Analysis of risk management strategies: A proposition for risk management model

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Summary:

This research analyses the different strategies of financial risk management, based on the results of an empirical survey on the practices of financial risk management implemented by non-financial firms. Financial risks are defined as the risk of commodity, currency risk and interest rate risk.

Four different management strategies are defined and identified; the internalization of risks, the management with operational tools as the netting, the management with linear derivatives as forwards and management with optional derivatives.

After identifying these strategies, a strategic choice model is developed. This model seeks to identify the determinants and predictors of choosing a strategy rather than another one. The Multinomial logistic model explains these strategic choices by financial and structural characteristics of firms. This model is tested and an alternative is developed with the logistic nested model.

Beyond these models, the purpose of this research is to develop a management model. This model explains which financial risk management strategy the firm implement according to their characteristics. The empirical results show that the sophistication of the hedging strategy increases as business and size growth. Finally, the discussion focuses on the difference between the two concurrent models and their explanatory power. This analysis shows that the superiority of the nested logit model is relative and evaluating the marginal effects of the explanatory variables on the choice of strategies according the two competitors models indicates that the choice of one or the other may change conclusions of this analysis.

Keywords: Financial risks. Strategic choice. Multinomial logistic model. Logistic nested model.

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INTRODUCTION

These last years are full of scandals and bankruptcies caused by a lack and mistakes of risk management, Enron, (2001), WorldCom, (2002). Risks management is classified by financial executives as one of the most important issues of financial management (Rawls and al, 1990).

Financial risks are defined by the risk of commodity, currency risk and interest rate risk. The methods of risk management are improved with the development of financial products. Indeed, financial innovation is continually developing new products more and more complex to manage risks (Shimpi, 2002). The use of derivatives is now widespread. ISDA (2009) report that 94% of the 500 largest U.S. companies (Fortune 500) use derivatives: 93.6% to manage the exchange rate, 88.3% to manage the rate of 50.9% interest and to manage the commodity price. However, the widespread use of derivatives for hedging purposes must not make us forget that there are other means of managing financial risks. Thus, some methods are sometimes referred as substitute to hedge both derivatives have become hedging tools of choice (Nance and al, 1993, Judge, 2006).

More generally, the issue of risk management and research of the determinants of hedging has been widely discussed in the literature, Aretz, Bartram et Dufey, (2007), Allayannis and Weston (2001), Guay and Kothari (2003), Brown, Crabb, Haushalter, (2006), Graham and Rogers (2002), Nain (2004), Kaushik (2008), Al Momani, Gharaibeh (2008), Benkhediri (2006), Bodnar G. Marston R. (1998), De Ceuster and al (2000), Grant and Marshal (2002). All these research have analyzed the risk management in non-financial companies. More specifically, they are interested in the determinants of coverage and explained and measured the implementation and intensity of hedging financial risks. Non-financial firms are defined as economic agents whose main function is to produce goods and nonfinancial services. Research

on risk management distinguishes financial firms and non-financial firms, because they do not face the same risks.

The present research is positioned in the focus of research above. However, its originality and its contribution is to identify and detail the different strategies of financial risk management implemented by non-financial companies, and also to explain and measure the choice of a strategy by the characteristics of the company. This paper seeks to identify and explain the empirical risk management strategies developed and implemented by non-financial companies. It seeks to answer the following questions: What are the various risk management strategies implemented by non-financial companies? What are the determinants of the choice of a strategy for risk management?

Beyond these issues, this research aims is wider and provides a model for risk management. Normatively, through the identification of predictors of strategic choice model proposes the strategy or method of financial risk management based on the financial structure of the company. This research is empirical. The analyses are conducted on the basis of a survey, itself based on a sample of non-financial enterprises French.

To provide answers to the above questions, this article is organized as follows; after the introduction, the second chapter presents the different strategies for managing financial risks and determinants of coverage identified in the scientific literature. The third chapter presents the sources of information used as the empirical investigation and external sources that have completed. The fourth chapter, meanwhile, presents various models and the discussion thereof. Finally, the conclusion discusses the answers to the main questions and also the limitations of this research.

