.30]	[10.35]
R&D	1.407***	-0.752	1.194**	1.775***	1.610***	1.766***	1.457***
	[9.83]	[1.10]	[2.15]	[4.37]	[9.12]	[9.76]	[5.50]
dR&D	0.324***	-0.474	0.906**	0.821**	-0.264**	0.222	0.290**
	[2.80]	[0.79]	[2.27]	[2.30]	[1.99]	[1.34]	[2.22]
dR&D2	1.455***	-0.062	1.898***	1.799***	1.239***	1.547***	1.561***
	[14.61]	[0.13]	[4.61]	[10.88]	[11.59]	[8.39]	[6.82]
Interest	-1.819***	-1.738	0.776	-0.51	-1.702***	-0.352	1.722***
	[4.31]	[1.10]	[0.50]	[1.53]	[2.94]	[0.56]	[3.58]
dInterest	-1.462***	-2.528***	-1.645**	-0.869***	-1.103***	-1.213***	-1.884***
	[4.61]	[3.82]	[2.10]	[2.89]	[5.45]	[4.80]	[4.57]
dInterest2	-1.858***	-0.914	0.579	-0.667**	-1.134***	-0.890***	-0.12
	[8.50]	[1.03]	[1.13]	[2.31]	[4.20]	[3.49]	[0.41]
Dividend	4.271***	4.473***	4.168***	2.511***	2.175***	3.629***	1.288***
	[12.07]	[6.05]	[3.45]	[6.49]	[6.63]	[7.55]	[3.43]
dDividend	-0.131	1.649***	-1.592**	0.570*	0.827***	-0.741	0.657**
	[0.40]	[2.65]	[2.25]	[1.76]	[3.45]	[1.47]	[2.16]
dDividend2	1.886***	2.227***	1.423**	2.012***	1.593***	1.462***	1.286***
	[7.19]	[4.62]	[1.97]	[8.76]	[7.64]	[5.31]	[3.79]
dMV2	-0.076***	-0.105***	-0.167***	-0.113***	-0.074***	-0.081***	-0.099***
	[12.17]	[7.04]	[3.26]	[17.54]	[12.02]	[8.53]	[6.02]
# of observations	173939	15548	25955	27150	31897	39526	29939
Adjusted R^2	0.196	0.302	0.261	0.194	0.105	0.172	0.206

Table 1.5 – *Continued*

	Panel B: Firm and industry-time fixed effect, firm clustering						
	All	1963-1971	1972-1979	1980-1987	1988-1995	1996-2003	2004-2012
E	0.117***	1.603***	0.590***	0.446***	0.08	0.297***	0.227**
	[3.61]	[3.75]	[3.65]	[3.08]	[1.34]	[4.94]	[2.48]
dE	0.237***	0.164	0.240**	0.031	0.181***	0.184***	0.215***
	[16.19]	[0.66]	[2.34]	[0.62]	[3.83]	[5.88]	[2.80]
dE2	0.096***	0.314**	0.394***	0.197***	0.086***	0.116**	0.092
	[6.39]	[2.30]	[4.87]	[3.06]	[2.69]	[2.44]	[1.53]
dAT	0.169***	0.268***	0.164***	0.102***	0.116***	0.138***	0.130***
	[28.91]	[7.69]	[7.60]	[4.05]	[9.92]	[5.50]	[9.47]
dAT2	0.275***	0.276***	0.247***	0.253***	0.236***	0.257***	0.281***
	[64.93]	[9.25]	[4.07]	[13.62]	[16.61]	[12.30]	[10.35]
R&D	1.407***	-0.752	1.194**	1.775***	1.610***	1.766***	1.457***
	[13.70]	[1.10]	[2.15]	[4.37]	[9.12]	[9.76]	[5.50]
dR&D	0.324***	-0.474	0.906**	0.821**	-0.264**	0.222	0.290**
	[4.21]	[0.79]	[2.27]	[2.30]	[1.99]	[1.34]	[2.22]
dR&D2	1.455***	-0.062	1.898***	1.799***	1.239***	1.547***	1.561***
	[23.04]	[0.13]	[4.61]	[10.88]	[11.59]	[8.39]	[6.82]
Interest	-1.819***	-1.738	0.776	-0.51	-1.702***	-0.352	1.722***
	[9.90]	[1.10]	[0.50]	[1.53]	[2.94]	[0.56]	[3.58]
dInterest	-1.462***	-2.528***	-1.645**	-0.869***	-1.103***	-1.213***	-1.884***
	[13.56]	[3.82]	[2.10]	[2.89]	[5.45]	[4.80]	[4.57]
dInterest2	-1.858***	-0.914	0.579	-0.667**	-1.134***	-0.890***	-0.12
	[20.14]	[1.03]	[1.13]	[2.31]	[4.20]	[3.49]	[0.41]
Dividend	4.271***	4.473***	4.168***	2.511***	2.175***	3.629***	1.288***
	[21.18]	[6.05]	[3.45]	[6.49]	[6.63]	[7.55]	[3.43]
dDividend	-0.131	1.649***	-1.592**	0.570*	0.827***	-0.741	0.657**
	[0.88]	[2.65]	[2.25]	[1.76]	[3.45]	[1.47]	[2.16]
dDividend2	1.886***	2.227***	1.423**	2.012***	1.593***	1.462***	1.286***
	[12.81]	[4.62]	[1.97]	[8.76]	[7.64]	[5.31]	[3.79]
dMV2	-0.076***	-0.105***	-0.167***	-0.113***	-0.074***	-0.081***	-0.099***
	[46.42]	[7.04]	[3.26]	[17.54]	[12.02]	[8.53]	[6.02]
# of observations	173939	15548	25955	27150	31897	39526	29939
Adjusted R^2	0.196	0.302	0.261	0.194	0.105	0.172	0.206

Table 1.5 – *Continued*

	Panel C: Firm and time fixed effect, firm clustering						
	All	1963-1971	1972-1979	1980-1987	1988-1995	1996-2003	2004-2012
E	0.165***	2.163***	0.641***	0.544***	0.173***	0.322***	0.281***
	[3.32]	[5.84]	[4.18]	[3.98]	[2.62]	[5.23]	[3.15]
dE	0.228***	-0.127	0.257***	-0.014	0.165***	0.181***	0.213***
	[7.20]	[0.92]	[2.79]	[0.32]	[3.21]	[6.03]	[2.76]
dE2	0.117***	0.384**	0.445***	0.236***	0.121***	0.122**	0.125**
	[4.32]	[2.44]	[5.80]	[3.68]	[4.96]	[2.40]	[2.08]
dAT	0.175***	0.266***	0.171***	0.113***	0.123***	0.141***	0.131***
	[16.18]	[8.05]	[7.53]	[4.84]	[11.04]	[5.34]	[9.31]
dAT2	0.274***	0.271***	0.238***	0.259***	0.237***	0.256***	0.283***
	[19.10]	[9.96]	[4.09]	[16.05]	[15.29]	[12.02]	[10.73]
R&D	1.466***	-0.614	0.747	1.782***	1.871***	1.852***	1.541***
	[10.08]	[0.95]	[1.35]	[4.80]	[9.67]	[10.15]	[6.03]
dR&D	0.295**	-0.514	1.140***	0.867***	-0.370***	0.196	0.234*
	[2.54]	[0.87]	[2.69]	[2.58]	[2.92]	[1.13]	[1.89]
dR&D2	1.482***	-0.02	1.777***	1.759***	1.292***	1.574***	1.622***
	[14.27]	[0.04]	[4.13]	[10.76]	[11.16]	[8.43]	[6.98]
Interest	-1.820***	-2.282	0.898	-0.594	-1.481**	-0.219	1.539***
	[4.23]	[1.47]	[0.59]	[1.62]	[2.48]	[0.34]	[3.35]
dInterest	-1.476***	-1.801***	-1.765**	-0.895***	-1.225***	-1.282***	-1.760***
	[4.49]	[2.90]	[2.28]	[2.94]	[5.58]	[4.94]	[4.41]
dInterest2	-1.903***	-1.046	0.652	-0.734***	-1.208***	-0.823***	-0.283
	[8.51]	[1.16]	[1.29]	[2.74]	[4.63]	[3.03]	[1.00]
Dividend	4.233***	4.025***	4.236***	2.518***	2.127***	3.627***	1.213***
	[11.87]	[4.87]	[3.54]	[6.89]	[6.30]	[7.56]	[3.24]
dDividend	-0.132	1.767***	-1.617**	0.427	0.864***	-0.758	0.707**
	[0.40]	[2.82]	[2.28]	[1.40]	[3.40]	[1.54]	[2.24]
dDividend2	1.878***	2.118***	1.402*	1.991***	1.566***	1.482***	1.267***
	[7.17]	[4.18]	[1.90]	[8.57]	[7.61]	[5.50]	[3.84]
dMV2	-0.077***	-0.107***	-0.171***	-0.121***	-0.076***	-0.082***	-0.101***
	[11.91]	[6.95]	[3.35]	[17.62]	[11.46]	[8.52]	[6.00]
# of observations	173147	15531	25927	26939	31685	39309	29858
Adjusted R^2	0.173	0.282	0.246	0.175	0.097	0.158	0.195

Table 1.6: Comparing Tobin's Q models

This table reports the Vuong z-stats comparing the explanatory power of BL and FF models estimated with the same panel data. The z-stat and the critical probability are reported. A negative (positive) z-stat indicates that BL (FF) should be preferred to FF (BL). In Panel A, models are compared over the whole period and six eight-year sub-periods. In Panel B, the models are estimated over the whole period on different groups.

	Panel A: 1963- 2012 and sub-periods						
	All	1963-1971	1972-1979	1980-1987	1988-1995	1996-2003	2004-2012
Vuong z-stat	-16.3279	-0.3329	3.5324	-13.0799	-9.9326	0.3165	22.9977
Vuong p-value	0.0%	73.9%	0.0%	0.0%	0.0%	75.2%	0.0%

	Panel B: Ten groups									
	1	2	3	4	5	6	7	8	9	10
Vuong z-stat	-0.8473	-5.5935	-2.3587	-1.6477	-1.7038	-2.7925	-1.5775	-6.0492	-3.8477	-2.53
Vuong p-value	39.7%	0.0%	1.8%	9.9%	8.8%	0.5%	11.5%	0.0%	0.0%	1.1%

Table 1.7 Specification Test for Reversible Treatment

This table reports the specification test of "Reversible" treatment. The numbers in table report the percentage of rejection of null in 500 iterations explained in the text at corresponding 1%, 5% and 10% significant levels. FE is firm and industry-time fixed effect. Single cluster is at estimation of standard errors robust to heteroskedasticity and autocorrelation at firm level while double clustering has additional industry-time clustering level. BS. is bootstrapping of standard errors with 200 resampling.

	20% of Firms are Treated			40% of Firms are Treated			60% of Firms are Treated		
Rejection at ->	1%	5%	10%	1%	5%	10%	1%	5%	10%
FE Single Cluster	3	9	14	2	5	9	2	4	6
FE Double Cluster	3	8	13	2	6	8	2	3	9
FE BS. Single Cluster	6	10	19	5	6	9	2	6	9
FE BS. Double Cluster	3	10	14	2	9	14	2	2	6
Random Effect	3	9	14	2	6	10	2	3	6

Table 1.8 Power Test for Reversible Treatment

This table reports the power test of "Reversible" treatment. The numbers in table report the percentage of rejection of null in 500 iterations explained in the text at corresponding 1%, 5% and 10% significant levels. FE is firm and industry-time fixed effect. Single cluster is at estimation of standard errors robust to heteroskedasticity and autocorrelation at firm level while double clustering has additional industry-time clustering level. BS. is bootstrapping of standard errors with 200 resampling.

	20% of Firms are Treated						40% of Firms are Treated						60% of Firms are Treated					
Abnormal Q ->	-20%			+20%			-20%			+20%			-20%			+20%		
Rejection at ->	1%	5%	10%	1%	5%	10%	1%	5%	10%	1%	5%	10%	1%	5%	10%	1%	5%	10%
FE Single Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE Double Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Single Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Double Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Random Effect	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Abnormal Q ->	-15%			+15%			-15%			+15%			-15%			+15%		
FE Single Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE Double Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Single Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Double Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Random Effect	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Abnormal Q ->	-10%			+10%			-10%			+10%			-10%			+10%		
FE Single Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE Double Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Single Cluster	100	100	100	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Double Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Random Effect	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Abnormal Q ->	-5%			+5%			-5%			+5%			-5%			+5%		
FE Single Cluster	89	94	95	91	95	96	94	98	100	89	98	99	82	91	94	80	90	95
FE Double Cluster	91	93	96	93	95	96	94	98	100	91	98	99	80	91	95	81	92	95
FE BS. Single Cluster	85	93	94	87	95	96	94	96	99	89	96	99	78	88	92	73	88	91
FE BS. Double Cluster	87	92	95	88	96	96	94	98	100	84	93	98	77	88	93	74	86	93
Random Effect	89	94	95	94	96	96	94	99	100	90	98	99	83	93	96	79	91	95

Table1.9 Specification Test for Continuous Variable of Interest

This table reports the specification test of "Continuous" variable of interest. The numbers in table report the percentage of rejection of null in 500 iterations explained in the text at corresponding 1%, 5% and 10% significant levels. FE is firm and industry-time fixed effect. Single cluster is at estimation of standard errors robust to heteroskedasticity and autocorrelation at firm level while double clustering has additional industry-time clustering level. BS. is bootstrapping of standard errors with 200 resampling.

	1% of Log(Q) Variance			2.5% of Log(Q) Variance			5% of Log(Q) Variance		
Rejection at ->	1%	5%	10%	1%	5%	10%	1%	5%	10%
FE Single Cluster	0	5	10	1	4	8	1	2	7
FE Double Cluster	0	5	9	1	4	8	1	2	8
FE BS. Single Cluster	2	5	9	3	7	12	1	4	11
FE BS. Double Cluster	3	8	12	2	11	12	1	5	9
Random Effect	0	3	9	2	6	7	1	3	10

Table 1.10 Power test for Continuous Variable of Interest

This table reports the power test of "Continuous" variable of interest. The numbers in table report the percentage of rejection of null in 500 iterations explained in the text at corresponding 1%, 5% and 10% significant levels. FE is firm and industry-time fixed effect. Single cluster is at estimation of standard errors robust to heteroskedasticity and autocorrelation at firm level while double clustering has additional industry-time clustering level. BS. is bootstrapping of standard errors with 200 resampling.

	1% of Log(Q) Variance						2.5% of Log(Q) Variance						5% of Log(Q) Variance					
Abnormal Q ->	-20%			+20%			-20%			+20%			-20%			+20%		
Rejection at ->	1%	5%	10%	1%	5%	10%	1%	5%	10%	1%	5%	10%	1%	5%	10%	1%	5%	10%
FE Single Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE Double Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Single Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Double Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Random Effect	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Abnormal Q ->	-15%			+15%			-15%			+15%			-15%			+15%		
FE Single Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE Double Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Single Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Double Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Random Effect	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Abnormal Q ->	-10%			+10%			-10%			+10%			-10%			+10%		
FE Single Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE Double Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Single Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Double Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Random Effect	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Abnormal Q ->	-5%			+5%			-5%			+5%			-5%			+5%		
FE Single Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE Double Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Single Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Double Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Random Effect	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Table 1.11 Specification Test for Specific Treatment

This table reports the specification test of "Specific" treatment. The numbers in table report the percentage of rejection of null in 500 iterations explained in the text at corresponding 1%, 5% and 10% significant levels. FE is firm and industry-time fixed effect. Single cluster is at estimation of standard errors robust to heteroskedasticity and autocorrelation at firm level while double clustering has additional industry-time clustering level. BS. is bootstrapping of standard errors with 200 resampling.

	20% of firms are treated								
	1% of Log(Q) Variance			2.5% of Log(Q) Variance			5% of Log(Q) Variance		
Rejection at ->	1%	5%	10%	1%	5%	10%	1%	5%	10%
FE Single Cluster	3	8	12	1	6	14	2	5	10
FE Double Cluster	3	8	13	0	5	14	2	5	10
FE BS. Single Cluster	3	8	18	3	10	15	4	11	16
FE BS. Double Cluster	5	10	14	5	8	15	1	6	10
Random Effect	1	7	13	1	5	13	2	4	7
	40% of firms are treated								
FE Single Cluster	0	7	12	1	9	15	0	2	8
FE Double Cluster	2	7	12	1	10	17	1	4	7
FE BS. Single Cluster	4	7	10	4	10	14	0	3	7
FE BS. Double Cluster	3	9	12	8	11	16	2	5	6
Random Effect	0	5	8	1	8	12	0	1	8
	60% of firms are treated								
FE Single Cluster	2	5	13	1	4	10	0	6	9
FE Double Cluster	2	5	12	0	4	11	0	6	9
FE BS. Single Cluster	2	9	15	3	7	12	1	7	15
FE BS. Double Cluster	5	8	14	0	9	17	3	4	11
Random Effect	2	4	7	0	4	10	0	7	9

Table 1.12 Power Test for Specific Treatment

This table reports the power test of "Specific" treatment. The numbers in table report the percentage of rejection of null in 500 iterations explained in the text at corresponding 1%, 5% and 10% significant levels. FE is firm and industry-time fixed effect. Single cluster is at estimation of standard errors robust to heteroskedasticity and autocorrelation at firm level while double clustering has additional industry-time clustering level. BS. is bootstrapping of standard errors with 200 resampling.

	Panel A: 20% of the firms are treated																	
	1% of Log(Q) Variance						2.5% of Log(Q) Variance						5% of Log(Q) Variance					
Abnormal Q ->	-20%			+20%			-20%			+20%			-20%			+20%		
Rejection at ->	1%	5%	10%	1%	5%	10%	1%	5%	10%	1%	5%	10%	1%	5%	10%	1%	5%	10%
FE Single Cluster	56	74	83	89	96	96	93	96	99	100	100	100	99	99	100	100	100	100
FE Double Cluster	54	76	86	90	96	96	92	97	99	100	100	100	99	99	100	100	100	100
FE BS. Single Cluster	54	74	81	84	95	96	91	98	99	100	100	100	98	99	100	100	100	100
FE BS. Double Cluster	49	69	81	83	95	97	94	97	98	100	100	100	98	100	100	100	100	100
Random Effect	55	77	83	91	95	97	92	98	99	100	100	100	99	100	100	100	100	100
Abnormal Q ->	-15%			+15%			-15%			+15%			-15%			+15%		
FE Single Cluster	62	79	88	87	95	96	93	98	100	100	100	100	99	100	100	100	100	100
FE Double Cluster	63	81	89	89	94	96	93	99	100	100	100	100	99	100	100	100	100	100
FE BS. Single Cluster	58	80	84	82	90	96	95	97	100	98	100	100	99	99	100	100	100	100
FE BS. Double Cluster	49	72	80	76	92	96	93	99	99	100	100	100	98	99	100	100	100	100
Random Effect	61	82	86	89	93	96	93	98	100	100	100	100	99	100	100	100	100	100
Abnormal Q ->	-10%			+10%			-10%			+10%			-10%			+10%		
FE Single Cluster	68	83	88	85	93	96	95	99	100	100	100	100	99	100	100	100	100	100
FE Double Cluster	69	87	89	89	93	96	95	99	100	99	100	100	99	100	100	100	100	100
FE BS. Single Cluster	58	80	86	78	90	95	96	99	100	98	100	100	100	100	100	100	100	100
FE BS. Double Cluster	64	80	88	74	92	93	96	100	100	99	100	100	99	100	100	100	100	100
Random Effect	68	83	91	86	93	96	96	100	100	100	100	100	99	100	100	100	100	100
Abnormal Q ->	-5%			+5%			-5%			+5%			-5%			+5%		
FE Single Cluster	70	87	90	80	90	96	98	100	100	98	100	100	99	100	100	100	100	100
FE Double Cluster	74	89	91	83	91	96	98	100	100	99	100	100	99	100	100	100	100	100
FE BS. Single Cluster	63	77	88	74	87	92	96	99	100	100	100	100	100	100	100	100	100	100
FE BS. Double Cluster	68	82	92	77	88	93	97	100	100	99	100	100	100	100	100	100	100	100
Random Effect	74	88	93	83	93	93	97	100	100	99	100	100	100	100	100	100	100	100

Table 1.12 - *Continued*

	Panel B: 40% of the firms are treated																	
	1% of Log(Q) Variance						2.5% of Log(Q) Variance						5% of Log(Q) Variance					
Abnormal Q ->	-20%			+20%			-20%			+20%			-20%			+20%		
Rejection at ->	1%	5%	10%	1%	5%	10%	1%	5%	10%	1%	5%	10%	1%	5%	10%	1%	5%	10%
FE Single Cluster	88	97	97	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE Double Cluster	89	96	97	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Single Cluster	81	93	96	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Double Cluster	84	97	99	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Random Effect	91	97	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Abnormal Q ->	-15%			+15%			-15%			+15%			-15%			+15%		
FE Single Cluster	92	97	98	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE Double Cluster	93	97	99	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Single Cluster	86	97	98	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Double Cluster	83	96	99	97	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Random Effect	92	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Abnormal Q ->	-10%			+10%			-10%			+10%			-10%			+10%		
FE Single Cluster	93	97	100	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE Double Cluster	95	99	99	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Single Cluster	86	98	100	98	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Double Cluster	89	98	99	98	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Random Effect	94	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Abnormal Q ->	-5%			+5%			-5%			+5%			-5%			+5%		
FE Single Cluster	97	100	100	97	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE Double Cluster	96	99	100	98	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Single Cluster	97	100	100	97	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Double Cluster	94	98	100	97	99	100	100	100	100	100	100	100	100	100	100	100	100	100
Random Effect	96	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Table 1.12 - *Continued*

	Panel C: 60% of firms are treated																	
	1% of Log(Q) Variance						2.5% of Log(Q) Variance						5% of Log(Q) Variance					
Abnormal Q ->	-20%			+20%			-20%			+20%			-20%			+20%		
Rejection at ->	1%	5%	10%	1%	5%	10%	1%	5%	10%	1%	5%	10%	1%	5%	10%	1%	5%	10%
FE Single Cluster	97	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE Double Cluster	97	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Single Cluster	94	99	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Double Cluster	97	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Random Effect	97	99	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Abnormal Q ->	-15%			+15%			-15%			+15%			-15%			+15%		
FE Single Cluster	98	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE Double Cluster	98	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Single Cluster	94	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Double Cluster	97	99	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Random Effect	98	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Abnormal Q ->	-10%			+10%			-10%			+10%			-10%			+10%		
FE Single Cluster	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE Double Cluster	98	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Single Cluster	98	100	100	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Double Cluster	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Random Effect	99	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Abnormal Q ->	-5%			+5%			-5%			+5%			-5%			+5%		
FE Single Cluster	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE Double Cluster	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Single Cluster	97	99	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FE BS. Double Cluster	98	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Random Effect	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Chapter 2: Which Firms Benefit from Interest Rate Hedging?

