

Empirical Determinants of Business Insurances in Non-financial Firms: Are They Different from Derivatives' Determinants?

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Abstract: The scientific literature has extensively studied and analyzed the determinants of risks management and focused mainly on the hedging by derivatives. This research focuses on another kind of hedging, namely business insurances and aims to validated and measure the determinants of the implementation and use of these insurances in the non-financial firms. Based on the results of an empirical survey on practices of risk management in non-financial firms, Tobit models are developed to explain the intensity of the use of business insurances by the theoretical determinants developed by risk management theory. Two types of business insurance are analyzed: the Property and Casualty (P&C) Insurance and the Operating Loss (OL) Insurance. These models measure the relationship between level of hedging and different financial characteristics of the firm. They show that the insurance policies are determined by Investment decisions and financing options for growth, by the convexity of the tax function to pay, and diversification and regulation of the activity sector, and the original result are the convex relationship between the size and the hedging intensity.

Key words: risk, insurance, tobit model, financial ratio

JEL codes: G22, G32

1. Introduction

Economic theory tells us that market imperfections lead companies to hedge against risks (Aretz & Dufey Bartram, 2007). A large literature deals with the issue of risk management and more generally, the research into the determinants of hedging have been widely discussed by academics (Aretz et al., 2007; Brown et al., 2006; Kaushik, 2008; Al Momani & Gharaibeh, 2008), this literature review of empirical research revealed the determinants of risk coverage and the Risk Management Theory (RMT) classifies these determinants into three categories, Froot, Scharfstein and Stein (1993), Aretz, Bartram and Dufey (2007), Rawls and Smithson (1990) and Stulz (2002). The first category is related to the assumption of the maximization of corporate value. The second category of determinants is related to the assumption of utility maximization managers. The third and final category includes the size of the company and the economies of scale.

Thus, this scientific literature has sought to highlight the determinants of risk coverage by focusing mainly on financial risks — such as commodity risk, interest-rate risk, or exchange-rate risk — in one hand and on derivatives on the other hand. So the development of derivatives has improved the methods of risk management.

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The use of derivatives is now widespread, the International Swaps and Derivatives Association (2009) reports that over 94% of the world's largest companies use derivatives to help manage their risks. The widespread use of derivatives for hedging must not lead us to overlook other means of managing financial risk. Although derivatives have become a reference in the hedging tools world (Nance et al., 1993; Judge, 2006).

However over the last ten years, corporate risk management has expanded well beyond derivatives and the hedging of financial exposures to include a variety of other kinds of risk — notably operational risk, reputational risk, and, most recently, strategic risk. So Firms face different kind of risks that financial, and they use insurance to manage some of them.

Historically, insurance is a primarily tool of risk management (Vaughan, 1997). More particularly, Business Insurance is defined as a coverage that protects businesses from losses due to events that may occur during the normal course of business. There are many types of insurance for businesses including coverage for property damage, legal liability and employee-related risks (Zeckhauser, 2008). Companies evaluate their insurance needs based on potential risks, which can vary depending on the type of environment in which the company operates. Within business insurance, we can then identify Property and Casualty (P&C) Insurance and the Operating Loss (OL) Insurance.

Property insurance provides protection against most risks to property, such as fire, theft and some weather damage. This includes specialized forms of insurance such as fire insurance, flood insurance, earthquake insurance, home insurance, or boiler insurance. Casualty insurance is often equated to liability insurance. It is mainly liability coverage of an individual or organization for negligent acts or omissions.

A company, which consistently generates operating losses, will require the Operating Loss Insurance (OL) in order to avoid bankruptcy. The net loss recorded as a result of a company's unprofitable operation, considering only the company's operating income versus its operating expenditures. An operating loss does not consider the effects of interest income, interest expense or taxes, but in some cases includes depreciation expense.

Thus, the risks can be covered by insurance or derivatives in function of their nature. The theory of risk management explains more precisely the implementation of derivatives by the three determinants cited above, which are the maximization of the value of the company, the maximization of utility manager and economies of scale. There is a rich scientific literature that has validated the above theory to the use of derivatives, but few researches have tested this theory on insurance products. This is the goal of this article.

