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SCUOLA DI INGEGNERIA INDUSTRIALE
E DELL'INFORMAZIONE

EXECUTIVE SUMMARY OF THE THESIS

ON THE ORGANIZATION OF EUROPEAN HIGH-TECH ENTREPRENEURIAL VENTURES AFTER VENTURE CAPITAL ENTRY

MASTER OF SCIENCE IN MANAGEMENT ENGINEERING

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ACADEMIC YEAR: 2020-2021

1. Introduction

This dissertation focuses on analyzing the Organization of High-tech Entrepreneurial Ventures (HTEVs) following Venture Capital (VC) entry. It tries to establish an empirical ground of analysis to study the influence of VC investment and investor type on some key events such as CEO replacement, hiring of a VP of Sales & Marketing and Top Management Team changes.
The dataset consisted of information related to a pool of 347 HTEVs based in France, Germany, Italy, and the United Kingdom. For each analyzed venture the data included investments, financial outcomes, and employees' roles across time.

Results indicate that the entry of a VC investor is associated to a higher likeliness and speed in replacing the CEO, hiring a VP of Sales & Marketing, and more changes to the Top Management Team. In addition, the analyses confirmed that the type of VC - after its investment in a venture - significantly impacts the probability and speed of replacing the venture's CEO: Independent VCs tend to lead ventures to change CEO more frequently and at a faster pace if compared to other types of Venture Capitalists.

In the explorative section, some key findings were highlighted: first, it was discovered that Sales & Marketing and R&D represent the most "populated" business functions. Second, a descriptive analysis showed that most of the HTEVs tend to receive a VC investment when they still have two C-level managers. Finally, empirical evidence found a direct correlation between venture's size - in terms of number of employees - and presence of a formalized Board of Directors.

2. Theoretical background

2.1. High-Tech Entrepreneurial Ventures

Entrepreneurial Ventures (EVs) are those young and independent firms established by one or more individuals to commercially exploit a novel business idea (Colombo, Rossi-Lamastra, & Matassini, 2016). This dissertation is focused on a specific type of EVs: those that operate in High-tech Industries. High-tech Industries are high-velocity industries (i.e., high product development rates) whose production processes and products have a high level of complexity (Steenhuis, & de Bruijn, 2006).
This implies the need of having a team with high human capital, composed of entrepreneurs and key employees with highly specialized knowledge. Once developed a strong team, HTEVs should adopt the proper organization to enable decision speed and comprehensiveness. Indeed, these levers are the key to overcome the challenges of High-Tech industries (Bourgeois, & Eisenhardt, 1988).

2.2. Organizational structure in HTEVs

The entrepreneur is more likely to be plural, rather than singular (Gartner, Shaver, Gatewood, & Katz, 1994). Scholars were indeed able to prove a strong correlation between firms created by a team and superior performances (Cooper, & Bruno, 1977; Eisenhardt, & Schoonhoven, 1990). Given that each team member should provide financial, social, and human capital resources, the venture may pursue harder tasks, develop more impacting products/services, and reach higher performances (Kraus, & Schjoedt, 2009).

Hence, EVs are usually founded by an Entrepreneurial Founding Team (EFT) which is the group of owners who hold a key role in the (strategic) decision-making of the venture at the time of the founding (Ucbasaran, Lockett, Wright, & Westhead, 2003).

EFTs often experience changes in their composition (Cooper, & Daily, 1997) across time. Focusing on HTEVs, Cooper and Bruno (1977) found that, in around half of the HTEVs interviewed, at least one founder left. Additions or changes to the initial team cause the entrance of new members that may not be founders or owners of the venture.

The most explicative change is the turnover of the CEO (i.e., Chief Executive Officer), the team leader. Given the dynamism within the EFTs, it is reasonable to name it "Top Management Team" (TMT), which allows to extend the team concept in time, identifying the TMT as the group of venture's members who hold a key role in the strategic and operational decision-making of the venture.

Consequently, the C-level management may be considered as the proxy to operationalize the TMT concept in the real context. Indeed, the C-level management consists of the venture's functional leaders who hold the power to make key strategic decisions in each respective area.

The organization is the structure and formal system of communication, division of labor, coordination, control, authority, and responsibility required to achieve a company's goals (Hamel and Pralahad, 1994). Nevertheless, the general belief argued that EVs are typically constituted by a few members working in the same place and having few tasks to make. Consequently, the information to be processed, thus the relative information costs, are low enough to not need an organization. In recent years scholars (Colombo, & Rossi-Lamastra, 2013) reviewed this concept: both information costs and agency costs may be high also in EVs. EVs have low dispersion of information internally, but most of the relevant information is distributed outside of the firm boundaries: among suppliers, customers, and other stakeholders. For what regards agency costs – costs due to non-aligned goals, information asymmetries, and different risk attitudes between the principal and the agent (Jensen, & Meckling, 1976) –, the costs include both the principal-agent (especially after the hiring of middle managers and for HTEVs operating at global scale) and the principal-principal relation within the TMT and between founders.

The last key aspect that emphasizes the need for an organizational structure within HTEVs is related to human capital: new ventures should adopt an appropriate organizational structure able to retain employees, allowing them to fully express their capabilities, keeping them motivated and proactive towards the company vision and goals.

2.3. VCs' impact on HTEVs' organization

A VC is "a person or company that invests money in new companies, especially when this involves risk" (Cambridge Dictionary).

The high uncertainty and information asymmetry that affect HTEVs' world typically make it hard for HTEVs to access the traditional financing channels (Davila, Foster, & Gupta, 2003). Conversely, VCs have the skills needed to face these environments and to do informed investment decisions (Fenn, Liang, & Prowse, 1995) by deeply studying the HTEVs teams and the relative ideas identified as a business opportunity (Fried, & Hisrich, 1994). Moreover, VCs' role goes beyond being a traditional financial intermediary (Hellman, & Puri, 2002): after the investment, a VC tends to support the invested HTEV providing additional capabilities, social contacts, and several measures to professionalize the HTEV.

There are different types of VCs, and their different nature can imply different goals.

- **Independent VCs** (IVCs) focus exclusively on financial returns coming from their investment thus, every decision is aimed at improving the HTEVs' performance (LiPuma, 2006).
- **Public VCs** (PVCs) are controlled by public entities (e.g., governments, universities) whose goals relate to the social sphere (Colombo, Rossi-Lamastra, & Piva, 2014), like developing the local economy or stimulating job creation.

- **Bank-affiliated VCs** (BVCs) fund new ventures to increase parent banks' probabilities to offer them loans (Hellman, 2002; Wang, Wang, Lu, 2002; Hellman, Lindsey, & Puri, 2008). Consequently, the key target becomes the stability of the company.
- **Corporate VCs** (CVCs) are controlled by non-financial corporations whose aim is to achieve non-financial strategic benefits for the parent company, like the acquisition of complementary capabilities or the exploitation of synergies to design and launch new products (LiPuma, 2006; Colombo et al., 2014).

VCs' processes can be generally reduced to *scouting* and *coaching* (Colombo, & Grilli, 2010). *Scouting* consists in searching for the right HTEV to invest in. *Coaching* is about influencing the HTEV and its surrounding environment to achieve the VC's goals. Such influence translates into the attraction of workforce and more capital due to a reduction of the uncertainty about the venture's potential success (Davila et al., 2003) after VC entry. VC's presence often leads to the replacement of the CEO and of other significant TMT positions (Hellman et al., 2002; Pollock, Fund, & Baker, 2009).

Moreover, VCs often help HTEVs in professionalizing their recruiting policies and in providing their business contacts to grow the HTEV (Hellman et al., 2002). VCs also tend to institute a Board of Directors (BoD) mixing members of the TMT - insiders - and VCs' directors or external experts - outsiders - who can bring additional value in designing the strategy to pursue (Gabrielsson, & Huse, 2002).

3. Hypotheses

3.1. Baseline Hypotheses

Hypothesis 1 *VC-backed HTEVs are more likely and faster to replace the CEO with an outsider if compared to non-VC-backed HTEVs. (Hellman et al., 2002)*

Hypothesis 2 *VC-backed HTEVs are more likely and faster to hire a VP of Sales & Marketing if compared to non-VC-backed HTEVs. (Hellman et al., 2002).*

These hypotheses were already validated by Hellmann and Puri in 2002 - around 20 years ago - considering a sample of 170 HTEVs based in Silicon Valley, United States. Instead, the sample used in this dissertation considers 347 European HTEVs with data until 2021 (see paragraph 4.1). Thus, given such geographic and temporal differences, it was deemed valuable to re-analyze hypotheses 1 and 2 in the present contest and with a different geographical scope.

Hypothesis 3 *VC-backed HTEVs make more changes to their TMT if compared to non-VC-backed HTEVs.*

Hypothesis 3 was elaborated following the study on the TMT by Boeker and Wiltbank (2005) which stated that new ventures with greater VCs' ownership make more changes to their C-level management. This created the basis for a further investigation on whether new ventures make more changes to their TMT, once they receive an investment from a VC.

3.2. New Hypotheses

The analysis now shifts to the impact of different categories of VCs on the organizational changes studied in the baseline hypotheses. Indeed, all VCs provide HTEVs with money and resources, but their objectives may differ. IVCs are the only ones to fund ventures as a core business: All the other VC types depend on another entity with different core activities: PVCs depend on the government, BVCs on their parent bank, CVCs on their parent company. In general, IVCs' main goal is to increase the value of invested ventures, then sell their ownership for a higher price. Therefore, IVCs must lead the venture to solid growth and economic performance. On the other side, PVCs, BVCs, and CVCs use this financing process as a propaedeutic phase to achieve further objectives (see paragraph 2.3). Given this, the following hypotheses were studied:

Hypothesis 4 *HTEVs backed by IVCs (or syndicates led by IVCs) are more likely and faster to replace the CEO with an outsider if compared to HTEVs backed by PVCs, CVCs or BVCs (or syndicates led by PVCs, CVCs, or BVCs).*

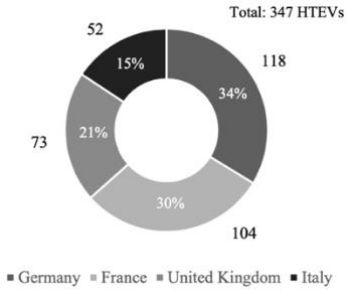
Hypothesis 5 *HTEVs backed by IVCs (or syndicates led by IVCs) are more likely and faster to hire a VP of Sales & Marketing if compared to HTEVs backed by PVCs, CVCs, or BVCs (or syndicates led by PVCs, CVCs, or BVCs).*

Hypothesis 6 *HTEVs backed by IVCs (or syndicates led by IVCs) make more changes to their TMT if compared to HTEVs backed by PVCs, CVCs, or BVCs (or syndicates led by PVCs, CVCs, or BVCs).*

4. Data & Methodology

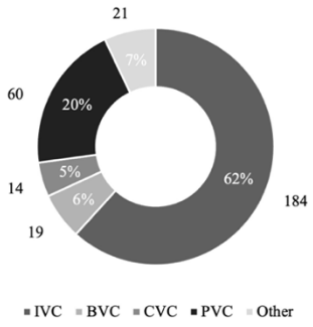
4.1. Dataset

The dataset used consists of information related to a pool of 347 HTEVs from France, Germany, Italy, and the United Kingdom as shown in *Graph 1*. The majority of which (80%) were founded between 2011-2016. For each venture analyzed, the data included investments, financial results, and employees' roles across time thanks to the manual extraction of public data from LinkedIn and the contribution of VICO's and Orbis' datasets.



Graph 1. Geographical distribution of HTEVs

Overall, the types of investors for the entire HTEVs pool are distributed as shown in *Graph 2*. IVCs are by far the most common type of investor (more than 60%). PVCs count for 20% of the pool, while BVCs and CVCs represent 10%.



Graph 2. Distribution of VC investors

Data was later standardized with a classification algorithm to homogenize roles. This was done according to the directives of Guadalupe, Li, & Wulf (2013) regarding C-Suite organizational structure as shown in *Table 3*.

Administrative Functions: back-end aimed at loss prevention	**Area**	**Role**	**Functional Managers with direct report to CEO**
	Finance	CFO (i.e., Chief Financial Officer)	
	Law	General Counsel	
	HR	CHRO (Chief HR Officer)	
	IT	CIO (Chief Information Officer)	
	Strategy	Business Developer	
	Communication	Communication Officer	
Product Functions: front-end aimed at value creation	**Area**	**Role**	
	Marketing	CMO (Chief Marketing Officer)	
	R&D	CTO (Chief Technical Officer)	
	Sales	Sales Director	
	Manufacturing & Operations	COO (Chief Operations Officer)	

Table 3. Standard Organizational Framework used by the classification algorithm

4.2. Methods

For hypotheses 1, 2, 4, 5 a monthly-based survival model was used and was followed by a Cox regression and Wald test to validate its results. For hypotheses 3 and 6, negative binomial regression was chosen since it was needed to count the number of TMT changes. The variables were operationalized in the following manner.

Dependent Variables

*CEO_turnover_* measures the replacement of the CEO with an outsider and it takes the value 1 if the venture hired an outside CEO in the specific month, or 0 otherwise.

*VP_turnover_* measures the hiring or replacement of a VP of Sales & Marketing and it takes the value 1 if the venture hired a VP of Sales & Marketing in the specific month, or 0 otherwise.

TMT_changes measure the number of changes in the C-level management and is measured with the yearly number of changes in the TMT.

Independent Variables

vc_invest measures if the venture is backed by a VC and equals 1 if the venture already received a VC investment or 0 if otherwise in each month.

ivc_invest measures if the venture was backed by an Independent VC and - every month - it equals 1 if the venture received an investment from an IVC, or 0 otherwise.

other_vc_invest measures if the venture is backed by a non-Independent VC, thus by a Public VC, a Bank-affiliated VC, or a Corporate VC. Every month, it equals 1 if the venture received an investment from a PVC, BVC, or a CVC, or 0 otherwise.

Control Variables

Venture's Country is operationalized by 4 dummy variables: *d_country1* for France, *d_country2* for Germany, *d_country3* for Italy, *d_country4* for United Kingdom. For each venture, each variable assumes 1, while the other three assume 0 depending on the country of belonging.

Venture's Sector is operationalized through 106 different dummy variables: from *sector_1* to *sector_106*, each variable equals 1, while the other 105 assume 0 depending on the sector where the HTEV is active.

Venture Size was measured by using *Sales*.

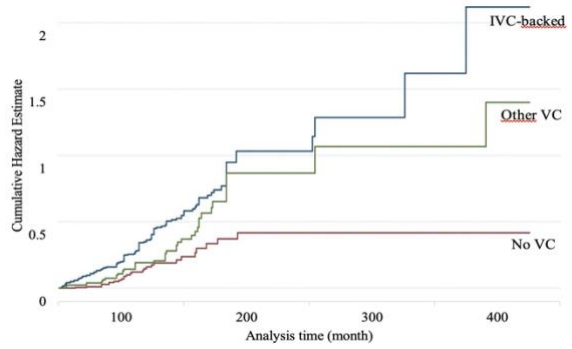
Venture Stability was measured by using *Cash*.

Profitability was measured by *EBIT*.

The financial control variables (i.e., Sales, Cash, EBIT) had a relevant percentage of missing datapoints. Including them in the models significantly reduced the number of observations. Therefore, the analyses were performed both with and without them, to understand their impact on the results.

5. Results & Discussions

Hypotheses 1 and 4, respectively related to the influence of VC investments and VC type on the CEO replacement, were validated by statistically acceptable p-values and coefficients in line with the propositions. Results could also be visualized through the Survival Model shown in *Graph 4*. There, it seems to be a clear hazard rate difference between VC-funded HTEVs and non-funded ones. The difference among different types of VCs is less evident, but still statistically confirmed by numeric results.



Graph 4. Comparison of CEO replacement hazard rates depending on VC type

Instead, hypotheses 2 and 5 were respectively related to the influence of VC investments and VC type on the hiring of a VP of Sales & Marketing. Hypothesis 2 was validated by result, and Graph 5 confirms it from a graphic standpoint. On the other side, hypothesis 5 did not find support in the results and the overlapping of the two curves in Graph 5 goes in this direction.