(In Collaboration with Michel Dubois)

2.1 Introduction

Theories state that risk management increases firm value in imperfect capital markets by reducing expected tax liabilities, financial distress costs, and by increasing firm's debt capacity and interest tax deductions; see e.g. Smith and Stulz (1985), Bessembinder (1991), Froot, Scharfstein, and Stein (1993), Nance, Smith, and Smithson (1993), Géczy (1997), and Leland (1998) [8]. However, empirical results on the relation between derivatives usage, one of the main tools of risk management, and firm value is inconclusive. For instance, Allayannis and Weston (2001), Graham and Rogers (2002), Carter, Rogers, and Simkins (2006), Adam and Fernando (2006) and Pérez-Gonzáles and Yun (2013) find a positive impact of hedging on firm value, while Tufano (1996), Jin and Jorion (2006), Lookman (2009b) and Bartram, Brown, and Conrad (2011) document no significant impact. Stulz (1984) and Smith and Stulz (1985) argue that managers may hold derivative positions for their own advantage that might not be aligned with shareholders' interests. Consistent with this idea, there is evidence that some firms use financial instruments for speculation; see e.g., Faulkender (2005) and Géczy, Minton, and Schrand (2007).

In this paper, we study whether creditors' control on hedging policies affects firm value. More specifically, we investigate the impact of interest rate protection covenants (IRPC) in

[8] For a literature reviews on hedging and firm value, see Smithson and Simkins (2005) and Aretz and Bartram (2010).

syndicated loans on firm value. By imposing covenants in credit agreements, creditors effectively limit the managers' opportunism and clarify the use of derivatives to both shareholders and bondholders. This setting should alleviate, at least partly, endogenous variations in hedging.

Previous empirical evidence suggests that, beyond payment default states, creditors play an active role in the governance of corporations that is beneficial to shareholders; see Nini, Smith and Sufi (2009, 2012). Moreover, commitment to hedge also reduces the agency conflicts between creditors and shareholders (Campbell and Kracaw, 1990) and mitigates underinvestment (Bessembinder, 1991; Nance, Smith, and Smithson, 1993; and Géczy, 1997) or overinvestment (Morellec and Smith, 2007). A floating rate loan with IRPC is beneficial to the borrower too when its manager and creditors disagree about the future credit quality of the firm at the time the loan is initiated. A fixed rate loan may carry an additional cost if the borrower expects an improvement of its credit quality before the loan matures, assuming that fixed rate loans have no or expensive repayment (call) option. Therefore, firms borrowing at a floating rate enjoy the benefit of performance-based interest expenses.[9] This argument provides an additional support for the value implication of IRPC in credit agreements. [10] In parallel to these theoretical studies, Campello, Lin, Ma, and Zou (2011) empirically document a significant reduction in the cost of debt (LIBOR spread in syndicated loans) for hedging firms. Beatty,

[9] Symmetrically, Vickery (2008) explains that maturity mismatch in banks' holdings makes them more inclined toward floating rate lending. This argument also applies to syndicated loan agreements since maturity mismatch is even more complicated to deal with several lenders. In addition, almost all syndicated loans have the repayment option that amplifies the issue of maturity mismatch in case of a fixed rate loan.

[10] One may argue that the borrower pays higher swap or collar rate instead. Since these financial instruments exchange the net amount of position not the notional, they have lower credit risk spread than in lending the same notional amount with fixed rate. Even with equal credit spread, the borrower still saves the extra cost of the call option of a fixed rate lending.

Petacchi and Zhang (2011) show that this reduction is restricted to firms whose contracts include IRPC. The natural extension of this line of research is to explore whether IRPC has a positive impact on firm value.

Three reasons motivate studying interest rate derivatives usage for firms raising funds through a syndicated loan. First, the use of mandatory interest rate derivatives reduces the likelihood of speculation, or manager's self-interest, in using derivatives since the decision-making is mostly outside shareholders' and managers' reaches. A derivative position imposed by creditors is not speculative and the borrower cannot terminate this position unless it bears the cost of breaching a covenant. Second, hedging covenants are more prevalent in bank loans than in bond indentures since banks' monitoring resources are more concentrated than those of individual bondholders; see Lookman (2009a). Interest rate hedging covenants are also more frequent than currency or commodity hedging covenants as it is more difficult for non-financial firms to pass-through, or naturally hedge, interest rate exposure compared to commodity price or exchange rate risk. Third, syndicated loan agreements have clear and detailed terms and covenants. Due to their material impact on firms' capital structure and operations, firms report this information in their SEC filings. Details and conditions of IRPC, which are less prone to measurement errors, allow the classification of interest rate derivatives positions as voluntary or mandatory

Our empirical analysis proceeds in four steps. First, we examine whether the valuation of firms with IRPC is higher than that of otherwise similar firms that do not use derivatives or use derivatives voluntarily. We also check if the results of our baseline model are robust to a selection bias. Second, we examine how additional monitoring tools, i.e. additional covenants, corporate governance, and competition on the product market, interact with hedging and whether they have explanatory power beyond that of IRPC in terms of firm's value enhancement. Third, we provide an additional check that reinforces the causality relation between IRPC and firm value. More specifically, we take advantage of the introduction of FAS133 as a (quasi) natural experiment. This rule makes mandatory the disclosure of hedging policies after January 1st, 2001. A difference-in-differences analysis shows that, after the implementation of FAS133, the difference in valuation between interest rate derivatives users, with and without IRPC, vanishes. Our interpretation of this result is that before the regulation, only credible hedging policies (i.e., those enforced by creditors) were value enhancing. Under FAS133, information on hedging policy is also available for voluntary hedgers through the annual financial statements. Therefore, everything else equal, their value should: (a) converge to that of mandatory hedgers and (b) be higher than that of non-hedgers. Our empirical results confirm this conjecture. Fourth, based on Campello et al. (2011), Beatty et al. (2012) and Perez-Gonzales and Yu (2013), we estimate how potential drivers of firm value enhancement (decrease of the LIBOR spread, changes in the financing and the investment policy) could explain the valuation effect of the IRPC.

Across a sample of 1117 firms (4636 firm-year observations) from 1998 to 2007, all exposed to interest rate risk, we show that firms using derivatives voluntarily are different in terms of profitability, risk and growth opportunities from those that use derivatives mandatorily. A multivariate analysis that controls for various determinants of firm value shows that mandatory interest rate derivatives usage increases firm value, while voluntary interest rate derivatives usage does not. These results are robust to the exclusion of firms using foreign exchange and commodity price derivatives and to alternative measures of hedging intensity. The special characteristics of the firms with IRPC, and their acceptance of this covenant in the credit agreement, leave simultaneity concerns.

To reinforce our conclusions, we specifically control for a potential selection bias by implementing a propensity score matching. Interest rate derivatives users are matched with non-users, year by year, along with profitability, risk and growth dimensions. The difference between the mean (median) of the Log of Q ratio of the two groups is not economically large (0.01 for both the mean and the median) and is not statistically significant (p-value = 17.8% and 42.5% respectively). However, when we match mandatory interest rate derivatives users and non-users based on their propensity score, our results confirm that the average (median) value of mandatory interest rate derivatives users is 5% (7%) higher than that of similar non-users and is significant at 2.9% (2.0%) level. These findings suggest that investors perceive positively the mandatory term of using interest rate derivatives while they do not price voluntary derivatives usage, whose purpose is not clear.

Next, we examine the concurrent effects of other covenants included in the loan, corporate governance, and competition pressure. First, we study the interaction of IRPC with other covenants usually found in syndicated loans contracts. These covenants impose different restrictions on cash flow, leverage, liquidity, capital expenditures or net worth assets. With such influence on firm's operations, these covenants may impact firm value in parallel to, or independently from, IRPC. Using a dummy variable for each type of covenant, and its interaction with IRPC, we find similar results to those previously obtained in the baseline model. Second, we also uncover that the strength with which firms are governed does not capture the positive valuation effect of mandatory interest rate hedging. On this ground, we use the index as defined in Allayannis, Lel, and Miller (2012). We find that strict governance has no direct significant effect on firm value. Then, we estimate the impact of the interaction of strict governance with interest rate derivatives usage, either voluntary or mandatory, on firm value. We show that the value enhancing effect of IRPC is lower for firms with strict governance, nevertheless, it remains significant. Third, we study whether competition pressure is a substitute for IRPC. Following Hoberg, Philips and Prabhala (2012), we measure market competition with the product market fluidity index. While the value of mandatory interest rate derivatives users is positively related to interest rate hedging, our results show that the value of voluntary interest rate derivatives users is not related to the product market fluidity index. All in all, our results confirm the positive effect of IRPC on firm value and show that additional monitoring tools as corporate governance or market competition are not acting as substitutes of creditors' control.

Finally, to reduce endogeneity concerns of mandatory hedging on firm value, we study the impact of the introduction of FAS133 as a natural experiment. This regulation was designed to reduce information asymmetries between managers and stockholders with regards to derivatives usage. The disclosure of the hedging policy in the financial statements through the 10-K form makes this information easily available to investors. We find that the introduction of FAS133 has a larger positive and significant valuation effect, both economically and statistically, on firms that voluntary hedge than on firms that mandatorily hedge their interest rate exposure.

This research contributes to the literature in several ways. We provide novel empirical evidence of the impact of interest rate derivatives usage on firm value by comparing non-users, voluntary and mandatory users. It is also a step forward to an unbiased estimation of the influence of derivatives on firm value by focusing on derivatives usage imposed by creditors rather than that decided by managers alone. It also complements empirical studies that examine the impact of hedging on the cost of debt. Campello et al. (2011), show that hedging reduces the cost of debt by lowering interest spread. Beatty et al. (2011) find that this reduction is effective only for mandatory interest rate derivatives users or for firms that practice conservative financial reporting. We examine such a reward from the shareholders' point of view and document a positive impact of IRPC on firm value as soon as the hedging policy is credible (i.e. under creditors' control or disclosed in the financial statements). Consistent with Nini, Smith, and Sufi (2012), this result illustrates that there are cases, such as imposing IRPC, for which creditors' and shareholders' interests are aligned.

The remainder of the paper is organized as follows. The next section describes the sample construction and outlines the methodology. Section 2.3 presents the contribution of interest rate protection on firm value. Section 2.4 reports the interaction of interest rate protection with additional covenants in syndicated loans, corporate governance, and competition on the product market. Section 2.5 explores how the introduction of FAS133 changed the impact of interest rate derivatives usage, either mandatory or voluntary, on firm value. The channels through which the IRPC creates value is also described in this section. Section 2.6 concludes the paper.

2.2 Data and methodology

2.2.1 Sample construction

After the adoption of regulation FRR48 on July 15th, 1998, quantitative information on derivative positions and market risks is disclosed in the 10-K filings[11]. To measure accurately interest rate risk hedging, we take advantage of this regulation so that our sample period starts on July 15th, 1998. Since IRPCs are more common when the LIBOR is high, we cover a full cycle in terms of US-LIBOR-3Month rate, the main index for variable interest rates; see Beatty and al. (2011). The end of the sample period is on December 31st, 2007. To identify the presence and the magnitude of interest rate risk, we collect syndicated loans from LPC's DealScan[12]. From this sample of syndicated loans, we retain "Term loans" because this is the only type of contracts that include IRPC[13]. We also directly search "Term loans" in 10-K and 10-Q filings. We exclude "Debtor-in-Possession" contracts, which are for bankruptcy cases, lease agreements, and loans issued by financial institutions and utilities due to their special capital structure and regulatory system. We extract 10-K filings from EDGAR and search for "term loan", "term-loan", "term agreement", "term contract", "term credit", "LIBOR" and "prime rate" keywords in the text file of each filing to make sure that the term loan is outstanding and is not repaid. Based on interest rate hedging information available from the contracts[14], 10-Q/10-K filings, firms are classified as mandatory interest rate derivatives users, voluntary

[11] Including 10-K405 and 10-KSB filings but we use only "10-K" in the text for brevity.

[12] Since LPC's Dealscan starts in 1988, we miss contracts initiated before that date and still outstanding in 1998. Their number should be extremely small since only 0.80% of the contracts launched during the 1998-2007 period had a maturity higher than ten years.

[13] We remove "notes" since their interest rate is fixed. "Revolvers" and "Line of credit" are also removed because these contracts do not include IRPCs.

[14] We thank Amir Sufi for providing the text of the contracts in his website: http://faculty.chicagobooth.edu/amir.sufi/data.html. 3720 contracts are extracted from this dataset. The rest, 5063 contracts, are evaluated with 10-Q and 10-K filing searches.

interest rate derivatives users and non-users. Firms with missing information are eliminated. Finally, we merge accounting and market data from COMPUSTAT/CRSP database to measure firm characteristics; see Appendix 2, Table 2.A1 for details on the sample construction.

2.2.2 Empirical methodology

To appraise the differential impact of mandatory interest rate derivatives usage on firm value, we examine the effect of hedging intensity, the existence of an IRPC and their interaction on Tobin's Q. We also control for a set of additional variables that are known to affect firm value, i.e. profitability, risk and growth options. On this ground, we estimate the following baseline regression specification:

$$Log\left(Q_{i,t}\right) = \boldsymbol{\alpha} + \beta_1 \times IRP_{i,t} + \beta_2 \times Mandatory_{i,t} + \beta_3 \times IRP_{i,t} \times Mandatory_{i,t} + \boldsymbol{\Gamma}'\mathbf{X}_{i,t} + \eta_{t,Industry} + \omega_i + \varepsilon_{it} \quad (1)$$

where the subscripts *i* and *t* represent respectively the firm, and the date of the fiscal year end. The dependent variable, $Log\left(Q_{i,t}\right)$ is the Log of Tobin's Q. We follow prior studies, e.g. Allayannis and Weston (2001), Jin and Jorion (2006), Fauver and Naranjo (2010) and Allayannis et al. (2012) and compute Tobin's Q as the Market Value of Equity plus Total Assets less the Book Value of Equity divided by Total Assets. We measure firm's interest rate protection with the ratio of Net notional value of interest rate derivatives (Float to Fixed Notional minus Fixed to Float) divided by Total Assets.[15] We capture mandatory interest rate derivatives usage with a dummy variable that equals one if the firm has an IRPC (float to fixed

[15] We use Total assets instead of the Debt in the financial statements because there is hedging in advance and the corresponding debt can be nil. We also use Float to Fixed Notional plus Fixed to Float (absolute values) and the results are qualitatively similar.

contract) and zero otherwise. Hence, the coefficient β_1 measures the impact of interest rate hedging on firm value. If interest rate hedging has a positive effect, this coefficient is positive. The coefficient of interest (β_3) in Equation (1) is on the interaction between *Mandatory* and *IRP*. This coefficient measures the marginal impact of the interest rate protection when hedging is mandatory (IRPC). Consistent with our hypothesis, this coefficient should be positive.

Also, in line with empirical studies on the valuation effect of risk management policies, Equation (1) includes variables $(\mathbf{X}_{i,t})$ that control for other potential time-varying determinants of firm value. First, we introduce firm interest risk exposure (*IR Exposure*) that measures the amount of debt carrying variable interest rate divided by Total Assets minus Equity. Following Chernenko and Faulkender (2011, p. 1751), we define variable debt as commercial paper, credit facilities, short-term debt classified as long-term and term loans unless stated otherwise in the 10-K filling. Second, we use return on asset (*ROA*) and a dividend dummy (*Dividend*) that equals one if the firm pays dividends during the corresponding year and zero otherwise, as proxies for internal financing resources. Third, as in Campello et al. (2011), we use the distance to default (*Dist. to Def.*) as a proxy for bankruptcy risk. This variable is based on Merton's structural model; see Crosbie and Bohn (2003) and Campello et al. (2011) for a definition. We retain this variable instead of Altman's Z-score or Ohlson's O-score because it incorporates market information (volatility of stock price) and not only accounting ratios already used as determinants of firm value. We also include Tangible Assets, which are more valuable as collateral in credit agreements. This variable is defined as the net amount of properties, plant and equipment divided by Total Assets. Fourth, we use CAPEX (capital expenditures) divided by Total Assets, Advertisement divided by Sales and R&D expenditures divided by Total

Assets as proxies for growth options. We also control for firm size and include (Log of) Total Assets. Finally, to account for firm/industry and time specific effects, we introduce firm fixed effect (ω_i) and industry (two-digit SIC code) time fixed effects $(\eta_{t,Industry})$ in Equation (1). The industry-time fixed effect controls for the time-varying characteristics of industries that are not controlled in the model such as competition or regulatory changes that affect a specific industry; see Gormley and Matsa (2014). We further adjust estimated standard errors for within-firm error clustering and heteroskedasticity; see Petersen (2009) and Gow, Ormazabal and Taylor (2010). The construction of the variables in the model is presented in the Appendix 2, Table 2.A2.

2.3 IRP and firm value

2.3.1 Univariate results

Overall, the sample covers 1117 individual firms (4636 firm-year observations) exposed to interest rate risk from 1998 to 2007. Among these firms, 548 (1646 observations) are voluntary interest rate derivatives users, 217 (664 observations) are mandatory interest rate derivative users, and 812 (2326 observations) are non-users. Firms in Transportation and Telecom industry have the highest number of voluntary and mandatory interest rate derivatives users followed by Machinery and electronics (voluntary users) and Personal and business services (mandatory users). The number of voluntary, mandatory and non-users is almost evenly distributed except in 2006, when we have the lowest number of observations for each group; see Appendix 2, Table 2.A1, Panel C.

Table 2.1, Panel A, reports descriptive statistics of the main variables for derivatives users and non-users. The mean (median) of Log of Q is respectively 0.30 (0.24) for users and 0.32 (0.25) for non-users; this difference is statistically (not) different from zero at 5%. The interest rate exposure is also different for both samples, derivatives users being more exposed to interest rate fluctuations. The average (median) difference is 0.09 (0.10), which is economically and statistically significant (at 1%). Derivatives users are larger in size, have more tangible assets, and are less risky; these variables have means and medians that are statistically different from those of non-users.