1. RISK MANAGEMENT STRATEGIES AND DETERMINANTS:

We define the risk management strategy as a singular position implemented by a firm in order to respond better to different exposures and by choosing to exercise this position in different way from those of its competitors. The strategy of risk

management is larger than risk management, in the sense that it is defined as a structured and consistent approach to identify, assess and manage risk own to the firm.

An analysis of the financial literature shows that there are several methods to manage financial risks, and we can group these methods in four strategies. The first strategy is called internalization of risk or No hedge, the second one is called Hedging without derivatives or Using operational management, the third strategy is Hedging with linear derivative and finally, the fourth is Hedging with non linear derivatives. Moreover, this proposed definition of risk management strategies based on the risk profile associated with each of the strategies. The risk profile is defined as the appetite for risk that is the maximum level of risk that a company agrees to take in order to increase its value (Planchet and Julliard, 2010). Indeed, these strategies enable the company to change its profile: with the decision to hedge or not, with the setting up or derivatives or not, with the choice of linear or non-linear derivatives.

1.1. Hedging strategies:

Thus, These four strategies for managing risks may be detailed as follows:

1st Strategy: No hedge or internalization of risk:

This strategy does not hedge the exposure, while the risk is identified. It is then called internalization of risk. The internalization of risk may relate to a wider range of the financial strength of the company's proven risk accordingly. It would make sense that only companies whose financial capabilities are more substantial, can reasonably and / or theoretically opt for internalization of these risks.

2nd Strategy: Hedging without derivatives or using operational management:

The second strategy is to use common management tools; it is also called operational risk management. It involves making adjustments and options business organization to reduce exposure. As the leads and lags which is a financial transaction to accelerate or decelerate the time an invoice payments made in foreign currencies, or the netting

which is a system of cash pooling cash balances of several subsidiaries of same company for example, which is intended to offset the debts and claims thereof.

Thus, a firm (a multinational specifically) can partially hedge currency risk, if each of its subsidiaries and cash invoice most of its turnover in its local currency and spends most of the cash that it releases its flow. This logic explains in part the installation of Airbus production units in the United States.

We may also mention the degree of diversification. A firm holding a certain percentage of assets whose purposes are not to continue the core business of the firm, will need less hedging, since its activities are more diversified (Garven, 2007).

3rd Strategy: Hedging with linear derivative:

This third hedging strategy is to hedge with derivatives linear, such as futures, forwards and swaps. These contracts back whole or any part of an exposition (Roncalli, 2004). This strategy is quite simple, because of the derivative instrument or contract, the buyer is obliged to yield to maturity exposure to predefined conditions, without the benefit, if any, of a change the price of the underlying would have been favorable to him in the absence of hedging.

4th Strategy: Hedging with optional derivatives:

The latter strategy is more sophisticated and requires more skills. It is consist to hedge asymmetrically against exposition by using instruments, guaranteeing a purchase price or maximum sales of the underlying. The option gives the holder the right but not the obligation to buy or sell an asset. Many types of option contracts exist in the financial markets. The underlying can be an interest, exchange rate or commodity (Roncalli, 2004). The two main options contracts traded options are options to purchase (call) and puts (put). We can say this strategy gives the firms the opportunity to hedge against a particular sense of variation underlying the options have accompanied the movement of political sophistication of risk management (Philippart, Colmant, 2003).

1.2. Determinants of hedging:

These four management strategies offer firms the ability to control the level of risk to allow them to control the cash flow from their investments and align with their financing needs on the one hand and reduce the aggressiveness of the imposition of the other and also to allow firms to reduce the likelihood of financial difficulties and cost involved. These elements, as is mentioned, are in fact the determinant of the hedging.

We find in the literature many researches that address the determinants of hedging (Cliché. 2000). It should first be noted that these determinants are those of the hedging in general and the use of derivatives in particular. In this research, the notion of coverage is no longer presented as a binary concept (hedging or not), but differentiated by four strategic choices. The underlying assumption, that is strong assumption, is that these hedging strategies share the same determinants identified for the "simple hedging or not".