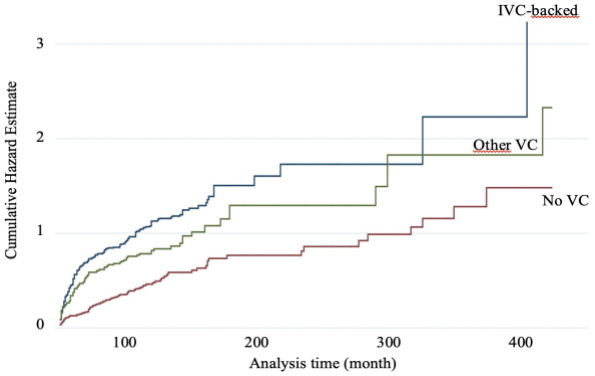


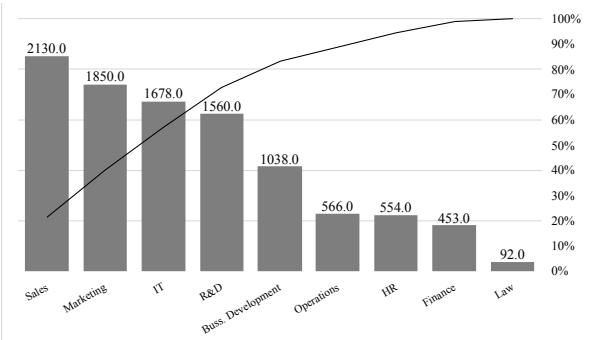
Table 5. Comparison of VP of Sales hiring hazard rates depending on VC type

Finally, hypotheses 3 and 6 respectively investigated the influence of VC investments and VC type on the number of TMT changes. Hypothesis 3 was confirmed by numeric results, while hypothesis 6 could not be validated. To study these hypotheses, the negative regression model was used, thus no illustrative representation is available.

To summarize, VC investments tend to enhance the probability of replacing the CEO, hiring a VP of Sales & Marketing, and making more changes to the TMT. Indeed, VCs want to professionalize the HTEVs, to make them grow and reach better performances. Moreover, IVCs seem to be more determined and faster in replacing the CEO, although this evidence is lighter and further investigation should be conducted.

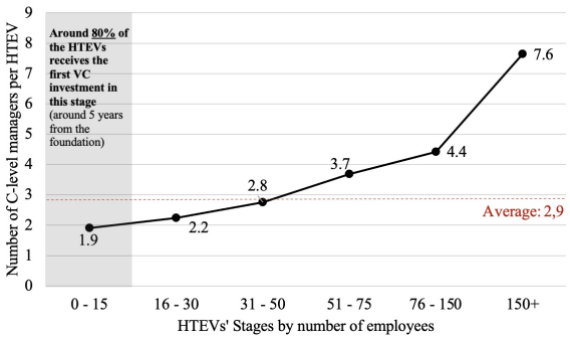
6. Explorative Section

Some additional key findings in organizational theory were obtained from the internally developed employees' dataset. First, it was discovered that Sales & Marketing and R&D represent the business areas with the lowest individual functional concentration. This seems coherent with the definition of the high-tech industries where HTEVs are active. Such industries are indeed characterized by high velocity in the product release rate and need a substantial salesforce and R&D department to create and market new products at sustained pace.



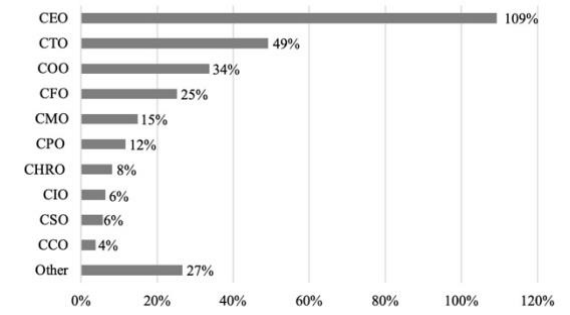
Graph 6. Business area concentration among all HTEVs (#employees by function %)

Moreover, while analyzing the formalization level adopted by these HTEVs, it emerged that the number of executives in the C-Suite increases in relation to the number of employees, and VC investors generally finance the EVs when these have on average two C-level managers (see *Graph 7*).



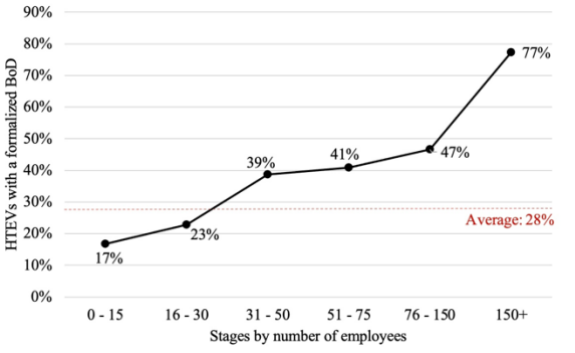
Graph 7. Number of C-level managers per HTEV related to number of employees

Related to this, it was interesting to study the typical composition of the C-level management. As illustrated in *Graph 8*, all the HTEVs have a CEO, in some cases even two Co-CEOs. The other main roles are CTO (i.e., Chief Tecnology Officer), CTO (i.e., Chief Tecnology Officer), COO (i.e., Chief Operations Officer), CFO (i.e., Chief Financial Officer), and CMO (i.e., Chief Marketing Officer).



Graph 8 Average presence of C-level managers (347 HTEVs, 829 C-level positions)

In addition, empirical evidence showed a correlation between employees' number and the presence of a Board of Directors (*Graph 9*). The higher the number of employees, the higher the probability of having a formalized BoD.



Graph 9. HTEVs with a formalized Board of Directors by number of employees (%)

It is reasonable to associate this trend with the consequences of being a larger venture. The higher the number of employees, the higher the funds collected, the more consolidated the business model, the larger the turnover, etc. All these effects bring to higher complexity that results in higher chances of creating inefficiencies and making wrong or opportunistic decisions. This implies the need for a standardization of the processes at any level, and - for the managerial level - the formalization of a BoD is a crucial step in this direction.

7. Conclusions & Limitations

7.1. Concluding Remarks

To summarize all the analyses, *Table 10* reports a synthesis of the results obtained. The baseline hypotheses 1, 2, and 3 resulted valid and statistically significant. Regarding the new hypotheses, proposition 4 can also be validated, while hypotheses 5 and 6 did not find support in the results.

#	Hypothesis	Result	Result with Financial var.	Model used
1	VC-backed HTEVs are more likely and faster to replace the CEO with an outsider if compared to non-VC-backed HTEVs.	Valid	Valid	Survival Model, Cox Regression
2	VC-backed HTEVs are more likely and faster to hire a VP of Sales & Marketing if compared to non-VC-backed HTEVs.	Valid	Valid	Survival Model, Cox regression
3	VC-backed HTEVs make more changes to their Top Management Team if compared with non-VC-backed HTEVs.	Valid	Valid	Negative binomial regression
4	HTEVs backed by IVCs (or syndicates led by IVCs) are more likely and faster to replace the CEO with an outsider if compared to HTEVs backed by PVCs, CVCs or BVCs (or syndicates led by PVCs, CVCs, or BVCs).	Valid	Valid, with reserves	Survival Model, Cox regression
5	HTEVs backed by IVCs (or syndicates led by IVCs) are more likely and faster to hire a VP of Sales & Marketing if compared to HTEVs backed by PVCs, CVCs, or BVCs (or syndicates led by PVCs, CVCs, or BVCs).	Invalid	Valid, but low number of observations	Survival Model, Cox regression
6	HTEVs backed by IVCs (or syndicates led by IVCs) make more changes to their Top Management Team if compared to HTEVs backed by PVCs, CVCs, or BVCs (or syndicates led by PVCs, CVCs, or BVCs).	Invalid	Invalid	Negative binomial regression

Table 10. Synthesis of results obtained from the analyses

Results confirmed that VC-backed ventures are associated with a higher likeliness of replacing the CEO, hiring a VP of Sales & Marketing, and making more TMT changes rather than non-VC-backed ventures. Going deeper, results also showed that IVC-backed companies tend to replace the CEO with higher probability and at a higher pace if compared with ventures backed by other types of VCs.

Shifting to the empirical evidence collected through the explorative section, some key findings in organizational theory were obtained from the internally developed employees' dataset. First, it was discovered that Sales & Marketing and R&D represent the business areas with the lowest individual functional concentration. Moreover, while analyzing the formalization level adopted by these HTEVs, it emerged that the number of executives in the C-level Management increases in relation to the number of employees, and VC investors enter the EVs when they have on average two C-level managers. In addition, empirical evidence showed a correlation between employees' number and the presence of a BoD.

7.2. Limitations

The analyses and evidence emerged from this dissertation have some limitations, mostly linked to the nature of the datasets and classification algorithm used.
Starting from VICO's dataset, the selected data only contained VC-backed companies, and the analyses completed to validate hypotheses 1, 2 and 3 compared the periods before and after the VC investment. Therefore, these analyses cannot be considered a difference-in- difference method.

About the ORBIS dataset, several missing financial variables did not allow to obtain stable and acceptable results when inserting them as control variables in regression models. This limitation is partially overcome thanks to the setting of two parallel regression models, one containing them, the other not. In this way, it was easier to have a more comprehensive view on the regression's results.

Regarding the employees' dataset, it should be noted that data was taken from LinkedIn where people are free to insert any title with little surveillance from the social network.

Moreover, the algorithm considers a standard organizational chart derived from late 1990s IBM's organigram. This may not be commonly adopted by HTEVs, especially at their very early stages of life.

Finally, other limitations concern that HTEVs were only taken from only four European countries, hence, the analysis may not be fully representative for the whole Europe.

8. References

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Academic Year 2020-2021

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Acknowledgements – Riccardo Bonani

Il lavoro su questa tesi si è svolto nel corso di un intero anno e corona la fine della mia breve ma intensa carriera accademica.

Il mio primo ringraziamento va al mio amico e co-autore in questo progetto, Andrea, il cui impegno e supporto sono stati sempre costanti e pieni di ispirazione. Lavorare assieme è stata per me un'importante occasione di crescita personale.

Ringrazio anche gli amici e amiche da SCOUT Consulting Club per gli innumerevoli stimoli di crescita che mi hanno sempre dato e che in primo luogo mi hanno portato a realizzare questo progetto con Andrea, anch'egli come me membro dell'associazione.

I miei ringraziamenti vanno anche al nostro Relatore Professor Massimo Gaetano Colombo per averci dato l'opportunità di lavorare su temi relativi al mondo dell'imprenditoria e delle start-up. Un ringraziamento speciale è doveroso nei confronti del Professor Vincenzo Butticè che ci ha sempre supportato negli aspetti più tecnici della tesi.

Infine, vorrei ringraziare i miei familiari – Papà, Mamma, Filippo e Beatrice – per avermi sempre sostenuto durante tutto il percorso. Questa tesi e tutto ciò che ha portato ad essa non sarebbero stati possibili senza il loro sostegno e la loro fiducia in me.

Un ultimo grazie, per il loro supporto e affetto, va all'intera famiglia Donati-Speri – da Carlo, Marta e Diletta fino a Fiorenzo, Giuseppina e Ileana –, che mi ha visto portare a termine non solo questo lavoro, ma il mio intero percorso al Politecnico.

Acknowledgements - Andrea Franchini

La laurea segna la conclusione di un periodo indimenticabile della mia vita, ma anche la realizzazione di un traguardo importante. Cinque anni, decine di esami, centinaia di libri. Tanto sacrificio e costanza che non sarebbero stati possibili senza le persone giuste al mio fianco.

Un primo grazie va a Riccardo per essere stato un grande compagno di tesi. Abbiamo imparato l'uno dall'altro, combinando periodi di intenso lavoro con meritati momenti di svago. Non potevo chiedere di meglio.

Ringrazio anche i Professori Massimo Gaetano Colombo e Vincenzo Butticè per averci introdotto al mondo imprenditoriale e per la fondamentale collaborazione in questo progetto di tesi.

Un immenso grazie alla mia famiglia per avermi sostenuto in questa avventura, standomi vicino nei periodi di difficoltà e festeggiando nei momenti di felicità. Il vostro supporto è stato essenziale.

Ringrazio infinitamente i miei amici di una vita per i momenti di puro divertimento, necessari per tenermi concentrato durante questo viaggio. Francesco, Marco, Daniele, Manuel, Manfredi e Giordano, siete come fratelli.

Grazie alle mie amiche Alessia, Sadaf e Vittoria per avermi sempre portato il sorriso, caricandomi di fiducia per raggiungere questo obiettivo.

Un profondo grazie ai miei compagni di corso Nicholas, Pietro, Alessio, Caio e Alberto. Avete reso leggeri e divertenti ogni lezione, ogni progetto, ogni esame.

Infine, un grazie speciale a Giorgia, la mia metà, che ogni giorno mi stimola a superare i miei limiti. Sei la mia ispirazione e, senza di te, non sognerei così in grande. Siamo una squadra, e questo è solo l'inizio.

ABSTRACT (Italian version)

Questo studio si concentra sull'analisi dell'organizzazione nelle startup high-tech a seguito dell'ingresso di Venture Capital. In particolare, cerca di stabilire una base empirica di analisi per studiare l'influenza che l'investimento di Venture Capital e il tipo di investitore hanno su alcuni eventi organizzativi chiave come la sostituzione del CEO, l'assunzione di un VP delle vendite e il numero di cambiamenti nel Top Management Team. Il set di dati analizzato è costituito da informazioni relative a un pool di 347 startup high-tech provenienti da Francia, Germania, Italia e Regno Unito. Per ogni startup analizzata, i dati includono l'ammontare degli investimenti, i risultati finanziari e i ruoli dei dipendenti durante la vita dell'impresa. I risultati indicano che l'ingresso di un Venture Capitalist è associato a una maggiore probabilità e velocità nella sostituzione del CEO e nell'assunzione di un VP Sales & Marketing, oltre che a un incremento dei cambiamenti nel Top Management Team. Inoltre, le analisi hanno confermato che la tipologia di Venture Capitalist - dopo l'investimento in una startup - ha un impatto significativo sulla probabilità e sulla velocità di sostituzione del CEO: gli Independent Venture Capitalist tendono a portare le imprese a cambiare CEO più frequentemente e velocemente rispetto ad altri tipi di Venture Capitalist. Nella sezione esplorativa sono stati evidenziati alcuni risultati chiave: in primo luogo, si è scoperto che i dipartimenti Sales & Marketing e R&D rappresentano le funzioni aziendali più "popolate". In secondo luogo, un'analisi descrittiva ha mostrato che la maggior parte delle startup high-tech tende a ricevere un investimento da un Venture Capitalist quando hanno in media due dirigenti appartenenti al C-Level. Infine, è stata trovata evidenza empirica riguardo alla correlazione tra le dimensioni della startup in termini di numero di dipendenti e la presenza di un Consiglio di amministrazione formalizzato (Board of Directors).

Parole chiave: Startup High-Tech; Venture Capitalist; sostituzione del CEO; struttura organizzativa; VP Sales and Marketing; C-Level; Top Management Team.

ABSTRACT (English version)

This dissertation focuses on analyzing the Organization of High-tech Entrepreneurial Ventures following Venture Capital entry. It tries to establish an empirical ground of analysis to study the influence of Venture Capital investment and investor type on some key events such as CEO replacement, hiring of a VP of Sales & Marketing and Top Management Team changes.

The dataset consisted of information related to a pool of 347 High-tech Entrepreneurial Ventures from France, Germany, Italy, and the United Kingdom. For each venture analyzed, the data included investments, financial results, and employees' roles across time.

Results indicate that the entry of a Venture Capital investor is associated with higher likeliness and speed in replacing the CEO, hiring a VP of Sales & Marketing, and making more changes in the Top Management Team. In addition, the analyses confirmed that the type of Venture Capitalist - after its investment in a venture - significantly impacts the probability and speed of replacing the venture's CEO: Independent Venture Capitalists tend to lead ventures to change CEO more frequently and at a faster pace if compared to other types of Venture Capitalists.

In the explorative section, some key findings were highlighted: first, it was discovered that Sales & Marketing and R&D represent the most "populated" business functions. Second, a descriptive analysis showed that most of the High-tech Entrepreneurial Ventures tend to receive a Venture Capital investment when they still have two C-level managers. Finally, empirical evidence found a correlation between venture's size in terms of employees and presence of a formalized Board of Directors.

Key words: High-Tech Entrepreneurial Ventures; Venture Capitalist; CEO replacement; Organizational structure; VP of Sales and Marketing; C-Level; Top Management Team.

1. INTRODUCTION

Venture Capital investments into High-Tech Entrepreneurial Ventures trigger many effects on these young companies. Among these effects, Venture Capitalists (VCs) tend to push the ventures to professionalize their structure by doing specific changes to the organization in order to pursue specific objectives.

This dissertation tries to establish an empirical ground of analysis to study the influence of Venture Capital investment and of investor type on some key organizational events that carry a significant effect on the whole venture. The main events analyzed are the CEO replacement, the hiring of a VP of Sales & Marketing, and the number of Top Management Team changes.

From the analysis of past research, it emerged that, although there currently is no uniquely approved definition, Entrepreneurial Ventures can be seen as those young and independent firms established by one or more individuals to commercially exploit a novel business idea (Colombo, Rossi-Lamastra, & Matassini, 2016). They are referred to as High-Tech Entrepreneurial Ventures when they compete in industries characterized by great process and product complexity with high product development rate (industry velocity).