[Table 2.1]

In Table 2.1, Panel B, we split the sample of interest rate derivatives users into mandatory and voluntary users. The mean (median) of Log of Q is respectively 0.32 (0.26) for mandatory users and 0.29 (0.23) for voluntary users with a difference that is (not) statistically significant at 10%. Compared to voluntary users, mandatory users are more exposed to interest rate fluctuations (*IR Exposure*) with a mean (median) of 0.40 (0.38) instead of 0.32 (0.28). Their hedging intensity (*IRP*) is also significantly higher with a mean (median) of 0.19 (0.15) for mandatory users versus 0.13 (0.08) for voluntary users. Compared to voluntary users, mandatory users are smaller in size, with fewer tangible assets; they are also less profitable and more risky. It is also interesting to note that our sample offers substantial variation in firms' size. For example, the inter-quartile range (75^{th} percentile minus 25^{th} percentile) is \$1527M for mandatory users and \$2344M for voluntary users. These results are similar to those presented in Beatty et al. (2012) and Campello et al. (2011).

Our univariate results are consistent with risk management theories predictions (Nance et al., 1993). However, some characteristics presented above are known to affect negatively firm value (e.g., lower profitability and higher risk to default), which precludes a direct comparison of Q ratios across sub-samples. Based on these figures, firms with IRPC demonstrate special characteristics, which exacerbate the potential of selection bias.

2.3.2 Multivariate results

We start the regression analysis by examining the average effect of hedging intensity on firm value. Table 2.2 displays the results from OLS estimation of Equation (1). The first column reports the impact of hedging on firm value, which represents the natural benchmark with respect to previous studies. We find that interest rate protection has an impact on firm value that is statistically significant (at 5%). However, its economic magnitude is small (i.e. a 1% increase in IRP translates into a 0.10% increase in firm value). The second column reports the baseline specification. The interaction between *Mandatory* and interest rate derivatives intensity (*IRP*) identifies the marginal impact of mandatory interest rate derivatives usage on firm value. As opposed to the results in column 1, interest rate derivatives do not have any impact on firm value, showing that voluntary derivatives users do not enjoy any value enhancement. Interestingly, the interaction between *Mandatory* and *IRP* captures the valuation effect previously documented. The corresponding coefficient (β_3) is positive and statistically significant (at 1%). After controlling for other determinants of Q ratio, on average, mandatory interest rate derivatives increase firm value by 6%.

[Table 2.2]

Then, we verify that our results are robust to the definition of *IRP*. In column 3, we modify the definition of *IRP*, which is restricted to Float to Fixed Notional only (instead of the Net value of the Notional) divided by Total Assets. Lel (2012) suggests that firms use frequently interest rate derivatives with currency and commodities derivatives. In column 4, we present the results after excluding these observations (373 firm-year) to avoid any interaction with the usage of other derivatives contracts. Overall, our results are little affected by these modifications.

Turning to the control variables, we find results that are consistent with previous research. Size and Tangibility have a negative sign that is statistically significant at 1%. Return on Assets (*ROA*), Financial Risk (*Dist. to Def.*) and Growth (*CAPEX*) have as a positive sign that is statistically significant at 1% while R&D and Advertisement are not significant; see e.g., Allayannis and Weston (2001) and Allayannis et al. (2012).

2.3.3 Controlling the selection bias with propensity score matching

As we document in Section 2.3.1., banks enforce firms with special characteristics to hedge interest rate risk. To control for this selection bias, we conduct a propensity score matching; see Bartram et al. (2011). Based on our hypothesis, we define two treatments: a) interest rate derivatives usage and b) mandatory interest rate derivatives usage. In both cases, we match the treated firms with non-users of interest rate derivatives.

For both tests, we generate propensity scores with a *logit* model. The dependent variable is equal to one if the firm uses interest rate derivatives during the current year and zero otherwise. The control variables are the explanatory variables already used in Equation (1). We iterate this procedure year by year so that the financial statements of treated and control firms are contemporaneous. After generating propensity scores for both tests, we conduct our analysis by matching a treated firm with firms from the controlling samples (with replacement) whose propensity score is the closest (Caliper 0.01)[16].

[Table 2.3]

Table 2.3, Panel A, reports the results for interest rate derivatives users and non-users. After matching, the mean (median) of the Log of Q ratio of interest rate derivatives users is 0.01 (0.01) lower than that of non-users (p-value = 17.8% and 42.5% respectively). Table 2.3, Panel B, reports the results for mandatory interest rate derivatives users and non-users. In contrast to Panel A, the mean (median) of the Log of Q ratio of mandatory users is 0.05 (0.07) higher than that of the non-users counterfactual. This difference is statistically significant at 2.9% (2.0%) level[17].

This result supports our previous findings and suggests that the higher firm value of mandatory hedgers is not biased by the special characteristics of mandatory users. As Panel B shows, our matching significantly reduces the bias of the variables from average (median) 14.8% (10.2%) to 4.4% (4.8%).

The low bias in observable variables reported in Table 2.3 significantly reduces the probability of unobservable variables impacting the results. More specifically, we perform a sensitivity analysis to evaluate the concern of hidden biases in our inference; see Rosenbaum (2002) and Bartram et al. (2011). In a large and purely random selection of observations, the

[16] We also estimated the *logit* model with industry-year dummies and constructed the controlling sample without replacement. The results, not reported here, are qualitatively similar and available upon request. All of the estimates are obtained using Leuven and Sianesi (2003) psmatch2 and pstest programs for Stata.

[17] When expressed in percent, the difference in valuation is $\exp[(Ln(Q_U) - Ln(Q_{NU})] - 1$. Therefore, the average (median) value of interest rate derivatives users (U) is 1% lower than that of non-users (NU) while the value of mandatory interest rate derivatives users is 5.1% (7.2%) higher.

expected odds ratio in having IRPC in a credit agreement is one for two firms with identical characteristics. Indeed, a hidden bias from an unobservable characteristic can produce a multiple of odds and reduce the precision of our inference about the impact of the treatment. In this analysis, we compute an interval of p-values related to uncertainty about the hidden bias for odds of treatment greater than one (0.01 steps). We stop our analysis at p-value greater than 5% where we have the maximum odds of treatment for which we reject the impact of hidden bias on the probability of receiving treatment, at 95% confidence level. The higher is the odds ratio at this level of confidence, the lower our result is sensitive to unobservable variables.

Our sensitivity analysis shows 1.05 (1.00) odds of mandatory hedgers (IR derivative users) with non-users. The value of odds of treatment at 95% confidence level for propensity score matching is 1.00 for interest rate derivatives users and non-users, which is consistent with Bartram et al. (2011). When we restrict our analysis to mandatory interest rate derivatives users, this value is larger (1.05). It indicates that IRPC is a strong signal for real risk management that significantly reduces the sensitivity of our results to hidden biases. We also conduct a sensitivity analysis, as in DiPrete and Gangl (2002), to quantify the impact of unobservable variables. This analysis shows to what extend the average of each observable variable should change to have the same impact as an unobservable variable. In matching mandatory users with non-users, the effect of an unobservable variable with potential impact on our inference is equivalent to 0.15 change in *IR exposure*, $770M change in *Total Assets*, 0.01 change in *ROA*, 0.55 changes in *Tangibility*, 0.05 change in *CAPEX*, 0.015 in *R&D*, and 0.07 change in *Advertisement*. Note that our result is almost insensitive to *Dist. to Def.* Notwithstanding all the reported numbers are based on conservative measures, these results indicate that the impact of an unobservable variable must be relatively large to change our conclusion about the value implication of IRPC. Therefore, it is unlikely that our results are driven by unobservable variables.

2.4 Firm value, IRP, and alternative monitoring tools

Our hypothesis states that shareholders' confidence in the real purpose of mandatory interest rate derivatives usage accounts for a significant difference in valuation between mandatory and voluntary users. Nevertheless, other covenants included in the loan contract along with IRPC could have also a positive valuation effect; see Nini et al. (2012). Moreover, strict corporate governance and competition in the product market have a positive impact on firm value through an increased monitoring pressure and a reduced flexibility in exerting corporate assets; see among other Beatty et al. (2012), Allayannis et al. (2012), and Adam and Fernando (2006). In fact, we check whether these forces increase the value implication of the voluntary interest rate derivatives usage. More specifically, we check whether they serve as a substitute or a complement to IRPC.

2.4.1 The impact of other covenants

It is possible that IRPC are bonded to other types of covenants whose impact on firm value is not controlled in our model. There is also a possibility of a tradeoff between relaxing such covenants and accepting IRPC. Therefore, we check the robustness of our results to the inclusion of other covenants in the syndicated loan agreements. Specifically, we use the typical classification of covenants in credit agreements including cash flow, leverage, net worth, liquidity, and capital expenditures covenants[18]. We add a dummy variable that equals one if the corresponding covenant applies to the baseline model. Then, we conduct our test for each class of covenants separately. To investigate the interplay between these covenants and interest rate derivatives usage as well as their impact on firm value, three interaction terms *Covenant* × *IRP*, *Covenant* × *Mandatory*, and *Covenant* × *IRP* × *Mandatory* are added. We estimate the following regression specification:

$$\begin{aligned} Log\ \left(Q_{i,t}\right) = \boldsymbol{\alpha} + \beta_1 \times IRP_{i,t} + \beta_2 \times Mandatory_{i,t} + \beta_3 \times Covenant_{i,t} \\ + \beta_4 \times IRP_{i,t} \times Mandatory_{i,t} + \beta_5 \times IRP_{i,t} \times Covenant_{i,t} + \beta_6 \times Mandatory_{i,t} \times Covenant_{i,t} \\ + \beta_7 \times IRP_{i,t} \times Mandatory_{i,t} \times Covenant_{i,t} + \boldsymbol{\Gamma}'\mathbf{X}_{i,t} + \eta_{t,Industry} + \omega_i + \varepsilon_{it} \quad (2) \end{aligned}$$

[Table 2.4]

The results are presented in Table 2.4. First, the estimates show that mandatory interest rate derivatives usage has a positive and significant impact on firm value in all our tests. Its magnitude (*Mandatory* × *IRP* coefficient) is similar to the one in the baseline model. Second, the interaction terms of these covenants with *IRP* are not significant. Despite the fact that these covenants impose restrictions on management, they do not change investors' perception about the use of derivatives as shown by the Wald tests. These covenants also do not influence the marginal impact of IRPC. It indicates that the positive impact of IRPC is not affected by the presence of other covenants in the credit agreement.

When firms violate a covenant out of states of bankruptcy, creditors actively get involved in corporate management; see Nini et al. (2012). In particular, creditors influence corporate

[18] Covenants in this classification are as follows. Earnings, cash flow, and coverage ratios are classified as cash flow covenants. Debt to capitalization, debt to assets, debt to equity and other debt to balance sheet covenants are classified as leverage covenants. Liquidity covenants are quick ratio, current ratio, and working capital restrictions. Net worth and capital expenditure covenants include any restriction for these terms.

governance quality, which has a positive impact on firm value. Hence, it is also possible that the valuation impact of the IRPC results from a technical default. To rule out this hypothesis, we proceed as follows. From Nini et al. (2009), we identify credit agreements in which the borrower violates a covenant in the year before the current syndicated loan and match these credit agreements with contracts including an IRPC. We find twelve firms (57 observations) in our sample having an IRPC in their credit agreements and a record of technical default in the year before. We remove these firms from our sample and re-estimate the baseline model. Reassuringly, the results are qualitatively similar to what we find for the whole sample. [19]

2.4.2 Does the valuation effect of IRPC go beyond that of corporate governance?

There is empirical evidence that corporate governance affects firm value; see, e.g., Gompers, Ishii and Metrick (2003), Aggarwal, Erel, Stulz and Williamson (2009) and Bebchuk, Cohen and Ferrell (2009). However, the number of provisions included in corporate governance indexes is highly variable, from six in Bebchuk et al. (2009) to forty four in Aggarwal et al. (2009). Bebchuk et al. (2009) document that only six of these provisions really matter in terms of firm valuation. These indexes include several provisions such as poison pill or supermajority to approve a merger, which do not address any special control in the use of derivatives. Instead, Allayannis et al. (2012) construct a corporate governance index (G7) containing seven provisions that is directly related to shareholders' ability to control the management practices concerning the use of derivatives. [20] They document that foreign exchange derivatives usage

[19] The corresponding results are available upon request.

[20] Allayannis et al. (2012) define the value of the index as the number of positive answers (out of seven possible) to the following provisions: 1) the firm has no inside blockholder, 2) there is at least one outside blockholder, 3) there is at least an institutional investor, 4) the CEO is not also the chairman, 5) the cash flow rights of the largest managerial blockholder is greater than its median value, 6) the voting rights of the largest managerial blockholder is lower than its median value, 7) there is no

has a positive effect on firm value only for firms that have strict corporate governance rules. In our setting, strict corporate governance could act as a substitute of mandatory interest rate derivatives usage. Therefore, to check the robustness of our previous findings, we follow Allayannis et al. (2012) and compute the G7 index using 10-K and DEF 14A (Definitive proxy statements) filings.

Due to data availability, we have complete information for 3366 firm-year observations (instead of 4625). We compare the means (medians) of the G7 index for mandatory and voluntary interest rate derivatives users to that of non-users. The means (medians) are 3.4 (3), 3.6 (4) and 3.6 (4) respectively. The mean (median) of the G7 index of mandatory hedgers is significantly different from that of voluntary and non-users (p-value = 1.0%).

To test the value implication of shareholders' rights with respect to mandatory interest rate derivatives usage, we follow Allayannis et al. (2012). We distinguish firms with strict corporate governance rules by defining a dummy variable (*StrictGov*) that equals one if their G7 index is higher than, or equal to, the median of the corresponding year. We measure the impact of *StrictGov* and its interactions with *IRP* and *IRP* × *Mandatory*. Table 2.5, column 1 reports the coefficients of *IRP* × *StrictGov* and *IRP* × *Mandatory*, which are positive and statistically significant at 10% and 1%, respectively. In parallel to previous findings (Allayannis et al., 2012 ; Lel, 2012 and Fauver and Naranjo, 2010), these results indicate that the monitoring pressure from shareholders shifts the use of interest rate derivatives toward real risk management with a positive impact on firm value. To test whether strict corporate governance has additional explanatory power beyond that of mandatory interest rate derivatives usage, we estimate the

discrepancy between the cash flow and the voting rights. A high value of this index indicates a strict corporate governance system.

model without *StrictGov*. The corresponding Wald test (p-value = 14.1%) shows that the incremental value is not statistically significant at the usual level. Hence, strict governance does not change the value implication of IRPC since shareholders regain their confidence in the motive of derivatives usage through creditor's enforcement.

2.4.3 Does competition on the product market reduce the valuation effect of IRPC?

Several theoretical (Hart, 1983; Schmidt, 1997; and Raith, 2003) and empirical studies (Hoberg et al., 2013 and Frésard and Valta, 2012) document how product market competition influences corporate financial policies and aligns managers' and shareholders' interests in the use of corporate resources. In the same spirit of shareholders rights, we expect that competition pressure positively influences the value implication of voluntary interest rate derivatives usage. However, we conjecture that the positive impact of IRPC does not vanish after controlling for the influence of product market competition. To test this argument, we use the product market fluidity index developed by Hoberg et al. (2013) as a proxy for market competition. This index is based on a text-search in corporate filings and address firm-level competitive threats by capturing the change in products of the firm relative to those produced by rivals.

We merge our dataset with that of Hoberg et al. (2013) [21] to collect the Product market fluidity index for each firm-year. We compare the mean (median) of the Product market fluidity index for both mandatory and voluntary interest rate derivatives users with that of non-users. The means (medians) for mandatory, voluntary users, and non-users are 7.4 (6.8), 6.3 (5.6) and 6.6 (6) respectively. Mandatory users face the highest competition pressure. Pairwise tests show

[21] We appreciate Gerard Hoberg and Gordon Philips for providing this dataset in their website (http://www.rhsmith.umd.edu/industrydata/industryconcen.htm).

that the mean (median) of its Product market fluidity index is significantly higher than that of the other groups (p-value = 1.0%).

Again, we construct a dummy variable *Competition* that equals one if *Product market fluidity* is larger than, or equal to, the sample median of the corresponding year and zero otherwise. This dummy represents the level of competition (high vs low) for each firm-year. We conduct our test similarly to the previous section and report the results in Table 2.5, column 2. The coefficient of *Mandatory* × *IRP* is positive and statistically significant at 5% while the coefficient of *Competition* × *IRP* is negative and not significant. Interestingly, the coefficient of *Mandatory* × *IRP* increases when *Competition* × *IRP* is introduced and, in parallel to previous tests, the coefficient of *Competition* × *IRP* × *Mandatory* is negative and not significant (p-value 52%). As a result, competition pressure does not increase the value implication of interest rate derivatives usage. However, it reduces the marginal impact of mandatory hedging since the manager of firms under competitive pressure have less flexibility in the use of corporates resources.

2.5 Information asymmetries, mandatory hedging and firm value

Issued in June 1998 by the Financial Accounting Standards Board, the Accounting for Derivative Instruments and Hedging Activities rule, known as FAS133, requires firms to book at fair value the assets and liabilities related to all derivative positions on their balance sheet. This rule attempts to clarify derivative positions for investors, enabling them to distinguish between derivatives used for risk management and those used for earnings management or speculation. Therefore, it lowers the information asymmetry between managers and investors with regard to interest rate derivatives usage. In this context, interest rate derivatives usage should enhance firm value for both mandatory and voluntary users (compared to a similar non-hedging firm) and the investors' perception about mandatory and voluntary interest rate derivatives usage should be reduced. Consequently, their Tobin's Q should be closer after the adoption of the rule.

2.5.1 The impact of FAS133: A difference-in-differences analysis

We use the adoption of FAS133 as an external (exogenous) shock and conduct a difference-in-differences estimate to check the robustness of our previous findings (i.e. the positive impact of interest rate derivatives usage). We construct our test based on the adoption of this standard. The effective date of this rule was June 15th, 1999 but its implementation was postponed to January 1st, 2001 with two amendments. We split the sample to before 2002 (including 2002) and after 2002. We apply a one year delay to make sure that the standard is settled in all firms and to reduce the impact of derivatives positions initiated before the implementation of FAS133. We follow the same procedure as in Section 2.3.3 to match mandatory (treated) and voluntary (control) interest rate derivatives users based on their propensity score. We also add interest rate protection (*IRP*) to the set of control variables to match voluntary and mandatory interest rate derivatives users. This procedure allows us to better control for firm's heterogeneity. After matching, we compute the mean (median) of the difference between treated firms and their corresponding control group, respectively before and after the adoption of

FAS133. Last, we test the equality of the difference (difference-in-difference) before and after the adoption of FAS133[22].

[Table 2.6]

Table 2.6 reports the results. In parallel with our prediction, we observe a significant decrease in the difference between the Log of Q ratio of voluntary and mandatory interest rate derivatives users after adopting FAS133. More importantly, this reduction is mainly related to the significant increase in the value of voluntary users. Before FAS133, the mean (median) of the mandatory users is 0.31 (0.22), which increases to 0.36 (0.34) after the standard is implemented. For voluntary users, the mean of the Log of Q significantly increases from 0.24 (0.19) to 0.39 (0.34) after FAS133. In fact, the value of both mandatory and voluntary users increases. However, the impact of accounting standard on the value of the voluntary users is higher. The average (median) gap between the Log of Q of the voluntary and mandatory users before and after the adoption is -0.10 (0.01) and is statistically (not) significant (p-value = 3.1% and 16.1% respectively) level. These results are consistent with the purpose of FAS133 since the disclosure of the hedging policy discourages firms to use derivatives for purposes other than risk management. The positive value implication of interest rate derivatives usage is also reassuring since the adoption of FAS133 is not directly related to endogenous factors.

To cement our finding about the value implication of interest rate derivatives usage after the adoption of FAS133, we define a dummy variable *After2002*, which is equal to one for years after 2002 and zero otherwise. We use the interaction of this dummy with *IRP* and conduct our

[22] We do not use the baseline model since the variable *IRP* that controls for the interest rate protection is continuous.

test on voluntary versus non-user and mandatory versus non-user subsamples. We also conduct our test based on Equation (2) on whole sample.

[Table 2.7]

Table 2.7 reports the results. Consistent with our previous finding, for voluntary versus non-users, the coefficient of *After2002* × *IRP* is positive and significant (p-value = 1.1%) while this coefficient is negative and insignificant (p-value = 62.9%) for mandatory versus non-users. It means that this standard significantly improves investors' perception about the use of IR derivatives for voluntary users while it does not alter the value implication of mandatory ones. In column 3, where we have all IR derivatives users and non-users, the coefficient of *After 2002* × *IRP* is positive and significant (p-value = 2.5%). The coefficient of *Mandatory* × *IRP* is still positive but is not as significant (p-value = 8.1%) as it is in the baseline model. The coefficient of *After 2002* × *Mandatory* × *IRP* is negative but insignificant. It indicates that the more transparent disclosure of IR derivatives after adoption of FAS133 standard reduces, but do not eliminate, the marginal impact of mandatory interest rate derivatives usage on firm value.