The main hypothesis of this research is to verify that the use of business insurance is explained by risk management theory. Thus the determinants of setting up a business insurance could be the maximization of the value of the company, the maximization of managers utility and economies of scale. For a better explanation, this hypothesis can be divided into two; the first hypothesis verified in the implementation of the P&C insurance is explained by the RM theory. The second hypothesis checks that the implementation of the OL insurance is explained by the RM theory.

The paper is structured as follows. Section 2 summarizes the theoretical determinants of RM theory, the corporate demands of hedging and details all the consequent hypotheses. Section 3 presents the research method and the empirical sample. Section 4 develops tobit models to explain and measure the determinants of the P&C and OL insurances, and discusses the results. Finally, the conclusion discusses the limitations and perspectives of this research.

2. Theoretical Determinants of Hedging and Research Hypotheses

The theoretical debate on the determinants of risk management by non-financial firms has arisen following the introduction of market frictions in the classic model of Modigliani and Miller (1958) on optimal capital structure. As part of their assumptions (the absence of market imperfections: the absence of taxes, bankruptcy costs, and transaction costs), the authors argue that risk management is a redundant activity and does not affect the value of the firm. Thus, if capital markets are perfect, the shareholders have the necessary information about the company's exposure to risks, and the tools to create their desired risk profiles; in this environment, there is no reason for hedging to be carried out by the firm.

Empirical research has tested the individual or full set of neoclassical assumptions made by Modigliani and Miller (1958). Through various surveys, other researchers have verified that financial structure directly affects the value of the company, and that being heavily indebted could be less valuable than being a "healthy" company, all other things being equal (Allayannis & Weston, 2001; Guay & Kothari, 2003; Brown et al., 2006; Graham & Rogers, 2002; Nain, 2004; Kaushik, 2008; Al Momani & Gharaibeh, 2008; Ben Khediri, 2006; Bodnar & Marston, 1998; De Ceuster et al., 2002; Grant & Marshall, 2002).

This empirical research highlights these determinants and their approximate variables, which can be categorized them into three points:

First category: determinants related to the assumption of maximizing the value of the firm (Graham & Rogers, 2002; Dwarf, 2004; Carter et al., 2004). These include:

- Investment decisions and financing options for growth and the problem of underinvestment. Hedging allows the firm to gain access to internal funds available when attractive investment opportunities arise. If the costs of external financing are higher than those of internal financing, a firm with an investment project has a greater probability of covering in order to stabilize itself and so avoid borrowing on the capital market. This is in accordance with the pecking-order theory. *Approximated by the following variable(s): market value/book value, quick ratio (assets liquidatable within one year minus debts due within one year), R&D/sales ratio and EBIT/sales.*

- The convexity of the tax function to pay. Hedging serves to reduce the variability of firm value or profits before tax, the anticipatory tax rate is reduced, and therefore the value of the firm after tax is increased, as the costs of coverage are not too high. It is better to have stable taxable income over time rather than having very random taxable income. *Approximated by the following variable(s): reported-loss/total-assets ratio.*

- The costs of financial distress associated with leverage and restrictive covenants related to debt. With the increase of the value of the firm, the probability of creditors being paid is higher and the remaining portion of shareholders increases. Thus, the costs of financial distress are negatively related with the residual part of the firm. As hedging decreases, the variability of the future value of a leveraged firm and the probability of incurring financial distress costs are therefore reduced. *Approximated by the following variable(s): earnings before interest and taxes (EBIT)/interest expenses, and total debt/equity.*

These determinants and their variables have the following theoretical relation with the implementation of hedging.

Table 1 Hypothetical Relations between First Category of Determinants and Hedging

Determinants and ratio	Relation
<i>Investment decisions and growth option</i>	
Market value/book value	+
Quick ratio: liquid assets within one year minus debts due within one year	-
R&D/sales ratio	+
EBIT/sales	+
<i>Tax</i>	
Reported-loss/total-assets ratio	+
<i>Financial distress</i>	
EBIT/interest expenses	-
Total debt/equity	+

According to the main hypothesis of this research, the first sub-hypothesis that can be created with this determinant has two levels, the first one, is about the determinant of Property and Casualty (P&C) Insurance, the second one, is about the determinant of Operating Loss (OL) Insurance.

