Informational value of intellectual capital and survival of French technology firms on the long term

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ABSTARCT.

This paper investigates the determinants of survival for French high technology firms that have gone public at the Euronext stock exchange from 1996 through 2004.

Conducting survival analyses using logit regressions, Kaplan Meier and Cox methodologies, the current research proves that the intellectual capital quality improves the survival profiles of IPO firms. This quality capital seems more useful to predict the survival or failure of French high technology firms compared to classic explanatory variables of the literature.

KEYS WORDS: Survival analyses, IPO, intellectual capital, High technology firms.

EFM CLASSIFICATION CODES: 130, 200.

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1. Introduction

In recent years, a big evolution of investors' needs in financial information was recorded. Recent reports (AICPA 1994; FASB 2001; SFAF & EURONEXT 2002…) and recommendations in academic and theoretical literature (Beattie & Pratt, 2002a, 2002b; Eccles & Mavrinac, 1995; Eccles *et al.* 2001a; Lev, 2001; Holland, 1997…) have argued that demand for external communication or information on knowledge-based resources is growing as companies increasingly base the value of their company on know-how, patents, skilled employees, customers… and other intangibles. The importance of such communication on initial public offering prospectuses was underlined. Buck & al (2003) argue that firms desiring access to capital markets take particularly care of its prospectus to answer the investors' expectations.

Moreover, Jenkinson & Ljungquist (2001) underline the multiplication of organized meeting, between investment banks and potential investors, trying to account for investors' information needs before finalising an IPO prospectus. As a result "*an IPO prospectus usually contains more information about future expectations regarding markets developments and earnings, strategic direction and intent, management and board composition, etc., compared to annual report"* (Buck et al., 2003,p.5).

This demand for external communication became more important after the burst of the internet bubble in the beginning of 2000. Many researchers in different areas such as accounting, finance, information systems, economics… examine firms' characteristics and specifically those of high tech firms to explain firms' post IPO performance.

In major cases, theses studies focus on the valuation of issuing firms (for instance Bartov et al, 2002; Johnston and Madura, 2002; Ljungqvist and Wilhelm, 2003; Loughran and Ritter, 2003; Wilbon, 2003)[1], and ignore the status of firms (survival or failure) in the aftermarket as an indicator of performance. However, the ultimate performance parameter, particularly for small to medium-sized firms such as those of the French market, is the survival of the enterprise over time.

[1] For a review, see Ritter, J. R., & Welch, I. (2002).

Several questions regarding the survival of technology firms and its determinants need to be answered, namely, do these surviving firms have a specific Know-how and developed intangibles? Does their innovative profile have a specific impact on survival probability? What type of observable characteristics at the time of the IPO can one take into account to predict the status of surviving firms in the aftermarket?

To my knowledge, only Wilbon (2002) explores these questions by studying the impact of some intellectual capital proxies (such as R&D expenditure, experienced senior executives, intellectual property rights…) on technology firm survival. Using logistic regression analysis, he shows that some of these proxies have a positive impact on high-technology firms' survival.

While this research explores elements of intellectual capital as variables predicting survival or failure in the aftermarket, the present article uses a proxy of the intellectual capital as a whole to explain the status of the issued firm. Synergies between the different elements composing the firm's intellectual capital may have a particular influence on survivability. So, using a proxy for intellectual capital may predict more precisely the survival of technological firms (Bejar, 2006).

The objective of this paper is to study the impact of intellectual capital quality of high-technology firms on their probability of survival. Specifically, I seek to identify the survival profile of IPO issuers on the French equity markets based on the IC (Intellectual Capital) information contained in the prospectus.

The remainder of the paper is organized as follows: the next section discusses the related literature; Section 3 describes the sample, the related statistics and methodology. Section 4 presents empirical findings and section 5 concludes.

2. Theory and Background

The evidence on the survival of IPO firms is not extensive and generally limited to the U.S. market. The first researches were developed by Gentry et al in 1984. The authors predict business failure based on financial ratios such as return on investment (ROI), capital turnover, financial leverage… Their work has been criticized for the lack of theoretical support since significant variables are selected from a set of financial ratios.

The authors try to correct the problem in 1985 and in 1987 by developing models based on funds flow. Their model suggests that dividends, investment and receivables can be used to classify healthy and failed firms.

Since these researches, many authors have examined the determinants of IPOs survival. Hensler et *al.* (1997) ; Jain et Kini (1999a) explore US market While Boubakri et al (2005) ; Yan et Sheu (2006) explore respectively Canadian and Taiwanese markets. To my knowledge, the French market hasn't been studied.

Hensler et al. (1997) estimate an accelerated failure time model for U.S. IPOs during 1976-1984. They find that the survival probability of issuing firms (1) increases with the size, the age of the firm at the offering, the underpricing, the market activity level at the time of IPO, and the percentage of insider ownership, and (2) decreases with the number of risk characteristics listed in the prospectus of the offering firm.