The theoretical debate on the determinants of risk management by non-financial companies has arisen following the introduction of market frictions in the classic model of Modigliani and Miller (1958) on the optimal capital structure. As part of their assumptions (absence of market imperfections: the absence of taxes, bankruptcy costs, transaction costs), the authors argue that risk management is a redundant activity and does not affect the value of the firm. As part of their assumptions (absence of market imperfections: the absence of taxes, bankruptcy costs, 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 required information about the company's exposure to risks, and the tools to create their desired risk profiles, for example by holding well-diversified portfolios to hedge and therefore in this environment there is no reason that the hedging is carried out by the firm. Empirical research released successively or jointly neoclassical assumptions of Modigliani and Miller. Thus, through various surveys, other researchers Jensen and

Meckling (1976), Bradley, Jarell, Kim (1984), Baker and Wurgler (2002) have verified that the financial structure directly affects the value of the company and that heavily indebted could be less valuable than another "healthy" company, all things being equal.

Thus, this empirical research highlighted these determinants. We can then classify its determinants and their approximate variables into three categories:

First category: Determinants related to the assumption of maximizing the value of the firm (Graham and Rogers, 2002, Dwarf, 2004, Carter, Rogers and Simkins, 2005). It includes:

- Investment decisions and financing options for growth and underinvestment problem, approximated by the following variables:

Market value / book value. And Quick Ratio (liquidable assets within one year - debts due within one year). And R & D/ Sales.

- The convexity of the tax function to pay, approximated by the following variables:

Report Loss / total assets.

- The costs of financial distress associated with leverage and restrictive covenants related to debt, approximated by the following variables:

EBIT / Interest expense. And Total Debt / Equity.

2nd category: Determinants related to the assumption of utility maximization managers (Aretz, Bartram and Dufey, 2007). It includes:

- Problems and agency costs, risk aversion of managers and the ability of managers, approximated by the following variables:

Number of options held by managers.

3rd category: Various assumptions; Allayannis and Weston, (2001, Guay and Kothari, 2003, Brown, Crabb, Haushalter, 2006). It includes:

- Economies of scale and size of the company (Judge, 2006 Benkhediri, 2006 Mefteh 2005), approximated by the following variables:

Ln (Total Assets)

- Diversification, approximated by the following variables:

Assets excluding sector / total assets.

- Regulation and control industry, approximated by the following variables:

Binary (regulated = 1, otherwise = 0).

2. METHOD OF RESEARCH:

To meet the requirement of empiricism on the one hand and to answer the main question, which seeks to explain the determinants of different strategies, on the other hand, a sample survey is conducted.

This empirical investigation is conducted to observe the different ways of financial risks management developed and implemented by the non-financial firms. This survey is conducted like the empirical investigations of risk management initiated by Bodnar and al (1998), De Ceuster and al (2000), Grant and Marshall (2002). It has been conducted as part of a doctoral thesis on a sample of 400 non-financial French companies. The sample is drawn at random according to a double stratification by size and industry, from a base INSEE database.

The questionnaire was sent to the CFO. It collects all the information about the practices of risk management. It consists of two parts. The first one is the organization of risk management and resources allocated for this function. The second part focuses on different strategies to measure, evaluate and hedge the financial and operational risks. The collection of information was done in June 2010, the entire survey has lasted more than a year.

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The sample is drawn at random according to a double stratification by size and industry, from a base INSEE data. The collection of information was done in June 2010, the entire survey has lasted more than a year. Questionnaires were sent to 1,200 companies by post then revived by telephone calls. This double collection, postal and telephone, has allowed having a response rate of almost 33% with a usable sample of 401 companies.

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We present below the first results of this survey.

Table 1: Types of Firms

	Total	%
Listed Firms	269	67
Unlisted Firms	132	33
	401	100

The first originality of the sample is composed of two types of companies listed and unlisted, (Table 1). This originality is emphasized because the majority of research has focused on behavior of listed companies.

Table 2: Distribution of firms by size (total assets)

Size	Total	%

0 – 5000 K€	37	9
5000 – 10000 K€	35	9
10000 – 50000 K€	94	23
50000 – 100000 K€	96	24
Over 100000 K€	139	35
	401	100

The second originality is its extensive. Indeed, as shown above (Table 2). This research, unlike most publications, therefore interested in any type of business: Small, Medium and large companies.