H1.1: The implementation of Property and Casualty (P&C) Insurance is determined by the assumption of maximizing the value of the firm overall.

H1.2: The implementation of Operating Loss (OL) Insurance is determined by the assumption of maximizing the value of the firm overall.

Second category: determinants related to the assumption of managers maximizing utility (Aretz et al., 2007). These include:

- Problems and agency costs, risk aversion of managers, and the ability of managers. According to agency theory, risk-averse managers who hold a large proportion of shares in the company they work for have an expected utility of wealth that is significantly affected by the variance in expected profits of the firm. As the shares provide a linear function of profit, these managers (as shareholders) will want to minimize the volatility of their profits. So, they take the opportunity to reduce some of the specific risks to which they are exposed. The more that managers own shares in the company, the greater the probability that the company uses hedging activities. *Approximated by the following variable(s): number of stock options held by managers, number of stock held by managers and dividend yield.*

These determinants and their variables have the following theoretical relation with the implementation of hedging.

Table 2 Hypothetical Relation between Second Category of Determinants and Hedging

Determinants and ratio	Relation
<i>Agency cost</i>	
Number of stock options held by managers	?
Number of shares held by managers	?
Dividend yield	?

According to the main hypothesis of this research, the second sub-hypothesis can be created with this determinant has two levels, the first one, is about the determinant of Property and Casualty (P&C) Insurance, the second one, is about the determinant of Operating Loss (OL) Insurance.

H2.1: The implementation of Property and Casualty (P&C) Insurance is determined by the assumption of managers maximizing utility.

H2.2: The implementation of Operating Loss (OL) Insurance is determined by the assumption of managers maximizing utility.

Third category: economies of scale (Allayannis & Weston, 2001; Guay & Kothari, 2003; Brown et al., 2006). These include:

- Economies of scale and size of the company (Judge, 2006; Ben Khediri, 2006; Mefteh 2005), and diversification. Economies of scale are an important factor in the decision on whether to hedge. Generally, larger firms have sophisticated financial strategies, whether or not they use derivatives. In addition, trading on the derivatives market requires heavy capital outlays, meaning that small firms will find it more difficult to participate, mainly because of their low liquidity. The determinant related to the size of the firm is *approximated by the following variable(s): Ln (total assets), and assets excluding sector/total assets.*
- Regulation and control industry. Firms that operate in a regulatory environment have less flexibility in their investment decisions, and firms that have less flexibility in their investment decisions have fewer agency costs and lower costs related to loan agreements. Therefore, these firms will be less likely to hedge. *Approximated by the following variable(s): Binary (regulated = 1, otherwise = 0).*

These determinants and their variables have the following theoretical relation with the implementation of hedging.

Table 3 Hypothetical Relationship between Third Category of Determinants and Hedging

Determinants and ratio	Relation
<i>Size and economies of scale</i>	
Ln (total assets)	?
Diversification	
<i>Off-area assets/total assets</i>	-
<i>Regulation</i>	
<i>Binary (1 = regulatory sector, 0 = not)</i>	-

According to the main hypothesis of this research, the third sub-hypothesis can be created with this determinant has two levels, the first one, is about the determinant of Property and Casualty (P&C) Insurance, the second one, is about the determinant of Operating Loss (OL) Insurance.

H3.1: The implementation of Property and Casualty (P&C) Insurance is determined by the assumption of economies of scale.

H3.2: The implementation of Operating Loss (OL) Insurance is determined by the assumption of economies of scale.

This section has presented the determinants of hedging and their approximated variables. It allows us to model the decision on whether or not to use hedging and to explain this using the variables presented above. This kind of model is used for explaining the implementation of business insurances by the theoretical determinant of hedging.