Recent studies highlighted the importance for Entrepreneurial Ventures to adopt an appropriate organizational structure that allows them to manage both agency and information costs, but also to maintain *flexibility*, which is their characteristic advantage when compared to large established companies. First, a venture should properly design its team. Then, it becomes essential to design an organization considering the following dimensions: hierarchy, allocation of decision authority, task allocation, formalization. The paper provides a deep literature review for each of these dimensions.

To conclude the overview of all the topics analyzed in this dissertation, a general description of the different types of VC investors is presented distinguishing between Independent, Public, Bank-affiliated, and Corporate VCs.

The dataset used for the analyses was composed of 347 High-Tech Entrepreneurial Ventures based in four European countries: France, Germany, Italy, and United Kingdom. To each venture are associated information about Venture Capital investments, financial results, and employees' roles across time.

The Entrepreneurial Ventures included in the dataset were founded in 2019 at the latest with most of them (80%) concentrated between the years 2011-2016.

To standardize the data concerning employees' roles across time, a classification algorithm was developed to automatically assign standard roles to employees. Such roles were assigned based on an organizational framework developed by Guadalupe, Li, & Wulf (2013) and inspired by the organization of IBM in the late 1990s.

The hypotheses stated in this dissertation are related to three main factors: the replacement of the CEO, the hiring of a VP of Sales & Marketing, and the number of changes in the Top Management team. The analysis attempts to find a correlation between these organizational changes and the following elements: the investment of VC - which validates the previous study of Hellmann & Puri (2002) at present times and in a different geographic scope -, and the type of Venture Capital investor, distinguishing between Independent VCs and other types of VCs. The operationalization of such elements was done through the use of dummy variables to allow the use of a survival model - accompanied by Cox regression - and a negative binomial regression.

Results confirmed that VC-backed ventures are associated with a higher likeliness of replacing the CEO, hiring a VP of Sales & Marketing, and making more Top Management Team changes rather than non-VC-backed ventures. Going deeper, results showed that IVC-backed companies tend to replace the CEO with higher probability and at a higher pace if compared to ventures backed by other types of VCs.

Finally, this dissertation also includes an explorative section that describes some key findings in organizational theory obtained from the newly developed internal dataset: first, Sales & Marketing and R&D represent the most "populated" business functions in High-tech Entrepreneurial Ventures. Thus, these are the functions with the lowest individual functional specialization. Second, a descriptive analysis showed that most of the High-tech Entrepreneurial Ventures tend to receive a Venture Capital investment when they still have two C-level managers. Finally, empirical evidence found a correlation between the venture's size in terms of employees and the presence of a formalized Board of Directors: the higher the number of employees, the higher the probability of finding a Board of Directors.

To conclude, this dissertation focused on the impact of VCs on the organization of High-tech Entrepreneurial Ventures. Nevertheless, the variables analyzed were mostly focused on the Top Management Team level and further research could identify other insights related to other hierarchical levels or the whole venture level.

2. THEORETICAL BACKGROUND

This dissertation focuses on analyzing the Organization of High-tech Entrepreneurial Ventures after Venture Capital entry. Thus, the study is built around *three macro-concepts* that are central in each part of the work:

1. High-Tech Entrepreneurial Ventures (called HTEVs for sake of simplicity).
2. Organizational Structure (within the HTEVs).
3. Venture Capitalists (called VCs).

Consequently, as a point of departure to fully understand the research, the theoretical background focuses on introducing HTEVs, their main characteristics, and giving an overview of the literature related to their organizational structures. Finally, there is a focus on what VCs are and what is known at the moment on their impact on HTEVs' organizational structure.

2.1 Overview of High-Tech Entrepreneurial Ventures

To define what HTEVs are, before it is crucial to define what Entrepreneurial Ventures are and the meaning of High-Tech. Each of these two arguments has a dedicated paragraph. Then, the other two paragraphs aim to respectively explain the key characteristics of HTEVs and why these are so important to be analyzed.

2.1.1 Definition of Entrepreneurial Ventures

In the XVIII century, Adam Smith was one of the first economists to analyze the profit motive that pushes business owners to create their firms, but entrepreneurship started to become a central topic in the academic world only in the 20th Century.

A key moment was when - in 1942 - Schumpeter defined the producers of *new* consumers' goods as the fundamental impulse that sets and keeps the capitalist engine in motion. Moreover, Schumpeter defined the entrepreneur as a "*person who is willing and able to convert a new idea or invention into a successful innovation*".

After Schumpeter, the entrepreneurship topic gained relevance decade by decade, bringing the concepts of entrepreneur and entrepreneurial ventures to be described over time in several different ways.

Still, nowadays there are no objective definitions; nevertheless, to precisely define the perimeter of the research, it was necessary to identify a clear and exhaustive definition of what an entrepreneurial venture is:

Entrepreneurial Ventures are those young and independent firms established by one or more individuals to commercially exploit a novel business idea.
(Colombo, Rossi-Lamastra, & Matassini, 2016)

This definition defines four main variables that must occur at the same time to identify a firm as an Entrepreneurial Venture (EV):

- Age: EVs are *young* firms.
- Legal Status: EVs are *independent*, thus not owned by other firms.
- Founder(s): EVs are established by *one or more individuals*.
- Business Model: Entrepreneurial ventures *commercialize* a novel business idea to create *value* (e.g., profits).

A further consideration to be underlined is that the *size* is *not* a discriminant variable to determine whether a firm is an entrepreneurial venture. Even if the majority of the entrepreneurial ventures are small, some of these may have a large size since their opening, due to the minimum efficient scale of their industry (Hart, 2003). For example, the airline business requires large sizes, even at the beginning.

This dissertation analyses only entrepreneurial ventures, therefore only firms responding to the four characteristics listed in the definition.

2.1.2 Definition of High-tech Industries

This dissertation is focused on a specific type of EVs: those that operate in High-tech Industries. There is currently not a single authoritative definition of the High-tech Industry. Many different approaches could be used to delimit the High-tech area e.g., by sector, by product. These methodologies aim to identify a group of economic sectors or products responding to a specific *rule* defined ex-ante to the selection process.

In 2006, Steenhuis and de Bruijn tried to remove the ambiguity of the previous definitions by considering the combination of three *rules*:

- Process complexity: determined over a scale (Technology Atlas Team, 1987) that measures the sophistication of the process steps based on the level of technology embodied in the four main actors along the production process: components (*Technoware*), human resources (*Humanware*), documents (*Inforware*), external institutions involved (*Orgaware*).

- Product complexity: relates to the R&D intensity needed to design a product and it can be quantitatively computed comparing the R&D expenses incurred to design the product and the relative revenues obtained. The product complexity is considered high when the indicator $\frac{R\&D\ Expenses^1\ [€]}{Revenue^1\ [€]}$ % overcomes 2% (Steenhuis & de Bruijn, 2006).
- Product development rate: it relates to the industry velocity, measured through an indicative industry clock speed (Carrillo, 1999). Each industry has an appropriate industry clock speed, which is directly related to the intensity of products introduction over time, thus to their lifecycle duration. Developing and launching products at a faster pace - in comparison with the industry clock speed - shrinks the relative lifecycles, damaging the profits. Consequently, each industry has its intrinsic characteristics that lead to setting an equilibrium around an appropriate clock speed and the relative product development rate. This defines the velocity at which the industry evolves.

These three rules concur to identify a unique definition of High-tech Industry:

High-tech Industries are high-velocity industries (i.e., high product development rates) which production processes and product developments are characterized by high level of complexity.

	Process complexity			
	Low			**High**
	Product complexity		**Product complexity**	
Product development rate	Low	High	Low	High
Low	LOW TECHNOLOGY			
High				HIGH TECHNOLOGY

Table 2.1 Positioning of the High-Tech Industry (Steenhuis, & de Bruijn, 2006)

To apply these theoretical concepts to reality, a clear example of High-tech Industry is the *computer industry*. Nowadays, this environment is studded of product launches day by day. R&D is a key function in product design and the products require complex processes to be realized.

2.1.3 Key characteristics of High-tech Entrepreneurial Ventures

After having introduced the definitions of EVs and High-tech Industries, it is possible to connect the dots: HTEVs are EVs operating in High-tech Industries.

The nature of EVs, combined with the High-tech sector in which these works determine some intrinsic characteristics. Firstly, High-tech Industries are characterized by high product

[1]R&D Expenses and Revenue quantities must be computed for the single product

and process complexities (Steenhuis et al., 2006). This implies the need of having a team with *high human capital*, composed of entrepreneurs and key employees with highly specialized knowledge (Colombo, et al., 2016). In particular, the higher the academic education in managerial fields and/or work experience in technical functions in the same industry, the higher the HTEV's expected growth (Colombo, & Grilli, 2005). Secondly, High-tech Industries are *high-velocity environments* characterized by frequent and discontinuous changes in demand, competitors, and technologies (Bourgeois, & Eisenhardt, 1988). Therefore, these industries are subject to a high level of uncertainty, making it hard to predict future disruptions (Knight, 1921) and increasing the risk of taking wrong decisions (Eisenhardt, & Martin, 2000). To face these challenges, *decision speed* and *comprehensiveness* are the key for HTEVs to obtain and keep high performances (Bourgeois et al., 1988).

A comprehensive decision-making process is "exhaustive in the generation and evaluation of alternatives" (Fredrickson & Mitchell, 1984) and scholars (Bourgeois et al., 1988) showed that speed and comprehensiveness are not mutually exclusive, thus, it is not a matter of finding a trade-off between being efficient and being effective in taking decisions. Indeed, the two scholars proved that "the greater the number of alternatives considered simultaneously, the greater the speed of the strategic decision process". In high-velocity environments, like HTEVs' ones, opportunities rapidly change, thus, a fast-decision-making process is mandatory, but also its comprehensiveness is fundamental to choosing the right direction.

The last key HTEVs' feature regards the age: HTEVs by definition are *young* firms, thus, these may suffer a *liability of newness* - for instance - related to a lack of knowledge of the industry environment, financial stability, or consolidated relationships with stakeholders (Freeman, Carroll & Hannan, 1983).

Moreover, scholars found that two crucial variables affecting HTEVs' performances are their *flexibility* and *efficiency* (Tushman, & O'Reilly, 1996, Brown, & Eisenhardt, 1997, Uzzi, 1997, Rowley, Behrens, & Krackhardt, 2000). The conventional wisdom was that optimal structures leverage on the balance between flexibility and efficiency as these two are the extremities of a trade-off and it is impossible to maximize both simultaneously. Nevertheless, Davis, Eisenhardt, and Bingham (2009) deepened the topic concluding that the real trade-off is between "flexible capture of widely varying opportunities vs. efficient execution of specific opportunities".

To sum up, HTEVs live in High-tech Industries thus, to obtain and keep high performances, having high industry-related human capital is a must-have. However, strong technical and managerial skills are not enough: HTEVs should be able to have a fast and

comprehensive decision-making process, capable to identify and exploit the right opportunities. To achieve this, and to mitigate the liability of newness, the literature says that HTEVs should find the appropriate organization enabling them to be flexible in identifying opportunities to pursue, and efficient then, in designing and implementing the relative strategies.

2.1.4 The relevance of High-tech Entrepreneurial Ventures in the economy

As mentioned in the introductory part of this theoretical background, HTEVs represent one of the three macro-concepts analyzed along with this dissertation.

Previous research showed that young firms have a crucial role in economic growth (Acs, & Armington, 2004). Moreover, young ventures, growing faster than their older counterparts, have higher job creation rates (Haltiwanger, Jarmin, & Miranda, 2013).

The relevance of EVs over the topic of economic growth becomes even stronger focusing on the High-tech sectors. As discussed in paragraph 2.1.2, these high-velocity environments are constantly characterized by micro and macro innovations and young firms appear to be crucial catalysts of technological innovation, even in case of failure (Scherer, 1992; Utterback, 1994). Furthermore, the older firms, thanks to the pressure of their young counterparties, are forced to innovate.

To summarize, HTEVs showed to be a key asset in the economy, gaining the attention of the world of research in entrepreneurship. This is thanks to their strong impact on economic growth, both through creating jobs and fostering technological innovation.

2.2 About the Organization of High-Tech Entrepreneurial Ventures

After having introduced what HTEVs are, the focus shifts to the key concept at the core of this dissertation: HTEVs' *organizational structure*.

As mentioned in the previous section, HTEVs should adopt the appropriate organizational structure to be *flexible* enough in identifying opportunities, and *efficient* in implementing the relative strategies. This would allow HTEVs to reach and keep high performances, creating jobs and fostering innovation.

The topic of organizational structure was mainly analyzed focusing on large established companies. Nevertheless, understanding the important role of EVs - and even more of HTEVs - in economic growth is bringing scholars to study deeper their organizational structure (see for

example Colombo et al., 2016; Burton, Colombo, Rossi-Lamastra, & Wasserman, 2019; Butticè, & Rovelli, 2019).

This section provides an overview of the extant knowledge about organizational structure in EVs, with a deep dive on HTEVs. Given its crucial role in affecting the organization - thus the firm performance -, the first concept to be analyzed is the Team at the top of the organization: after a brief introduction to describe what it is, the focus goes to the team creation and development processes. Then, the section follows entering in its main topic: how to organize an HTEV. This part presents, one by one, the main dimensions related to the design of the organizational structure: hierarchy, allocation of decision authority, task allocation, and formalization.

2.2.1 Entrepreneurial Founding Team and Top Management Team definitions

"The entrepreneur in entrepreneurship is more likely to be plural, rather than singular" (Gartner, Shaver, Gatewood, & Katz, 1994). This statement has the goal to highlight that, behind ventures, typically there is more than one person. Scholars were able to prove a strong connection between firms created by a team and superior performances in respect to solo entrepreneurs' ventures (Cooper, & Bruno, 1977, Eisenhardt, & Schoonhoven, 1990). On this line, given that each team member should add financial, social, and human capital resources, the venture may pursue harder tasks, develop more impacting products/services, and reach higher performances (Kraus, & Schjoedt, 2009). For instance, in 2006 Beckman took a sample of around 200 HTEVs and found that less than 10% of these were founded by solo entrepreneurs.

At this point, it becomes useful to define what the Entrepreneurial Founding Team (EFT) is:

> The *Entrepreneurial Founding Team* (EFT) is the group of owners who hold a key role in the (strategic) decision-making of the venture at the time of the founding.
> (Ucbasaran, Lockett, Wright, & Westhead, 2003)

Then, Kraus and Schjoedt (2009) added the concept of cohesion within the team, stating that EFT members "are seen as a social entity by themselves and by others".

It was also discovered that EFTs often experience changes in their composition (Cooper, & Daily, 1997). Focusing on HTEVs, Cooper and Bruno (1977) found that, in around *half* of the HTEVs interviewed, at least one founder left. Additions or changes to the initial team cause

the entrance of new members that may not be owners of the venture. Despite this, the new entrants are team members, thus they have a main role in strategic decisions. The most explicative example is the turnover of the CEO (i.e., Chief Executive Officer), the team leader. The new CEO is not part of the EFT – since she is not a founder –, even though she is at the top of the venture's organization. Therefore, given the dynamism within the EFTs, it is reasonable to use "Top Management Team" (TMT) to name the team. In this way, the entity is more comprehensive and allows to extend the team concept in time, identifying the TMT as the *group of venture's members who hold a key role in the (strategic) decision-making of the venture*. Related to this, the C-level management (or C-suite) consists of the venture's functional leaders (i.e., Chiefs) who hold the power to make the key strategic decisions. Thus, the C-level management may be considered as the proxy to operationalize the TMT concept in the real context. Coherently to this, in this paper, the TMT is considered as the team with the power to make the strategic decisions, and in each venture, it is composed of its C-level managers.

2.2.2 Team creation

The previous paragraph underlined the importance of EFTs and TMTs, given that new ventures funded and developed by teams tend to outperform their counterparties created by individuals. Nevertheless, having a team at the lead of a new venture implies creating, thus defining the composition, and then organizing the team. Given that the focus of this dissertation is the organizational structure of HTEVs after VC entry, it is relevant to have a brief overview of how typically new ventures create, and then organize their teams, at the very early stage.

In 2012, Balagopal Vissa developed a high-level procedure to standardize the design of the new venture team composition. Here are the 7 steps:

1) *Identify the totality of the skills required*: define all the technical, interpersonal, and industry-related skills needed by the venture to operate the business. The organizational culture that the founding team wants to build should already be clear.
2) *Assess the expertise of team members in executing the key activities*: matching of the key activities and the relative skills required - identified in the previous step - with the capabilities of the existing members. This phase aims at identifying the skills not covered by the founding team, and consequently at designing the ideal candidates to hire, including at least one member with start-up context skills - if not present in the founding team -.