Based on the theorical determinants of hedging (as seen in previous chapter), financial ratios were constructed from another source, a database called Point.Risk. This database distributed by Altares Institute offers access to a vast database of over 2,150,000 French companies, it validate the status of each company, with a history of annual accounts of 10 years, 8 million balance available, 925 search criteria.

The combination of the survey and this source built a file that connects the risk management practices with the financial characteristics of companies. This is the file that allows all analyzes and answers to research questions. The results of the survey showed the following distribution of these dominant strategies.

Table 3: The dominant strategies to manage financial risk

	N	**%**
S1: No hedging, risk internalization	104	25,9
S2: Hedging without derivatives	99	24,4
S3: Hedging with linear derivatives (futures, swaps)	106	26,7
S4: Hedging with nonlinear derivatives (options)	92	22,9
Total	401	100

74% of French corporates hedged against financial risks, all sizes and all sectors combined. Bailly, Browne, and Skerrat Hicks (2003) found that 72% of companies covered, their study is concerned only with the cover derivatives and listed companies. Judge (2006) found a hedging rate of 77.9%.

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

Table 4: Financial ratios

Determinants and ratio	Mean	Median	Standard Deviation
Investment decisions and growth option			
Market value / book value	3,7100	2,2100	6,22159
Quick Ratio: liquidable assets within one year - debts due within one year	1,6230	0,9800	2,30678
R & D / Sales	2,2449	0,3400	4,06226
Tax			
Report loss / total assets	0,3952	1,0500	0,41152
Financial distress			
EBIT / Interest expense	5,3144	4,0800	3,04571
Total Debt / Equity	0,7421	1,1500	1,21986
Agency cost			
Number of options held by managers	0,1640	0,3200	0,26645
Diversification			
Off area assets/ total assets	0,3345	0,2800	0,20756
Size, Economies of scale			
Ln (Total Assets)	4,4532	6,3456	6,3464
Regulation			
Binary (1= regulatory sector, 0 if not)	0,3461	0,6542	0,2345

We note that these statistics (Table 3) are significantly lower than those calculated in comparable surveys, such as De Ceuster et al (2002), Grant and Marshall (2002), Judge (2006), Benkhidiri (2006). This difference is due to the originality of our sample that contains small business unlike other surveys that cover only major listed firms.

3. EMPIRICAL MODELS

After the definition of these several strategies, we want to develop a model that explains the strategic choice. We can do this by explaining the variable "dominant strategy of risk management" by some others, (financial distress, agency costs, taxation, size, etc....), to find the determinants of these strategic choices. Thus, we have to use a discriminating approach that seeks to highlight the distinctive features of each strategy. Where the dependent variable "dominant financial risk management strategy" of this model is multiple choices variables. These terms of this variable are:

(S1): Strategy 1. Internalization of risk.
(S2): Strategy 2. Hedging without derivatives.
(S3): Strategy 3. Hedging by linear derivatives.
(S4): Strategy 4. Hedging by nonlinear derivatives.

In this family of models that explain the multiple-choice variables, the multinomial logit model is considered as the basic model. It meets the specific nature of the dependent variable (dominant strategy of risk management). Assume that each firm i has to choose between the four strategies (j = 0 - 3) previously exposed (internalisation, current management, derived from linear, non-linear derivatives). In an unordered choice model, firm i will compare the different levels of utility associated with various options and choose the one that maximizes its usefulness among the J choice.

3.1.The multinomial logit model

The estimation of the equation of strategic choice of companies is done using a multinomial logit model. This model is estimated by maximum likelihood and provides the following results:

Table 5: Information about the fit of the model:

Criteria	Values
log Likelihood	0,012
R^2 Cox et Snell	0,293
R^2 Negelkerke	0,321
R^2 Mac Fadden	0,296
Estrella	0,567
Adjsuted Estrella	0,525

The quality criteria of the LM model: all R^2 and Estrella coefficient show that the explanatory model of "dominant strategy" variable is of good quality.

Table 6: Coefficients of LM model; (Reference Category S1: No hedging.).