Jain and Kini (1999) propose a survival analysis for a sample of 877 IPO firms that went public between 1977 and 1990. They find that lower risk, larger firm size, higher investment banker prestige, higher pre-IPO operating performance, and higher industry R&D intensity increase the probability of survival relative to failure.

More recent research, also related to US market, explores the survival of internet firms. Kauffman and Wang (2003) analyze a sample of 115 firms that generated more than 90% of their revenues on the Internet and find that selling digital goods or services, an entry of additional Internet firms via IPOs in the stock market, a larger firm size and a lower leverage reduced the likelihood of failure.

Botman et al. (2004) investigate the determinants of survival for internet firms that have gone public at the NASDAQ stock exchange from December 1996 through February 2001. Their empirical results provide evidence that surviving firms are associated with lower risk, higher underwriter reputation, higher investor demand, lower valuation uncertainty, higher insider ownership retention, compared to non surviving ones.

The literature exploring the other international markets is less developed. Only some papers were published:

Boubakri et al (2005) examine the survival profile of Canadian Initial Public Offerings. Using multinomial logit model and accelerated-failure-time model, the authors find that the larger is IPOs experience and the higher is underpricing at the time of the IPO, the lower is the probability of delisting.

Boubakri et al (2005) conclude that leaving money on the table is not a bad thing as it is generally perceived and has some beneficial outcomes such as enhancing the survivability of the firm.

Yang & Sheu (2006) examine the determinants of IPOs survival in the Taiwanese Market. They find evidence that the percentage of insider ownership has a positive impact on firms' survivability.

My goal in this research is to contribute to this recent strand of literature on IPOs survival by testing the impact of intellectual capital quality on the status of French issuing firms. I'm interested in high technology firms because of their innovative profile and their high concentration of intellectual capital. It is not surprising that a better quality of intellectual capital reduces significantly the probability of failure or bankruptcy of issued firms.

Variables identified in the literature are going to be included in empirical models to test their predictive power comparing to the intellectual capital quality.

3. Methodology and data

3.1 Methodology

The empirical analysis of the paper involves two steps. First the paper develops a logit model for distinguishing survivor and failing firms 5 years after the date of the IPO. Then it develops survival models to support age and calendar time based analyses.

The logit model determines the probability of the occurrence of a specific event through its estimated parameters β such in

$$P(Y=1/X)=\frac{e^{\beta_0+x_{i1}\beta_1+x_{i2}\beta_2+\ldots+x_{ip}\beta_p}}{1+e^{\beta_0+x_{i1}\beta_1+x_{i2}\beta_2+\ldots+x_{ip}\beta_p}}$$

The coefficients β can be estimated with maximum likelihood methods.

To palliate the insufficiencies of logit models, survival analysis was developed in the paper. Oppositely to logistic regression that estimated probability of survival from the status of the firm at a given moment, survival methods take into account the firm's status and its duration on financial markets since its IPO.

These models use two types of observations:

- Censored observations which contain partial information: it concerns firms still surviving at the end date of the study and to which the event of "delisting" can occur in the future;
- Uncensored observation : it concerns firms delisting from financial markets

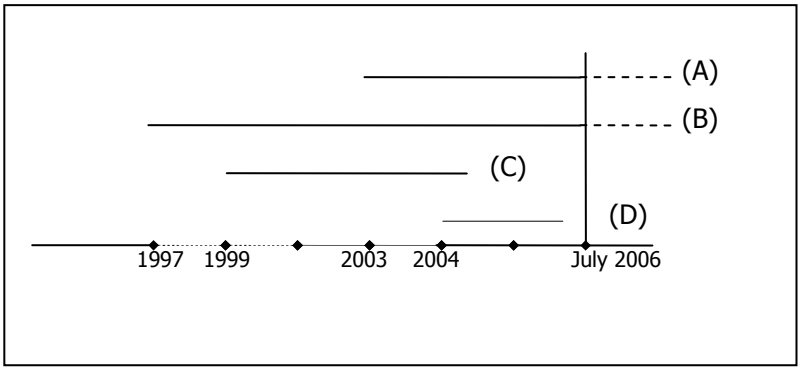
Models estimated with censored data are more efficient. Figure 1 illustrates graphically some examles of duration.

Models developed in the paper are Kaplan Meier (1958) and Cox (1972):

The first model is a non parametric estimation of hazard function. It gives the probability of survival of a firm issued on financial markets. The model can also compare the probability of two sub-samples having one different characteristic.

The second model (Cox, 1972) is a semi parametric estimation of hazard function. It gives the probability of survival for a firm issued on financial markets by including different explanatory variables[2].

Figure 1 : Examples of duration



(A) Censored observation: a firm that was issued in 2003 and still trades at the 31th of July 2006.
(B) Censored observation: a firm that was issued in 1997 and still trades at the 31th of July 2006.
(C) Uncensored observation: a firm that was issued in 1999 and has been delisted in 2004.
(D) Uncensored observation: a firm that was issued in 2004 and has been delisted in 2006.