3) *Understand team member motivations and align incentives within the team*: the goal is to assign to each member the appropriate responsibilities, based on the matching set in the previous step between activities and the relative skills. Moreover, the team should contextualize the passion for the venture, the level of personal risk, and the appropriate salary for each member. It is important to be flexible in this phase since the venture is at the very early stage and every member-specific lever may change.
4) *Think through equity allocation and document ground rules for shareholder behavior*: in this critical step, the team should take into account an infinite/indefinite set of variables to split the equity. To summarize, there is no perfect timing to do it: at the very beginning, the team does not have enough information (e.g., who will find the investor) to decide on a fair split, however, waiting too much could create conflicts and opportunistic behaviors. There is not even a standard process: the most common procedure consists of splitting the equity into equal parts (Hellmann, & Wasserman, 2008). Despite this, the higher variables like team size, difference in capital invested, prior entrepreneurial or industry-related experience, the higher the probability of going for an unequal split. Consequently, even here, the success factor is flexibility: everything may change within the team, thus a dynamic agreement defining an early split to be revised later, based on well-defined rules, could be the most appropriate solution.
5) *Think through team composition*: in addition to the complement of the missing skills, each team should try to define the profiles to hire also aiming at acquiring heterogeneous social characteristics (e.g., age, gender, ethnicity, nationality). Social diversity may indeed create *healthy* conflicts: when conflicts focus on task issues, social heterogeneity enlarges the thinking boundaries, bringing different perspectives, thus, increasing flexibility and quality in the decision-making process (de Vliert, & de Dreu, 1994). Conversely, if conflicts focus on social issues, the team performance tends to lower due to higher tension levels and lower quality in the decision-making process. To mitigate this risk and enhance the flexibility given by the social diversity, three non-mutually exclusive solutions are: emphasizing similarity in deeper variables (e.g., personality traits, core values), fostering an outward orientation, and designing a well-defined and shared vision to keep in mind the True North along each decision-making process.
6) *Ensure you develop the right norms in your venture team*: identification of the core norms to be followed by the team members with the goals of drawing the behavioral boundaries and driving team members to take an active role - rather than a reactive one -.

7) *Leverage the team external network*: contacts are key in each business. A good strategy to optimize the networking process consists of mapping the contacts, identifying for each type of contact (i.e., customers, investors, suppliers, partners) an:

- *Inner Circle* containing the closest and trustworthy connections.
- *Outer Circle* containing the acquaintances that have less motivation in helping the team.

The team should try to have a contact for each combination type-circle, exploiting the closest contacts to brainstorm on key activities and decisions, and the outer circle acquaintances to collect insights from the external environment.

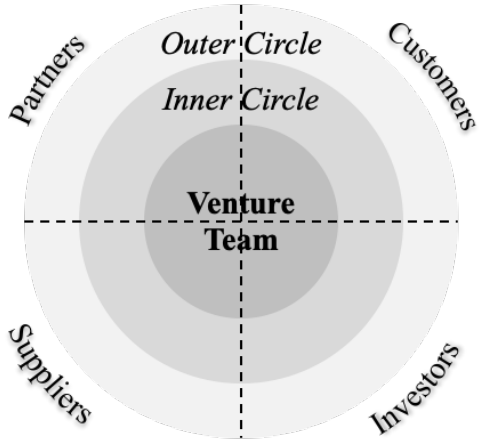


Figure 2.2 Networking Map

This process ends with the definition of the members of the new venture team, thus the skills possessed by the venture, the core norms to respect, and the networking map with the major contacts to exploit. Once set the team composition, the focus shifts to the key topic of this section: how to *organize* the team to get the most from each member and maximize the performance.

2.2.3 Organizational Structure: definition and recent developments

The *organization* is the structure and formal system of communication, division of labor, coordination, control, authority, and responsibility required to achieve a company's goals (Hamel and Pralahad, 1994). This definition is valid for any firm, no matter the age, the size, or the sector. Nevertheless, as mentioned in the introductory part of this section, most of the works on organizations were focused on established companies.

The conventional wisdom backed that the Entrepreneurial Ventures (EVs) must bear low agency and information costs, thus, the organization of new ventures tends to be so simple that it made no sense to study it in depth (Mintzberg, 1979). However, Colombo and Rossi-Lamastra (2013) gave a different point of view justifying why both agency and information costs may be high also in EVs, hence, arriving to conclude that an appropriate organization is key also for these.

The *information-processing theory* was applied by Tushman and Nadler (1978) to the organizational context. The model developed assumed that the team members, even having the same company vision, are boundedly rational, thus they have limited capacity in processing

information among them (Simon, 1945). Nevertheless, the general belief argued that EVs are typically constituted by a *few* members working in the same place and having *few* tasks to make. Consequently, the information to be processed, thus the relative information costs, are low enough to not need an organization. Despite this, scholars (Colombo, & Rossi-Lamastra, 2013) in the last years reviewed this concept: EVs have low dispersion of information internally due to the fact that most of the relevant information is distributed outside the firm boundaries, among suppliers, customers, and other stakeholders. In parallel with the effectiveness in processing information, the other key lever is the speed at which the process is performed, especially in high-velocity environments like HTEVs' ones. In these contexts, there is the need to rapidly process the relevant information to be able to make the decision-making process faster and exploit the opportunities on the market. According to this, information costs may be high also in EVs.

The *agency costs* argument went in the same direction. An agency relation occurs when a principal delegates a certain role/task/responsibility to an agent. Agency relations create potential problems, thus agency costs that are due to non-aligned goals, information asymmetries, and different risk attitudes between the principal and the agent (Jensen, & Meckling, 1976). Established companies tend to have high agency costs due to the presence of many hierarchical levels, therefore, having an optimal organization helps in managing these agency relations, reducing the relative costs. On the other side, scholars thought that, since in EVs the entrepreneurs are also the managers, there are no agency relations, thus agency costs are negligible. However:

- EVs are created by teams. This only shifts the problems from the principal-agent relations to the principal-principal ones, but it does not remove the related problems and costs.
- Also, in EVs, principals hire middle managers and/or employees creating agency relations.
- The Top Management Team (TMT) could be subject to changes or additions, but the new managers may not be owners, leading to the creation of agency relations.
- EVs, and especially HTEVs, often operate on global scales, making it hard to monitor individuals working at long distances and consequently generating information asymmetries.

These facts imply that agency costs may be high also in EVs, and even more in HTEVs, in which products and processes are complex (see paragraph 2.1.2), making it hard to constantly monitor tasks executions.

Another key argument that brought scholars to think that EVs do not need an organization is *flexibility*. Compared to their established counterparties, EVs have not yet

consolidated linkages with external stakeholders and/or made large investments in physical and human capital. Due to this, established firms can count on more resources, but simultaneously are more subjected to inertia. This is a relevant and hard problem to face, especially in high-velocity environments like High-tech Industries, where EVs can leverage their flexibility to pivot, improve and be at the forefront. The loss of flexibility would take away from EVs one of their main competitive advantages against incumbent companies. In this way, Burns and Stalker (1961) introduced the concept of organic structure: an unstructured organization aimed at fostering flexibility by leaving much freedom to venture members. The two scholars thought this organic structure would have been the best for HTEVs, nevertheless, while flexibility is crucial in identifying the opportunities to pursue (see paragraph 2.1.3), efficiency is fundamental in implementing the relative strategies, and HTEVs should have enough organization to be efficient in developing their business.

Finally, the last key aspect that emphasizes the need for an organization is related to *human capital*. Ventures cannot purchase and own the human capital of their members (Coff, 1997) like it is possible to do with physical and financial capital. Team members can quit and move to a more competitive firm, ask for higher salaries or reject the authority. Consequently, new ventures should adopt an appropriate organizational structure that allows team members to fully express their capabilities, keeping them motivated and proactive towards the company vision and goals.

To summarize, even in HTEVs, information and agency costs may be high, and, adopting a proper organization to reduce them keeps the venture's members motivated. Moreover, being efficient in operating the business, does not necessarily imply losing flexibility. On this line, the section follows with an in-depth examination of the key dimensions to be considered designing the organizational structure of an HTEV: hierarchy, allocation of decision authority, task allocation, and formalization. To make more structured and understandable the explanation of all the variables affecting the organization of HTEVs, each dimension is presented through the framework: *What, Why & Why not, Where, How*.

2.2.4 Hierarchy

What: according to the Cambridge dictionary, the *hierarchy* is "a system in which people are arranged according to their importance". The hierarchical structure is composed of a ranked series of *layers* (or levels). Each level has one or more formal leaders who generally have the authority over all the venture's members at lower levels (Colombo et al., 2016).

Consequently, individuals have the power to approve or deny decisions coming from their relative lower levels.

The *opposite* configuration that a venture may assume is the *polyarchy* in which there are several decision-makers, possibly competing among them and who can follow different projects independently (Sah, & Stiglitz, 1986).

Each of the two configurations can be taken to the extreme: going from a vertical-oriented organization, many layers with a few members each, to a horizontal-oriented one, few layers with many members each.

Why & Why not: the goal always consists of trying to improve the venture's performance by adopting the most proper organization that guarantees decision speed and comprehensiveness. Previous research found some advantages and disadvantages related to adopting a hierarchical structure.

The first advantage coming from the adoption of a hierarchical structure relates to the decision-making process: a multi-level organization implies that decisions from a lower level are revised from the higher one. These double-checks create a *decision funnel* that reduces the number of decisions approved, theoretically limiting the probability of taking wrong decisions (Sah et al., 1986). On the other side, a polyarchic structure is less conservative, leaving more freedom to the decision-making process, but increasing the decision speed since decisions tend not to be double-checked. Therefore, a hierarchical structure should fit the most when there is a high probability of making wrong decisions and the relative mistakes significantly impact the venture's performance (Colombo et al., 2016).

Another aspect to consider relates to the information processing theory. Having a hierarchical structure implies the transfer of information from the lower to the higher levels. The higher the number of levels, the higher the steps the information must pass on average. This may imply higher information processing costs, thus, possible delays and information leaks along the firm hierarchy (Keren, & Levhari, 1979, 1983, 1989, Van Zandt, 1999). Ventures with the need for high efficiency and speed in processing information should pursue a *delayering strategy*: reducing the number of hierarchical layers (Littler, Wiesner, & Dunford, 2003). This consideration starts from the assumption that the authority is centralized at the top of the hierarchy. Given this, an alternative or complementary solution to the delayering is the decentralization of decision authority, to keep the hierarchical structure as it is, but shortening the path followed by the information to arrive at the decision-maker. Connected to the delegation of the decision authority there is another advantage: by decentralizing the routine decisions to the lower levels, the members at the top of the hierarchy and with the highest

human capital have more time and energies to focus on taking the right strategic decisions (Garicano, & Rossi-Hansberg, 2006). The negative effect of delegating the authority derives from the creation of an agency relationship, which implies the potential emergence of agency costs and damages to the venture's performance (see paragraph 2.2.3).

Furthermore, young ventures may suffer from the liability of newness (see paragraph 2.1.3) and find it hard to attract valuable human and financial resources. To solve - or at least mitigate - this problem, new ventures need to improve their legitimacy. In this direction, new ventures tend to imitate the hierarchical organizations of their established counterparties. Thus, legitimacy is the last important advantage taken by the hierarchical dimension.

The following image summarizes the effects deriving from the adoption of a hierarchical structure.

Hierarchy	
PROS	***CONS***
1) **Improving decision making** thanks to double-check	1) **Slowing down decision making** due to double-check
2) **Gaining legitimacy** by imitating the organization of established firms	2) Creating **information leaks and delays** along the venture's hierarchy
3) **Freeing the time** of those who are responsible **for strategic decisions**	3) Causing **agency problems**
Combining with delegation of decision authority	

Table 2.3 Advantages and Disadvantages of Hierarchy

Where: an investment can be defined as *risky* when it meets two conditions: the investor knows - at the time of the investment decision - all possible outcomes of the investment and, for each of them, the relative probability of occurrence (Wald, 1950). Conversely, if these conditions are not met and the investor does not know - at the time of the decision - all possible outcomes, nor their probability of occurrence, the investment can be defined as *uncertain* (Knight et al., 1921).

Having introduced these concepts helps to understand the meaning behind the statement "High-tech Industries are subject to a high level of uncertainty" (see paragraph 2.1.3). High-tech Industries are uncertain environments where it is impossible to define all possible future scenarios and their relative likelihood to happen. This implies a less precise knowledge of what

is going to happen and to change, thus, a higher probability of betting on the wrong investment. Moreover, a wrong strategic decision tends to have a significant impact on the performance of a firm, even more in a new firm. Entrepreneurs must take this into account, devoting all the time needed to these key strategic decisions. As described in the "*Why & Why Not*" sub-paragraph, this is exactly the type of situation in which adopting a hierarchical structure may mitigate the problems generated by the conditions of uncertainty intrinsic in High-tech Industries.

Nevertheless, another major characteristic of High-tech industries - in addition to *uncertainty* - is their high velocity (see paragraph 2.1.3). On this point, a hierarchical structure with a centralized authority on the top level would slow down the decision process, thus, the solution is to combine delegation of decision authority with the multi-level organization.

To conclude, HTEVs must adopt an organization that allows dealing with High-tech Industries' main variables: high velocity and uncertainty. The first organizational dimension to set in this direction seems to be the adoption of a hierarchical structure with the proper degree of authority decentralization - the intensity of the authority delegation is analyzed in greater detail in the next paragraph -.

How: once studied what is hierarchy, its pros and cons, and that HTEVs are perfect candidates to adopt it, the focus shifts on how to implement hierarchy in HTEVs' organizational structures. The main ways are *by appointing a CEO* at the lead of the heads of the venture's functions, or *by hiring a middle manager*. A focused analysis follows for each of these alternatives.

A hierarchical structure may emerge even within the TMT and a concrete and typical example is the CEO model (Talaulicar, Grundei, & Werder, 2005). In the CEO model, the CEO has the authority over the whole TMT and could potentially define alone the venture's strategy.

Moreover, the TMT may be organized through a horizontal division of labor, in which each TMT member works as a head of a department, therefore, as the main authority of the relative area of responsibility. The two models, not being mutually exclusive, can be combined to obtain a TMT with a two-layer structure in which each venture's department has a leader, who reports to the CEO. It was demonstrated that decision speed and comprehensiveness increase when TMT members have individual authority over their relative areas of responsibility (Talaulicar, et al., 2005). On the other side, results from the same research related to the CEO model were weaker but suggested a positive impact in decision speed and comprehensiveness in case of trust among TMT members.

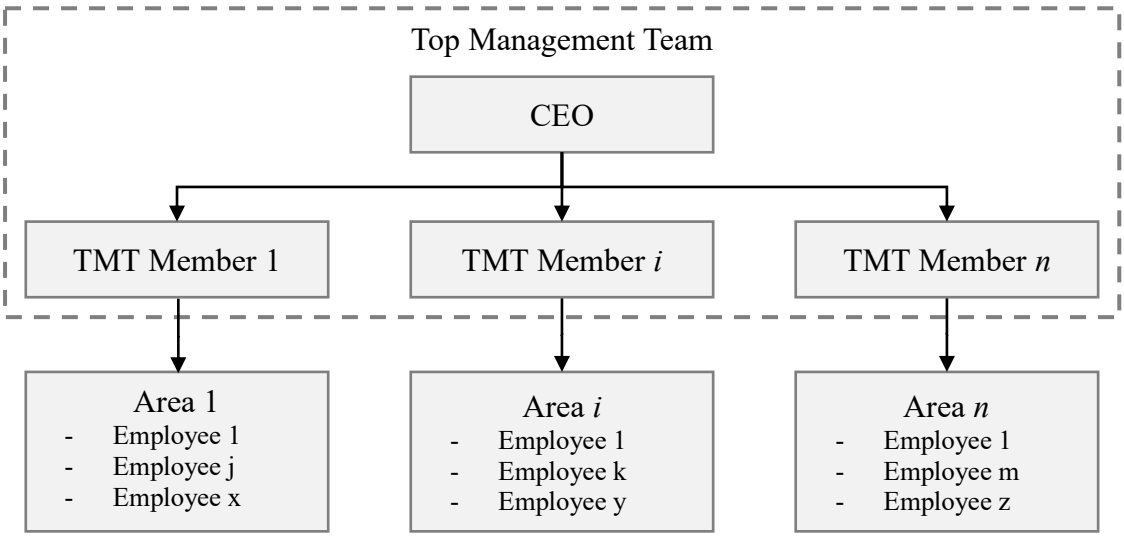


Figure 1.4 Hierarchical structure with a CEO model and horizontal division of labor among TMT members

Once decided to appoint a CEO, the key issue becomes who should own this role. In this direction, Alvarez & Barney (2005) identified three possible configurations that new ventures could adopt in conditions of uncertainty like it happens to HTEVs:

- Clan-based HTEV: if there is trust among ET members, decision-making practices tend to be more democratic and aimed to reach a consensus, working more as a *clan* or a *polyarchy* (see *What* subparagraph) than a traditional hierarchy.
- Expert-based HTEV: if ET members have no prior relationships, thus there is no trust among them at the beginning, the ET member that tends to be appointed as the CEO is the individual with the highest *expertise*. This member, using these skills in the new venture, incurs the highest opportunity costs and has the most to gain from trying to grow the HTEV.
- Charisma-based HTEV: if ET members have no prior relationships, thus there is no trust among them at the beginning and differences in skills among ET members are limited, the CEO role should be assigned to the most *charismatic* member, who can bring the team members towards a common vision.