Variables	S2 / S1	S3 / S1	S4 / S1
Constant	2,544**	3,765**	2,643**
Market value / book value	2,376	2,158*	3,386
Liquidity Ratio: liquidable assets within one year - debts due within one year	-3,987**	-2,834**	-2,438**
R & D / Sales	1,065	1,576	0,773*
Loss carry	2,167	2,845*	2,845**
EBIT / Interest expense	1,665	-1,634**	2,032**
Total Debt / Equity	2,654**	1,267	2,074
Off area assets/ total assets	2,045**	-1,665	-2,362
Ln (Total Assets)	1,723*	2,664**	2,967**
Binary: 1 = regulated activity, 0 = otherwise.	1,542	1,483*	0,976

The table above indicates the significance of the variables and also the sign of the relationship with the independent variable.

Table 7: Marginal Coefficients of LM model; (Reference Category S1: No Hedging).

Variables	**S2 / S1**	**S3 / S1**	**S4 / S1**
Constant	0,0254	0,0186	0,0427
Market value / book value	0,0175	0,0332	0,0332
Liquidity Ratio: liquidable assets within one year - debts due within one year	0,0087	0,0076	0,0176
R & D / Sales	0,0275	0,0464	0,0227
Loss carry	0,0397	0,0226	0,0321
EBIT / Interest expense	0,0221	0,0404	0,0328
Total Debt / Equity	0,0097	0,0286	0,0228
Off area assets/ total assets	0,0332	0,0467	0,0269
Ln (Total Assets)	0,0523	0,0386	0,0397
Binary: 1 = regulated activity, 0 = otherwise.	0,0098	0,0224	0,0253

Marginal coefficients above, measure the effect of explanatory variables on the dependent variable. These explain the strategic choices and identify the effect and weight determinants of each strategy and that compared to the reference strategy, which is the no hedging.

Explanation of the choice of strategy 2, hedging without derivatives: The liquidity ratio, the debt ratio, the rate of diversification and size are the (significantly) determinants of this choice.

Explanation of the choice of strategy 3, hedging with linear derivatives: The market value on book value ratio, liquidity ratio, loss carryforward, the debt ratio, the size and regulation are significant.

Explanation of the choice of strategy 4, hedging with nonlinear derivatives: The liquidity ratio, the R & D report on sales, loss carryforwards, the debt ratio and size are significants.

3.2.The independence of irrelevant alternatives

After the multinomial logit model with results discussed above, it is necessary to return to a review for this one. Indeed, the percentage chance of making a particular choice is independent of each other in the LM model. This property, in which the ratio Pj / Pk is independent of the other remaining possibilities of choice is called the independence of irrelevant alternatives (IIA). It is sometimes presented more explicitly as "red-bus/blue-bus problem. This property also means that the percentages (predicted by the model) of firms choosing each alternative will decrease in proportion to their initial magnitudes if we introduce an additional choice in the model (and whatever that choice).

Indeed, in this context, one can for example assume that the percentage chance to implement a hedging strategy derived by linear rather than a hedging strategy with nonlinear derivatives depends at least in part because the we can also choose to internalize the risk or cover with current management means. In other words, it is likely that in practice, the choice of business is done by considering simultaneously the advantages and disadvantages in terms of utility of all the options for presenting them. The choice of a strategy is not based solely on observation of the attributes of the latter and its possible interactions with the characteristics of the company; suggests that the IIA. It also depends on the number of alternative strategies, attributes thereof and their interactions with the characteristics of the company.

For McFadden (1984), the IIA is theoretically unlikely in many applications. However, he stressed that the empirical experience shows that the LM model is relatively robust in many cases for which the IIA property is yet theoretically implausible. This retains some operational validity to the widespread use of LM models for the analysis of choice on several segments.

It is possible to test the validity of the IIA assumption, Hausman and McFadden (1984) suggest that if a subset of all possible choices is actually irrelevant, then its omission in the model does not fundamentally change parameter estimates. Furthermore, the addition of these choices will be ineffective, but will not make the insignificant model. By cons, if the percentages of chance to choose some alternative are not really independent of the choice (assuming IIA is not checked), then the estimated parameters are eliminated when these choices are not significant. Three additional tests the hypothesis IIA, respectively based on the use of a Lagrange multiplier, a plausibility check or a Wald statistic were given by McFadden.