[2] For an extensive theoretical discussion of hazard models, refer to Kalbfleisch and Prentice (1980), Keefer (1988) and Lancaster (1990)

3.2 variables and descriptive statistics

The majority of variables used in this paper have been hand collected from the final offering prospectus of the issuing firms. The other variables concerning survival status and prospectus quality information on intellectual capital have been estimated from Euronext databases and Bejar's (2006) prior work. Table 1 lists variables used in the paper.

3.3.1 Post-IPO survival

The status of the firm on the aftermarket can take two forms: Survivors and non survivors. It was impossible to follow Jain and Kini (1999b) who segmented their sample into three aftermarket status (Survivors, acquired firms and non survivors).

The number of acquired technology firms in the sample is too small to operate statistical regression. In their work, Fischer and Pollock (2004) considered acquisitions or mergers as survivors.

- Survivors are firms that remain listed in Euronext stock exchange from the time of the issue throughout the studied period.
- Non- survivors firms are classified as firms delisted from the Euronext stock exchange due to negative reasons. Those reasons include both failing firms and firms moving to other exchanges with less strict listing criteria.

  The other firms moving from an exchange to another with stricter criteria are considered as "survivors". Mergers and acquisitions are also considered as "survivors"

  These states of French high technological IPOs in the aftermarket are identified as of July 2006, using news media and data from databases such as www.euronext.com and AMF (Financial Market Authority). Status, dates and reasons of failure were picked up.

3.3.2 The intellectual Capital quality

For this paper, I used a measure of intellectual capital quality identified by Bejar (2006). The author developed an indicator through the answers of financial analysts and portfolio managers to questionnaires.

The indicator regroups 19 pieces of information identified as relevant to qualify intellectual capital of high technology firms and to make more useful firms' valuation in IPOs. Each piece of information is judged against its quantitative and qualitative contents.

A score is attributed to each issuing firm according to the quality of the information disclosed on intellectual capital and its adequacy with investors' needs. This score is assimilated as an indicator of intellectual capital quality.

3.3.3 Control variables

Six control variables were used in this study. All control variables were identified in the literature and picked up from information in a firm's IPO prospectus.

First, the percentage of equities sold by the management at IPO date : this measure is seen to affect the aftermarket status in Yang and Sheu, 2006 and in Hensler et *al.,* 1997); it was operationalized by the total number of equity sold by management at IPO date / Total number of equities after IPO.

Second, the quality of the underwriter conducting the IPO: Two proxies are developed to measure this variable:

- UND: was coded 1 for prestigious underwriter, 0 otherwise.
- UND_MM: was coded 1 for IPOs conducted by underwriters who have accepted function of marker maker.

Third, market activity was used to control the impact of hot markets. This variable influences firms' survivability in prior survival studies (Hensler and *al.* (1997).

The fourth control, firm size, was used to capture the relative maturity of an IPO firm and measured as the logarithm of market value at the date of IPO. This measure has been used in previous IPO research.

The fifth and sixth control variables, found in most IPO survival studies, are bubble impact and firm sector. Bubble was identified as it occurred in the French financial market between 1st January 1999 and 31 mars 2000 (Labégorre et Boubaker, 2005 ; Bejar, 2006).

As the study is interested in only one sector (high technology), firms are identified by the intensity of their R&D. Firms with high R&D expenditure (expenditure higher than the average of the sample) were coded 1, 0 otherwise.

Table 1 : Definitions of model variables

Variables	Definition
Dependent variable - Logit Model	
Status	is a binary dependent variable. The variable is 1 if the firm is a survivor one « 0 » otherwise[3].
Dependent variable : Cox Model	
Status	"1" if firm survive on financial market; « 0 » otherwise.
Duration	Number of months that has elapsed from the time a high technology firm goes public till the time of its bankruptcy filing or liquidation or the end of the study period if the firm is still alive
Independent variables	
SCORE	Measure of intellectual capital quality. The value of SCORE ranges from 0 to 1, with 0 indicating the absence of IC, and 1 indicating high quality of IC.
(1-α)	Percentage of equities sold by management at IPO date = Number of equity sold by management at IPO date / Total number of equities after IPO.
UND	"1" if the underwriter reputation is high, « 0 » otherwise
UND_MM	"1" if the underwriter assumes the function of the market maker, "0" otherwise
AMP	"1" if the firm went public in high market period activity, "0" otherwise
SIZE	Logarithm of market value at date of IPO
BUBBLE	"1" if the firm went public between the 1st January 1999 and 31 mars 2000"1" if the firm went public
SECTOR	"1" if the R&D firm expenditure is higher than the average of the sample, , "0" otherwise

3.2 Sample and descriptive statistics

3.2.1 Sample selection

The survivability of French high technology IPOs that went public during the period Mars 1996 through December 2004 is studied in this paper:

The sample was selected from the Euronext list IPOs. During the study period, 422 companies went public (177 on the "New Market" and 245 on the Second Market[4]). Non technological firms, financial firms and transfers between markets are excluded from the sample.