3. Research Method and Empirical Survey

An empirical investigation was conducted to observe the different ways in which financial risk management

is developed and implemented by non-financial firms. This survey was conducted in the same way as the empirical investigations of risk management initiated by Bodnar and Marston (1998), De Ceuster et al. (2002), and Grant and Marshall (2002). It was conducted as part of a doctoral thesis on a sample of 400 French non-financial companies. The sample was drawn at random according to a double stratification by size and industry, from a base INSEE database.

The questionnaires were sent to 1,200 companies by post, and then followed up with telephone calls. This double collection (by post and telephone) produced a response rate of almost 33%, with a usable sample of 401 companies. The collection of information was completed in June 2010; the entire survey took more than a year.

The questionnaire was sent to CFOs and collected information on risk-management and insurance practices. It consisted of two parts: The first part looked at the organization of risk management and resources allocated to this function, and the second part focused on different strategies for measuring, evaluating, and hedging financial and operational risks. A first version of the questionnaire was constructed on the basis of questionnaires used by De Ceuster et al. (2002) and Judge (2006), and was then tested and adapted in a survey undertaken during the author's master's degree year.

We present below the first results of this survey.

Table 4 Types of Firms

	Number	%
Listed firms	269	67
Unlisted firms	132	33
	401	100

The first analysis of the sample is by type of company: listed or unlisted (Table 4). This is emphasized because the majority of research has focused on the behavior of listed companies.

Table 5 Distribution of Firms by Size (Total Assets)

Size (€K)	Number	%
0–5,000	37	9
5,001–10,000	35	9
10,001–50,000	94	23
50,001–100,000	96	24
Over 100,000	139	35
	401	100

The second analysis is by size of company, as shown above (Table 5). Unlike most research, this study is therefore concerned with all sizes of businesses: small, medium, and large.

Based on the theoretical determinants of hedging (as seen in the previous section), financial ratios were constructed from another source, a database called Point Risk. This database, distributed by the Altares Institute, offers access to a vast database of over 2.15 million French companies. It validates the status of each company, and carries a ten-year history of annual accounts, with 8 million balance sheets and 925 search criteria available.

The results of the survey showed the following distribution of these approximated variables of the determinants presented above.

Table 6 Financial Ratios

Determinants and ratio	Mean	Median	Standard deviation
<i>Investment decisions and growth option</i>			
Market value/book value	1.7100	0.9100	1.2215
Quick ratio: liquid assets within one year minus debts due within one year	1.6230	0.9800	1.3067
R&D/sales ratio	1.2449	0.3400	1.0622
EBIT/ sales	2.0536	1.9675	2.0056
<i>Tax</i>			
Reported-loss/total-assets ratio	0.3952	1.0500	0.4115
<i>Financial distress</i>			
EBIT/interest expenses	2.3144	1.0800	1.0457
Total debt/equity	0.7421	1.1500	1.2198
<i>Agency cost</i>			
Number of stock options held by managers	0.1640	0.3200	0.2664
Number of shares held by managers	0.6237	0.8432	0.4345
Dividend yield	4.0675	3.0786	3.6573
<i>Size and economies of scale</i>			
Ln (total assets)	4.4532	6.3456	6.3464
<i>Diversification</i>			
Off-area assets/total assets	0.3345	0.2800	0.2075
<i>Regulation</i>			
Binary (1= regulatory sector, 0 = not)	0.3461	0.6542	0.2345

We note that these statistics (Table 6) are significantly lower than those calculated in comparable surveys, such as those by De Ceuster et al. (2002), Grant and Marshall (2002), Judge (2006), and Ben Khediri (2006). This difference is due to the originality of our sample, which contains small business (unlike other surveys, which cover only major listed firms).

Table 7 Type of Business Insurances Used by Non-Financial Firms

	Number	%
P&C Insurance	344	91.5
OL Insurance	181	48.2
Total	376	

Nearly 94% of non-financial companies implement Business insurances to cover various operational risks (fire, explosion,...) according to the FFSA (Fédération Française des Sociétés' Assurance) this rate should be close to 100%. Specifically, 91.5% of companies use P&C insurance and 48.2% of companies use OL insurance. Both operational risk management means are not exclusive.