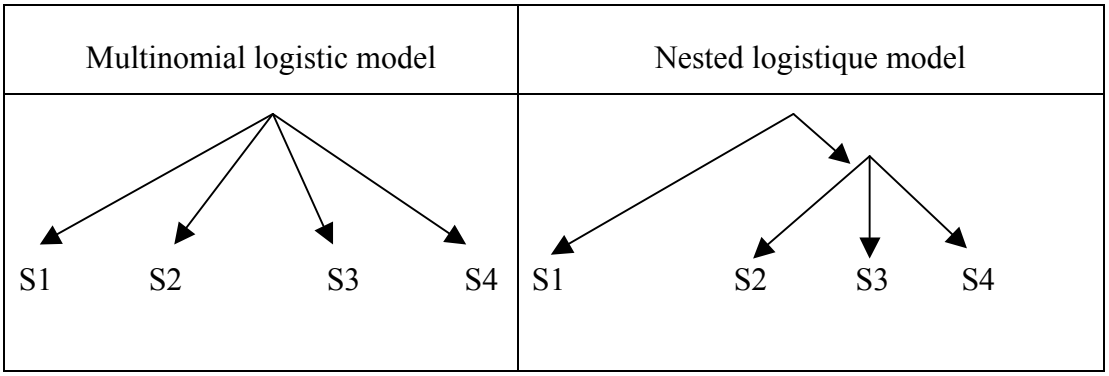
The IIA test is calculated by the following statistics:

$$\chi^2 = (\hat{\beta}_S - \hat{\beta}_E)' [\hat{V}_S - \hat{V}_E]^{-1} (\hat{\beta}_S - \hat{\beta}_E)$$

Where S indicates the estimators based on the small subset of selection, E indicates those ranked based on the set of possible choices and VS and VE are the respective estimated asymptotic covariance matrices. It is distributed under a law of χ^2 with k degrees of freedom.

As discussed above, the first model (multinomial logistic) is underpinned by the assumption of independence of irrelevant alternatives (IIA). It is believed that the firm chooses a group of alternatives n then made his "final" j among different alternatives of Group choices. This process leads to a similar example in Figure 1 tree structure, considering two groups "choice" and four options. This hierarchical form does not necessarily require that the selection process is sequential. The only thing that is needed in this model is to allow some relaxation of the IIA assumption.

Figure 1: The two alternative models



In the model we are interested in the partition choices subgroups comes rather naturally to the extent that we can clearly separate the choice not to cover all the other choices are choices of coverage but different strategies.

The calculation of the test statistic shows a χ^2 of 75.045 with a significance of 0.002. We decided to reject the IIA assumption. An alternative model to the multinomial logit model must be found. As discussed in the previous chapter, it is estimated a nested model.

3.3.The nested multinomial logit model

The test of the IIA is not conclusive. An alternative model to the LM model should be used. The natural alternative to it is a multivariate probit model which, however, the estimate is complex in the current state of knowledge and especially technology. Another more operational model was developed in order to partially relax the strong assumption of the IIA, it is the nested multinomial logit model (LE), as shown above (Figure 1). The original structure consists of assembling the various alternatives subgroups variance may differ between these subgroups but the IIA assumption is kept inside them.

Model parameters (LE) thus defined may be approximated by the usual techniques of maximum likelihood.

Table 8: Information on the fit of the model:

Criteria	**Values**
log Likelihood	0,009
R^2 Cox et Snell	0,162
R^2 Negelkerke	0,221
R^2 Mac Fadden	0,223
Estrella	0,456
Adjusted Estrella	0,421

Inclusive value λ_1	1
Inclusive value λ_2	0,237

The quality criteria of the LE model; all R^2 and Estrella coefficient show that this second explanatory model of "dominant strategy" variable is of lower quality than the first (LM).

Table 9: Coefficients Model LE; (Reference Category S1: No hedging.).