The second main way to create a hierarchical structure is by hiring a *middle manager*, who creates a middle layer in the organizational structure between the ET and the employees.

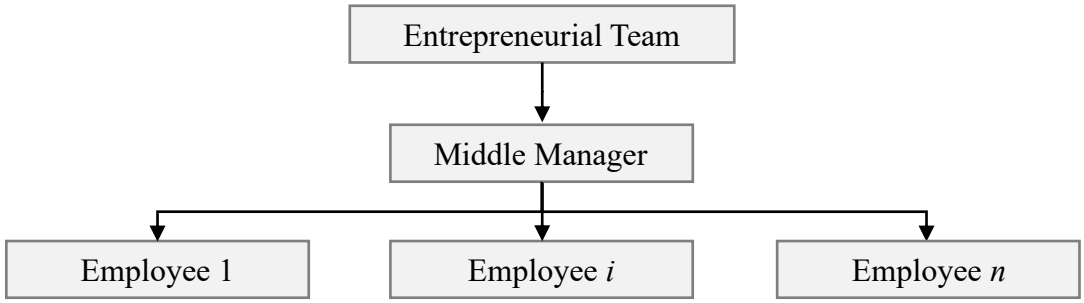


Figure 2.5 Hierarchical structure with a Middle Manager

Scholars (Colombo, & Grilli, 2013, Grimpe, 2019) showed that hiring a middle manager allows HTEVs to increase information processing and decision-making capacity: TMT members have the highest human capital and, by delegating the operations to the middle manager, they could have more time to dedicate to the strategic decisions. In uncertain environments, like High-tech industries, strategic decisions are essential and the positive effect of freeing the time of TMT members becomes even more relevant. On the other side, the two possible problems of this hiring strategy relate to the information asymmetries often present between the TMT and the potential middle manager. Firstly, attracting a middle manager is not easy for new ventures: compared to established firms, HTEVs have on average more uncertain future performances and offer lower wages and more risky career prospects. Furthermore, if an HTEV can recruit a middle manager, there is a potential emergence of agency problems in the case that the middle manager's objectives differ from the HTEV's ones.

To conclude, HTEVs should create the proper level of hierarchy to be efficient and effective in high-velocity environments. To do this, HTEVs should appoint a CEO at the top of the hierarchy. Moreover, if the TMT needs more time to focus on the strategic decisions and there is a good profile to delegate the management of the venture's operations, the HTEV should hire her as a middle manager.

2.2.5 Allocation of decision authority

What: the allocation of decision authority consists of how the TMT decides to distribute - among ventures' members - the power and the responsibility to make specific decisions.

The previous paragraph brought to the high-level conclusion that, for HTEVs, it is appropriate to combine hierarchy with the delegation of decision authority. Delegation allows to free the time of the TMT members for the strategic decisions and to mitigate the slowing down of information processing and decision-making generated by the hierarchy.

However, these are not the only aspects to consider planning the delegation strategy, and the following subparagraphs aim to give a deeper overview of the proper level of delegation to adopt.

Why & Why not: alongside the advantage of freeing the time of TMT members for the key strategic decisions, the delegation of decision authority may bring two other important benefits: a better information processing and more efficient use of individual-specific knowledge in decision-making (Jensen, & Meckling, 1992).

Firstly, delegating routine decisions limits the number of layers along which the information must be transmitted, smoothing the information processing, and mitigating the information leaks and delays.

Moreover, humans are boundedly rational, and transferring information is costly, thus, "all decisions can never be located in a single individual or a body of experts" (Jensen et al., 1992). To solve this, a well-defined system of delegation must be designed to allow the venture to make decisions efficiently. This system should be aimed to assign the decision authority on specific areas to the individuals with the relative proper knowledge and skills.

The two downsides that may emerge from delegation relate to the agency problems (see paragraph 2.2.3). The first problem may arise from the loss of control: delegating a decision to a lower level, the agent could decide not to follow the principal's vision, making opportunistic or second-best decisions. The higher the misalignment between the goals of principal and agent, the higher the probability of losing the control (Jensen et al., 1976). Sometimes, although goals between principal and agent are aligned, they may have different visions, intended as different beliefs on the right course of action. Nevertheless, principals with a strong vision tend to hire individuals with a similar vision, generally solving this problem (Van den Steen, 2005).

Delegation may generate a second issue, related to coordination. Indeed, individuals at lower levels generally have higher knowledge about their relative areas of responsibility thus a higher probability to do the right decisions on matters related to those areas. Nevertheless, those decisions could be locally optimal but sub-optimal at the whole-venture level, penalizing the venture's performance. Luckily, even here, the objects under analysis are new ventures, in which typically also individuals at lower levels have a clear and updated view of the entire organization. Thanks to this, the probability of loss of coordination is less severe than expected. The following image summarizes the effects deriving from the delegation of decision authority.

Allocation of decision authority

PROS	***CONS***
1) **Freeing the time** of those who are responsible **for strategic decisions** 2) **Better information processing** and less information leaks/delays 3) More efficient **use of individual-specific knowledge**	*Agency relationships may imply:* **1. Loss of control** due to non-aligned goals between ET and delegates who may decide to pursue private objectives **2. Loss of coordination** due to delegates' decisions that may be locally optimal, but suboptimal at the venture-level

Table 2.6 Advantages and Disadvantages of allocating decision authority

Where: the advantages coming from the delegation of decision authority make the difference in sectors marked by high competition and heterogeneity.

Firstly, scholars (Acemoglu, Aghion, Lelarge, Van Reenen, & Zilibotti, 2007) found a strong correlation between competition and decentralization of decision authority. In competitive environments, the value of the information is higher and the relative costs to obtain them increase as well. Since lower-level managers have superior information on their specific areas, delegating the relative area-specific decisions to them becomes highly beneficial for the venture. Moreover, competition mitigates the potential loss of control that could derive from delegation: indeed, competition reduces the margin of error that the firms can allow themselves, forcing each venture's member - individuals delegated included (the agent) - to always take profit-maximizing decisions, in line with the TMT preferences (the principal). Remembering that High-tech Industries are high-velocity environments (see paragraph 2.1.3), marked by strong competition (Bourgeois et al., 1988), HTEVs are the proper candidates to exploit this organizational dimension.

The second aspect enabling the effectiveness of delegating the decision rights is industry heterogeneity. The higher the industry heterogeneity, the more ambiguous and less relevant the industry-level information that new ventures could have access to. This unreliable information makes difficult to predict the possible industry prospects and to consequently make the right decisions to win against competitors in the future. Thus, using the observation of competitors' behaviors as a variable of all decision-making processes may be detrimental. What becomes helpful in these cases is the individual-specific knowledge of some lower-level ventures' members, and delegation is the necessary condition to exploit the capabilities of these individuals. In this direction, High-tech industries are full of heterogeneous young ventures which may develop unique products, adopt alternative business models, or create TMTs with different skills (Colombo et al., 2016). Basing on this, HTEVs should face industry heterogeneity by developing a delegation strategy to exploit all the knowledge of their lower-level members.

To recap, delegation of decision authority is effective in highly competitive and heterogeneous sectors, and High-tech Industries are in line with these two characteristics, making HTEVs the proper candidates to develop a delegation strategy.

How: as just introduced, HTEVs heterogeneity makes difficult to predict the possible industry prospects and define the right decisions to make. Given the low reliability of external information, to optimize the probabilities of making the right decisions, the best option is using the internal venture's knowledge. Thus, when there is a shared vision, the most efficient

strategy consists of delegating the decision authority of an area to the individuals with the highest knowledge in that area (Acemoglu et al., 2007, Colombo et al., 2016). Conversely, if there are divergent visions, the most appropriate solution is to delegate the decision rights to the individual with the strongest belief on the right course of action (Van den Steen, 2010).

To summarize, designing the organization, HTEVs should generally adopt a decentralized hierarchical structure, in which decisions of each area are delegated to the individual with the highest knowledge in that area, or, in case of divergent beliefs on the right course of action, to the member with the strongest vision.

2.2.6 Task allocation: individual functional specialization & functional concentration

What: defining the organizational structure of a new venture, another key dimension to set is the task allocation. By assigning tasks to the venture's members, the TMT is setting both:

- *Individual functional specialization* (individual's point of view): the concentration of the types of tasks assigned to each venture's member (Sine, Mitsuhashi, & Kirsch 2006). Thus, given a set of tasks allocated to a venture's member, the more these tasks are concentrated on a specific function, the higher the individual functional specialization of that employee.
- *Functional concentration* (function's point of view): the number of venture's members that work in each functional area (Piva, 2020). The lower the number of venture's members in a specific function, the higher its relative functional concentration.

Functions / Venture's Members	R&D	Procurement	Production	Finance	Sales & Marketing	
Member 1	✓	✓	✓		✓	Lowest Individual Functional Specialization
Member 2		✓		✓	✓	
Member 3	✓					Highest Individual Functional Specialization
Member n	✓		✓			
	Lowest Functional Concentration			Highest Functional Concentration		

Table 2.7 Example of task allocation: focus on individual functional specialization and functional concentration

An optimal task allocation is characterized by a strong matching between tasks and individuals' skills. In a utopic situation, each task is assigned to all and only members with the appropriate skills to complete that task. Each venture should try to get as close as possible to this idealistic task allocation, to get the most from each member, increasing the venture's performance.

Why & Why not: designing a proper task allocation contributes reaching a healthy and high-performance environment, where people are motivated in doing their tasks, and the venture's performance can only gain from that.

Each member could be allocated from doing a series of tasks in different functions to doing just one task in one area, shifting from a low to a high *individual functional specialization* (see Table 2.1). By adopting a high specialization, individuals can learn by doing, developing a high task-related knowledge, and increasing their productivity (Moreland & Argote, 2003). On this line, it was found a positive impact of specialization on sales growth (Sine et al., 2006).

Moreover, assigning to individuals the specialized tasks they prefer is a way to motivate them (Hackman, & Oldham, 1976). Previous research showed an increase in decision speed and comprehensiveness (Talaulicar et al., 2005) when there is a proper matching of TMT members with tasks that allow them to continue specializing in their field of expertise.

Specialization brings other two advantages: more efficient information processing and better monitoring. The more task-related information is concentrated on single individuals, the less dispersed it is, making easier and more efficient the information collection and elaboration (Piva, 2020) from one side, and the monitoring from the other (Colombo et al., 2016): it is easier to monitor one person totally focused on a task rather than a group composed by *n* individuals, each one responsible for a little part of the task.

Like every organizational dimension, also specialization has its downsides: potential loss of coordination, a more limited exchange of ideas and knowledge, and possible poor matching between members' preferences and tasks. Firstly, managing *n* people, that have a narrow view of the only tasks (or functions) they are responsible for, is harder than a situation in which each member has a vision of the whole venture. In this second case indeed, coordination partially emerges spontaneously, while specialization brings higher coordination costs. Then, a situation in which each venture's member is focused on a specific area may lead to their spontaneous isolation, limiting flexibility, the exchange of knowledge, and the collaboration in finding new ideas (Burns, & Stalker, 1961). Finally, the upside of leaving people doing their preferred tasks can evolve at a disadvantage. Indeed, teams of new ventures - especially HTEVs - tend to be formed by people with similar competencies (Reuf, Aldrich, Carter, 2003). In these cases, the majority of the venture's members prefer the same few tasks, inevitably leading to assign to few members the most desired tasks and to the others - the majority - the tasks left, that they may not be as competent in performing.

As previously introduced, the complementary side of the individual functional specialization is the *functional concentration*. Here, the task allocation is seen from the function

point of view: the number of venture's members allocated to a specific function and the relative functional concentration are inversely proportional (see Table 2.1). The extreme case is having only one individual in a specific function. From one side, this situation brings to have zero coordination costs within the function, but on the other, it limits the exchange of information and knowledge with the other functions. Moreover, assigning a function to just one individual is risky: for any reason, she may want to leave the venture taking with her all the function-specific knowledge and skills developed.

To sum up, there is not an objective response on how to manage specialization and functional concentration: new ventures must find the right intermediate level for both, allowing people to develop strong expertise, but also creating a flexible environment where they can exchange ideas, knowledge and have a clear view of the company vision to coordinate among themselves in an effective way.

The following image summarizes the effects deriving from the task allocation process split between individual functional specialization and functional concentration.

Task allocation	***PROS***	***CONS***
Individual functional specialization	1) Learning by doing brings to **strong task-related knowledge** 2) **Better information processing** 3) **Better monitoring**	1) **Limited exchange of ideas** and knowledge across functions 2) **Loss of coordination**
Functional concentration	1) **Low coordination costs** within the function	1) **Limited exchange of ideas** and knowledge across functions

Table 2.8 Advantages and Disadvantages of Task Allocation

Where: one of the main advantages coming from individual functional specialization is the development of a strong task-related knowledge. High-tech industries are known for the complexity of their products and processes, thus, also for the difficulty of the tasks aimed to design them (see paragraph 2.1.2). The higher the task complexity, the higher the knowledge and skills needed to realize those tasks, the higher the usefulness of individual functional specialization. Moreover, in high-velocity environments like High-tech ones, being efficient in processing information is a fundamental upside, and specialization allows to improve it.

Nonetheless, too much specialization may relevantly increase coordination costs and damage flexibility, creating more problems than benefits.

To summarize, HTEVs should find the appropriate intermediate level of individual functional specialization and functional concentration that may allow these new ventures to face complex and high-velocity environments, like High-tech ones, in a strong way.

How: the how dimension, in this case, is not so relevant as for the other dimensions. Given the heterogeneity of HTEVs, and thus of the relative tasks, there are no standard ways to allocate the list of tasks that guarantee to reach the most appropriate individual functional specialization and functional concentration.

The optimal solution consists of intermediate levels of both, to allow individuals to specialize in their tasks, not damaging flexibility, coordination, and information exchange across different functions. Finally, it is opportune to have at least two individuals accounting for each function, so that, if one individual decides to leave the venture, the knowledge developed is (at least partially) preserved by the venture.

2.2.7 Formalization

What: formalization refers to the extent to which roles, rules and procedures are described in writing (Dalton, Todor, Spendolini, Fielding, & Porter, 1980, Child, 1973). Formalization aims at defining *what* one is asked to do, clarifying her or his responsibilities, but also limiting her or his "freedom". To be more concrete, a clear example relates with the creation of roles (e.g., Chief Executive Officer, Chief Financial Officer), including the written stipulation of the responsibilities associated to who is owning those roles.

Each behavior, action, or situation can be written down, meaning that ventures may prefer to formalize some aspects, but some others not: thus, formalization is not an on-off decision, but a process aimed at defining the space of action in which the venture's members can move. The following sub-paragraphs focus on providing a deeper overview of the actual research about this topic.

Why and Why not: formalization allows companies to concretely define their organizational structures: although a venture has already set its organizational decisions, it is by writing them down that venture's members, but also external stakeholders, can have the reference points to respect and pursue.

The most important upside deriving from formalization is legitimacy (Colombo et al., 2016). Especially for new ventures, it is not easy to gain a strong reputation from the external

stakeholders due to their lack of credibility (Aldrich, 1999). Typically, the liability of newness affecting new ventures results in them being resource-constrained (see paragraph 2.1.3). Their prospects are extremely uncertain and external resources providers (e.g., investors, suppliers) want to mitigate the risk of losing capital. Given this, external stakeholders tend to rely on symbolic signals of competence to assess a new venture (Meyer, & Rowan, 1977). Just the creation of common formal positions, like Chief Operating Officer, signals management experience and acceptation of the best management practices. This clearly has a positive effect on legitimacy, helping new ventures to have access to external resources, then resulting in higher performances (Sine et al., 2006). As introduced in the "*What*" sub-paragraph, formalization aims at defining *what* one is asked to do. This, in addition to favor the roles' building, improves coordination by clarifying venture's rules and individual responsibilities (Child, 1974): it is easier to coordinate a team in which everyone perfectly knows what to do. Another positive consequence from the adoption of formalization relates with the diffusion and transfer of know-how. By writing down the best practices and the knowledge acquired overtime, the venture can spread and keep them (Heylighen, 1999). Finally, formalizing roles, rules, and procedures promotes transparency and accountability within the venture, increasing reputation in the external eyes of resource providers (Hannan, & Freeman, 1984).

Like the other organizational dimensions, formalization also has its disadvantages. Firstly, writing down roles, rules and procedures in a comprehensive and clear way is not an easy task. This process requires time and resources, but new ventures are time and resource constrained, making this process even more costly. In addition, new ventures evolve at a fast pace and formalized roles, rules and procedures need to be revised and updated frequently. Moreover, in parallel to the benefits in coordination, formalization draws the behavioral boundaries to the venture's members. The higher the formalization in roles, rules, and procedures, the more static the individuals' decisions. This may result in a lower flexibility at a venture-level, damaging the venture's capability to react to environmental changes (Blau, & Schoenherr, 1971).