[3] In logit model, the status of the firm is picked five year post IPO. In Cox model, the status of the firm is picked at 31 July 2006.

[4] "New Market" and "Second market" dead in 2005. Mergers of French markets create Eurolist and Alternext.

Initial sample includes 138 technology firms. Only 107 prospectuses were available at the AMF (French Financial Market Authority). The other 31 firms were excluded from the sample. Table 2 presents the different steps of sample selection.

Table 2 : Steps of sample selection

Sample	Number of firms
French IPOs (New and Second Market)	422
- transfers, mergers	56
- Non technological and financial firms	228
= technological firms	138
- Technological firm who the final prospectus is not available	31
= Final sample	107

The final sample consists of 107 high technological offerings. Table 2 illustrates market and time distribution of these IPOs. Peaks were recorded in 1998, 1999 and the beginning of 2000.

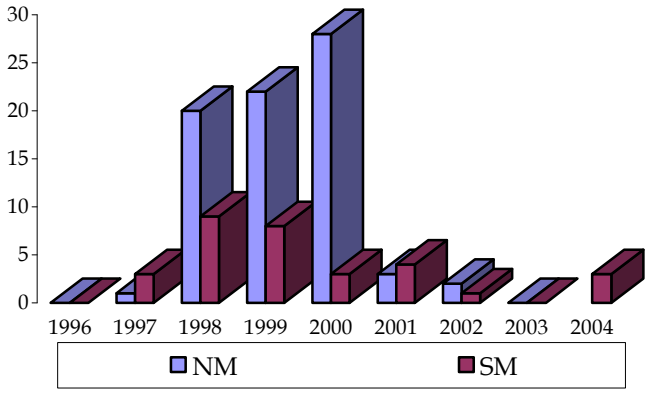
The majority of firms (71% of the total sample) were introduced in the New market. This is due to the profile of firms which go public: in the majority of cases, the initial public offerings of technology firms operate on the New Market. IPOs on "Second market" are fewer and often result from firms transfers from other markets.

Furthermore, the distribution of the sample over the period of study is homogenous: 33 companies were introduced before the Internet bubble. Respectively, 32 and 42 companies were introduced during and after the Bubble[5].

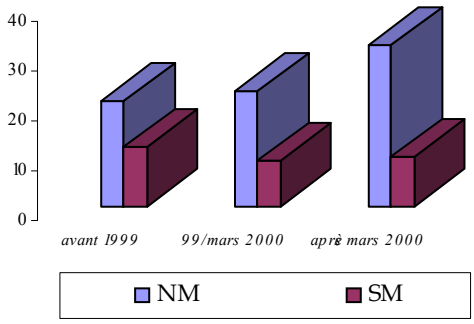
5 The 1st of January 1999 and the 31st March 2000 are considered as being the dates of the beginning and the end of the French internet bubble. The same dates are chosen in precedent researches on French market Labegorre and Boubaker, (2005); Bejar, (2006).

Table 3 : Distribution over time of French high technological IPOs

	NM	SM	Total
1996	0	0	
1997	1	3	4
1998	20	9	29
1999	22	8	30
2000	28	3	31
2001	3	4	7
2002	2	1	3
2003	0	0	0
2004		3	3
Total	76	31	107



	NM	SM	Total
before 1999	21	12	33
January 99/mars 2000	23	9	32
After mars 2000	32	10	42
Total	76	31	107



3.2.2 Descriptive statistics

Table 4 illustrates the distribution of aftermarket IPO status by the estimated quality of intellectual capital. 82,24 % of firms in the sample are survivors 5 years post-IPO, a survival rate higher than recent IPO survival studies of US market (67% in Fischer & Pollock, 2004 and 69% in Jain & Kini, 1999).

The survival rates for high technology firms characterized by the presence of intellectual capital and firms characterised by the absence of intellectual capital are similar for the first 3 years of existence. After this period rates start to diverge for the tow types of firms. These rates are higher for firms intensive on intellectual capital (94,59% for year 4 and 92,96% for year 5) compared to the other firms (76,67% for year 4 and 73,33% for year 5).

Table 4 : Firm survival descriptive statistics

Y: binary variable equal 1 if the firm is considered as having a qualitative intellectual capital, 0 otherwise; SURVIVOR_3 : binary variable equal 1 if the firm is a survivor one three years after its IPO, 0 otherwise; SURVIVOR_4 : binary variable equal 1 if the firm is a survivor one four years after its IPO, 0 otherwise; SURVIVOR_5 : binary variable equal 1 if the firm is a survivor one five years after its IPO, 0 otherwise; SURVIVOR_July : binary variable equal 1 if the firm is a survivor one at 31 July 2006.