2.5.2 Analyzing the value creation

In this section, we discuss *how* the premium on firm value is generated. For that purpose, we focus on the impact of IRPC on the financial constraint, the subsequent increase of investment, and the reduction of the cost of debt documented in the literature; see Campello et al. (2011) and Beatty et al. (2011). In fact, financially constraint firms commit themselves to hedge their interest rate risk to grant the credit facility and invest in projects. The impact of IRPC on financial constrains is noticeable, in particular for mandatory interest rate derivatives users.

To estimate the firms' external finance constraints, we use the index proposed in Whited and Wu (2006) (hereafter WW index[23]). We measure the change in WW-index around the loan inception. The mean (median) of WW-index decreases by 6% (3%) for mandatory interest rate derivatives users, while this reduction is 5% (2%) and 4% (2%) for voluntary interest rate derivatives users and non-users, respectively. The pairwise difference between mandatory interest rate derivatives users and non-users is significant at 5% while the difference between mandatory and voluntary interest rate derivatives users is not significant (p-value = 27%). The differences between the medians are not significant (p-value = 33% and 57% respectively).

In this context, we compare the dynamic of investments over mandatory users, voluntary users and non-users. We measure the change of capital expenditures two years after the credit facility is granted. Our analysis shows that, on average, this growth rate is about 24% for mandatory users while it is 14% for voluntary users and 13% for non-users, respectively. The corresponding differences (mandatory vs. voluntary and mandatory vs. nonusers) are statistically significant at 5.4% and 2.1%. Referring to the baseline model, where the coefficient of CAPEX is 0.57, a 10% increase in CAPEX increases the firm value by almost 6%. The median of change in CAPEX for mandatory, voluntary and nonusers are -10%, -8%, -8%, respectively. The p-value of the difference between the median of the change in CAPEX of mandatory and that of voluntary (non-user) is 57% (68%). In firms with high probability of risk-shifting, creditors impose restrictions on capital expenditures. The commitment to hedge the interest rate risk reduces the probability or willingness of risk-shifting in a firm that

[23] We use the estimates of Whited and Wu (2006, p. 543, eq. 3). When computed over different sample periods, Whited and Wu (2006) show that the cross-sectional correlation is high. Therefore, our results should not affected by the fact that our sample periods do not match.

encourages creditors to relax this restriction (Campello et al., 2011). Therefore, the growth in investments is the result of relaxing financial constraints for funding new investment opportunities as well as the reduction in investment restrictions imposed by creditors. The significant gap between the dynamic of investments of mandatory hedgers and that of the other two groups explains the value implication of IRPC.

We then examine the reduction of the cost of debt resulting from IRPC. Beatty et al. (2012) document that IRPC reduces the cost of debt measured as the spread paid over LIBOR or Prime rates. Moreover, as discussed before, since most of the syndicated loans have a performance pricing, firms have the opportunity to reduce the spread by improving their creditworthiness. In the same spirit, the reduction in the cost of debt increases the value of the firm. We estimate the change in the LIBOR spread paid two years after loan initiation for the three groups of firms. Credit agreements have several types of performance pricing grids. Consequently, we calculate interest expenses as follows. First, we split interest payments into the fixed and the floating part based on the ratio of Variable Debt to Total Debt. Then, we decompose the floating part of the debt in three components: a) the part covered by swap, b) the part covered by collar, and c) the unhedged part. For each part, we apply the corresponding rate, i.e. swap rate, collar rate if the LIBOR is below the floor or above the cap, and LIBOR rate for the remaining part, to its notional. The total is the interest expenses without the spread charged in the agreement. Therefore, the floating rate interest expense calculated from the first stage minus this sum and divided by floating rate debt is an approximation of the LIBOR spread. Our analysis indicates that, on average, mandatory interest rate derivatives usage reduces the LIBOR spread by 97 basis points (median is 36 basis points) in two years while this change is almost zero for voluntary users and non-users. The difference between the mean of reduction in spread of mandatory users and voluntary users (non-users) is statistically significant at 1.0% (0.0%) while the difference between the median is significant at 9.4% (15.2%). We multiply this reduction in the cost of debt by the average value of floating debts in the year of initiation and two years after to calculate the dollar value of this saving. We multiply this value by (1 - tax rate) in which tax rate is the income tax divided by sales. Then we divide this value by total assets to measure the impact of this saving on return on assets (ROA). This reduction in cost of debt increases ROA by about 0.02 for mandatory users and has zero impact on that of voluntary and non-users. The coefficient of ROA in the baseline model is 0.46. Therefore, this saving increases the firm value by almost 1%. We should note that the impact of hedging is isolated in this calculation and this reduction is merely related to the change in the spread paid over LIBOR.

To identify the source of reduction in the cost of debt, we also analyze the change in creditworthiness of three groups by measuring the change in distance to default in two years after credit agreement. Two years after the loan inception, the average (median) increase in *Dist. to Def.* is almost 30% (16%) for mandatory users while it is 17% (8%) and 20% (10%) for voluntary and non-users, respectively. The mean (median) difference between mandatory and voluntary users is significant at 0.0% (0.0%) while it is significant at 0.0% (3.6%) for mandatory users and non-users. These results indicate one of the channels through which firms with IRPC reduce the cost of debt.

2.6 Conclusion

In this paper, we study the value implication of interest rate derivatives usage. We identify interest rate derivatives mandated by credit agreements. These derivatives are used for risk management purposes in contrast to voluntary hedging positions, which could be used for the self-benefit of the managers. We find that the average mandatory interest rate derivatives user enhances its value by 6% while a similar voluntary interest rate derivatives user does not experience any significant change. Our propensity score matching analysis shows that this impact is not influenced by selection bias. By interacting IRPC with cash flow, leverage, net worth, liquidity and CAPEX covenants, we show that the positive impact of IRPC is independent from the impact of other covenants in the credit agreements. Several empirical studies document that corporate governance and product market competition reduce the flexibility of managers in the (mis)use of corporate resources. In parallel to these findings, we show that these factors, particularly corporate governance, significantly reduce the gap between the value implication of mandatory and voluntary derivatives usage. We also study the impact of the FAS133 accounting standard for derivatives and hedging instruments. Consistent with the purpose of this rule, we document a positive and statistically significant valuation effect of FAS133. The positive valuation impact of interest rate hedging imposed by creditors remains positive, even after the adoption of FAS133. Interestingly, the valuation of voluntary users does not differ from that of mandatory users. Lastly, we also analyze the sources of value creation following the implementation of IRPCs. We find that the growth in investments and the reduction in cost of debt are the main consequence of imposing IRPCs, which generate value for the firm.

In summary, this study provides a new insight into the value implication of risk management and highlights the critical role of shareholders' perception about derivative positions in value generation of financial instruments; see Campello et al. (2011) and Chernenko and Faulkender (2011). It also complements the empirical studies that show a reduction of the cost of debt by mandatory use of IR derivatives and documents the ultimate positive impact of these derivatives on firm value; see Beatty et al. (2011). The result of this research illustrates how shareholders value the indirect influence of creditors on financial decisions despite the existence of conflict of interest between creditors and shareholders.

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Appendix 2

Table 2.A1: Sample construction

Panel A: Sample selection			
	Contracts	Firm-year	Firms
Initial sample	8783		1618
Term Loans from 10-K and 10-Q search	330		382
Special contracts	-5047		-120
Maturity year before 1998 and less than one year	-221		-124
Utilities and Financials	-236		-130
Map contract-years to firm-years		6536	1297
Merge with COMPUSTAT		-336	-38
Missing IR hedging information		-365	-43
Missing or zero float rate exposure		-1199	-99
Final sample		4636	1117

Panel B: Industry distribution (firm-years)			
	Mandatory users	Voluntary users	Non-users
01-09 Agriculture	0	4	5
10-19 Mining and construction	36	136	253
20-27 Food, paper, and finished goods	74	198	269
28-29 Chemicals and pharmaceuticals	28	109	135
30-34 Rubber, leather, and metal works	29	134	178
35-36 Machinery and electronics	53	203	324
37-39 Other equipment and machinery	63	167	240
40-48 Transportation and telecom	149	216	210
50-51 Wholesalers	15	103	132
52-59 Retailers	43	133	151
70-79 Personal and business services	133	181	277
80-99 Other services	41	62	152
Total	664	1646	2326

Panel C: Year distribution (firm-years)			
	Mandatory users	Voluntary users	Non-users
1998	51	181	252
1999	61	180	252
2000	85	185	248
2001	86	187	260
2002	87	178	279
2003	70	172	263
2004	63	167	239
2005	62	157	235
2006	37	86	127
2007	62	153	171
Total	664	1646	2326

Table 2.A2: Definitions and sources of the variables

Variable name	Description	COMPUSTAT Item
Advertisement	Advertising expense divided by sales. Zero for missing variables.	data45 / data12
Assets	Book value of total assets.	data6
CAPEX	Capital expenditures divided by total assets.	data128/data6
Distance to Default	See Crosbie and Bohn (2003).	
Dividend	A dummy equals to one if common dividend is paid and zero otherwise.	data21
IRP	Net notional value of interest rate derivatives divided by total assets.	
IR exposure	Notional value of debts with variable interest rate divided by (Total assets – book value of equity).	
Q ratio	Market value of equity at fiscal year-end plus total assets minus book value of equity) divided by total assets.	(data199 × data25 + data6 – data60)/data6
R&D	Research and development expenses divided by total assets (zero if missing).	data46/data6
ROA	Net income divided by total assets.	data172/data6
Tangibility	Net properties, plant and equipment divided by total assets.	data8 / data6

Table 2.1: Descriptive statistics

This table reports the characteristics of the firms depending on derivatives usage. The definition of the variables is available in the Appendix, Table A2. Panel A reports the characteristics and a pairwise test of the difference between interest rate derivatives users versus non-users. Panel B split the interest rate derivatives users into mandatory interest rate derivatives users and voluntary interest rate derivatives users. *, **, *** represent 10%, 5%, and 1% significant level of the t-test (Wilcoxon rank-sum Z-test) for the mean (median) comparison.

Panel A: Interest rate derivative users versus non-users

	Interest rate derivative users (i) N = 2310					Interest rate derivative non-users (ii) N = 2326					(i) – (ii)	
	Mean	SD	25th	50th	75th	Mean	SD	25th	50th	75th	Mean	Median
Log of Q	0.30	0.42	0.02	0.24	0.53	0.32	0.45	0.01	0.25	0.56	-0.02**	-0.01
IRP	0.14	0.17	0.05	0.10	0.19	-	-	-	-	-	-	-
IR Exposure	0.35	0.29	0.17	0.31	0.47	0.26	0.28	0.09	0.21	0.38	0.09***	0.10***
Assets	3176.12	8388.69	338.93	973.19	2387.00	1825.70	8281.07	176.52	493.95	1285.56	1350.42***	479.24***
Tangibility	0.34	0.23	0.14	0.28	0.48	0.32	0.24	0.13	0.25	0.47	0.02**	0.03***
ROA	0.02	0.12	0.00	0.03	0.06	0.01	0.15	-0.01	0.03	0.07	0.01***	0.00
Dist. to Def.	29.78	32.27	22.90	33.65	45.40	26.71	29.44	20.32	29.38	40.80	3.07***	4.27***
CAPEX	0.06	0.06	0.02	0.04	0.07	0.06	0.07	0.02	0.04	0.07	0.00	0.00
R&D	0.01	0.03	0.00	0.00	0.01	0.01	0.03	0.00	0.00	0.01	0.00	0.00
Advertisement	0.01	0.03	0.00	0.00	0.01	0.01	0.03	0.00	0.00	0.00	0.00	0.00
Dividend	0.01	0.02	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.01***	0.00

Panel B: Mandatory versus Voluntary IR derivative users												
	Mandatory users (i) N = 664					Voluntary users (ii) N = 1646					(i) – (ii)	
	Mean	SD	25th	50th	75th	Mean	SD	25th	50th	75th	Mean	Median
Log of Q	0.32	0.44	0.02	0.26	0.57	0.29	0.41	0.02	0.23	0.50	0.03*	0.03
IRP	0.19	0.16	0.09	0.15	0.24	0.13	0.17	0.04	0.08	0.16	0.06***	0.07***
IR Exposure	0.40	0.27	0.23	0.38	0.54	0.32	0.30	0.16	0.28	0.44	0.08***	0.10***
Assets	1564.6	2636.04	236.5	654.1	1763.48	3826.21	9721.26	402.52	1143.94	2746.7	-2261.61***	-489.84***
Tangibility	0.31	0.22	0.12	0.26	0.44	0.35	0.24	0.15	0.3	0.51	-0.04***	-0.04***
ROA	0.00	0.17	-0.02	0.02	0.05	0.03	0.1	0.01	0.03	0.06	-0.03***	-0.01***
Dist. to Def.	25.78	32.32	20.11	30.06	41.38	31.39	32.13	24.49	34.87	47.14	-5.61***	-4.81***
CAPEX	0.06	0.06	0.02	0.04	0.08	0.06	0.06	0.02	0.04	0.07	0.00	0.00
R&D	0.01	0.02	0.00	0.00	0.00	0.01	0.03	0.00	0.00	0.01	0.00	0.00
Advertisement	0.01	0.03	0.00	0.00	0.01	0.01	0.03	0.00	0.00	0.01	0.00	0.00
Dividend	0.01	0.03	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.01	0.00	0.00

Table 2.2: The impact of IRP on firm value

This table presents the results of the regressions examining the impact of interest rate protection on firm value. The dependent variable is the log of Tobin's Q ratio. *IRP* measures the interest rate derivatives hedging intensity. *Mandatory* is a dummy equal to one if the *IRP* is required by lenders. The description of the remaining variables is available in the Appendix, Table A2. In column (1) and (2), *IRP* is the net value of the notional of float-to-fixed and fixed-to-float derivatives divided by Total Assets. In column (3), Fixed to Float derivative users are excluded. In column (4), firms hedging currency risk exposure and commodities with derivatives are excluded, the intensity of hedging being estimated as in column (2). The estimations are corrected for heteroskedasticity and within-firm error clustering. We report the corresponding coefficient and the *t* statistics below. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

	IR Hedging	Baseline	Float to Fixed Only	Without FX and Other hedgers
	(1)	(2)	(3)	(4)
IRP	0.112**	0.052	0.053	0.047
	[2.17]	[1.21]	[1.15]	[1.06]
Mandatory		-0.049	-0.052	-0.046
		[1.60]	[1.57]	[1.43]
IRP×Mandatory		0.307***	0.316***	0.276**
		[2.79]	[2.85]	[2.46]
IR Exposure	-0.026	-0.018	-0.014	-0.014
	[0.85]	[0.61]	[0.41]	[0.47]
Log of assets	-0.194***	-0.192***	-0.189***	-0.205***
	[8.63]	[8.57]	[7.83]	[8.51]
ROA	0.454***	0.460***	0.465***	0.447***
	[4.08]	[4.18]	[4.00]	[3.90]
Dividend	0.007	0.005	0.003	0.008
	[0.30]	[0.18]	[0.10]	[0.31]
Tangibility	-0.273**	-0.273**	-0.285**	-0.285**
	[2.22]	[2.23]	[2.08]	[2.19]
Dist. to Def.	-0.003**	-0.003**	-0.004**	-0.003**
	[2.06]	[2.33]	[2.27]	[2.20]
CAPEX	0.562***	0.572***	0.600***	0.595***
	[3.80]	[3.90]	[3.71]	[3.89]
R&D	0.621	0.617	0.738	0.525
	[0.86]	[0.85]	[0.98]	[0.69]
Advertisement	-0.273	-0.248	-0.322	-0.309
	[0.36]	[0.32]	[0.35]	[0.39]
Firm FE	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.71	0.71	0.71	0.71
# of Observations	4625	4625	4127	4252

Table 2.3: The impact of IRP on firm value: A propensity score approach

This table presents the comparison of Log of Tobin's Q ratios of interest rate derivatives users versus non-users, and mandatory versus non-users. The treatment effect is the use (mandatory use) of interest rate derivatives in Panel A (B). Control firms are the matched firm-years after propensity score matching procedure explained in the text. The number of observations (firm-year) is reported separately. In Panel A, non-users whose propensity scores are equal to or lower than 0.01 are used as controlled firms (caliper). In Panel B, we exclude voluntary IR derivatives users and repeat the test as in Panel A. The difference of the mean (median) of Log of Q ratios of treated and controlled firm-years and the corresponding p-value of pairwise *t*-test (Wilcoxon rank-sum *Z*-test) is reported.

	Observations		Mean		Median	
	Before matching	After matching	Before matching	After matching	Before matching	After matching
Panel A: All IR derivatives users versus non-users						
Log of Q (Treated)	2207	2084	0.30	0.30	0.24	0.25
Log of Q (Control)	2420	2245	0.32	0.31	0.24	0.26
Difference			-0.02	-0.01	0.00	-0.01
p-value			6.1%	17.8%	37.3%	42.5%
Bias (absolute)			14.5%	3.3%	8.4%	2.6%
Panel B: Mandatory IR derivatives users versus non-users						
Log of Q (Treated)	653	608	0.32	0.33	0.26	0.28
Log of Q (Control)	2429	1839	0.32	0.28	0.24	0.21
Difference			0.00	0.05	0.02	0.07
p-value			50.3%	2.9%	48.2%	2.0%
Bias (absolute)			14.8%	4.4%	10.2%	4.8%

Table 2.4: Interest rate derivatives and other covenants

This table presents the results of the regressions examining the impact of covenants in credit agreements and their interaction with *IRP* on firm value. The dependent variable is the log of Tobin's Q ratio. *IRP* measures the interest rate derivatives hedging intensity of firms. *Mandatory* is a dummy equal to one if the *IRP* is required by lenders. *Covenant* is a dummy equal to one if the firm-year is subject to the financial covenant corresponding to each column and zero otherwise. The description of the remaining variables is available in the Appendix, Table A2. The estimations are corrected for heteroskedasticity and within-firm error clustering. We report the corresponding coefficient and the *t* statistics below. The *p*-values of the Wald test for the difference between each and its nested model (without *Covenant* and its interaction terms) is reported, separately. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

	Cash flow (1)	Leverage (2)	Net worth (3)	Liquidity (4)	CAPEX (5)
IRP	0.017	0.063	0.023	0.037	0.02
	[0.38]	[1.39]	[0.51]	[0.94]	[0.47]
Mandatory	-0.051	-0.048	-0.035	-0.05	-0.043
	[1.51]	[1.47]	[0.94]	[1.63]	[1.32]
Covenant	-0.009	0.048*	-0.02	-0.016	-0.013
	[0.52]	[1.77]	[1.07]	[0.40]	[0.63]
IRP × Mandatory	0.274**	0.300***	0.384***	0.314***	0.274**
	[2.16]	[2.62]	[2.97]	[2.90]	[2.10]
IRP × Covenant	0.219**	-0.05	0.11	0.115	0.118
	[2.15]	[0.54]	[1.27]	[0.95]	[1.20]
Mandatory × Covenant	0.007	-0.018	-0.029	-0.034	-0.018
	[0.15]	[0.28]	[0.55]	[0.20]	[0.35]
IRP × Mandatory × Covenant	-0.033	-0.022	-0.287	0.24	0.087
	[0.17]	[0.05]	[1.47]	[0.31]	[0.45]
IR Exposure	-0.021	-0.015	-0.017	-0.019	-0.024
	[0.73]	[0.50]	[0.60]	[0.66]	[0.77]
Log of assets	-0.191***	-0.192***	-0.192***	-0.192***	-0.192***
	[8.59]	[8.53]	[8.60]	[8.52]	[8.57]
ROA	0.464***	0.457***	0.461***	0.460***	0.460***
	[4.27]	[4.28]	[4.23]	[4.17]	[4.17]
Dividend	0.004	0.003	0.003	0.005	0.004
	[0.14]	[0.12]	[0.14]	[0.21]	[0.18]
Tangibility	-0.281**	-0.273**	-0.267**	-0.271**	-0.262**
	[2.29]	[2.22]	[2.18]	[2.21]	[2.12]
Dist. to Def.	-0.003**	-0.003**	-0.003**	-0.003**	-0.003**
	[2.37]	[2.29]	[2.23]	[2.34]	[2.42]
CAPEX	0.570***	0.575***	0.569***	0.572***	0.567***
	[3.91]	[3.92]	[3.90]	[3.94]	[3.89]
R&D	0.64	0.616	0.606	0.616	0.606
	[0.89]	[0.85]	[0.84]	[0.86]	[0.84]
Advertisement	-0.202	-0.247	-0.256	-0.248	-0.236
	[0.26]	[0.32]	[0.33]	[0.32]	[0.31]
Firm FE	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.71	0.71	0.71	0.71	0.71
# of Observations	4625	4625	4625	4625	4625
Wald test (p-value)	14.5%	48.2%	10.1%	87.1%	55.8%