Table 8 Amount of Hedging by Business Insurances Used by Non-Financial Firms

	Mean (10 ⁶ euros)	St Deviation
P&C Insurance	1394.50	187.12
OL Insurance	2127.00	295.42

The average amounts covered by P&C insurance are 1,394.5 million euros. The average amount covered by the OL insurance is about 2,127.00 million euros. These statistics represent the level or degree of coverage of such insurance.

4. Empirical Models

To measure the effect of the determinants of the development and intensity of insurance coverage by non-financial companies, two of Tobit models are developed. Both models are developed according to the type of insurance policy. Model I seeks to explain the determinants of the intensity of the hedging of the P&C Insurance. Model II, meanwhile, explains the determinants of the intensity of the hedging of OL insurance.

In each model, the dependent variable Y^* is measured by the total amount covered by the insurance reported total assets. The independent variables X_i are the variables approximate theoretical determinants presented above and correspond to the determinants developed by the scientific literature to explain the financial risk management.

The model takes the following form:

$$Y^* = \beta X_i + \mu \text{ where } N(0, \sigma^2)$$

$$Y_i = Y_i^* \text{ if } Y_i^* > 0$$

$$Y_i = 0 \text{ if not}$$

The estimations by maximum likelihood method are:

Table 9 Quality Indicators

Indicators	Model I.1	Model I.2	Model II.1	Model II.2
AIC	13,6343	12,6545	11,9564	11,2967
SC	11.2234	11.0034	10.5634	10.8564
-2Log L	3056.3345	3207.845	3845.5564	3784.7756
Pseudo R ²	0.561	0.441	0.489	0.467

Note for different models; AIC is between 13.63 and 11.29. SC is between 11.22 and 10.56. The -2 log likelihood ratio is between 3784.77 and 3056.33. Pseudo R² is between 0.56 and 0.44. These statistics confirm that the quality of the models is good.

Table 10 Models' Coefficients

	Model I.1	Model I.2	Model II.1	Model II.2
<i>H1: Investment decisions and growth option</i>				
Market value/book value	0.7656**	0.6745*	1.2234**	1.3412*
Quick ratio: liquid assets within one year minus debts due within one year	0.7989**	0.8234*	1.3365**	0.9856*
R&D/sales	0.7563*	0.7765**	1.1287**	0.8456**
EBIT/ sales	0.6532*	0.8234*	0.9867*	0.9945*
<i>H1: Financial distress</i>				
Total debt/equity	0.8566*	0.9534*	0.9561*	0.9561*
<i>H2: Agency cost</i>				
Number of shares held by managers	0.3456	0.2345	0.5634*	0.6753*
<i>H3: Size and economies of scale</i>				
Ln (total assets)	1.6343		1.3421	
Ln (total assets) ²		0.4218**		0.5586**
Binary (1= regulatory sector, 0 = not)	-0.4453*	-0.3346*	-1.8756*	-1.5343*

Note: * significant at 5%; **significant at 1%.

First analysis indicates that the variable size is not significant. Which contradicts the theory of financial economies of scale. To find a relationship between the size and hedging by insurance, variable size square — $(\ln(\text{total assets}))^2$ — is introduced into the vector of explanatory variables for the models I2 and II2. Otherwise, Market value/book value ratio, quick ratio, R&D/sales, EBIT/sales, Total debt/equity and regulatory sector are

significant for all models. Number of shares held by managers is significant just for models II. The square of size is significant, this result shows the convexity of the size in the intensity of the coverage of operational risk. These are smaller as larger companies tend to good hedge against operational risk and therefore there is no economy of scale for this type of risk as opposed to financial risk.

We have to note the observed relation between the variables/determinants and the explanatory variable (hedging). The relation of Market value/book value ratio, R&D/sales, EBIT/ sales, Total debt/equity, regulatory sector, number of shares held by managers and size, with hedging are in accordance with the theory, but it's not the case of the quick ratio. It presents a negative relationship with hedging.

5. Discussion

The aim of this article is to verify that the use of business insurance is explained by risk management theory. Thus the determinants of setting up business insurance could be the maximization of the value of the company, the maximization of managers' utility and economies of scale.