Variables	**S2 / S1**	**S3 / S1**	**S4 / S1**
Constant	1,874**	2,345**	2,083**
Market value / book value	3,666	2,034*	2,386
Hedging	3,214**	3,564**	3,664**
Liquidity Ratio: liquidable assets within one year - debts due within one year	-2,567*	-2,434*	-1,623*
R & D / Sales	0,564	1,243	0,886*
Loss carry	1,756	1,867*	2,453*
EBIT / Interest expense	2,076	-2,865**	2,325**
Total Debt / Equity	1,956*	1,645	1,675
Off area assets/ total assets	1,645**	-2,776	-3,665
Ln (Total Assets)	2,223*	2,657*	3,187**
Binary: 1 = regulated activity, 0 = otherwise.	0,876	1,274*	1,556

The table above indicates the significance of the variables and also the sign of the relationship with the independent variable.

Table 10: Coefficients Marginal Model LE; (Reference Category S1: No hedging.).

Variables	**S2 / S1**	**S3 / S1**	**S4 / S1**
Constant	0,0232	0,0056	0,0274
Market value / book value	0,0234	0,0123	0,0546
Hedging	0,0123	0,0156	0,0143

Liquidity Ratio: liquidable assets within one year - debts due within one year	0,0154	0,0123	0,0197
R & D / Sales	0,0345	0,0215	0,0284
Loss carry	0,0287	0,0187	0,0234
EBIT / Interest expense	0,0115	0,0234	0,0331
Total Debt / Equity	0,0154	0,0321	0,0363
Off area assets/ total assets	0,0254	0,0362	0,0332
Ln (Total Assets)	0,0342	0,0475	0,0537
Binary: 1 = regulated activity, 0 = otherwise.	0,0154	0,0138	0,0231

We can conclude that in our case, the LM model is not appropriate to assess the factors explaining the choice of business tool. This is not a surprising result given the obvious "crack" between the decision to hedge and the choice of different hedging strategies. The results suggest that the proposed alternatives on hedging strategies represent them closer substitutes for example the choice to cover or not against financial risks.

For the sake of control, we push a little further investigation by the implementation of another test of the possible "superiority" of the model (LE) on the model (LM). This is a test using a likelihood ratio test implement.

The idea of the test is to compare the log likelihoods calculated under the constraint H_0. L_r are then the likelihood under H_0 and H_1 in L_u. The fact that in the maximization of the function where the first maximization is under stress, while that the second maximization is not, we can say that $L_u >= L_r$. The test statistic is then $\lambda = L_r / L_u$ must be between zero and one.

Under the regularity conditions and under H_0 , the statistic $-2 \ln \lambda$ follows the χ^2 law with degrees of freedom as the number of constraints. Finally we accept the null hypothesis at the 5% level if and only if $-2 \ln \lambda < \chi^2$ 95% .

The likelihood ratio test leads to a rejection of the LM model 1% confirming the initial test of the hypothesis of IIA.

Marginal regression coefficients (Table 10) measure the LE model the effect of explanatory variables on the dependent variable.

- The first point: the variable "hedging" that makes the nested level is significant. Thus, the grouping of the three strategies S1, S2 and S3 is statistically significant.

- The second point: beyond the difference of modelling, the two models share the same significant determinants of strategic choices.

Determinants of strategy 2 are: Liquidity ratio, Debt, Rate of diversification and size.
The determinants of the strategy 3 are: Market value on book value ratio, liquidity ratio, loss carry, debt ratio, size and the regulation of the sector.
Determinants of strategy 4 are: liquidity ratio, R & D report on sales, loss carry, debt ratio and the size.

- The third point: The significant variables indicate that they are more significant in the LM model in the LE model.

- The fourth point: The marginal effects of the variables are very different and vary from simple to double for sure.

The test of the hypothesis of IIA was conducted on the LM model and it has highlighted the "superiority" of the model (LE). The model (LE) seems to be better in the case before us. Recall that the main advantage of the model (LE) is to release at least partially, the strong IIA assumption model-specific (LM). However, the LM model seems more robust than the LE model.

Discussion of the strategic choices: Modeling strategic choice allows the following remarks and explanations. According to our model, the strategies are explained in relation to the strategy 1 lack of hedging as reference.