Table 2.5: Interest rate derivatives and controlling forces

This table presents the results of the regressions examining the impact of corporate governance and competition in the product market and their interaction with *IRP* on firm value. The dependent variable is the log of Tobin's Q ratio. *IRP* measures the interest rate derivatives hedging intensity of firms. *Mandatory* is a dummy equal to one if the *IRP* is required by lenders. *StrictGov* (respectively *Competition*) is a dummy equal to one if the level of the G7 index (respectively Product market fluidity index) is equal or greater than the median of the sample in the same year and zero otherwise. The description of the remaining variables is available in the Appendix, Table A2. The estimations are corrected for heteroskedasticity and within-firm error clustering. We report the corresponding coefficient and the *t* statistics below. The *p*-values of the Wald test for the difference between each and its nested model (without *Force* and its interaction terms) is reported, separately. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

	StrictGov (1)	*Competition* (2)
IRP	-0.078	0.078
	[0.82]	[1.12]
Mandatory	-0.111***	-0.064
	[2.59]	[1.42]
Force	-0.023	0.012
	[0.94]	[0.66]
IRP × Mandatory	0.594***	0.423**
	[4.23]	[2.24]
IRP × Force	0.193*	-0.04
	[1.86]	[0.53]
Mandatory × Force	0.119**	0.015
	[2.11]	[0.31]
IRP × Mandatory × Force	-0.514**	-0.145
	[2.13]	[0.67]
IR Exposure	-0.012	-0.022
	[0.36]	[0.68]
Log of assets	-0.194***	-0.193***
	[8.10]	[8.59]
ROA	0.506***	0.463***
	[4.06]	[4.17]
Dividend	0.013	0.003
	[0.47]	[0.13]
Tangibility	-0.339**	-0.278**
	[2.41]	[2.27]
Dist. to Def.	-0.003*	-0.003**
	[1.94]	[2.25]
CAPEX	0.553***	0.580***
	[3.35]	[3.97]
R&D	0.33	0.61
	[0.38]	[0.85]
Advertisement	-0.247	-0.263
	[0.31]	[0.34]
Firm FE	Yes	Yes
Industry-Year FE	Yes	Yes
Adjusted R^2	0.71	0.71
# of Observations	3366	4609
Wald test (p-value)	14.1%	87.3%

Table 2.6: Interest rate derivatives and FAS133 accounting standard

This table reports the difference-in-differences estimate of the Log of Tobin's Q ratio of mandatory (treated) and voluntary (control) interest rate derivatives users until 2002 (one year after FAS133 generally takes effect) and after 2002. Mandatory and Voluntary IR derivative users are matched with propensity scores explained in the text. Panel A and B report the comparison before and after the adoption of FAS133, respectively. The difference between the mean and the median of the distance between the Log of Q ratios of the mandatory and voluntary IR derivative users before and after FAS133 is reported in Diff-in-Diff estimates. The p-values are reported for the *t*-test (Wilcoxon rank-sum *Z*-test) for the mean (median) comparison.

	Observations		Mean		Median	
	Before matching	After matching	Before matching	After matching	Before matching	After matching
Panel A: Mandatory IR derivatives users versus voluntary users until 2002						
Log of Q (Treated)	362	325	0.29	0.31	0.19	0.22
Log of Q (Control)	872	659	0.23	0.24	0.14	0.19
Difference			0.06	0.07	0.05	0.03
p-value			1.1%	2.6%	5.4%	24.1%
Bias (absolute)			24.8%	5.7%	22.9%	3.8%
Panel B: Mandatory IR derivatives users versus voluntary users after 2002						
Log of Q (Treated)	291	252	0.35	0.36	0.32	0.34
Log of Q (Control)	682	506	0.37	0.39	0.34	0.30
Difference			-0.02	-0.03	-0.02	0.04
p-value			23.5%	23.6%	24.1%	20.9%
Bias (absolute)			25.2%	4.4%	20.7%	2.9%
Diff-in-Diff (matched)			-	-0.10	-	0.01
p-value			-	3.1%	-	16.1%

Table 2.7: Interest rate derivatives and FAS133 accounting standard

This table presents the results of the regressions examining the influence of FAS133 accounting standard on value implication of interest rate derivatives and the marginal impact of mandatory use of these derivatives. The dependent variable is the log of Tobin's Q ratio. *IRP* measures the interest rate derivatives hedging intensity of firms. *Mandatory* is a dummy equal one if the *IRP* is required by lenders. *After*2002 is a dummy equal one if year is after 2002 (one year after FAS133 generally takes effect), and zero otherwise. The explanations of all variables are available on Appendix A2. The estimations are corrected for heteroskedasticity and within-firm error clustering. We report the corresponding coefficient and the *t* statistics below. The p-values of the Wald test for the difference between each and its nested model (without *After2002* and its interaction terms) is reported, separately. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

	Voluntary vs. non-users (1)	Mandatory vs. non-users (2)	IR derivatives users vs. non-users (3)
IRP	0.007	0.319**	0.012
	[0.15]	[2.39]	[0.29]
After2002	0.358***	0.068***	0.522***
	[3.61]	[2.58]	[7.90]
After2002 × IRP	0.182**	-0.075	0.151**
	[2.55]	[0.48]	[2.24]
Mandatory			-0.043
			[1.06]
Mandatory × IRP			0.281*
			[1.75]
After2002 × Mandatory			-0.009
			[0.18]
After2002 × Mandatory × IRP			-0.030
			[0.15]
IR Exposure	-0.023	-0.052	-0.019
	[0.67]	[1.18]	[0.65]
Log of assets	-0.190***	-0.214***	-0.192***
	[8.00]	[6.27]	[8.56]
ROA	0.470***	0.386***	0.460***
	[5.17]	[3.20]	[4.17]
Dividend	0.003	0.002	0.003
	[0.10]	[0.07]	[0.13]
Tangibility	-0.260**	-0.376**	-0.274**
	[1.98]	[2.34]	[2.23]
Dist. to Def.	-0.002*	-0.004*	-0.003**
	[1.66]	[1.85]	[2.28]
CAPEX	0.534***	0.607***	0.576***
	[3.51]	[3.80]	[3.97]
R&D	-0.015	0.946	0.604
	[0.02]	[1.06]	[0.84]
Advertisement	-0.050	-0.636	-0.255
	[0.05]	[0.59]	[0.33]
Firm FE	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes
Adjusted R^2	0.74	0.71	0.73
# of Observations	3972	3073	4625
Wald test (p-value)	0.0%	3.1%	0.0%

Chapter 3: Why do firms with investment grade rating borrow from private lenders?

3.1 Introduction

Starting with Modigliani and Miller (1958), the choice between debt and equity has attracted a lot of attention in the academic world. A large body of theoretical and empirical research explains how market frictions shape the corporate decision-making in financing projects; see Frank and Goyal (2008), Graham (2008) for recent surveys. In particular, information asymmetries between creditors and borrowers help understand the co-existence of public and private debt markets. Diamond (1984, 1991) and Fama (1985) argue that private lenders are better at monitoring borrowers compared to individual bondholders who have less experience, fewer resources, or willingness to control. To summarize, private lenders are superior to public creditors in financing "information-problematic" firms; see Carey, Post and Sharpe (1998, p. 845). In addition, the renegotiation of private debt contracts is easier when firms default, which significantly reduces the liquidation costs; see, e.g., Berlin and Master (1992), Rajan (1992), and Gorton and Kahn (2000). Therefore, information asymmetries between investors and the firm combined with an easy renegotiation in case of default shape the private loans market.

However, empirical evidence shows that investment grade firms facing lower information asymmetries sometimes raise private debt. In this paper, I ask the following question: Why investment (non-investment) grade firms, with reduced information asymmetries, sometimes prefer private (public) debt to public bond (private debt) markets? I explore an alternative hypothesis, i.e. the impact of firm systematic risk, on the choice between private and public debt.

Empirical evidence shows that the private and public debt markets are populated with investors having different investment horizons. On one hand, the private debt market attracts "hold-to-maturity" investors while, on the other hand, the public debt market is mainly composed of investors that rebalance their holdings more frequently. The typical maturity (median) of a private debt is half of maturity of a public debt, their respective trading volumes is one to ten.

From a theoretical perspective, a corporate bond can be seen as a portfolio of long on a risk free bond and short on a European put option written on the corporate assets, with an exercise price and a maturity equal to the face value and the maturity of the debt; see Merton (1974). If the bondholder closes her position before maturity, the bondholder cares about the price of the put option, which includes the expected cost of default. While investors rebalancing their portfolio care about the total value of the put option, "hold-to-maturity" investors are only concerned with the cost of default. When the premium associated to credit risk is negligible (investment grade issues), I argue that high systematic risk firms issuing public instead of private debt pay a premium. Conversely, when the credit risk premium is significant (non-investment grade issues), high systematic risk firms issuing private debt pay a premium.

To test my conjecture, I use a sample of 3323 (984) private and 2929 (1843) public investment (non-investment) grade debts of US listed firms from 1990 to 2011. I test the impact of systematic risk, lender type, and their interaction on the yield spread of these contracts. After controlling for debt contract specifications, firm characteristics, and macroeconomic factors, I find that the impact of the systematic risk (beta) on the real cost of investment grade debt is significantly higher (p-value = 1.8%) in public debt than in private debt. The impact of systematic risk is almost 16% higher than that of its counterfactual (private debt). For non-investment grade issuers, the result is the opposite. Choosing a public contract significantly reduces the impact of systematic risk on the cost of debt (p-value = 0.0%). A typical non-investment grade issuer reduces the impact of systematic risk on the real cost of debt by almost 18% through the issuance of a public debt. To summarize, these empirical results are consistent with my conjecture.

To cement my hypothesis, I show that debt issuers consider the impact of systematic risk when issuing private or public debt. Indeed, investment grade public debt issuers have a significantly lower beta (*p*-value = 1.1%) than private debt issuers. I also find that non-investment grade public debt issuers have a significantly higher systematic risk than private issuers (p-value = 1.20%). A 1% increase in log of beta reduces (increases) the odds of choosing a public agreement by 12% (28%) for investment (non-investment) grade borrowers. It indicates a considerable difference in the systematic risk of private and public debt issuers. These findings are robust to different systematic risk estimates (i.e., the beta from the CAPM or the Fama and French (1992) three-factor models, time horizon - one to five years - and the frequency of returns -daily vs monthly).

Despite this strong evidence, the selection bias and simultaneity are concerns in interpreting these results. To address these issues, I match private and public investment (non-investment) grade issuers based on their propensity score. For investment (non-investment) grade public debt issuers, the average beta is 7% (22%) lower (higher) than that of private debt issuers (p-value < 1%).24 A nonparametric test between the beta of public debt issuers and of their private issuers' counterfactual asserts that the results are not driven by a small number of observations. The propensity score matching significantly reduces the average (median) bias from 49.7% (26.1%) and 21.5% (12.9%) to lower than 4.1% (3.1%) and 4.0% (3.0%) for investment and non-investment grade debts, respectively. Given the low bias in the controlling variables, there is little chance that unobservable variables affect significantly the results. To alleviate the remaining

[24] The difference in systematic risk between the medians of public debt issuer is 5% (19%) lower (higher) than that of private debt issuers and where the difference is significant at 1% level.

concern of unobservable variables and simultaneity in my result, I turned my attention to the secondary loan market. The introduction of syndicated loan ratings by Moody's and S&P in 1995 had a significant impact on liquidity and trading volumes in the secondary loan market. Consequently, this innovation changed private lenders investment horizon. Therefore, I consider the initiation of a loan rating service as a quasi-natural experiment and conduct a difference-in-differences matching test between the difference of systematic risk of private and public debt issuers before and after the introduction of a rating service for investment grade debt issuers. For this test, I focus on non-speculative debts to reassure that the incentive of trade was not related to the private information of the poor performance of the debt. This analysis reveals that the systematic risk of private debt issuers is significantly lower than that of public debt issuers before the introduction of the loan rating service. This difference vanishes after the loan rating service is settled in the market.

This paper contributes to the debt structure literature by contrasting the impact of systematic risk in the private and public debt markets. I show that the emergence of the fast growing secondary loan market must be taken into account. An active secondary market diminishes the advantage of private lending based on information asymmetry and controlling incentives while it raises the exposure of loan securities to systematic risk. This research shows empirically how the investment horizon influences the impact of systematic risk in pricing risky assets. It also documents the indirect impact of the secondary loan market on the cost of debt in private lending which is unfavorable for firms with high systematic risk.

The remainder of the paper is organized as follows. Section 3.2 reviews the related literature. Section 3.3 explains the construction of the sample. Section 3.4 presents the empirical models and reports the results. Section 3.5 describes how potential selection bias is controlled for and reports the difference-in-differences estimates based on the introduction of a loan rating service. Some additional robustness checks are also presented Section 3.6 concludes the paper.

3.2 Review of the literature

This intuition concerning the role of systematic risk on the choice of private debt versus public debt comes from the similarity of risk characteristics in stock and bond returns. Campello, Chen, and Zhang (2008) explain that bonds and equity naturally share similar risk factors since both are contingent claims written on the same risky assets. In their multi-period cross-sectional tests, they show that firms with a higher systematic risk have a higher yield, even after controlling for default risk. Kwan (1996) and Hotchkiss and Ronen (2002) also show a strong correlation between stock and bond returns. At first glance, these findings contradict Fama and French (1993), who show that the interest rate risk (*TERM*) and the default premium (*DEF*) dominate the impact of market risk and almost completely explain bond returns. However, by working on the spread between corporate bond yields and Treasury (or AAA corporate bond) and by separating the premium for default risk from the yield spread, the impact of *TERM* and *DEF* is almost eliminated.

The empirical evidence shows that bond yields net of *TERM* and *DEF* are largely explained by market risk. Elton, Gruber, Agrawal, and Mann (2001) demonstrate that systematic risk strongly explains the spread between corporate and Treasury bonds yields, even after controlling for the costs related to expected default. Moreover, in contrast to government bonds, corporate bond returns move systematically with other assets in the market. Therefore, investors require a premium for corporate bond yields to compensate for this risk, just like as for any other asset. Since the compensation for this risk in capital markets changes over time, it introduces a systematic impact on yield spread as well. Further research reaffirms these findings by explaining that the impact of systematic risk is not limited to its influence on the probability of default. Chen, Lesmond, and Wei (2007) show that default risk does not fully explain the yield spread in the bond market. Consequently, the impact of systematic risk on the yield spread is significant, even in states with low probability of default. Huang and Huang (2012) also find that a small fraction of the yield spread is associated with credit risk, particularly for non-speculative bonds. In sum, as stated in Fama and French (1993), interest rate and default risk are the main risk factors in bond returns while systematic and default risks are the major factors in yield spreads.

An important difference between the bond and the loan secondary markets is their respective trading volumes. While private lenders are akin to a "hold-to-maturity" strategy, bondholders are generally trade-oriented investors. From 2002 to 2012, the median of annual trading volume in the bond market is more than $4255B while the median of trading volume at secondary loan market is $395B.[25] The difference in the median of the trade volume over new issue is also significantly different. For the same period, the median of this ratio is more than 5.1 for the bond market compared to 1.2 for the loan market. The securitization of corporate loans also does not show any significant trading activity compared to the bond market. For instance, the median of the annual Collateralized Loan Obligation (CLO) issuance is $20B from 2002 to 2012, according to Thomson Reuters CLO Primer 2013 report.

Assuming zero default probability, the "hold-to-maturity" investment strategy in the debt market makes the cash flow of a corporate bond deterministic (coupon payments plus face value paid at maturity). Therefore, "hold-to-maturity" limits the impact of systematic risk to its influence on the probability of default.[26] I mirror the distinction

[25] These figures are from the Securities Industry and Financial Markets Association and LPC DealScan respectively.

[26] As I discuss the yield spread in corporate bonds, I assume the interest rate risk is negligible in spread.

between short and long-term investment horizons to the investment strategy of public bondholders and private lenders, respectively.

As shown above, private lenders are less likely to trade. Hence, they are not concerned about the inter-temporal price variations of debt securities and have a lower expected premium for systematic risk. All else being equal, the cost of public debt should be higher than the cost of private debt for firms with high systematic risk. However, for debt with low credit quality, systematic risk is more related to the probability of default, which weakens the advantage of a "hold-to-maturity" strategy. In this case, because private lenders have more concerns about the default, they ask for a higher premium compared to public bondholders who are typically dispersed and exposed to smaller fractions of the debt. In addition, some specific private lenders, such as banks or insurance companies, face regulatory issues in holding low credit quality debts that offer extra cost burdens compared to individual bondholders.

I assume that the put option related to an investment grade debt is completely "out-of-the-money" (the face value of the debt is substantially lower than corporate assets and is less likely to be exercised) while the same option related to a non-investment grade debt is almost "at-the-money" (the face value of the debt is almost equal to corporate assets and more likely to be exercised). Moreover, an investor with a "hold-to-maturity" investment strategy closes her position (buys the put option) near to maturity while a trade-oriented investor might close her position at any time before maturity. Since my argument is based on yield spread, I ignore the interest rate risk (i.e., the sensitivity of the value of the risk free bond) and analyze the sensitivity of the value of the put option to the volatility of its underlying assets. I decompose the volatility of the assets to systematic and idiosyncratic risks. Investors are able to diversify specific risk. As a result, systematic risk is the main factor of volatility. In this context, I evaluate the sensitivity of the put option (delta) in four different scenarios.

[Figure 3.1]

Figures 3.1.A and 3.1.B show the delta for arbitrary out-of-the-money put options which replicate investment grade debts with 0.1 and five-year maturity, respectively. The sensitivity of “out-of-the-money” put options close to maturity is almost zero (see Figure 3.1.A). In addition, it does not change significantly with the volatility of the underlying asset. However, delta increases when time to maturity is five years and, more importantly, it increases significantly with volatility (see Figure 3.1.B). Trade-oriented (“hold-to-maturity”) investors have more concern about delta during life (close to maturity) of the put option. This sensitivity is considerable in periods distant from maturity. Since systematic risk mainly drives sensitivity (investment grade debt has a low probability of default), it also shows that trade-oriented investors in public debt market expect a higher premium. Results for an “at-the-money” put option akin to non-investment grade debts are shown in Figure 3.1.C and 3.1.D. In contrast to the previous scenario, the price of an “at-the-money” put option close to maturity (T = 0.1) is very sensitive to the volatility of the underlying asset. With a five-year maturity, delta changes slowly with volatilities lower than 20% and even decreases with volatilities above 20%. Therefore, in opposite to investment grade debts (out of the money options), “hold-to-maturity” investors have more concern about volatility and expect a higher premium for bearing systematic risk.

While increase in systematic risk raises the yield spread based on market risk premium, it also accounts for an increase in the premium for default risk. Therefore, to test my hypothesis, I need to disentangle the impact of beta on default risk from its impact on the real cost of debt (net of default premium). Following Cooper and Davydenko (2007), I calculate the spread related to the expected default loss (δ). Then, I conduct my tests on the real cost of debt (*Net spread*), (i.e., the total spread minus δ).[27] Similar to Huang and Huang (2012), I separate investment from non-investment grade issuances, which are more vulnerable to default, and I conduct my test on the two groups separately. In this context, I test the interplay between the impact of systematic risk on the real cost of debt and lender type (public versus private) in states distant from default (investment grade issuance). Similarly, I evaluate this relation in states close to default for non-investment grade (high-yield) debts.

3.3 Data and methodology

3.3.1 Impact of systematic risk on the cost of debt

I collect bank loans from 1990 to 2011 on Loan Pricing Corporation's DealScan. From this list, I identify firms publicly traded in the US by matching names and tickers. This leaves 6016 contracts in my list including contract details such as all-in-spread of the loan, currency, amount, maturity, type, rating, and purpose. I drop deals with currencies other than US dollars since the term structure is not similar for all currencies. I also drop deals with special purposes such as "debtor in possession" or "commercial paper backup". I also exclude financial institutions and utilities (SIC code starting with 6 or 9), and loans with less than one year to maturity. I obtain 5604 contracts, of which 455 are non-investment grade issues.