To sum up, formalization brings strong advantages, in particular legitimacy, but the consequent decrease in flexibility and its higher costs makes that its adoption must be carefully managed. Ventures should try to find the level of formalization needed to gain enough legitimacy to convince external resources providers to invest in the venture. In this way, the venture would be able to obtain the resources needed, preserving its flexibility, and increasing its performances.

The following image summarizes the effects deriving from formalization.

Formalization	
PROS	***CONS***
1) **Gaining legitimacy** in the eyes of resource providers	1) **Reducing flexibility**
2) **Improving coordination**	2) **Requiring time and resources**
3) Favoring the **diffusion of knowledge** and transfer of best practices	3) **Obsolescence** of rules, roles and procedures as new ventures evolve
4) Favoring the **roles' building**	
5) Promoting **transparency and accountability**	

Table 2.9 Advantages and Disadvantages of Formalization

Where: age and sector are the two topics to be analyzed to define which type of firms are good candidates to adopt a certain degree of formalization.

Firstly, the "*Why and Why not*" sub-paragraph allowed to understand that new ventures should adopt formalization, but to the appropriate degree, to preserve their flexibility. Indeed, their young age creates role ambiguity and formalization helps in clarifying the responsibilities of each venture's member.

Shifting to the sector topic, High-tech Industries are high-velocity environments (see subparagraph 2.1.2), frequently affected by relevant changes, that make it hard to coordinate the tasks within the HTEVs since these tasks continuously evolve. This creates inefficiencies in processing information, thus a slowdown in the decision-making process (Colombo et al., 2016). Through formalization, HTEVs can mitigate this problem by defining in a more precise way the tasks, thus favoring coordination. As already mentioned, this practice must not overcome the limit to which formalization relevantly damages the venture's flexibility in reacting to key changes in the environment.

To conclude, new ventures are good candidates to adopt formalization because it allows them to gain legitimacy. This is valid even more if the ventures are HTEVs: the right degree of formalization allows them to increase coordination, therefore, to speed up the decision-making process, a key lever in high-velocity environments like High-tech ones.

How: as already mentioned, role formalization is the perfect example to understand what formalization is about. The written definition of the position responsibilities allows to get benefits from each perspective:

- Venture's member: the individual in charge of the position is aware of what the venture is expecting from her or him (Sine et al., 2006), and consequently knows what to do.
- Venture: the venture can improve coordination and transparency. By formally assigning tasks to individuals, the venture can plan, monitor, and manage in a more efficient way. It may also allow the development - over time - of an historical record of the venture's key variables like the organizational chart or the performance of relevant positions.
- External stakeholders: the venture can gain legitimacy and significantly increase its reputation in the eyes of potential resources providers and job seekers.

On top of role formalization, the other two relevant examples of formalization are the written definition of the ownership structure and the creation of a Board of Directors. The first consists of designing the structure of shareholding by splitting the equity, and it was already introduced in paragraph 2.2.2. On the other side, the Board of Directors is an endogenously determined institution that seeks to ensure that shareholders' interests are pursued (Hermalin, & Weisback, 2003), by monitoring the TMT course of action, and eventually collaborating in the definition of the venture's strategy. It is typically composed of both venture's members and outside individuals who represent owners. The outside members can bring complementary skills to the venture, also improving venture's performance through more neutral monitoring (Garg, 2013).

To sum up, new ventures - especially HTEVs - need to formalize up to the point that preserves their flexibility. Indeed, formalization can bring relevant advantages (see "*Why & Why not*" sub-paragraph), and role formalization or the creation of a Board of Directors are just two of the options that a venture could pursue to formalize.

2.3 About the impact of Venture Capitals on HTEVs Organization

The previous section focused on a deep analysis of the actual research on the organization of HTEVs. The attention now shifts to the last key dimension of the dissertation: Venture Capitals.

The section is divided into paragraphs. The first one aims to give an overview of what Venture Capitalists are, their different typologies, and why they are relevant for HTEVs. The

second paragraph provides a literature review on how Venture Capitalists generally affect HTEVs organization, highlighting research areas that have not been investigated yet.

2.3.1 Overview of Venture Capitalists: definition, types, and relevance for HTEVs

According to Cambridge Dictionary, a Venture Capitalist (VC) is "*a person or company that invests money (= gives or lends it in order to make a profit) in new companies, especially when this involves risk*".

The high uncertainty (see paragraph 2.1.3) and information asymmetry (see paragraph 2.2.3) that affect HTEVs' world typically make it hard for HTEVs to access the traditional financing channels (Davila, Foster, & Gupta, 2003). Conversely, VCs have the skills needed to face these environments. They carefully monitor the technology and market developments in their sectors of expertise. This allows VCs to do informed investment decisions (Fenn, Liang, & Prowse, 1995) by deeply studying the HTEVs teams and the relative ideas identified as a business opportunity (Fried, & Hisrich, 1994). Moreover, VCs' role goes beyond being a traditional financial intermediary (Hellman, & Puri, 2002): after the investment, a VC tends to support the invested HTEV providing additional capabilities, social contacts and it may even introduce several measures to professionalize the HTEV's organizational structure (see paragraph 2.3.2).

Nevertheless, there are different types of VCs, and their different nature can imply different goals. Independent VCs (IVCs from this point on) tend to focus exclusively on the financial return coming from their investment. Thus, every decision is aimed to improve the HTEV and its performance (LiPuma, 2006). In addition to the most common IVCs, there are three other types of VCs: Public, Bank-affiliated, and Corporate.

Public VCs (PVCs from this point on) are another type of VC investor. PVCs are controlled by public entities (e.g., governments, universities) whose goals are related to the social sphere (Colombo, Rossi-Lamastra, & Piva, 2014). PVCs objectives involve non-financial results, like the development of the local economy or job creation.

Bank-affiliated VCs (BVCs from this point on) can be seen as a vehicle created and used by banks to extend lending to new ventures. HTEVs can suffer from liability of newness and smallness, bringing to volatile conditions (e.g., unstable cash flow, insufficient retained earnings) that make these companies out of the requirements to receive a loan. However, financing these new ventures may allow them to become (in the future) stable enough to comply with the requirements and receive a loan. In this direction, previous literature (see for

example Hellman, 2002; Wang, Wang, Lu, 2002; Hellman, Lindsey, & Puri, 2008) suggests that BVCs differ from IVCs in terms of objectives. BVCs' priority is trying to increase parent banks' probabilities to offer loans to these young ventures. Consequently, the venture growth remains important, but the key target becomes the stability of the company, to bring the venture itself to meet the loan requirements in the next future.

Finally, Corporate VCs (CVCs from this point on) represent those VCs controlled by non-financial corporations. Their goals tend to be of strategic nature, with the aim of creating benefits for the controlling company like the acquisition of complementary capabilities or the exploitation of synergies to design and launch new products (LiPuma, 2006; Colombo et al., 2014).

After having identified the four main categories of VCs, it is possible to shift the focus on the process through which they act. This allows providing an overview of the previous research on how VCs affect HTEVs' organizational structure, thus concluding the literature review needed to have a complete context along with this dissertation.

The two main process steps through which VCs act are *scouting* and *coaching* (Colombo, & Grilli, 2010). Scouting consists of the phase in which the VC looks for the right HTEV to invest in. Scholars tried to determine the criteria considered by VCs along with the scouting phase (see for example Davila et al., 2003; Beckman, & Burton, 2008; Colombo et al., 2010). Nevertheless, the focus of this dissertation is concentrated on the impact that VCs have on HTEVs' organizational structure, thus on a branch of the coaching phase, deeply analyzed in the next paragraph. Just to provide a high-level literature review of the scouting phase: managerial competencies, prior industry-specific experience, and education of ventures' founders were found to be correlated with the probability to be funded by a VC. Also, adopting functional specialization and being an innovator instead of an imitator tended to attract VCs. Growth was one of the first criteria analyzed by the literature (Davila et al., 2003), although the results of the research showed there was no correlation between new venture growth and the probability of receiving a VC fund. Instead, VCs are mostly interested in identifying the new ventures to which they can add the highest value through their industry-specific expertise, no matter if these ventures do not coincide with those that would take the highest benefits from the VC investment (Colombo et al., 2010).

To recap, VCs are full-time professional investors who invest in their partnership funds (Hellman et al., 2002). Their courses of action depend on their nature (IVC, BVC, PVC, or CVC), although the process can be standardized in two steps: *scouting* and *coaching*. The scouting phase is affected by several criteria already mentioned above, but the research area of

this dissertation is concentrated on a branch of the coaching phase: how VCs affect HTEVs' organizational structure, and the next paragraph gives an overview of the previous research on this topic.

2.3.2 Impact of Venture Capitals on the organizational structure of HTEVs

This dissertation focuses on the organization of the HTEVs along the period after the VC funding, thus on the so-called *coaching phase*. The goal is to identify the impact of the VCs on the organizational structure of the HTEVs. As already mentioned, as well as relaxing the financial constraints of the HTEVs, VCs take an active role in the professionalization of these ventures, and the impact is stronger in earlier stages - when HTEVs are not publicly listed - (Hellman et al., 2002; Gorman, & Sahlman 1989; Bygrave, & Timmons 1992). Receiving investment from a VC provides a signal of quality internally and to the market, reducing the uncertainty about the venture's potential success (Davila et al., 2003). This brings several benefits which indirectly affect the organizational structure of the company. For instance, it increases the HTEV's reputation in the labor market (Gompers, & Lerner, 1999), which translates to easier talent recruitment, thus a potential faster employment growth.

Besides these indirect effects, previous research identified several organizational dimensions which are the direct object of interest for VCs. The first example relates to the CEO replacement. From empirical evidence, most of the VCs invest in HTEVs starting with the default assumption that the CEO will not be the right leader of the company (Wasserman, 2003). Indeed, a professional CEO from outside generally intervenes by providing to the HTEV a more structured and formalized organization, for example enhancing the functional specialization and adding external competencies through the hiring of managers from the market (Talaulicar et al., 2005). Moreover, the CEO replacement is perceived by the market as a signal of good and active governance from the VC (Shen, & Cannella, 2002). Sometimes the founders themselves prefer to focus on different areas of the business and look for the help of VC's contacts to find an external CEO. Consequently, VC's presence often leads to the replacement of the CEO (Hellman et al., 2002; Pollock, Fund, & Baker, 2009). Previous research showed that this strategic move happens in about 40% to 60% of the VC-backed entrepreneurial ventures (Boeker & Karichalil, 2002; Certo, Daily, & Dalton, 2001; Fischer & Pollock, 2004; Jain & Tabak, 2008; Nelson, 2003; Wasserman, 2003). This change is particularly relevant for early-stage HTEVs that do not have a strong reputation yet. Nevertheless, if the HTEV has already achieved important results and the direction seems to

be right, VCs are likely as other investors to change the CEO with an outside top manager (Hellman et al., 2002).

Moreover, VCs often help HTEVs in professionalizing their recruiting policies (e.g., introducing stock options plans that encourage valuable job seekers in being interested in the HTEV), and provide their business contacts to ease the research of the right individuals to grow the HTEV (Hellman et al., 2002). In this direction, VCs with greater ownership in the HTEVs tend to do more changes in the TMT (Boeker, & Wiltbank, 2005). Related to this, an organizational milestone generally achieved by VC-backed HTEVs consist of the hiring of a VP in Sales & Marketing (Hellman et al., 2002). The employment growth and the hiring of experienced profiles require additional capital and network, especially if it involves the recruitment of specialized managers. The capital and the network are provided by the VCs, which consequently tend to have high bargaining power in shaping the hiring practices, then causing an impact on the organizational structure of the company.

Another dimension affected by the entrance of VC funding is the Board of Directors, introduced in paragraph 2.2.7 as an institution aimed at enhancing formalization by controlling that shareholders' interests are pursued. VCs tend to create the Board mixing members of the TMT - insiders - and VCs' directors or external experts - outsiders - who can bring additional value in designing the strategy to pursue (Gabrielsson, & Huse, 2002). Thus, the Board becomes the meeting place between the C-level managers and the VCs, and it tends to have a low size to avoid the inefficiencies created by too many perspectives. In conclusion, the Board helps in three main directions: first, it increases the legitimacy of the HTEVs enhancing the probability of attracting further investors and valuable stakeholders (e.g., key partners). Second, it helps the VC and the TMT to find a common direction to pursue. Third, by including external experts and experienced VC directors, the Board allows adding complementary competencies to the ones owned by the TMT, to take the most from each stakeholder of the HTEV.

Another dimension on which VCs generally have an impact is functional specialization – introduced in paragraph 2.2.6 –. Previous research (Boeker et al., 2005; Beckman et al., 2008) found that VCs tend to increase and strengthen the venture's functional structure. Increasing it does not only allow employees to learn by doing and develop specialized skills, but it contributes to the professionalization of the venture, showing business acumen to the market. Therefore, VC-backed HTEVs tend to create functional positions at a higher rate (Beckman et al., 2008). Moreover, VCs can leverage their extended networks to find the right profile for

each function and position, leading to a greater "division of labor" (Haeussler, Hennicke, & Mueller, 2019).

To summarize, VC-backed ventures tend to structure and professionalize more than non-VC-backed ventures (Beckman, et al., 2008). Given this, it is interesting to understand how VCs act. The mechanisms implemented aim at improving the ventures' performances by causing an impact on the organizational structure of the company. As underlined by one of the most recent literature reviews (Burton et al., 2019), the previous research has made progress in this topic in the last years, but there is still great space for further investigation, and this dissertation goes in this direction.

The theoretical background just presented represents the basis for the next chapter, which aims at defining the hypotheses that will be the object of the analysis.

3. HYPOTHESES

The theoretical background provided an overview of the previous literature about HTEVs, how they tend to structure, and how VCs tend to affect this organizational process. This is the starting point to design the hypotheses of this dissertation.

3.1 Baseline hypotheses

As already introduced, the previous literature about VCs' impact on the HTEVs' organization is mostly focused on the highest level of the hierarchy: the CEO, the VP of Sales & Marketing, and the TMT. Regarding the first two, the hypotheses studied were:

H1. *VC-backed HTEVs are more likely and faster to replace the CEO with an outsider if compared to non-VC-backed HTEVs.*

(Hellman et al., 2002)

H2. *VC-backed HTEVs are more likely and faster to hire a VP of Sales & Marketing if compared to non-VC-backed HTEVs.*

(Hellman et al., 2002)

It is straightforward to understand why VCs tend to have an impact on these dimensions. First, the CEO represents the top of the organizational structure, which makes its contribution crucial to the venture's results. Different CEOs may have different strengths and behaviors which may lead the venture to operate in different ways. Sometimes the VC finds out that the founder-CEO has not the right capabilities to be the leader of the venture. In other cases, the founders themselves prefer to devote their energies to other major tasks or even exit the venture to pursue other business opportunities. Both these situations lead to changes in the leadership, and the VC has a key influence on finding the right profile. An external CEO can bring (1) managerial experience and (2) industry-specific expertise. Moreover, she can have a (3) strong network to exploit in order to find and hire additional managers who can enhance the venture's competencies and professionalization (Talaulicar et al., 2005). Finally, hiring an experienced and prepared CEO provides a (4) signal of high-quality governance from the VC (Shen et al., 2002). These potential benefits lead around half of the VC-backed ventures to change their leader (Boeker et al., 2002; Certo et al., 2001; Fischer et al., 2004; Jain et al., 2008; Nelson, 2003; Wasserman, 2003). Second, *Sales & Marketing* is one of the key functions to professionalize before and after the market launch. At this stage, the venture is young: its

intrinsic liability of newness (and smallness) makes it necessary to spread the market awareness about the product/service offering. Therefore, an expert leadership at the top of the Sales & Marketing function may make a difference. Because of this, it is common to see VC-backed ventures hiring a specialized VP of Sales & Marketing.

These findings have been already discovered by considering a sample of 170 HTEVs based in Silicon Valley, United States. Instead, the sample used for the analyses of this dissertation considers 347 HTEVs founded in the European area (see paragraph 4.1.2). Moreover, the study from Hellman et al., (2002) was published around 20 years ago, while the dataset studied in this paper contains information until 2021. Over the last 20 years, the insights found by the past research may have been strengthened or changed. Thus, given these geographic and temporal differences, it seems valuable to *re-analyze* hypotheses H1 and H2 in the present contest and with a different geographical scope.