Sample	Variables	Y=1				Y=0			
		N (#)	Sample	Number	Frequency	N	Sample	Number	Frequency
104	SURVIVOR_3	74	SURVIVOR_3 = 1	71	95,95%	30	SURVIVOR_3 = 1	28	93,33%
			SURVIVOR_3 = 0	3	4,05%		SURVIVOR_3 = 0	2	6,67%
104	SURVIVOR_4	74	SURVIVOR_4 = 1	70	94,59%	30	SURVIVOR_4 = 1	23	76,67%
			SURVIVOR_4 = 0	4	5,41%		SURVIVOR_4 = 0	7	23,33%
101	SURVIVOR_5	71	SURVIVOR_5 = 1	66	92,96%	30	SURVIVOR_5 = 1	22	73,33%
			SURVIVOR_5 = 0	5	7,04%		SURVIVOR_5 = 0	8	26,67%
107	SURVIVOR_July	77	SURVIVOR_July = 1	65	84,42%	30	SURVIVOR_July = 1	21	70,00%
			SURVIVOR_July = 0	12	15,58%		SURVIVOR_July = 0	9	30,00%

(#) Calculating the number of delisted firms after 5 years of existence in financial markets necessitates the elimination of firms issued after the first of July 2001. In the same vein, calculating the number of delisted firms after 4 years (respectively 3 years) of existence on financial markets necessitates the elimination of firms issued after the first of July 2002 (respectively, the first of July 2003)

4. Results

4.1 Logit Model

The relation between the independent variables described earlier with post- 5 years IPO firm status is explored through a multinomial logistic regression analysis.

Table 5, describes the Pearson correlation analysis. It indicates that several of the variables are positively correlated one to another. The relationships were tested for multicollinearity, including the variance inflation factor and the Eigenvalues. The multicollinearity test demonstrated that the explanatory variables are independent.

Table 5 : Correlation matrix: survival factors

SCORE, is a measure of intellectual capital quality (The value of SCORE ranges from 0 to 1, with 0 indicating the absence of IC, and 1 indicating high quality of IC) ; UND_MM is a binary variable equal to "1" if the underwriter assumes the function of the market maker, "0" otherwise; (1-α), Percentage of equities sold by the management at IPO date = Number of equity sold by the management at IPO date / Total number of equities after IPO; SIZE, logarithm of market value at date of IPO; AMP is a binary variable equal to "1" if the firm went public in high market period activity, "0" otherwise; BUBBLE is a binary variable equal to "1" if the firm went public between the 1st January 1999 and 31 mars 2000"1" if the firm went public; SECTOR is a binary variable equal to "1" if the R&D firm expenditure is higher than the average of the sample, "0" otherwise.

	SCORE	UND_MM	(1-α)	SIZE	AMP	BUBBLE	SECTOR
SCORE	1	0,340	-0,164	-0,099	-0,174	-0,167	0,151
	.	0,001***	0,099*	0,315	0,074*	0,086*	0,121
UND_MM		1	0,256	0,018	0,238	-0,111	-0,122
		.	0,029**	0,877	0,037**	0,338	0,291
(1-α)			1	-0,038	0,078	0,005	-0,181
			.	0,713	0,447	0,963	0,075*
SIZE				1	0,039	-0,082	-0,203
				.	0,691	0,401	0,037**
AMP					1	0,243	-0,220
					.	0,012**	0,023**
BUBBLE						1	-0,119
						.	0,222
SECTOR							1
							.

Some interesting correlation can be underlined: The quality of intellectual capital (Score) is negatively correlated with the Percentage of equities sold by management at IPO date (at the 10 % level with a correlation coefficient of -0,164).

As the managers retain a bigger participation in their firm when they believe in its quality, it is plausible to consider intellectual capital quality as an indicator of the firm's performance.

The positive correlation between the quality of intellectual capital (Score) and the underwriter function (UND_MM) at the 1 % level (***) (correlation coefficient is 0,340)[6]confirm this conclusion. In fact, the underwriter is more likely to assume market marker functions when the issued firm has a better intellectual capital quality and implicitly firm quality.

The multinomial logistic regression results are reported in Table 6. The table presents the estimated coefficients and their degree of significance. Only significant models are reproduced in the paper.

As the khi 2 demonstrates, presented models are significant at the 0.05 level and the classification indicates that all models predict survival with respectively 89.40; 88.60; 89.90% accuracy.

From table 6, the analysis of the firms in the sample shows no statistically significant difference between survivors and non survivors regarding the majority of the explanatory variables presented in the literature.

The reputation of the underwriter, the Percentage of equities sold by the management at IPO date, the firm size and the market activity do not have any impact on high technology firm survival. The Results of the French market are non consistent with the international literature. Schultz (1993) Hensler et *al.* (1997), Jain et Kini (1999) attribute positive rules to these variables for US market.