By modeling the relation between the amount of insurance businesses and financial structure, these empirical evidences allow to validate or note the research hypotheses.

The first categories of hypotheses are:

H1.1: The implementation of Property and Casualty (P&C) Insurance is determined by the assumption of maximizing the value of the firm overall.

H1.2: The implementation of Operating Loss (OL) Insurance is determined by the assumption of maximizing the value of the firm overall.

We note that, for the investment decisions and growth option determinant, Market value/book value, Quick ratio, R&D/sales, EBIT/sales. So, in accordance with the model of Froot, Scharfstein and Stein (1993), insurance business allows the firm to access necessary and available internal funds when opportunities to present interesting investment and the costs of external financing are higher than those of internal financing, a firm with an investment project has a higher probability to cover its cash flows, to stabilize and thus avoid to borrow on the capital market. But we have to note the negative relationship between quick ratio and hedging, in the case of insurance, liquidity has not the same role like with derivatives, because, liquidity is an alternative way to hedge against financial risks (Judge, 2006).

For tax determinant, no variables are significant. This theoretical determinant is not valid for insurance. Insurance don't serves to reduce the variability of firm value or profits before tax, the anticipatory tax rate is reduced, and therefore the value of the firm after tax is not increased, as the costs of coverage are not too high. It is not necessarily better to have stable taxable income over time rather than having very random taxable income.

For Financial distress, total debt/equity, in accordance with the model of Aretz, Bartram and Dufey (2007), Judge (2006) Bartram, Brown, Fehle, (2006), the costs of financial distress encourage companies to hedge. The higher the value of the firm, the greater the creditors have a high probability of being paid and the remaining portion of shareholders increases. Coverage decreases as the variability of the future value of a leveraged firm; the probability of incurring financial distress costs is therefore reduced.

So, we can overall, validate H1.1 and H1.2 hypotheses.

The second categories of hypotheses are:

H2.1: The implementation of Property and Casualty (P&C) Insurance is determined by the assumption of

managers maximizing utility.

H2.2: The implementation of Operating Loss (OL) Insurance is determined by the assumption of managers maximizing utility.

We observe that for determinant agency cost, the variable Number of shares held by managers is significant just for models II. So, we can validate agency theory, for LO insurance, risk-averse managers who hold a large proportion of shares in the company they work for have an expected utility of wealth that is significantly affected by the variance in expected profits of the firm. As the shares provide a linear function of profit, these managers (as shareholders) will want to minimize the volatility of their profits. So, they take the opportunity to reduce some of the specific risks to which they are exposed.

We validate only H2.2 hypothesis, and reject H2.1 Hypothesis.

The third categories of hypotheses are:

H3.1: The implementation of Property and Casualty (P&C) Insurance is determined by the assumption of economies of scale.

H3.2: The implementation of Operating Loss (OL) Insurance is determined by the assumption of economies of scale.

We observe a significant relationship between the size (square) and the implementation of insurance. This result is very original; there is convex relationship between insurance and size of firms. That means the small and the large firms use a lot of insurance P&C and OL, but the medium firms use less insurance.

The hypotheses of economies of scale are not valid for P&C and OL insurances.

Finally, we can note that, regulatory sector are determinant for using Business insurances. That is a natural, because the regulatory forces the firms to insure themselves.

6. Conclusion

This research analyzed the implementation of two kind of business insurances, like P&C and OL insurance, and aim to measure the determinant this kind of hedging in the non-financial. The risk management theory is used to develop the determinant of hedging. Empirical models measure and validate one theoretical determinant, the assumption of maximizing value of the firm. The assumption of maximizing the utility of the manager is valid only for OL insurance. The assumption of economies of scale is note valid. But we have provided evidences for a convex relationship between the implementation of business insurance (P&C and OL) and the size of the firm.

The research has some limitations. These models present the hedging use as a result of its financial characteristics. Actually the internal environment (employees, shareholders) and external (competition, regulators) are also determinants of strategic choices. Thus, a research integrating these environmental aspects in addition to the financial characteristics will better measure and explain hedging strategies.

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