Finally, Boeker and Wiltbank (2005) focused their analysis on the TMT, arriving at the conclusion that new ventures with greater VCs' ownership make more changes to their C-level management. As discussed for the CEO and the VP of Sales & Marketing, making changes to the TMT provides a series of benefits to the venture: if the VC and the venture decide to hire an outsider for a C-level position, it is because she can add external (1) managerial and (2) industry-specific skills, not currently in the venture portfolio. (3) The venture can attract the networks of new team members (e.g., potential clients, investors, additional managers). (4) The VC, having an active role in the organization of the TMT, provides a signal of involvement and quality of the venture to the market. These benefits lead the VCs to make changes in the TMT, and the higher the ownership, the higher the power, the higher the number of changes. Moreover, this creates the basis for a further investigation: understanding if new ventures make more changes to their TMT once they receive an investment from a VC. Boeker and Wiltbank (2005) analyzed the impact of a higher quantity of VC's ownership, while now the distinctive variable is being VC-backed or non-VC-backed. The relative hypothesis was formulated as it follows:

H3. *VC-backed HTEVs make more changes to their Top Management Team if compared to non-VC-backed HTEVs.*

H3 completes the set of the *baseline hypotheses* – related to the previous literature -, while the next paragraph focuses on the formulation of three *new* hypotheses through a deep dive into the different types of VCs.

3.2 New hypotheses

After a validation/confutation of the baseline hypotheses, the analyses shift to a more in-depth review of the different categories of VCs and their impacts on HTEVs. Indeed, all VCs provide HTEVs with money and resources to help them grow, but different types of VCs may have different objectives. IVCs are the only ones to fund ventures as a core business. IVCs are called *Independent,* since all the other types of VCs depend on another entity with different core activities: PVCs depend on the government, BVCs on their parent bank, CVCs on their parent company.

IVCs are the only VCs created for the purpose of directly making money through the usual VC business of buying and selling ventures. IVCs' goal is to increase the value of these ventures, then sell their ownership for a higher price. Therefore, IVCs must show to the market that the venture is highly valuable. To do it, IVCs must lead the venture to solid growth and economic performance. On the other side, PVCs, BVCs, and CVCs use this financing process as a propaedeutic phase to achieve further objectives. Diving deep into the approach used by each VC category is necessary to understand the different shades of their actions.

In the market, there are a lot of valuable young ventures and IVCs try to scout the ones with the highest probability of success. Nevertheless, it is impossible to exactly predict which ventures are going to succeed, especially in industries characterized by high uncertainty e.g., High-tech (see section 2.1). Moreover, even after an exit or a failure, it is impossible to conclude which were the best ventures since the probability of success is clearly enhanced by being VC-backed. Consequently, there are "second-best" ventures in the market that may succeed having the right support, but they would not receive any extra funds or resources being discarded by IVCs. This situation creates the space for an intervention from the government, which acts through PVCs to try to solve market inefficiencies and foster the economy and society. PVCs' priority is to create social and economic value: creating jobs and innovations are two examples of their concrete goals. To do it, PVCs should address the so-called *equity gap*: helping (second-best) young ventures associated with a too high-risk profile to attract IVCs. This generally brings to a longer investment duration.

Banks create BVCs to enlarge the scope of their core business - providing loans - by helping young ventures in becoming stable enough to comply with the requirements to receive a loan. Thus, BVCs possibly select companies that are even less risky than IVC-backed ones. Company stability and growth are not mutually exclusive objectives but are hard to combine. Both BVCs and IVCs want to achieve these two goals, but BVCs prioritize stability to increase

demand for their financial services, while IVCs prioritize growth to get a financial return from the exit.

Finally, big companies invest their capital - CVCs - in young ventures to look for and acquire complementary resources (e.g., skills) or innovations, useful to improve their processes and offerings. For instance, a young venture designed a technology that has the potential to solve a major problem in the manufacturing processes of a big company. This large company decides to invest its capital - CVC - in the venture to buy the technology and push the venture to improve it even more. In this case, the parent company may not be interested on marketing plans, or any other type of strategy aimed at fostering the venture's growth and economic performance.

Now, it is clear that all four types of VCs have different goals and Table 3.1 summarizes the previously mentioned concepts.

VC type	Objective (Why)	Drivers (How)*
Independent	Financial return selling the ownership for a higher price	1) Venture growth 2) Higher economics performances
Public	Creating social and economic value (e.g., employment growth, innovation)	1) Venture growth (targeting second-best ventures) 2) Longer investment duration
Bank-affiliated	Extending lending business and other financial services of the parent bank to ventures	1) Venture stability 2) Venture growth (to make them ask for larger loans)
Corporate	Complement the parent company resources/offering	1) Improving the know-how/ innovation developed by the venture

*Table 3.1 Summary of objectives and drivers of the different types of VC investors *Drivers in order of priority*

From this picture, it is reasonable to assume that IVCs are the only ones that prioritize ventures growth, besides economic performance. Providing money is a necessary but not sufficient condition to grow and improve economic performances in the long term. The VC must also help the venture to adopt the right changes (i.e., organizational changes) that lead to sustainable growth and performance improvement. Indeed, different organizational changes lead to different results: growth and better economic performances must be the top priority for ventures to achieve them, and this happens only in the case of IVC's and PVC's investments. Venture growth and performance improvement are not the primary goals of BVCs and CVCs. Consequently, the expectations are that BVCs and CVCs have fewer and less immediate impacts on the organizational structure of these ventures. Moreover, as already highlighted, PVCs are generally associated with a longer investment duration, and it is reasonable to predict

that organizational changes will be less frequent in time. This reasoning brings to expect that IVC-backed ventures are generally *more likely* and *faster* in operating organizational changes to enhance professionalization, thus growth and better economic performances.

Paragraph 3.1 provided an overview of the main reasons associated to the higher likeliness and speed of VC-backed ventures in replacing the CEO and hiring a VP of Sales & Marketing. The combination of these statements and the previous considerations about the expected *stronger* and *faster* impact from IVCs - in comparison with the other types of VCs - leads to the formulation of the following hypotheses:

H4. *HTEVs backed by IVCs (or syndicates led by IVCs) are more likely and faster to replace the CEO with an outsider if compared to HTEVs backed by PVCs, CVCs or BVCs (or syndicates led by PVCs, CVCs, or BVCs).*

H5. *HTEVs backed by IVCs (or syndicates led by IVCs) are more likely and faster to hire a VP of Sales & Marketing if compared to HTEVs backed by PVCs, CVCs, or BVCs (or syndicates led by PVCs, CVCs, or BVCs).*

Finally, the last hypothesis enlarges the scope to the whole TMT, which exercises the power on the major strategic decisions of the venture. As discussed in the first part of this section, IVCs focus on venture's growth and economic performance. Combining this and the benefits brought by hiring external valuable individuals in the TMT - see paragraph 3.1 -, the expectations are that IVCs tend to complete more changes in less time if compared to other types of VC. More specifically:

H6. *HTEVs backed by IVCs (or syndicates led by IVCs) make more changes to their Top Management Team if compared to HTEVs backed by PVCs, CVCs, or BVCs (or syndicates led by PVCs, CVCs, or BVCs).*

To sum up, the *new hypotheses* try to find some insights about the impact of different types of VC - comparing IVCs with PVCs, BVCs, and CVCs - on *their* HTEVs: H4 focuses on the CEO replacement, H5 on the VP of Sales & Marketing hiring, H6 on the number of TMT changes.

4. DATA AND METHODOLOGY

The data upon which this dissertation was developed has three main sources: the VICO dataset, the Orbis dataset, and LinkedIn's publicly available data. The VICO dataset is owned by Politecnico di Milano and contains information about VCs' investments in European HTEVs. On the other side, the raw data obtained from LinkedIn had to be subsequently standardized following predetermined guidelines and using a Python-based classification algorithm specifically developed for the analysis. The first part of this section provides a thorough description of the datasets and how data were classified.

The last part of this section focuses on presenting the methods used to operationalize the variables needed to study the hypotheses introduced in Section 3.

4.1 Datasets' description

The analyses of this dissertation are based on three different sub-datasets merged using multiple primary keys. The first dataset, VICO, contains information about the dates of VCs' investments in European HTEVs and their types. VICO is owned by Politecnico di Milano and was already available at the time of the analysis. On the other side, the second dataset had to be built from scratch, starting from the HTEVs' names contained in VICO. The third dataset comes from Orbis, a private data company. The information extracted from Orbis' dataset mostly includes data relative to the HTEVs' economic and financial performances over the years.

4.1.1 VICO Dataset

The VICO Dataset contains information on HTEVs operating in seven European countries. The data infrastructure was built during the VICO project, funded by the 7th Framework Program of the European Commission. The aim of the VICO project was to conduct an extensive study about the impact of VCs' financing on the economic performance of European HTEVs.

Data could be broadly classified as firm-level data, investor-level data, and investment-level data. The dataset includes two strata of companies: the first is a sample of VC-backed companies, while the second is a control group of non-VC backed - but potentially investable - companies. However, this dissertation only considered VC-backed HTEVs.

For VC-backed ventures, investment and investor level data were first obtained from VentureXpert while additional information was collected using country-specific sources (e.g., VCPro-Dataset, or Private Equity Monitor, or BVK Directory and extensive web searches).

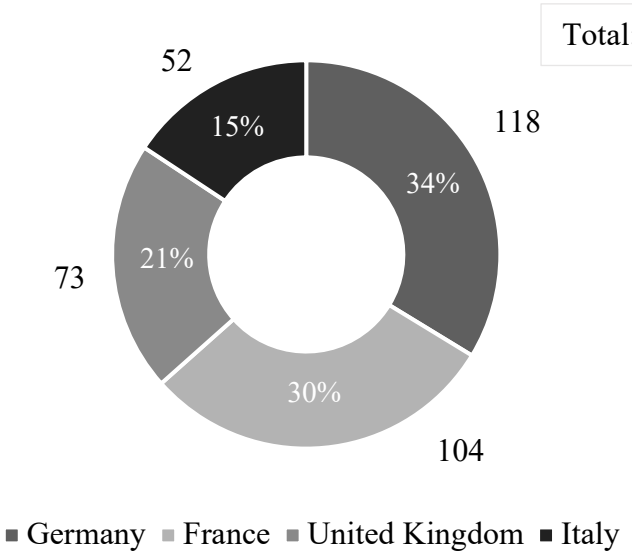
Overall, the available data could be grouped into three main categories:

1. Firm-level:
   a. General company information: *Name, Address, Country, NUTS 2 region, Industry classification, contacts, Status (active, acquired, bankrupt).*
   b. Data on innovative activity (patents): *Patent id codes, complete history of the application process, citations, IPC codes*.
2. Investor-level
   a. VC identity: *name of the management company and, if applicable, of the VC fund.*
   b. Year of foundation of the management company.
   c. VC type: *IVC, PVC, BVC, CVC.*
   d. Size: *assets under management and headcount.*
   e. Experience: *number of deals by sector and geographic area, number of exits by type*
   f. Specialization.
3. Investment-level
   a. Date of the investment.
   b. Amount invested.
   c. Equity interest acquired.
   d. Stage of development of the company (EVCA classification).
   e. Who retains leadership, if the deal was syndicated:
   f. Exit: if the investor exited the investment, when and how.
   g. Contact person for the investment: name, phone, email, mail address.

Data about some HTEVs were missing and were integrated using LinkedIn and Crunchbase websites.

A randomized sample of 347 HTEVs from France, Germany, Italy, and the United Kingdom was extracted from VICO's dataset. To give a big picture of the VICO's data on this sample, some descriptive statistics about the final pool collected are presented below.

The distribution of HTEVs for each country is represented in figures 4.1 and 4.2.



Graph 4.1 Geographical distribution of HTEVs included in the sample

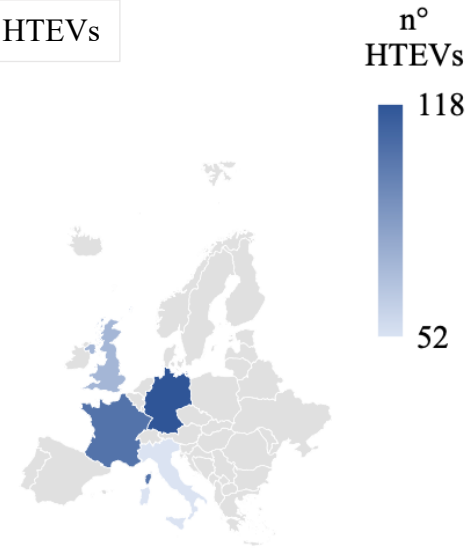
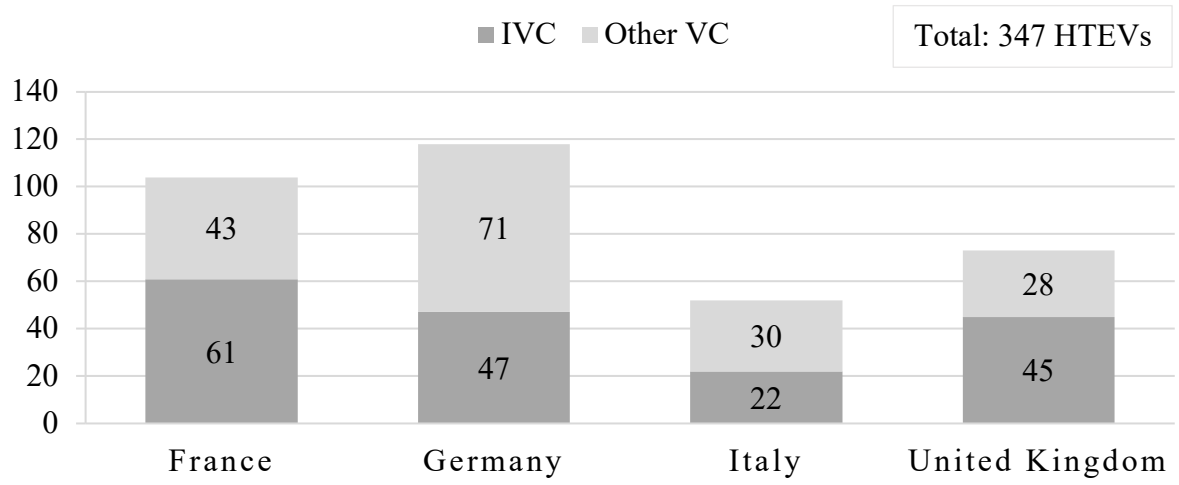


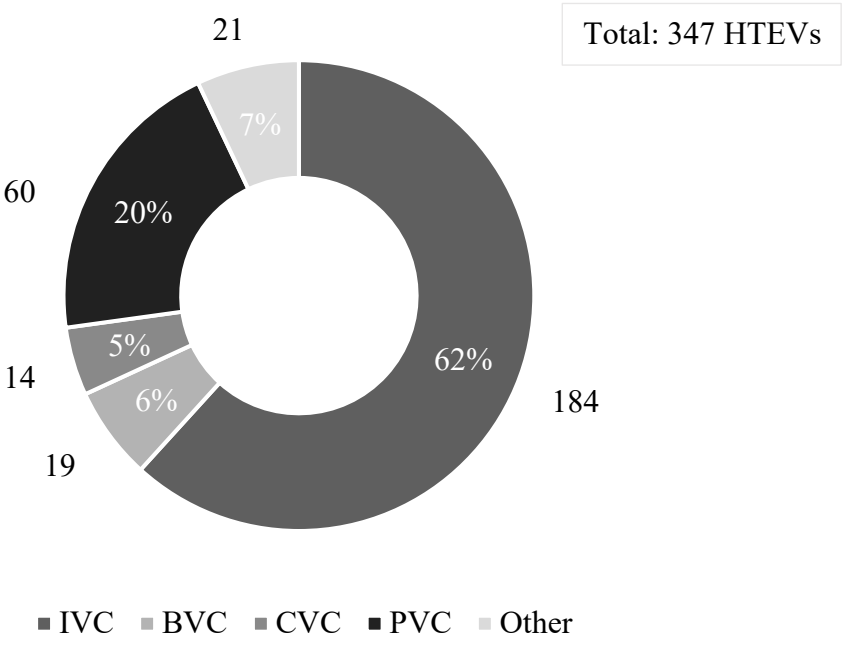
Figure 4.2 Geographical concentration of HTEVs

The type of investors varies depending on the country (see graph 4.3). For example, Italian, French, and British HTEVs received funding mostly from IVCs, while German ones from other types of VCs.