Explanation of the choice of strategy 2, hedging without derivatives: The liquidity ratio, the debt ratio, the rate of diversification and size are the (significantly) determinants of this choice. This result is consistent with the model of Froot, Scharfstein and Stein (1993). Hedging activities are determined by the interaction between investment and financing decisions, and as the costs of external financing are higher than internal financing, a firm with an investment project has a greater likelihood of cover its cash flows in order to stabilize and thus avoid going to borrow on the capital market. Moreover, the size effect is related to several factors that make the relationship between firm size and coverage as significant. Large companies have more human resources and access to resources needed to implement the most appropriate coverage solutions. Finally, business diversification reduces the volatility of cash flows and therefore the probability of bankruptcy.

Explanation of the choice of strategy 3, hedging with linear derivatives: The market value on book value ratio, liquidity ratio, loss carryforward, the debt ratio, the size and regulation. We find the liquidity ratio, the debt ratio and size that reference the model of Froot, Scharfstein and Stein (1993). Deferring losses that are a proxy variable tax avanatges, Aretz, Bartram and Dufey (2007) and Stulz (2002) show that the coverage of pre-tax income can increase the value of the company if the tax structure is convex. Indeed, the cover can reduce the amount of expected tax by reducing the volatility of pre-tax income, the fact that taxable income, which is very high in a given period, is associated with a high rate of tax then if taxable income is low for the following periods. Finally, with regard to the regulation, supervision company has much less flexibility in its funding policies that same company and unconstrained firms have less flexibility in their investment decisions have less agency costs and costs related to Loan relatively lower.

Explanation of the choice of strategy 4, hedging with nonlinear derivatives: The liquidity ratio, the R & D report on sales, loss carryforwards, the debt ratio and size are significants. We find the liquidity ratio, the debt ratio and size that reference the model of Froot, Scharfstein and Stein (1993) and the deferral of losses reference, meanwhile, the models Aretz, Bartram and Dufey (2007) and Stulz (2002). The R & D / sales ratio is a proxy variable of maximizing the value of the business, specifically the variable used to measure the importance of the growth of the company and its development policy.

In conclusion, this model has allowed putting in evidence the different risk management strategies and measuring the determinants of strategic choice. However, besides the influence of the financial characteristics of the company in these strategic decisions, the pressures of stakeholders obviously should not be overlooked.

4. CONCLUSION

This research analyzed the different strategies for managing financial risks and proposed a model of choice for risk management strategies based on the financial structure of the company.

This model can be summarized as follows:

A non-financial company will implement strategy type 2 instead of a strategy type 1 if the liquidity ratio decreased by 1.54% and the debt ratio increases 1.54%, and the rate of diversification increases of 12.4 % and the increase in size of 3,42 %.

It will develop strategy type 3 instead of a strategy type 1 if the market value over book value ratio increases to 12.3%, and the liquidity ratio decreased by 12.3%, and the postponement of loss increases by 18.7% and the debt ratio increased by 3.21 % and 4.75% increase in size and the ratio of regulation of the sector increased 1.38%.

It will develop strategy type 4 instead of a strategy type 1 if the liquidity ratio decreased 1.97%, and R & D to sales ratio increased by 2.84 % and the loss ratio reports increases of 2.34 % and the debt ratio increased by 3.63% and 5.37% increase in size.

Beyond this managerial contribution, this research has also a methodological contribution. The two "competitors" explanatory strategic choice models are the multinomial logistic model and logistic nested model. Allow relaxing the assumption of independence of irrelevant alternatives (IIA) related to the first model, the second model has the great advantage. However, recall that according to McFadden (1984) empirical experience shows that the LM model is relatively robust in many cases for which the IIA property is yet theoretically implausible. This retains some operational validity to the use of LM models for the analysis of multiple choices. Finally, note that the use of this type of model is still untapped in this field.

The analysis shows that the use of either model can result in significant changes in the estimated coefficients and can therefore alter the substance of the conclusions drawn from such studies. However, it is clear that the logistic model considers followed suit better the strategic choices of risk management as a multinomial logit model.

Thus, in our case, the understanding of how implementation of hedging, essential in defining strategies for managing financial risks, could well be improved by use of the nested model. However, this type of model itself could be improved in future research and that through two channels, one for testing different variables determining the hedging and also through its empirical validation.

One limitation of this model is to present the strategic choice of a company 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 strategies.

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