On the other hand, table 6, shows that intellectual capital quality and the implication of underwriter in the firm market making increase the chances of survival.

First, let's consider the effect of intellectual capital quality (SCORE). Results suggest that the higher the intellectual capital at the IPO date, the bigger is the chance of firm survival (coefficient is significant at the 5% level for model 1 and at the 5% level for model 3)..

[6] These correlations are specific to the « new market ». Firms issued on NM must have an "underwriter, market maker" during the 3 first years of existence on financial markets. In practise only some firms were introduced by an underwriter who assumes market marker functions.

This result supports Wilbon's work (2002). The author demonstrates that some intellectual capital elements such as (intellectual property rights, executive technology experience…) increase high technology firms' probability of survival.

Table 6 : Results of the logistic regression analysis for survival

STATUS is a binary dependent variable equal to 1 if the firm is a survivor one « 0 » otherwise[7]; SCORE, is a Measure of intellectual capital quality (The value of SCORE ranges from 0 to 1, with 0 indicating the absence of IC, and 1 indicating high quality of IC) ; UND_MM is a binary variable equal to "1" if the underwriter assumes the function of the market maker, "0" otherwise;
Model 1 concerns the whole sample, models 2 and 3 concern only firms issued on the "new market"

Dependent variable: STATUS (0,1)			
Model	1	2	3
Constant	0,442	0,916	-1,035
Wald	0,381	2,399	1,328
sig.	0,537	0,121	0,249
SCORE	5,138		9,538
Wald	5,342		7,079
sig.	0,021**		0,008***
UND_MM		1,569	0,425
Wald		4,342	0,241
sig.		0,037**	0,623
χ^2	5,732	4,027	13,464
sig.	0,017**	0,045**	0,001***
R^2 Cox Snell	5,36%	4,97%	15,67%
R^2 Nagelkerke	10,92%	9,78%	30,85%
% Correct	89,40%	88,60%	89,90%
N	107	76	76

(*=10% ; **=5% ; ***=1%)

[7] In logit model, the status of the firm is picked five years post IPO. In Cox model, the status of the firm is picked at 31 July 2006.

Let's now consider the function of the underwriter as a market maker of the issued firm. A firm issued by an underwriter who accepts to assume market marker functions at the IPO date is more likely to survive (coefficient significant at the 5 % level in model 2).

This result is not too surprising and is consistent with the notion that an underwriter may have private information that allows him to identify high quality firms. When the underwriter is sure about the quality of the firm, he accepts to assume market maker functions.

4.2 Survival analysis

The binary logit models that we have just exposed explain the probability of firm survival only at a given moment. Because of its static analysis, logit model doesn't take into account the probability that a survivor company should be a non survivor one after the date chosen for the end of the study.

Survival analysis developed in the rest of the paper palliates to this insufficiency by including censored observations and by estimating the probability of survival on financial markets taking into account the impact of time (non-parametric Kaplan Meier model) or different explanatory variables (semi parametric Cox model).

4.2.1 The Kaplan Meier Model

The Kaplan Meier model estimates the proportion of firms witch can survive to the studied event (to be delisted from financial markets because of negative reasons) for a given period in the same circumstances. From a practical point of view, the model calculates the probability of appearance of the studied event at a given period.

This probability is estimated each time the event occurs by calculating the fraction of companies really "delisted" compared to all companies exposed to the occurrence of the event (see Table 7: Life table).

The life table reports the number of firms exposed to the risk « to be delisted from the market » at a given time and the probability associated to this risk.

The conditional probability is calculated each time a new firm is delisted from the market. It reveals that the majority of the failures for French high technology firms have occurred between the 17^{th} month of presence on exchanges and the 89^{th} one.

The probability of failure increases seriously after year 3. The period between year 3 and year 7 after a technology firm has gone public is critical to its longer term survival. Afterwards, the probability of failure or bankruptcy becomes too low.

Table 7 : Life table (Kaplan Meier results)

Month: time participation to the study (bankruptcy or liquidation date –IPO date), « Exposed » : number of firms exposed to the event ; « delisted » : Number of firm delisted from the market the month j ; *P*(delisted) : probability of the occurrence of the event at month j ; *P*(survival) : probability of survival at moth J ; P_{cum} (Survival) : cumulative probability of survival at month j.

Month	Exposed	« delisted »	*P*(delisted)	*P*(survival)	P_{cum} (survival)
0	107		0	1	1
17,83	107	1	0,009	0,9907	0,9907
25,77	106	2	0,019	0,9811	0,9720
26,53	104	3	0,029	0,9712	0,9528
…	…	…	…	…	…
…	…	…	…	…	…

Decomposing the Kaplan Meier Model as shown in figure 2 for two sub samples of high technology firms characterized by differences in intellectual capital quality suggests that the survival functions may be different.