Nonconvertible public debt issuance and non-bank private loans are from Security Data Company (SDC) for the same period. As with the bank loans, financial institutions and utilities (one-digit SIC codes equal to 6 or 9 respectively), deals with currencies other than USD, and bonds with maturity lower than one year, are eliminated. This leaves 3695 (5969) private (public) contracts of which 1370 (1637) are non-investment grade

[27] Campello, Lin, Ma, and Zou (2011) also use the same methodology for calculating the real cost of debt.

issuances. Debt issues with credit rating equal or better than BBB are classified as investment grade. For debt issues without rating, I refer to the SDC classification in which high yield bonds are explicitly identified. Speculative loans in LPC DealScan are classified as "non-investment grade" securities.

Next, I merge these two datasets and match these observations with CRSP and COMPUSTAT. I keep those with: (a) no missing share price for twenty four consecutive months before debt issuance, and (b) non-missing firm characteristics such as assets, long term debts, outstanding shares, and EBIT at the end of the fiscal year following the debt issuance. In the last stage, I remove contracts with the same issuer, month, and year of issuance. I filter outliers with negative or zero sales or assets, and firms with negative EBITDA larger than assets. Ultimately, I have 3323 (984) investment (non-investment) private contracts, including private placements and bank loans, and 2929 (1843) investment (non-investment) grade public bonds in my sample; see Appendix 3.A.

3.3.2 Methodology

Since, the focus of this study is on the impact of systematic risk on the real cost of debt, I follow Cooper and Davydenko (2007) to disentangle the premium for default risk from the real cost of debt. I also follow Graham et al. (2008) for modelling debt spreads and testing the impact of systematic risk. My baseline model is:

$$Log\left(Net\ spread_i\right) = \alpha + \varphi_1 \times Public_i + \varphi_2 \times Log\left(Beta_i\right) + \varphi_3 \times Public_i \times Log\left(Beta_i\right) + \boldsymbol{\Gamma}'\mathbf{X} + \omega_i + \varepsilon_i \quad (1)$$

where *Log* (*Net spread*) is the logarithm of the yield spread net of premium for default as the dependent variable. This variable is constructed as follows. For bank loans, I follow Graham, Li, and Qiu (2008) and use the spread which is usually charged over an index, such as LIBOR, as the cost of debt[28]. For corporate bonds, I calculate the spread

[28] To control the maturity for spread in bank loans, I use the average of all AAA rating as a benchmark instead of those with the same maturity to have the spreads comparable between public and private debts.

between the yield-to-maturity of the issue and the average yield of AAA corporate bonds[29] at the issuance date since most public issues have fixed coupons. I find that LIBOR is more correlated to the yield of AAA corporate bonds than that of Treasury, i.e., 86% compared to 80% during my sample period (both are statistically significant at the 1% level). This makes the cost of debt between public and private debts more homogeneous.

The remaining variables are *Public,* a dummy variable that equals one if the contract is public and zero otherwise. *Beta* represents systematic risk extracted from CAPM or Fama and French (1992) three-factor model[30]. As the estimated betas are positively skewed, I use the natural logarithm of Beta as a measure of systematic risk. The coefficient of interaction between *Public* and *log (Beta)* is my main interest. In fact, this coefficient shows the difference in the impact of systematic risk on real cost of debt in public versus private debts. Based on my hypothesis, the coefficient φ_3 is positive (negative) and significant for investment (non-investment) grade debts. Control variables are firm characteristics (cash flow volatility, profitability, tangibility, market-to-book and leverage), contract details (type of contracts, credit ratings, callable bonds, performance pricing, and purpose of debts), and macroeconomic factors, which are used in Graham et al. (2008). Instead of Altman's (1968) Z-score, I use KMV-Merton distance to default (see Crosbie & Bohn, 2003), which is more informative because it takes into account the volatility and the value of assets. I also control for Industry fixed-effect (ω_i), and for non-bank debts with dummy variables.

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[29] A considerable portion of the yield spread between Treasury and corporate bonds is related to taxes; see, e.g. Elton et al. (2001) and Liu, Shi, Wang, and Wu (2007). Therefore, the yield spread of a bond over an AAA corporate bond issue is more comparable to the yield spread over LIBOR in bank loans.

[30] To ensure that missing prices or illiquid trading do not induce biases in systematic risk estimates, I use a two-year trailing period of monthly stock returns and CRSP value-weighted return before debt issuance. This time frame is sufficient to estimate the systematic risk and does not linger long enough to create a significant change in the systematic risk of the firm. In addition, since the average time between the two issues of the same firm is about twenty three months in my sample, this period minimizes the overlap of the period in calculation of the systematic risk.

3.4 Empirical tests and results

3.4.1 Univariate results

Table 3.1 shows the yearly distribution of public and private contracts for investment and non-investment grade issues. The number of contracts for each type is balanced in all years except during financial crisis in 2008 and 2009.

[Table 3.1]

It shows that in each year, a substantial number of investment grade borrowers issue private debt. Moreover, a significant increase in private debts with rating is observed after 1995.

Table 3.2 shows firm and contract specification of public and private debt issuers for investment and non-investment grade issuances, separately.

[Table 3.2]

The average (median) size and maturity of public investment grade debts is $291M ($200M) and 15.6 (12.2) years respectively. The average (median) size and maturity of investment grade private debts were $222M ($65M) and 7 (5) years respectively. These results are close to Denis and Mihov (2003) who study the determinants of placement structure of debt. The profitability, leverage, and tangibility are also comparable. However, due to the difference in the sample period, (1990-2011 in this paper as opposed to 1995-1996 in Denis and Mihov, 2003), the average of total assets is larger in my sample.

[Table 3.3]

As demonstrated in Table 3.3, public investment grade issuers have a significantly lower beta than private investment grade issuers while I find the opposite for non-investment grade issuers. Public debt issuers are more profitable, tangible, and stable in terms of cash flow volatility compared to private debt issuers. They have also higher (lower) distance to default (leverage). The comparison of debt contract specifications in Table 3.3 shows that the spread in private debts is larger than that of public ones. Nevertheless, the difference is negligible for speculative debts. The comparison between investment and non-investment grade issuers also shows that speculative debts have higher spread, lower maturity, and size. Non-investment grade issuers are also less profitable, have lower distance to default, and have lower proportion of debt with maturity longer than three years compared to investment grade issuers. In sum, private and public debts are significantly different in terms of contract and issuer characteristics. Therefore, a multivariate analysis is needed to compare the systematic risk of the different group of borrowers

3.4.2 The impact of systematic risk on the net spread

To test my hypothesis on the impact of systematic risk on the net spread, I estimate equation (1) with an OLS regression. Table 3.4, Panel A displays estimates robust to heteroskedasticity and serial correlation (clustered at industry level) with betas estimated from CAPM and FF models, respectively. In parallel to my hypothesis, the coefficient of interaction between systematic risk and public dummy is positive for investment grade debts and statistically significant at 5% level; see columns (1) and (2). The impact is also economically significant. Based on this model, the impact of systematic risk on the real cost of debt is almost 16% higher than that in private debt.

[Table 3.4]

The coefficients of the control variables are consistent with Graham et al. (2008). Public debts have lower spread. Increases in profitability and tangibility reduce the real cost of debt while an increase in leverage, maturity, and size increases *Net spread*. The coefficient of *D-to-D* (Distance to Default) is positive and surprising at first glance. However, as I separate the premium for default in the spread, an increase in *D-to-D* diminishes the portion of spread related to default and leaves a higher spread related to the real cost of debt.

I conduct the same test on non-investment grade debts; see columns (3) and (4). In parallel to my hypothesis, the coefficient of the interaction between *log (Beta)* and *Public* is negative and statistically significant at 1% level. The impact of systematic risk is about 18% lower in public debts for non-investment grade debts in contrast to investment grade debts.

Despite the fact that my results are robust to different measurements of yield, one could argue that the spreads in loans and bonds are not homogeneous as LIBOR is a floating rate index. To address this concern, first I highlight the issue that my tests are conducted on spreads at the time of issuance where both LIBOR and corporate bond yields are deterministic. Second, I propose an alternative methodology for calculating yields. In fact, if a floating rate borrower bought a swap contract with the same maturity of the loan, it looked like it had issued a debt with fixed coupon payments equal to the swap rate plus the loan spread. In addition, since the face value of the loan is the amount that the borrower receives from the lender, I assume that this virtual bond is issued at par and consequently its yield is equal to coupon payments. The issue of upfront or annual fees in bank loans does not weaken my assumption of issuing a loan at par, as the all-in-spread item in LPC DealScan includes all fees including upfront and annual fixed charges. In this context, I have the yields for both public and private debts, which enables me to generate the spread based on a single index such as yields in AAA corporate bonds. The credit spread paid for swap contracts is negligible for investment grade debt issuers, but it is considerable for firms with a low credit rating. It should be noted that the data for swap rates with different maturities is available for years on and after 2000. Therefore, the drawback of this estimate is that my results are limited to investment grade debts after 2000.

Table 3.4, Panel B, reports the results based on this measurement of spreads. As reported in columns (1) and (2) of the table, the calculation of spread does not alter the coefficient of interplay between public debts and systematic risk. For both betas estimated by CAPM and FF models, the sign of interaction is positive and significant at 5% and is not significantly different from those in previous test. Altogether, these results strongly support my hypothesis and highlight the different impact of systematic risk in public and private debt for investment grade and non-investment grade debts, separately.

However, in doing all estimates with spreads based on Treasury and spreads based on corporate bonds with the same maturity, I find similar results. Moreover, I have a dummy variable for public debt in my model that assumes a distinct intercept for spread in public and private debts and control for unobservable differences in the two types of debts.

3.4.3 Impact of systematic risk on placement structure of debt

To test whether debt issuers identify this interaction, I infer that investment grade issuers with high systematic risk are less likely to issue public debt while the relation for non-investment grade issues is the opposite. Following Denis and Mihov (2003), I implement the following Logit regression:

$$\text{Prob}\left(\textit{Debt issuance} = \textit{Public}_i\right) = \alpha + \varphi_1 \times \textit{Log}\left(\textit{Beta}_i\right) + \mathbf{\Gamma}'\mathbf{X} + \omega_i + \varepsilon_i \quad (2)$$

where, *Public* is equal to one if debt issued is public and zero otherwise. Control variables are those used in Denis and Mihov (2003). To this baseline model, I also add the (logarithm of) age of the issuing firm, cash flow volatility, credit supply (quarterly GDP growth rate) as well as competition in choosing between public and private debts (Herfindahl index based on sales and two-digit SIC); see Krishnaswami, Spindt, and Subramaniam (1999) and Morellec et al. (2013). To proxy for information asymmetries, I also include the number of analysts covering the firm and idiosyncratic risk (measured by the standard deviation of the residual in the CAPM or FF models) in the model. In contrast to Denis and Mihov (2003), I conduct my test on investment and non-investment grade issuers separately.[31]

[Table 3.5]

Table 3.5 reports the estimates robust to heteroskedasticity and serial correlation (clustered at industry level). Column (1) and (2) show the coefficients with betas extracted from CAPM and FF models, respectively. As expected, the coefficient of *log of Beta* is negative and statistically significant at the 5% level. However, as reported in column (3) and (4), this coefficient is positive and (not) significant at 5% level for CAPM (FF) betas in non- investment grade debts. Investment grade debt issuers with high systematic risk are less (more) likely to issue a public debt. For instance, a 1% increase in systematic risk (CAPM) decreases the odds of issuing a public debt by 12% for investment grade issuers. The same increase in systematic risk would increase the odds of issuing public debt by 28% for speculative debts. This shows how debt issuers identify the distinct impact of systematic risk on the cost of public and private debts. The coefficients of the control variables are consistent with Denis and Mihov (2003), Krishnaswami et al. (1999) and Morellec et al. (2013). Information asymmetries are important factors in the placement structure of debt. In parallel to previous findings, the coefficient associated to the number of analysts (idiosyncratic risk) is positive (negative) and statistically significant at 1% level. Moreover, larger, older, and more profitable firms are more likely to issue public debts. Leverage and the proportion of debts with maturity longer than three years have an opposite sign for investment grade issuers compared to the estimates in Denis and Mihov (2003), but not so for speculative issuers. In parallel to Morellec et al. (2013), cash flow volatility and credit supply have a negative impact on issuing public debt particularly for non-speculative debts, but I do not

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[31] An alternative test is the use of dummy for speculative debts and its interaction with log (beta), conducting the test on whole sample. The results are consistent with those in equation (2). I report the results with this model to have consistency with equation (1) and propensity score matching reported in next section.

find any significant impact from competition on the placement structure of debt.

In parallel to previous studies, I also conduct the tests with other variables such as the amount of issue instead of size (Krishnaswami et al.,1999), a dummy for bankruptcy (Z-score < 1.81) instead of profitability (Denis and Mihov, 2003), and the product market fluidity index (Hoberg, Philips, and Prabhala, 2012) instead of the Herfindahl index (Morellec et al., 2013). The results are qualitatively similar.

3.5 Selection biases and simultaneity

3.5.1 Propensity score matching

To implement this test, I use the same control variables as in equation (2). With propensity scores generated by this model, I match each public debt issuer with private debt issuers whose propensity score is not more than 0.005 different (caliper 0.005) with replacement[32].

[Table 3.6]

Table 3.6, Panel A and B report the results with *Log* of Beta extracted from the CAPM and FF models for investment grade debts, respectively. The mean (median) of Log of Beta estimated with the CAPM is 7% (5%) lower for public debt issuers compared to private debt issuers; this difference is statistically significant at the 1% level. The mean (median) of FF systematic risk of public debt issuers is 6% (4%) lower than that of private debt issuers and statistically significant at the 1% level. The propensity score matching significantly reduces the mean (median) of biases to 4.1% (3.1%) and 5.6% (6.3%) for CAPM and FF tests, respectively. The results for non-investment grade issues are reported in Panel C and D. I find that the mean (median) of *Log of Beta* estimated by CAPM model of non-investment grade public debt issuers is 25% (21%) higher than that

[32] All of the estimates are obtained using Leuven and Sianesi (2003) psmatch2 and pstest programs for Stata.

of private issuers (p-value < 1%). However, this difference is only 2% (1%) for *Log of Beta* extracted from FF model and is not significant. Propensity score matching significantly reduces the bias in this test as well. The mean (median) of biases is 4.0% (3.0%) and 4.9% (4.3%) for the CAPM and FF models, respectively.

3.5.2 Loan rating in secondary market and Diff-in-Diff estimates

Despite the fact that the low biases in observable variables diminishes the likelihood of the impact of unobservable variables on the result, the concern of the selection bias from unobservable variables and simultaneity remains.

To address this issue, I need to define a factor with potential influence on the "hold to maturity" strategy of investors in the private debt market but exogenous to the characteristic and investment strategies of firms with respect to public debts. In this context, I test the impact of this exogenous factor on the difference between the systematic risk of private and public debt issuers.

To do so, I turn my attention to the introduction of loan rating in 1995 in the secondary loan market. This credit rating service was largely welcome in the market. For instance, by 2004, 30% of public firms had a loan rating while they did not have such credit figures in 1995; see Sufi (2009). Also, as shown in Table 3.1, there is a significant increase in the number of rated private debts that starts in 1996, particularly for non-investment grade debts. This loan rating service increases liquidity in the secondary market. It facilitates investment in private loans by investors such as CDOs or specialized loan funds who have limited resources in monitoring these issuers. As a result, the introduction of loan ratings has had significant impact on the trading volume of loans, e.g., from $8B in 1991 to $520B in year 2007 (Figure 3.2) and consequently, on the investment behavior of private lenders.

[Figure 3.2]

As discussed in Parlour and Plantin (2008), banks have two incentives in selling their loan portfolio in the market. They trade the loans with poor performance based on their private information, or they offer the loan in the secondary market to raise funds and exploit new investment opportunities. An active secondary market is an indication of low adverse selection risk. In liquid markets, new investment opportunities are the main incentive of trading loans. In this context, private credit markets migrate from relationship lending to the trade-oriented like bond market; see Effenberger (2003), Kiff and Morrow (2003) and Rule (2001). Lenders who aim to resell the loan individually (or as part of a structured product) in the secondary market ask for a higher systematic risk premium. Consequently, potential buyers allocate more weight on public information and market conditions in pricing loans. Altogether, I consider the introduction of loan rating in 1995 as a natural quasi-experiment. Hence, the difference in pricing related to systematic risk in private and public debt should vanish after this year. To test this argument, I split my sample to until and to after 1996. I assume a one year delay to assure the rating would be obtained by a number of borrowers and settled in the market. I also focus on investment grade debts to assure that the incentive of offering these loans was not based on the private information about the poor performance of the loan that minimizes the risk of adverse selection. Since the introduction of loan rating is exogenous to investment strategies in the public debt market, I conduct a difference-in-differences estimate between the systematic risk in public and private debts.

As discussed, the introduction of loan rating shifted the private credit market from relationship lending toward a trade-oriented like bond market. As a result, the pricing of systematic risk in public and private debts converged after this event. Hence, the difference between the beta of public and private debt issuers should vanish accordingly. To test this prediction, I implement a propensity score matching between private and public debts before and after 1996 based on firms and macroeconomic variables used in model (2). Then, I compare the differences between systematic risk of public and private debt issuers before and after this event.

[Table 3.7]

Table 3.7, Panel A, reports the results for beta extracted from CAPM model. Before the event, the mean (median) of *Log of Beta* of public debt issuers is 9% (7%) lower than that of private debt issuers and is statistically significant at the 1% level. This difference alters to 4% (6%) higher and is not significant (57% and 56% p-value for mean and median, respectively) after the event. The difference between the mean (median) of the gaps is 14% (9%) and is significant at 1% level. In parallel to my prediction, private lenders incline to trade the loan in secondary market after the introduction of loan rating. Consequently, private loans, like public debts, are also exposed to systematic risk. Therefore, the difference between *Log of Beta* of private and public debts issuers diminishes after 1996. As shown in Panel B, the same trend exists for *Log of Beta* as estimated with the FF model. The mean (median) of systematic risk of public debt issuers is 6% (6%) lower than that of private debt issuers and significant at 5% level until 1996 while this difference is 4% (6%) higher after and is not significant (17% and 25% p-value for mean and median, respectively). The mean (median) difference between the gaps of systematic risk of private and public debt issuers before and after 1996 is 10% (9%) and significant at 5% level. In parallel to results based on CAPM beta, my analysis shows that systematic risk of private and public debt borrowers converged after the introduction of loan rating in the secondary market.

Since systematic risk is a major determinant of the real cost of debt, I expect an increase in the correlation between the spreads of public and private debts after the introduction of loan rating. This correlation is -29% (not different from 0, p-value = 52%) before and 49% (different from 0, p-value = 4.6%) after 1996. The correlation between annual medians is

-28% (p-value = 54%) before and 53% (p-value = 2.6%) after 1996. Consistent with my results in difference-in-differences estimates, the costs of private and public debt are more correlated after the introduction of loan ratings.

3.5.3 Who benefits from loan rating in secondary market?

My analysis reveals that the loan rating exposes private debts to systematic risk. Moreover, the results in Table 3.4 shows that in general the cost of public debts, (coefficient of *Public* dummy), is significantly (somehow) lower (higher) than private debts for investment (non-investment) grade debts. Therefore, a borrower with high credit quality prefers to issue public debt rather than a private debt with rating unless it has a high systematic risk. In this case, a borrower would issue a private debt to reduce the impact of systematic risk on its cost of debt. This borrower also does not like to trade its debt in secondary market since it increases the impact of systematic risk on its cost of debt. Therefore, I expect that investment grade borrowers with high systematic risk do not apply for loan rating. However, this interrelation does not exist for borrowers with low credit quality for three reasons. First, the cost of public debt is higher for these firms as indicated in Table 3.4. Second, loan rating reduces information asymmetries for these firms and reduces their cost of debt. Third, the premium for default risk is high for these firms. As a result, loan rating increases the potential of trading their debt in the market where private lenders could share the risk of default with other lenders and reduce the premium for default risk. As shown in Table 3.1, loan rating is more welcome by non-investment grade borrowers. From 1995, the number of rated speculative debts exceeded the number of non-rated ones in contrast to investment grade debts. Sufi (2009) also explains that the introduction of loan rating was at the benefit of low credit quality borrowers who increased their level of debt and investment after 1995. To analyze the consistency of my results to these arguments, I conduct two empirical tests. First, I implement equation (2) but instead of *Public* dummy as dependent variable, I use *Private Rated*, a dummy that equals one if the firm has a loan rating and zero otherwise. I also limit my sample to private debts.