Starting from their IPOs, the Kaplan Meier curves for high technology firms characterized by the presence of intellectual capital and firms characterised by the absence of intellectual capital are similar the first 3 years of existence. After this period when bankruptcy and failures start to emerge, the two Kaplan Meier curves start to diverge.

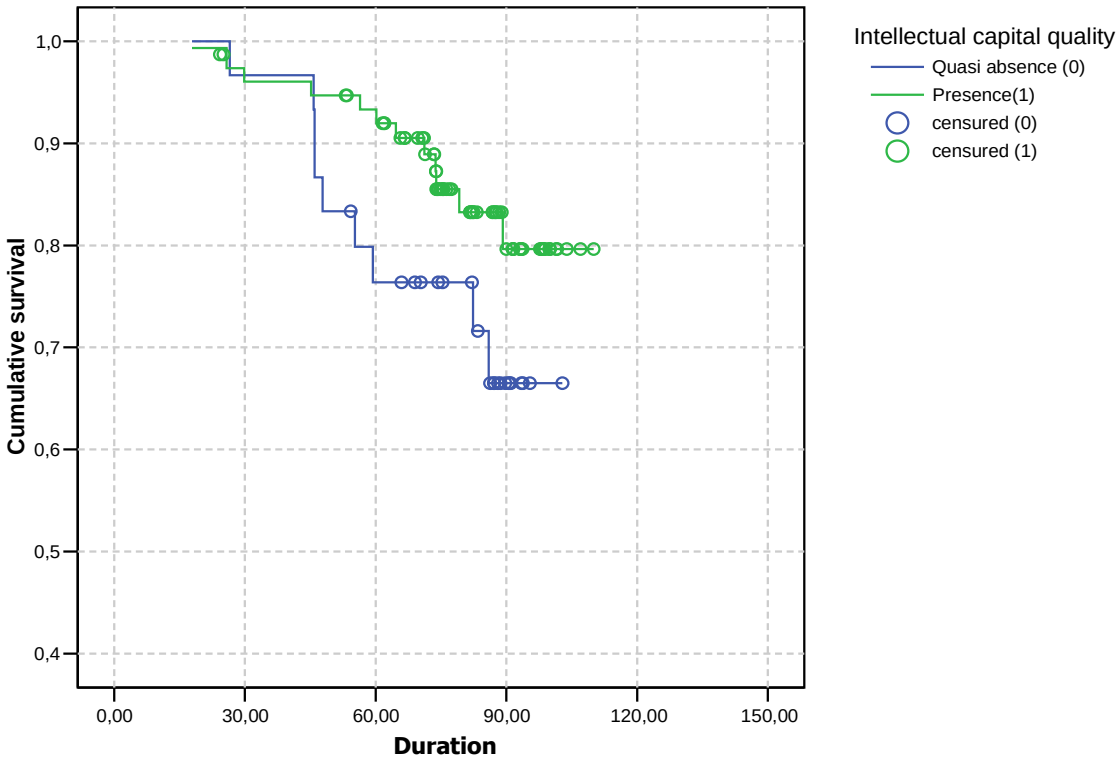
This divergence in KM curves is confirmed in statistical tests. The null hypothesis of homogeneous survival probabilities is rejected at the 95% confidence level. According to log-rank test and Breslow test, a significant difference exists between survival curves of firms characterized by the presence of intellectual capital at time of IPO and the others.

The KM curves show that the probabilities of survival remain high the first three years of firm existence on financial markets (for both firms with high intellectual capital quality or not).

During this period, French market makers required by the law give customers the best bid or ask price for each market order transaction. If these regulations were not in place, customers' profits would be gouged and share prices would be much more

volatile than they already are. This function accords to the market marker the possibility to support the price of the least successful IPOs and to engage the stabilization of prices.

Figure 2 : Survival Curves (Kaplan Meier Methodology)



In this context, it could be justified to think that some "bad" firms were artificially maintained on the exchange during the first three years after IPO.

This explanation can be credible if we consider the quality of the intellectual as an element characterizing "good firms". In fact, as from the 46th month of existence ion financial markets, the probability of survival for firms with intellectual capital remains much higher than the probability of survival for firms without intellectual capital.

The failure of firms characterized by the presence of intellectual capital at the time of IPO was gradual compared with the other firms. For these firms, the level of survival was 94.70% at the 46th month of existence on financial market (against 86.67% for firms without Intellectual capital at time of IPO) and 83.26% at the 85th month (against 66.5% for firms without Intellectual capital at time of IPO)

The rest of the paper reports results from the Cox regression, which enables to quantify the impact of various factors as well as intellectual capital quality over a long period of time.

4.2.2 Cox Model

Table 8 presents the results for Cox regressions models. As can be seen in the table, the likelihood ratio statistic is significant at the 5 percent level for models 1 and 4. Regressions for models 2 and 3 are significant at the 1 percent level.