[Table 3.8]

These results are reported in Table 3.8. As predicted, the coefficient of *Log of Beta* (CAPM or FF) is negative and statistically significant at 5% level for investment grade firms. It means that investment grade borrowers with high systematic risk are less likely to apply for loan rating. However, the coefficient of *Log of Beta* is not statistically significant for speculative debt issuers. It shows that systematic risk does not demonstrate any impact on applying for loan rating for non-investment grade firms. To test the different impact of obtaining loan rating on the cost of debt in investment and non-investment grade debts, I re-estimate equation (1) with two additional dummies, *Loan Rating* (equal to one if a firm applies for rating and zero otherwise) and *Speculative* (equal to one for non-investment grade debts and zero otherwise). I also add the interaction of these dummies to the model. The corresponding coefficient captures the marginal impact of applying loan rating for high yield debts.

[Table 3.9]

Table 3.9 reports the result. In parallel to previous findings, *Loan Rating* reduces the cost of debt but not significantly. The coefficient of *Loan Rating* × *Speculative* is negative and significant at 1% level. The reduction in cost of debt by obtaining a loan rating is about 35% higher for non-investment grade debt issuers compared to investment grade debts. Consequently, speculative debt issuers are more likely to apply for loan rating to reduce their cost of debt.

3.5.4 Other robustness tests

As a robustness test, I conduct my tests on total spread including default risk premium and I do not find any difference between the impact of systematic risk on total spread in public and private debts. I control specific debt contracts in all tests by assigning a dummy variable to them. However, to make sure that the results are not biased with these observations, I remove specific contracts and conduct my tests. For instance, I remove callable bonds in private and public debts and test the models. In private debts, I exclude non-bank loans, line of credits, and loans with performance pricing. In all tests, I find results qualitatively similar to the main test.

To have a more homogenous sample of private and public debt issuers, I exclude those who issued only public or only private debt during the sample period. As a result, I have at least one private and one public contract from the same borrower but in different periods. I do find consistent results with this reduced sample. Even changes in systematic risk of a borrower could influence its preference between private and public debts. I also apply difference-in-differences estimates in years 1993 and 2005 (placebo test) , far from the 1995 event. In all tests, I do not find any significant difference between the systematic risk in public and private contract before and after these years.

3.6 Conclusion

The literature has shown strong evidence that systematic risk is a major pricing factor in yield spreads, even for borrowers with low probability of default. I have argued that this pricing factor is less important for an investor who holds the debt security until its maturity. Since private investors are more likely to follow the “hold-to-maturity” strategy, the impact of systematic risk is lower in private debts compared to public debts. However, when the probability of default is high, the “hold-to-maturity” strategy is less likely and systematic risk increases the premium for default risk.

Based on this argument, I have provided empirical evidence that systematic risk has higher impact on the real cost of debt (net of premium for default) in public debts compared to private debts for investment grade debts while this relation is in opposite for speculative debts. I also find that investment (non-investment) grade borrowers with private debt agreement have higher (lower) systematic risk. Borrowers also consider the difference of the impact of systematic risk on the cost of debt in private and public debt and on the placement structure of their debts. The propensity score matching results reaffirm that the difference in systematic risk in public and private debt borrowers is not biased by firm characteristics.

I have also presented my analysis of the impact of introducing in 1995 loan rating in the secondary market on the interplay between systematic risk and placement structure of debt. I find that the difference between systematic risk of private and public debt holders vanishes after the introduction of a loan rating service. The change in "hold to maturity" strategy of private lenders and its relation to market risk premium is the best explanation for this convergence of systematic risk in public and private debts. Last but not least, I have shown that investment grade borrowers with high systematic risk are less likely to obtain a loan rating. In parallel to previous findings, I have also demonstrated that obtaining a loan rating is more beneficial for non-investment grade borrowers.

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Appendix 3.A: Sample Construction

This table describes each stage of sample selection and the detail of observations in each step.

	Deals	
	Private	Public
LPC DealScan database		
Loans in LPC from 1990 to2011	34451	
Keep borrowers publicly traded in the US capital market	6016	
Drop non-USD loans, special purpose loans, less than one year maturity, and financials, and firms with SIC code starts with 9	5604	
SDC database		
Deals with valid CUSIP from 1990 to 2011	9598	
Drop 1-digi SIC equal to 6 or 9, non-USD bonds, and with less than one year maturity	3695	5969
Total	9299	5969
Merge with CRSP-COMPUSTAT database and drop firms with missing share price in last 24 month before issuing debt, negative or zero asset or sales, with negative EBITDA larger than assets, those with available data for less than 3 consecutive years before issuing debt and, those issue public and private debt in the same month and year	4303	4772
Investment (Non-investment) grade classification	3323(984)	2929(1843)

Appendix 3.B: Data Definitions

Variable name	Description	COMPUSTAT Item
Firm characteristics		
Asset volatility	σ_a in calculation of distance to default.	
Assets	Book value of total assets.	Data6
Age	The number of years between the first year of observation in CRSP/COMPUSTAT database and the year of debt issuance.	
Beta	Beta extracted from CAPM or Fama and French (1992) model using the trailing 2 years of monthly returns data before debt issuance.	
Callable dummy	Equal one if bond is callable.	
Cash flow volatility	Standard deviation of cash flows in last 5 years, minimum three consecutive years, before debt issuance.	
Credit rating dummies	Dummy variable for each S&P credit ratings, including AAA, AA, A, BBB, BB, and B or worse. I have also a separate dummy for firms without rating.	
Debt > 3 year	The portion of total debt with maturity longer than 3 year.	(Data93+data94)/(data9+data34)
D-to-D	Distance-to-default (Crosbie and Bohn, 2003) based on KMV-Merton model = $(V_a\text{-}D)/V_a\sigma_a$ where V_a is the value of the assets, D is half of long term debt plus debt in current liabilities. σ_a is the volatility of the assets. Since V_a and σ_a are not observable, I approximate them by solving Merton's (1974) model of pricing firm's debt and value of the equity for 1-year period: $V_e = V_aN(d_1)\text{-}e^{-r}DN(d_2)$ *and* $\sigma_e = N(d_1)V_a\sigma_a/V_e$. $d_1 = (\ln(V_a/D)+r+0.5\sigma_a^2)\ \sigma_a$ *and* $d_2 = d_1\text{-}\ \sigma_a$.	
EBITDA	Earnings Before Interest, Taxes, Depreciation, and Amortizations.	Data13 + data15 + data16
HHI	*Herfindahl index* based on three-digit SIC level and firms' net sales.	
Industry dummy	Industry dummies are based on two-digit SIC code.	
Insider ownership	Shares held by insiders divided by total number of shares.	*Closely Held Shares* item in DataStream.
Leverage	Long term plus debt in liabilities divided by total assets.	(Data9+data34)/data6
Market to book	(Market value of equity at fiscal year-end + total assets – book value of equity)/Total assets.	(data199 × data25 + data6 – data60)/data6
Profitability	EBITDA/Assets.	(data13 + data15 + data16)/data6
Tangibility	Net Properties, Plant and Equipment divided by total assets.	Data8 / data6
Zero outstanding debt dummy	One if there is no outstanding debt before issuing date of debt.	

Appendix 3.B – *continued*

Variable name	Description	COMPUSTAT Item
Debt characteristics		
Amount	Amount of debt in dollars.	
Maturity	Debt maturity in month.	
Callable dummy	Equal one if debt is a callable bond and zero otherwise.	
Debt purpose	Dummy variable for each loan purpose, including corporate purpose, working capital, debt repayment, acquisition, commercial paper backup, and others.	
Debt type	Dummy variable for each type, including term loan, revolver, notes, and bonds.	
Performance dummy	Equal one if the credit agreement uses performance pricing.	
Public (Private) dummy	One if the debt contract is public (private) and zero otherwise.	
Seniority dummy	One if debt is senior and zero if it is subordinated.	
Non-bank dummy	One if debt is private but is not a bank loan and zero otherwise.	
Expected Default Loss (δ)	Yield equivalent of expected default loss based on Cooper and Davydenko (2007). First, I solve for asset volatility (σ) and debt maturity (T) from Merton (1974) risky debt pricing model. $(1-P_D)=N(d_1)-P_D e^{sT}N(d_2)$ and $\sigma_E(1-P_D)=\sigma N(d_1)$ in which P_D is market leverage, s is spread, σ_E is equity volatility, $N(.)$ is the cumulative normal distribution function, $d_1=[-\ln(P_D)-(s-0.5\sigma^2)T]/(\sigma\sqrt{T})$, and $d_2=d_1-\sigma\sqrt{T}$. Then δ is: $\delta = -(1/T)\ln[e^{(\pi-s)T}N(-d_1-(r_E-r)\sqrt{T}/\sigma_E)/P_D+N(d_2+(r_E-r)\sqrt{T}/\sigma_E)]$.	
$Spread_{loan}$	All-in spread charged by the bank over LIBOR reported in DealScan database.	
$Spread_{bond}$	Yield of the bond – average yield of AAA issues in the same month and year of bond issue.	
Net spread	$Spread_{loan(bond)} - \delta$	
Others		
Term spread	The difference between the yields of 10-year and 1-year Treasury bonds.	
GDP growth rate	Real GDP quarterly growth.	
Credit spread	The difference between the yields of average BAA and AAA corporate bonds.	

Figure 3.1: Sensitivity (Delta) of an out of the money and at the money put option

Stock price is $100. Strike price is $100 for at the money (ATM) and $50 for out of the money options. Risk free is 3% and dividend is zero. T is time to maturity in years.

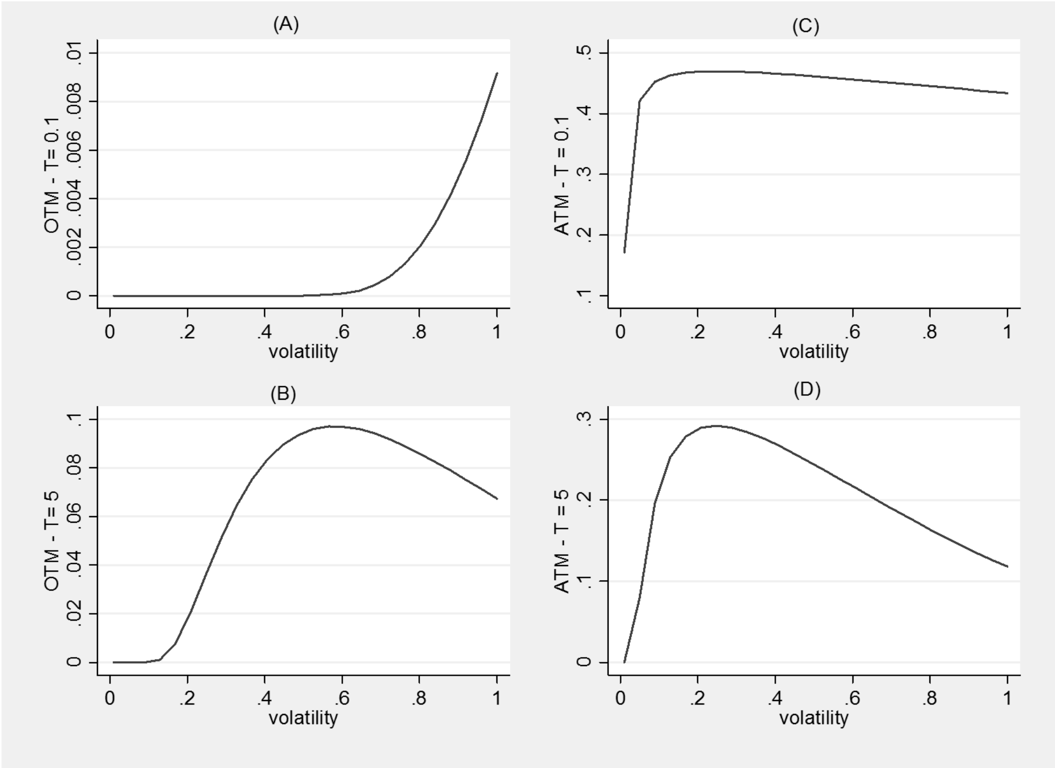


Table 3.1: Description of Sample by Year, Investment Grade, and Placement Type

This table provides the number of sample public and private debt contracts in each year for investment and non-investment grade debts, separately.

	Investment Grade				Non-investment Grade			
year	Private Debt Not Rated	Private Debt Rated	Public Debt	Total	Private Debt Not Rated	Private Debt Rated	Public Debt	Total
1990	198	1	79	278	26	0	7	33
1991	194	7	172	373	11	0	24	35
1992	155	18	136	309	7	0	55	62
1993	158	19	151	328	3	3	49	55
1994	164	21	102	287	6	2	25	33
1995	180	11	156	347	4	9	30	43
1996	201	18	148	367	5	21	37	63
1997	196	31	181	408	37	75	18	130
1998	196	27	245	468	29	87	21	137
1999	196	60	143	399	16	66	22	104
2000	133	37	101	271	24	16	12	52
2001	147	48	119	314	21	64	20	105
2002	175	41	144	360	16	63	30	109
2003	159	47	132	338	4	97	36	137
2004	75	18	75	168	2	72	29	103
2005	33	14	71	118	1	70	15	86
2006	34	8	82	124	1	24	33	58
2007	29	3	105	137	1	30	24	55
2008	22	10	125	157	0	8	25	33
2009	21	2	178	201	0	20	87	107
2010	40	2	134	176	2	6	142	150
2011	151	23	150	324	12	23	118	153
Total	2857	466	2,929	6,252	228	756	859	1,843

Table 3.2: Descriptive Statistic of Sample

Panel A (B) describes sample debt (firm) characteristics for investment and non-investment grade debts, separately. Definition of variables is available in Appendix B.

Panel A: Debt Contracts Specifications										
	Investment Grade									
	Public					Private				
	mean	SD	p10	p50	p90	mean	SD	p10	p50	p90
Spread	69	81	10	46	141	227	152	54	213	400
Net spread	59	70	8	40	121	188	113	50	175	335
δ	10	28	0	1	27	42	82	0	6	141
Amount (m$)	291	368	25	200	650	222	504	10	65	550
Maturity (month)	187	162	24	122	365	84	70	24	62	146
Non-bank dummy	-	-	-	-	-	0.38	0.49	0.00	0.00	1.00
Callable dummy	0.17	0.38	0.00	0.00	1.00	0.01	0.11	0.00	0.00	0.00
Seniority dummy	0.99	0.08	1.00	1.00	1.00	0.98	0.15	1.00	1.00	1.00
# of Observations			1359					2889		
	Non-investment Grade									
Spread	261	161	89	232	477	260	155	97	237	455
Net spread	173	116	39	160	322	162	122	38	140	299
δ	82	114	0	33	234	90	124	0	39	235
Amount (m$)	301	228	100	250	600	255	339	25	160	500
Maturity (month)	116	67	73	121	133	98	56	48	101	122
Non-bank dummy	-	-	-	-	-	0.77	0.42	0.00	1.00	1.00
Callable dummy	0.72	0.45	0.00	1.00	1.00	0.53	0.50	0.00	1.00	1.00
Seniority dummy	0.76	0.43	0.00	1.00	1.00	0.70	0.46	0.00	1.00	1.00
# of Observations			859					984		

Table 3.2 - *continued*

Panel B: Firm Specifications										
Investment Grade										
	Public					Private				
	mean	SD	p10	p50	p90	mean	SD	p10	p50	p90
Assets (m$)	21362	33379	1837	10407	45027	3883	11844	53	635	9678
Log of Beta (CAPM)	-0.34	0.81	-1.27	-0.16	0.42	-0.11	0.88	-1.13	0.04	0.76
Log of Beta (FF)	-0.28	0.78	-1.20	-0.11	0.46	-0.12	0.87	-1.13	0.04	0.77
Idiosyncratic risk (CAPM)	0.07	0.03	0.04	0.06	0.10	0.11	0.06	0.05	0.10	0.20
Idiosyncratic risk (FF)	0.06	0.03	0.04	0.06	0.10	0.11	0.06	0.05	0.10	0.19
Cash Flow SD.	0.02	0.02	0.01	0.02	0.04	0.05	0.14	0.01	0.03	0.10
Profitability	0.15	0.06	0.08	0.14	0.23	0.12	0.11	0.04	0.12	0.22
Tangibility	0.43	0.24	0.12	0.39	0.78	0.38	0.24	0.09	0.33	0.74
Market-to-book	1.75	0.91	1.06	1.45	2.75	1.61	1.20	0.93	1.31	2.51
Leverage	0.32	0.12	0.18	0.32	0.47	0.35	0.21	0.13	0.33	0.59
D-to-D	14.94	5.72	8.62	14.06	22.83	9.75	4.97	4.56	8.70	16.56
Age	36.08	15.14	13.00	39.00	54.00	18.74	14.61	3.00	15.00	42.00
Debt Maturity > 3 years	0.13	0.13	0.00	0.10	0.29	0.16	0.31	0.00	0.09	0.41
Zero outstanding debt	0.01	0.09	0.00	0.00	0.00	0.03	0.17	0.00	0.00	0.00
Insider ownership	0.09	0.15	0.00	0.01	0.26	0.20	0.21	0.00	0.13	0.52
# of Observations			2929					3323		
Non-investment Grade										
Assets (m$)	5127	7351	479	2276	11871	2652	4736	181	1129	6662
Log of Beta (CAPM)	0.11	0.84	-0.78	0.23	0.93	-0.03	0.90	-1.10	0.09	0.90
Log of Beta (FF)	0.03	0.80	-0.94	0.20	0.85	-0.06	0.98	-1.32	0.14	0.93
Idiosyncratic risk (CAPM)	0.12	0.06	0.06	0.11	0.20	0.14	0.06	0.07	0.12	0.22
Idiosyncratic risk (FF)	0.11	0.05	0.06	0.10	0.19	0.13	0.06	0.07	0.12	0.21
Cash Flow SD.	0.05	0.07	0.01	0.03	0.12	0.06	0.13	0.01	0.03	0.11
Profitability	0.11	0.09	0.04	0.11	0.19	0.11	0.10	0.04	0.11	0.20
Tangibility	0.45	0.29	0.05	0.44	0.86	0.40	0.28	0.06	0.36	0.83
Market-to-book	1.39	0.49	0.95	1.28	1.96	1.43	0.73	0.92	1.26	2.07
Leverage	0.46	0.19	0.25	0.44	0.70	0.47	0.21	0.21	0.45	0.71
D-to-D	8.51	3.94	4.16	7.83	13.58	7.97	3.66	4.04	7.36	12.42
Age	19.54	15.00	4.00	15.00	42.00	14.79	12.71	3.00	10.00	34.00
Debt Maturity > 3 years	0.20	0.22	0.00	0.13	0.51	0.17	0.24	0.00	0.08	0.49
Zero outstanding debt	0.01	0.07	0.00	0.00	0.00	0.02	0.12	0.00	0.00	0.00
Insider ownership	0.18	0.20	0.00	0.12	0.48	0.25	0.23	0.00	0.20	0.59
# of Observations			859					984		

Table 3.3: Debt and Firm Characteristic Comparison

This table compares the mean and median of debt (firm) characteristics based on investment grade and placement type, separately. Definition of variables is available in Appendix B. *, ** and *** represents 10%, 5% and 1% significant level of the *t*-test and Wilcoxon rank-sum *Z*-test for the mean and median comparisons, respectively.

		(Public) – (Private)				(Investment) – (Non-investment)			
		Investment Grade		Non-investment Grade		Public		Private	
		Diff. in mean	Diff. in median	Diff. in mean	Diff. in median	Diff. in mean	Diff. in median	Diff. in mean	Diff. in median
Debt Contracts Specifications	Spread	-158***	-166***	1	-5	-192***	-186***	-33***	-24***
	Net spread	-130***	-135***	11*	20**	-114***	-120***	26***	35***
	δ	-33***	-6***	-8	-6	-72***	-32***	-48***	-33***
	Amount (m$)	69.00***	135.00***	46.00***	90.00***	-10.00	-50.00***	-33.00*	-95.00***
	Maturity (month)	102.42***	60***	18.18***	20.00*	70.61***	1.00***	-13.63***	-39.00***
Firm Specifications	Assets (m$)	17479***	9772***	2475***	1147***	16235***	8131***	1230**	-494***
	Log of Beta (CAPM)	-0.23***	-0.20***	0.14***	0.14***	-0.45***	-0.39***	-0.08***	-0.05***
	Log of Beta (FF)	-0.16***	-0.15***	0.09**	0.06	-0.31***	-0.31***	-0.06	-0.10**
	Idio. risk (CAPM)	-0.04***	-0.04***	-0.02***	-0.01***	-0.05***	-0.05***	-0.03***	-0.02***
	Idio. risk (FF)	-0.05***	-0.04***	-0.02***	-0.02***	-0.05***	-0.04***	-0.02***	-0.02***
	Cash Flow SD	-0.03***	-0.01***	-0.01	0.00	-0.03***	-0.01***	-0.01	-0.01***
	Profitability	0.03***	0.02***	0.00	0.00	0.04***	0.03***	0.01***	0.01***
	Tangibility	0.05***	0.06***	0.05***	0.07***	-0.02*	-0.04***	-0.02**	-0.04**
	Market-to-book	0.14***	0.14***	-0.04	0.02	0.36***	0.17***	0.18***	0.05***
	Leverage	-0.03***	-0.01***	-0.01	-0.01	-0.14***	-0.12***	-0.11***	-0.12***
	D-to-D	5.18***	5.37***	0.55***	0.47**	6.42***	6.23***	1.79***	1.33***
	Age	17.34***	24.00***	4.75***	5.00***	16.54***	24.00***	3.95***	5.00***
	LT debt > 3 years	-0.04***	0.01***	0.02*	0.05***	-0.07***	-0.03**	-0.01	0.01
	Insider ownership	-0.11***	-0.11***	-0.08***	-0.08***	-0.09***	-0.11***	-0.06***	-0.08***

Table 3.4: Systematic Risk and Net Spread

The dependent variable is the log of *Net spread*. In Panel A, column (1) and (2) reports the estimates based on equation (1) with Beta extracted from CAPM and Fama and French (1992) three-factor models respectively, for investment grade (IG) borrowers. Column (3) and (4) report the results with the same sequence for non-investment grade (NIG) issuers. In Panel B, for floating rate debts, LIBOR rate is replaced with SWAP rates as explained in the text and the results are reported with the same sequence as those in Panel A for investment grade debts. Definition of variables is available in Appendix B. *t*-statistics robust to heteroskedasticity and serial correlation (clustered at industry level) are reported in brackets. *, ** and *** represent 10%, 5% and 1% significant level, respectively.

Panel A: LIBOR as the Index rate				
	IG		NIG	
	CAPM (1)	FF (2)	CAPM (3)	FF (4)
Public	-1.625***	-1.552***	0.223	0.209
	[8.07]	[7.43]	[0.31]	[0.29]
Log of Beta	0.012	0.011	0.082*	0.102*
	[0.50]	[0.34]	[1.78]	[1.76]
Public × Log of Beta	0.165**	0.161***	-0.200***	-0.183***
	[2.56]	[2.99]	[4.29]	[3.01]
Size	-0.095***	-0.100***	-0.083**	-0.089**
	[2.97]	[3.11]	[2.11]	[2.08]
Cash Flow volatility	-0.041	-0.131	-0.195	-0.093
	[0.24]	[0.71]	[0.29]	[0.13]
Profitability	-0.814**	-1.284***	-0.860**	-0.752*
	[2.11]	[5.26]	[2.19]	[1.67]
Tangibility	-0.047	0.074	0.189	0.182
	[0.34]	[0.55]	[0.89]	[0.73]
Market to Book	-0.031	-0.003	-0.028	-0.059
	[1.11]	[0.11]	[0.28]	[0.58]
Leverage	0.162	0.191	0.043	0.052
	[1.08]	[1.41]	[0.23]	[0.28]
D-to-D	0.014**	0.013*	0.004***	0.004***
	[2.04]	[1.81]	[2.68]	[2.72]
Amount	0.062**	0.076**	0.057	0.042
	[2.10]	[2.54]	[1.10]	[0.74]
Maturity	0.189***	0.206***	-0.13	-0.114
	[4.50]	[4.35]	[1.00]	[0.91]
Credit Spread	79.499***	80.515***	49.418***	51.138***
	[14.11]	[14.44]	[7.21]	[7.04]
Term Spread	-6.765***	-6.468**	-13.389***	-14.180***
	[2.74]	[2.61]	[4.11]	[4.34]
Industry FE	Yes	Yes	Yes	Yes
Credit rating dummies	Yes	Yes	Yes	Yes
Performance pricing dummy	Yes	Yes	Yes	Yes
Callable dummy	Yes	Yes	Yes	Yes
Debt type dummies	Yes	Yes	Yes	Yes
Seniority dummy	Yes	Yes	Yes	Yes
Debt purpose dummies	Yes	Yes	Yes	Yes
Non-bank dummy	Yes	Yes	Yes	Yes
# of Observations	1936	1896	880	828
Adjusted R^2	0.48	0.48	0.31	0.29

Table 3.4 – *Continued*

	IG	
	CAPM (1)	FF (2)
Public	-2.523***	-2.420***
	[10.97]	[11.02]
Log of Beta	-0.095***	-0.035
	[2.93]	[1.14]
Public × Log of Beta	0.142**	0.162**
	[2.01]	[2.16]
Size	-0.073*	-0.074
	[1.68]	[1.60]
Cash Flow volatility	-0.001	-0.013
	[0.01]	[0.20]
Profitability	-1.014***	-0.886***
	[4.01]	[3.46]
Tangibility	0.163	0.177
	[1.11]	[1.33]
Market to Book	-0.032	-0.041
	[0.80]	[1.03]
Leverage	0.427**	0.425**
	[2.14]	[2.11]
D-to-D	-0.035***	-0.031***
	[4.52]	[4.17]
Amount	0.031	0.005
	[0.85]	[0.13]
Maturity	0.291***	0.278***
	[4.60]	[4.55]
Credit Spread	71.853***	71.393***
	[11.69]	[10.28]
Term Spread	-13.340***	-13.780***
	[4.31]	[4.59]
Industry FE	Yes	Yes
Credit rating dummies	Yes	Yes
Performance pricing dummy	Yes	Yes
Callable dummy	Yes	Yes
Debt type dummies	Yes	Yes
Seniority dummy	Yes	Yes
Debt purpose dummies	Yes	Yes
Non-bank dummy	Yes	Yes
# of Observations	1128	1121
Adjusted R^2	0.70	0.70

Table 3.5: Systematic Risk in Public versus Private Debt

The dependent variable is a dummy equal one if debt contract is public and zero otherwise. Column (1) and (2) reports the estimates based on *logit* equation (2) with Beta extracted from CAPM and Fama and French (1992) models respectively, for investment grade (IG) debts. Column (3) and (4) report the results with the same sequence for non-investment grade (NIG) debts. Definition of variables is available in Appendix B. *Z*-statistics robust to heteroskedasticity and serial correlation (clustered at industry level) are reported in brackets. *, ** and *** represent 10%, 5% and 1% significant level, respectively.

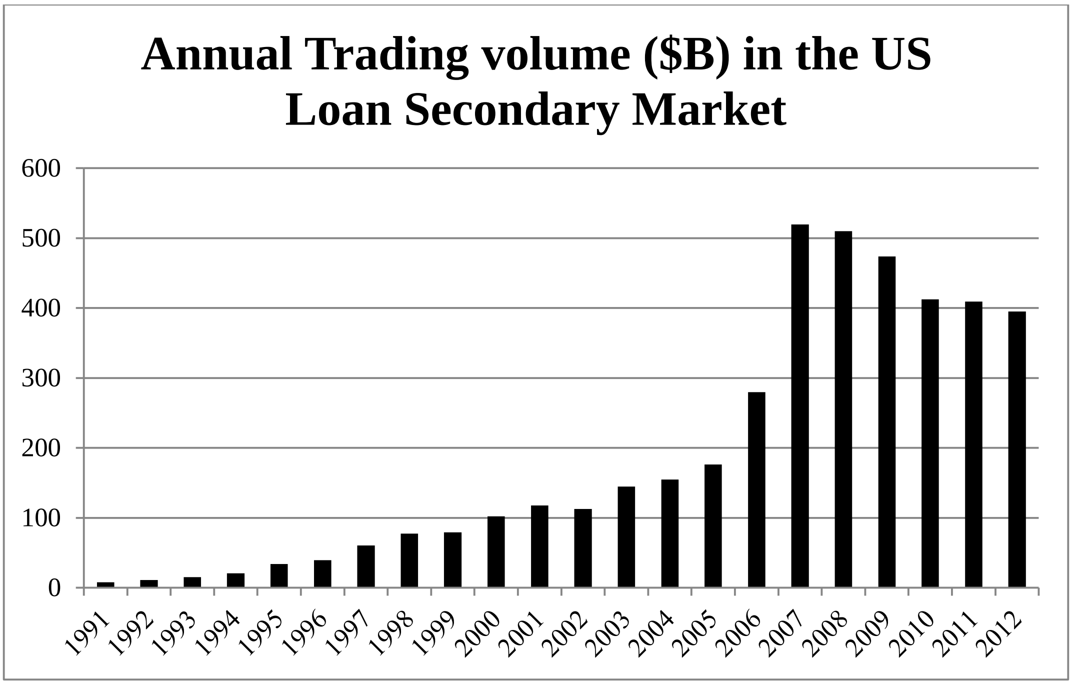
	IG		NIG	
	CAPM (1)	FF (2)	CAPM (3)	FF (4)
Log of Beta	-0.125**	-0.158**	0.248**	0.123
	[2.19]	[2.49]	[2.07]	[1.25]
Standard deviation of residuals	-0.152***	-14.970***	-0.045***	-3.670***
	[5.74]	[5.44]	[4.35]	[3.21]
Number of Analysts	0.065***	0.065***	0.063***	0.064***
	[8.42]	[8.48]	[6.27]	[6.13]
Log of Age	0.378***	0.377***	0.204**	0.185*
	[3.86]	[3.89]	[2.02]	[1.73]
Market to Book	-0.210**	-0.215**	-0.08	-0.083
	[2.52]	[2.46]	[0.38]	[0.38]
Cash Flow volatility	-7.497***	-7.928***	0.609	0.68
	[3.41]	[3.63]	[0.57]	[0.69]
Profitability	3.695***	3.730***	0.482	0.493
	[2.92]	[2.77]	[0.51]	[0.53]
Debt > 3 year / Total debt	-0.494	-0.495	0.511**	0.597***
	[1.47]	[1.48]	[2.51]	[2.86]
Zero outstanding debt	0.421	0.544	-0.633	-0.739
	[1.12]	[1.46]	[1.34]	[1.55]
Insider ownership	0.38	0.355	-0.532	-0.631*
	[1.08]	[0.91]	[1.57]	[1.91]
Leverage	0.535	0.412	0.079	0.059
	[1.08]	[0.82]	[0.25]	[0.17]
Tangibility	0.173	0.213	0.108	0.053
	[0.51]	[0.62]	[0.37]	[0.16]
Size	0.437***	0.435***	0.017	0.013
	[5.09]	[4.90]	[0.29]	[0.19]
HHI	0.18	0.278	0.573	0.669
	[0.33]	[0.55]	[0.94]	[1.01]
GDP growth	-13.322**	-12.263**	-69.724***	-57.343***
	[2.22]	[2.00]	[6.53]	[5.63]
# of Observations	5269	5086	1588	1522
Pseudo R^2	0.39	0.39	0.12	0.11

Table 3.6: Systematic Risk in Propensity Score Matched Private and Public Debts

Public debts are matched with Private debts with maximum 0.005 difference in propensity scores (caliper 0.005) with replacement as explained in the text and *Log of Beta* of two groups is compared. Panel A and B report the results of comparison between systematic risks of public and private debt issuers estimated by CAPM and FF models for investment grade debts, respectively. Panel C and D report the results with the same sequence for non-investment grade debts. *, ** and *** represents 10%, 5% and 1% significant level of the *t*-test and Wilcoxon rank-sum *Z*-test for the mean and median comparisons, respectively.

	Observations		Mean		Median	
	Before matching	After matching	Before matching	After matching	Before matching	After matching
Panel A: Public vs. Private – Investment grade – CAPM Beta						
Log of Beta (Treated)	2934	2805	-0.34	-0.34	-0.16	-0.15
Log of Beta (Control)	2907	2435	-0.11	-0.27	0.03	-0.10
Difference			-0.23***	-0.07***	-0.19***	-0.05***
Bias (absolute)			49.7%	4.1%	26.1%	3.1%
Panel B: Public vs. Private – Investment grade – FF Beta						
Log of Beta (Treated)	2957	2832	-0.28	-0.29	-0.11	-0.12
Log of Beta (Control)	2847	2383	-0.12	-0.23	0.04	-0.07
Difference			-0.16***	-0.06***	-0.15***	-0.04***
Bias (absolute)			48.9%	5.6%	25.0%	6.3%
Panel C: Public vs. Private – Non-investment grade – CAPM Beta						
Log of Beta (Treated)	838	772	0.11	0.11	0.23	0.23
Log of Beta (Control)	875	794	-0.03	-.011	0.09	0.04
Difference			0.14***	0.22***	0.14***	0.19***
Bias (absolute)			21.5%	4.0%	12.9%	3.0%
Panel D: Public vs. Private – Non-investment grade – FF Beta						
Log of Beta (Treated)	819	751	0.03	0.02	0.20	0.19
Log of Beta (Control)	823	748	-0.06	0.00	0.14	0.18
Difference			0.09**	0.02	0.06*	0.01
Bias (absolute)			20.9%	4.9%	12.3%	4.3%

Figure 3.2: Trading volume in Loan Secondary and Bond Markets



Source: LPC DealScan database

Table 3.7: Systematic Risk and introduction of loan rating service

This table reports the difference between the systematic risk of private and public debt issuers before and after the introduction of loan rating service in loan secondary market. Public debts are matched with private debts with maximum 0.005 difference in propensity scores (caliper 0.005) with replacement before and after 1996 as explained in the text. Panel A (B) report the results of comparison between systematic risks of public and private debt issuers estimated by CAPM (FF) model for investment grade debts. *, ** and *** represents 10%, 5% and 1% significant level of the *t*-test and Wilcoxon rank-sum *Z*-test for the mean and median comparisons, respectively.

Panel A: Public vs. private investment grade debt before and after 1996 – CAPM Beta						
Until 1996						
	Observations		Mean		Median	
	Before matching	After matching	Before matching	After matching	Before matching	After matching
Log of Beta (Treated)	944	848	-0.16	-0.14	-0.02	-0.01
Log of Beta (Control)	1085	849	0.02	-0.05	0.18	0.06
Difference			-0.18***	-0.09***	-0.20***	-0.07***
Bias (absolute)			45.1%	3.1%	23.7%	2.8%
After 1996						
Log of Beta (Treated)	2015	1942	-0.36	-0.37	-0.18	-0.18
Log of Beta (Control)	1779	1549	-0.20	-0.41	-0.04	-0.24
Difference			-0.16***	0.04	-0.22***	0.06
Bias (absolute)			52.1%	6.5%	27.0%	5.7%
Diff-in-Diff (matched)			-	0.13***	-	0.09***
Panel B: Public vs. private investment grade debt before and after 1996 – FF Beta						
Until 1996						
Log of Beta (Treated)	942	874	-0.12	-0.11	0.01	0.01
Log of Beta (Control)	1068	834	0.02	-0.05	0.16	0.07
Difference			-0.14***	-0.06**	-0.15***	-0.06**
Bias (absolute)			44.8%	4.0%	23.2%	2.6%
After 1996						
Log of Beta (Treated)	2015	1942	-0.36	-0.37	-0.18	-0.18
Log of Beta (Control)	1779	1549	-0.20	-0.41	-0.04	-0.24
Difference			-0.16***	0.04	-0.14***	0.06
Bias (absolute)			52.1%	6.5%	27.0%	5.7%
Diff-in-Diff (matched)			-	0.10**	-	0.09**

Table 3.8: Systematic Risk and applying for credit rating

The dependent variable is a dummy equal one if debt contract is a private rated loan and zero otherwise. Sample is restricted to private debt issuers only. Column (1) and (2) reports the estimates based on *logit* equation (2) with Beta extracted from CAPM and Fama and French (1992) models respectively, for investment grade (IG) debts. Column (3) and (4) report the results with the same sequence for non-investment grade (NIG) debts. Definition of variables is available in Appendix B. *Z*-statistics robust to heteroskedasticity and serial correlation (clustered at industry level) are reported in brackets. *, ** and *** represent 10%, 5% and 1% significant level, respectively.

	IG		NIG	
	CAPM (1)	FF (2)	CAPM (3)	FF (4)
Log of Beta	-0.290***	-0.244***	0.101	-0.143
	[5.06]	[3.72]	[0.90]	[1.46]
Standard deviation of residuals	-0.021	-2.435	0.02	3.381
	[1.30]	[1.50]	[1.00]	[1.55]
Number of Analysts	-0.054***	-0.054***	0.09	0.089
	[4.51]	[4.67]	[1.48]	[1.37]
Log of Age	0.199	0.208*	-0.222	-0.234
	[1.63]	[1.72]	[1.34]	[1.28]
Market to Book	0.241***	0.219***	-0.277	-0.179
	[3.77]	[3.80]	[1.58]	[1.04]
Cash Flow volatility	-5.429**	-3.017	-0.218	-0.298
	[2.24]	[1.28]	[0.21]	[0.27]
Profitability	2.663***	3.276***	2.981***	2.728**
	[3.09]	[3.78]	[2.77]	[2.47]
Debt > 3 year / Total debt	-0.361	-0.34	0.566	0.597
	[0.94]	[0.96]	[1.19]	[1.13]
Zero outstanding debt	-1.094	-1.777	-1.460**	-1.401*
	[1.11]	[1.50]	[2.07]	[1.83]
Insider ownership	-0.538	-0.486	0.721	0.767
	[1.21]	[1.06]	[1.27]	[1.29]
Leverage	-1.457***	-1.512***	0.154	0.064
	[3.07]	[3.26]	[0.32]	[0.13]
Tangibility	0.266	0.261	0.736	0.847
	[1.01]	[1.00]	[0.97]	[1.11]
Size	0.817***	0.827***	0.087	0.112
	[8.50]	[8.09]	[0.30]	[0.38]
HHI	0.488	0.234	2.379**	2.672**
	[0.87]	[0.42]	[2.00]	[2.10]
GDP growth	-6.075	-10.524	23.039	24.842
	[0.77]	[1.35]	[0.78]	[0.83]
Observations	2435	2383	794	729
Pseudo R^2	0.23	0.22	0.11	0.12

Table 3.9: Impact of loan rating on cost of debt

The dependent variable is the log of *Net spread*. *Loan Rating* is a dummy equal one if the private debt has a rating and zero otherwise. *Speculative* is a dummy equal one (zero) if debt is non-investment (investment) grade. Column (1) and (2) report the estimates based on equation (1) with Beta extracted from CAPM and Fama and French (1992) three-factor models, respectively. Definition of variables is available in Appendix B. *t*-statistics robust to heteroskedasticity and serial correlation (clustered at industry level) are reported in brackets. *, ** and *** represent 10%, 5% and 1% significant level, respectively.

	CAPM (1)	FF (2)
Loan Rating	-0.179	-0.178
	[0.98]	[1.00]
Speculative	0.06	0.087
	[0.45]	[0.57]
Loan Rating × Speculative	-0.439***	-0.418**
	[2.77]	[2.63]
Public	-1.595***	-1.528***
	[7.39]	[6.79]
Log of Beta	0.028	0.039
	[1.30]	[1.41]
Size	-0.093***	-0.099***
	[3.51]	[3.52]
Cash Flow volatility	-0.036	-0.077
	[0.22]	[0.44]
Profitability	-0.873***	-1.209***
	[2.90]	[5.72]
Tangibility	-0.031	0.036
	[0.25]	[0.28]
Market to Book	-0.044	-0.025
	[1.59]	[0.94]
Leverage	0.156	0.173
	[1.29]	[1.50]
D-to-D	0.005***	0.005***
	[2.74]	[2.72]
Amount	0.081***	0.090***
	[3.12]	[3.28]
Maturity	0.126***	0.140***
	[2.96]	[3.02]
Credit Spread	71.752***	72.081***
	[15.76]	[15.16]
Term Spread	-8.213***	-7.682***
	[4.06]	[3.58]
Industry FE	Yes	Yes
Credit rating dummies	Yes	Yes
Performance pricing dummy	Yes	Yes
Callable dummy	Yes	Yes
Debt type dummies	Yes	Yes
Seniority dummy	Yes	Yes
Debt purpose dummies	Yes	Yes
Non-bank dummy	Yes	Yes
# of Observations	2816	2724
Adjusted R^2	0.46	0.45