All regressions presented in table 8 show that survivor firms have a better quality of intellectual capital. This quality estimated at date of IPO reduces significantly the probability of failure or bankruptcy. Intellectual capital quality seems to be a good indicator to predict the survival of French high technology firms. Results of Cox model confirm prior empirical finding (Logit and Kaplan Meier models) and strengthen the conclusion.

Table 8 also confirms the positive role of the underwriter on survivability. Firms issued by an underwriter who assumes the market maker functions, have a lower probability of failure.

Furthermore, the regression of the Cox model underlines some other interesting results:

First, the internet bubble has a negative impact on firm survival. Firms that have gone public during the internet bubble have a lower probability of survival compared to those that have gone public in other periods.

Second, the size of issued firm has a positive impact on survivability. The larger the size of the issued firm, the higher is the probability of survival. This observation supports the findings of Shultz (1993); Hensler et al. (1997) and Jain & Kini (1999) that show that larger IPOs tend to experience less risk of delisting.

Third, the Cox model concludes to the absence of a significant relation between equities owned by management, the level of market activity and firm's survivability. These results are not consistent with the international literature: Yang and Sheu (2006); Hensler and *al.* (1997) observe that survival time of IPOs increases with the percentage of insider ownership (management and other insiders). Hensler and *al.* (1997), studying the impact of market activity on the survivability of firms, prove that firms introduced in hot markets have a lower probability of survival.

Table 8 : Results of Cox model

SCORE, is a measure of intellectual capital quality (The value of SCORE ranges from 0 to 1, with 0 indicating the absence of IC, and 1 indicating high quality of IC) ; UND_MM is a binary variable equal to "1" if the underwriter assumes the function of the market maker, "0" otherwise; (1-α), Percentage of equities sold by the management at IPO date = Number of equity sold by the management at IPO date / Total number of equities after IPO; SIZE, logarithm of market value at date of IPO; AMP is a binary variable equal to "1" if the firm went public in high market period activity, "0" otherwise; BUBBLE is a binary variable equal to "1" if the firm went public between the 1st January 1999 and 31 mars 2000"1" if the firm went public; SECTOR is a binary variable equal to "1" if the R&D firm expenditure is higher than the average of the sample, "0" otherwise.

Event: « delisting from financial markets because of negative reasons »				
Model	1	2	3	4
SCORE	-2,594	-4,632	-4,878	-4,618
Wald	2,883	4,521	4,877	5,153
Sig.	0,090*	0,033**	0,027**	0,023**
Exp(B)	0,075	0,010	0,008	0,010
(1-α)	-1,872	-8,267	2,207	
Wald	0,811	0,533	0,056	
Sig.	0,368	0,465	0,813	
Exp(B)	6,502	0,000	9,087	
UND_MM			-0,971	-0,869
Wald			3,927	3,209
Sig.			0,085*	0,073*
Exp(B)			0,397	0,419
AMP		13,594		
Wald		0,000		
Sig.		0,987		
Exp(B)		8,012E+05		
FIRM SIZE		-0,455		-0,484
Wald		1,574		3,197
Sig.		0,210		0,074*
Exp(B)		0,635		0,616
BUBBLE	1,875	1,408		1,400
Wald	6,048	3,071		3,438
Sig.	0,014**	0,080*		0,064**
Exp(B)	0,153	0,245		0,247
SECTOR		-0,165		
Wald		0,066		
Sig.		0,797		
Exp(B)		0,848		
-2 Log Likelihood	87,553	86,275	108,646	136,718
χ^2	8,917	11,441	6,851	11,127
Sig.	0,035**	0,076*	0,077*	0,011**

5. Conclusion

In this paper, I examine the evolution of high technology IPO firms and the impact of intellectual capital quality as a determinant of survivability during the 1996-2004 period.

To do so, I develop multinomial logit models and survival analysis based on the information contained in the prospectus and attempt to determine whether the quality of intellectual capital estimated at the IPO date influence the aftermarket status.

The main findings of the paper are that prospectus information about intellectual capital quality could help potential investors in predicting the IPO survival profile. More specifically, survivor firms have a better quality of intellectual capital. This quality reduces significantly the probability of failure or bankruptcy. Intellectual capital quality seems to be a good indicator to predict the survival of French high technology firms. This result supports Wilbon's work (2002). The author demonstrates that some intellectual capital elements such as (intellectual property rights, executive technology experience…) increase high technology firm's probability of survival.

Furthermore, a firm issued by an underwriter who accepts to assume market marker functions at the IPO date is more likely to survive. The underwriter may have private information that allows him to identify high quality firms. When the underwriter is sure about the quality of the firm, he accepts to assume market maker functions.

The other empirical finding in this paper are non consistent with the international literature. The reputation of the underwriter, the percentage of equities sold by the management at IPO date, the firm size and the market activity do not have any impact on high technology firm survival. Schultz (1993) Hensler et *al.* (1997), Jain et Kini (1999) attribute positive rules to these variables for US market.

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