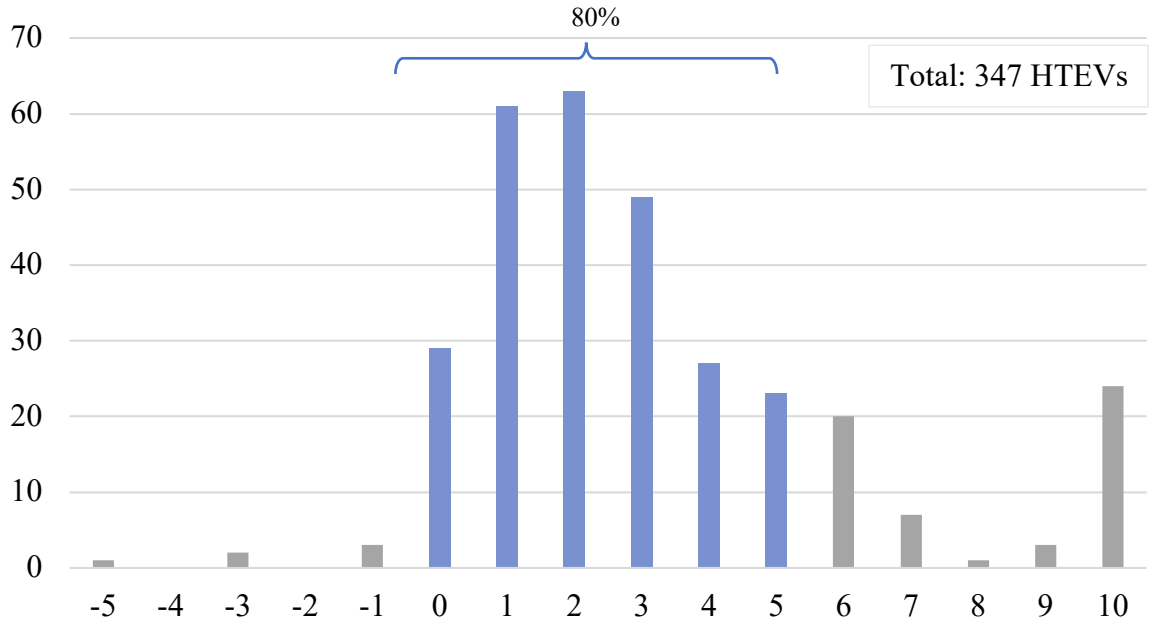
Graph 4.3 Distribution of VC investments in the different countries

Overall, the types of investors for the entire HTEVs pool are distributed as shown in the figure below. IVCs are by far the most common type of investor (more than 60%). PVCs count for 20% of the pool, while BVCs and CVCs represent 10% of the whole pool (see Graph 4.4).



Graph 4.4 Distribution of HTEVs by VC investors

Graph 4.5 shows the time – measured in years – that the 347 HTEVs required to receive the first VC investment. Year 0 corresponds to the foundation of the HTEV. More than 80% of the HTEVs obtained the first VC investment within 5 years.

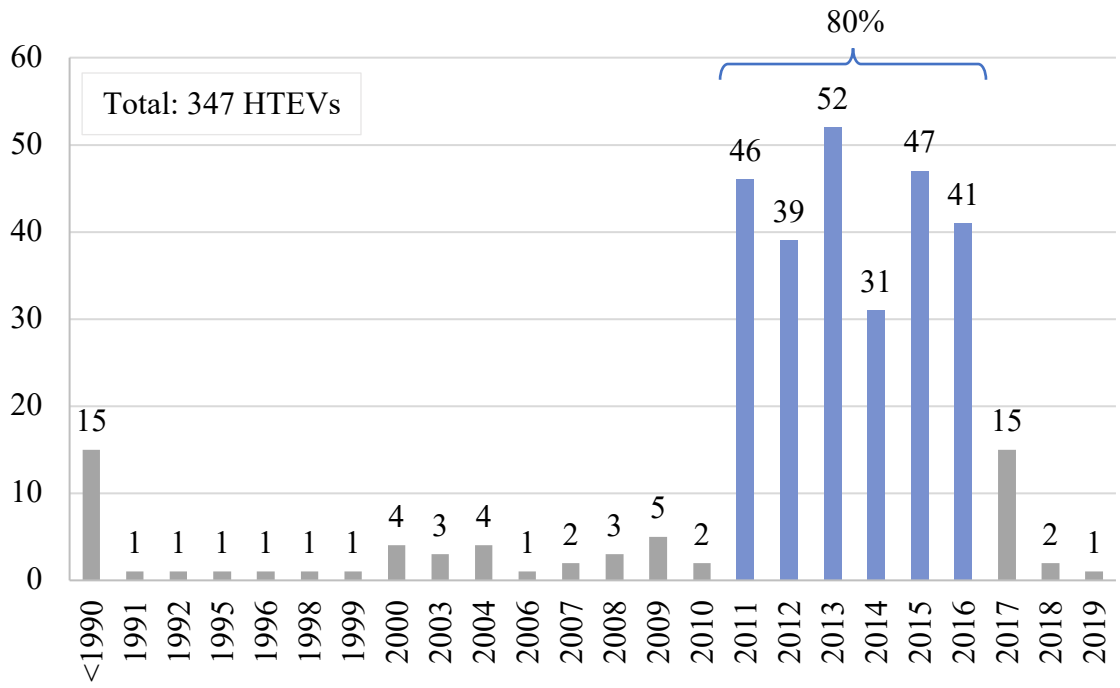


Graph 4.5 Time to obtain the first VC investment for all HTEVs included in the sample (Year 0 = Company founded year)

4.1.2 Dataset of HTEVs' Employees

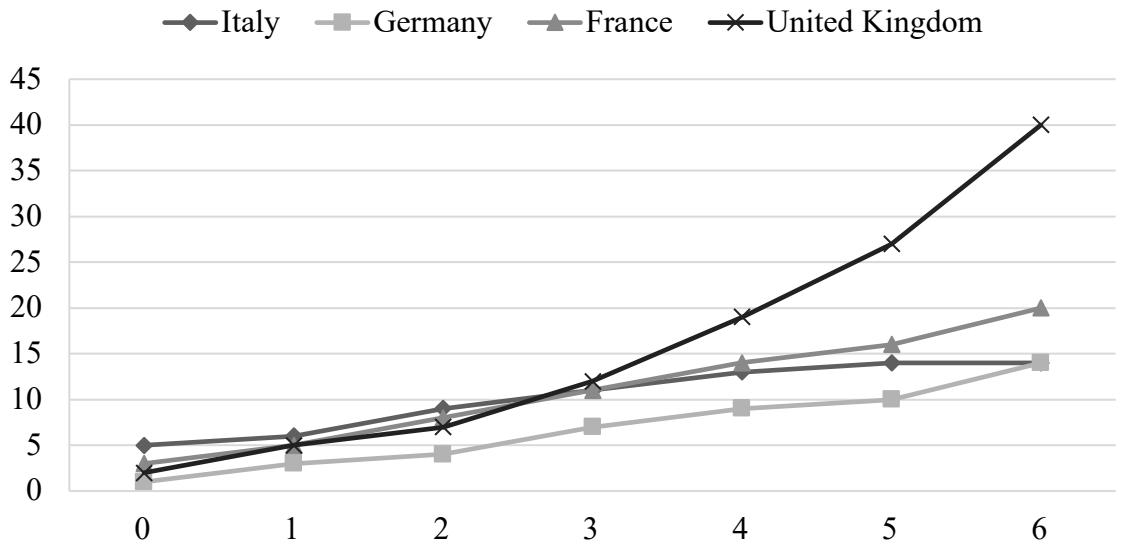
Having the HTEVs' names from VICO as input, manual searches on LinkedIn's publicly available data were performed by a team of graduate students. This process allowed to obtain a list of all the employees that worked and are working in each HTEV. For each employee, data about the role covered and the relative starting and ending dates were collected. Through a proper elaboration, the final dataset may provide the organizational chart of each venture at the time of foundation, and its evolution overtime.

Combining some information of VICO, Crunchbase, and LinkedIn, it was also possible to obtain all the founded years for the 347 HTEVs of the sample analyzed. The majority of HTEVs in the dataset were founded after 2010: 80% of them were founded between 2011 and 2016.



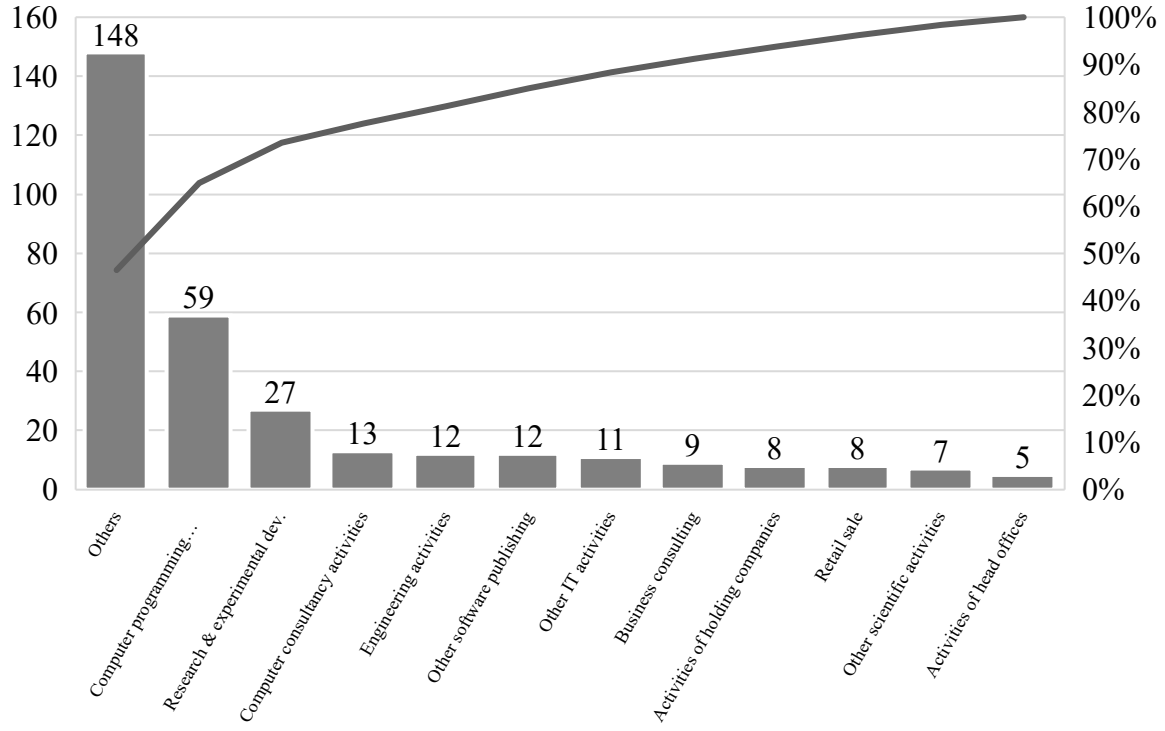
Graph 4.6 Distribution of HTEVs by Company Founded Year

For what regards the number of employees at the time of the HTEV's foundation, there are some differences depending on the country of origin: by analyzing HTEVs that were founded between 2011 and 2016 for their first 6 years of activity, it emerges that Italian ventures start with a higher number of employees: around 5. On the other side, German HTEVs tend to have fewer employees along their lifespans. Looking at the entire 6-year period, English HTEVs appear to have the highest growth trend in terms of the number of employees.



Graph 4.7 Average number of employees per HTEV in the first 6 years of life (for HTEVs founded between 2011-2016)

As for what concerns the sectors where these HTEVs operate, there is a vast fragmentation with 106 different sectors (see Graph 4.8). "*Computer Programming Activities"* is the most common sector: around 20% of the HTEVs are active in this sector. The top-8 of the most common sectors represents almost 50%, while the remaining part (i.e., 98 sectors) is shown in the figure below under the name of "*Others*".



Graph 4.8 Distribution of HTEVs by sector

To gather all the data, each HTEV's name was searched on LinkedIn and publicly available information about every employee was collected. More specifically, every line of the final dataset represents an employee and contains the following information:

- HTEVs' affiliation.
- Role covered.
- Time spent in Role (includes both begin and end dates).

If an employee was internally promoted, the dataset records two lines, one for each role.

All these data were condensed into single .csv files that were later unified into one large excel file. Before being merged with VICO's dataset, data had to be cleaned, especially for what regards date formats. Therefore, a Python code was developed to uniform data.

Also, new columns were inserted to provide more granularity to data and to prepare the dataset for the following standardization done by the algorithm whose functioning will be explained in section 4.2.2.

The new inserted columns are:

- **Business Area**: department where the employee is working.
- **Begin**: begin date of employment in the role.
- **End**: end date of employment in the role.
- **Standardized Role**: contains the standardized name of the role.
- **Co-Founder status**: contains dummy variables "yes" or "no".
- **BvD ID number**: primary key to uniquely identify each HTEV.

4.1.3 Orbis Dataset

Orbis is a private database with information about 400 million companies and entities across the globe, 41 millions of which have detailed financial information. It is the most powerful comparable data resource on private companies, and it also includes listed companies. Its value is not only based on the huge number of observations. Instead, the dataset also provides comparable information, extensive corporate ownership structures, and a holistic view of companies.

Orbis has carefully captured a wide variety of data that are preventively appended and standardized to make it richer, more powerful, and easier to interrogate. Data comes from resources internal to Orbis and more than 170 separate external providers.

For this dissertation, Orbis provided financial data for each of the 347 HTEVs analyzed. More specifically, the yearly data collected from Orbis regarded Total Assets, Sales, Cash Equivalents, EBIT, and EBITDA.

As noted in the limitation paragraph in section 8, the data coming from Orbis is often missing, resulting in the decision to apply the regression models in two iterations: one that includes the financial data from Orbis and another that does not.

4.2 Data Standardization and Automatic Classification

The dataset of the HTEVs' employees had to be standardized before the merger with VICO and Orbis. Among different organizations, it is common knowledge that professionals tend to identify their roles with different names although they pertain to the same business macro-area. Hence, to correctly classify roles in each HTEV, an original algorithm was developed and used to automatize the standardization of roles. After this standardization, data about different HTEVs were comparable.

4.2.1 Standardization Framework

First, an organization framework containing several business areas and related roles that report directly to the CEO was created. The framework was developed following guidelines given by the academic paper "Who Lives in the C-Suite? Organizational Structure and the Division of Labor in Top Management" (Guadalupe, Li, & Wulf, 2013).

As shown in Table 4.9, there is a major distinction between two macro-functions:

1. **Administrative Functions**: corporate roles with back-end activities whose objective is loss prevention and cost optimization.
2. **Product Functions**: front-end roles aimed at value creation and with the objective of revenues maximization.

Each macro-function consists of several Business Areas, and each Business Area is associated to a C-level manager, who directly reports to the CEO.

When analyzing the role of the VP of Sales & Marketing, it was decided to overlap the roles of Sales Director and Chief Marketing Officer since HTEVs present in the dataset commonly had either one or the other.

Administrative Functions: back-end aimed at loss prevention	**Area**	**Role**	**Functional Managers with direct report to CEO**
	Finance	CFO (i.e., Chief Financial Officer)	
	Law	General Counsel	
	HR	CHRO (Chief HR Officer)	
	IT	CIO (Chief Information Officer)	
	Strategy	Business Developer	
	Communication	Communication Officer	
Product Functions: front-end aimed at value creation	**Area**	**Role**	
	Marketing	CMO (Chief Marketing Officer)	
	R&D	CTO (Chief Technical Officer)	
	Sales	Sales Director	
	Manufacturing & Operations	COO (Chief Operations Officer)	

Table 4.9 Standard Organizational Framework used by the classification algorithm

4.2.2 Classification Algorithm

Following Table 4.9, a Python-based classification algorithm was developed to standardize the raw data automatically and correctly regarding role names across different HTEVs. Prior to the development of the algorithm, approximately 20 man-hours were spent to manually classify data for each role to build a knowledge of the most used words to define roles in different business areas. Such knowledge was later condensed into lists and included in the algorithm whose basic functioning consists in comparing them to the raw input data. The algorithm proceeds in ordered steps listed below:

1. Assignment of Business Area and "Founder" or "Co-Founder" status to each employee.
2. Assignment of CEO status to one or more employees.
3. Assignment of C-level status for each business area.
4. Assignment of "Middle Manager" or "Operator" and relative business area to each non-C-level manager.

Each of these steps is analyzed more in-depth below. Then, to give an idea of the final result, some examples of the outcome are presented.

1. Assignment of Business Area and "Founder" Status

First, the input excel files are converted into a Pandas DataFrames for easier data management and more fluid iteration.

For each relevant business area, a specific list with pre-determined keywords is created. Then, with a "for" cycle, the algorithm checks whether in the input raw data – the employee's self-declared role – any keywords are included. When a keyword is found, the "for" cycle is stopped and the algorithm assigns to the column "Business Area" the name of the department depending on which list contains the keyword (e.g., Finance, Marketing, Operations).

For coding necessities, the keywords inside the list objects and the lists themselves are specifically ordered to avoid overlaps between different business areas and roles.

Here are the lists used in order:

- **l_finance** = ['finan', 'invest', 'accountant', 'accounting', 'cfo', 'control', 'risk', 'analyst', 'trading', 'lending', 'saving']
- **l_operations** = ['plant', 'coo', 'supply chain', 'engine', 'logistic', 'factory', 'operat', 'warehous', 'qualit', 'qm', 'production',' manutenz', 'mainten', 'inge', 'ingé']
- **l_marketing** = ['marketing', 'cmo', 'market', 'design', 'art', 'ux', 'social media', 'cpo', 'seo', 'product', 'produit', 'brand',' communic', 'crm']
- **l_sales** = ['ventes', 'vendite', 'sale', 'commerc', 'customer', 'cso', 'account', 'cco', 'trade', 'client', 'revenue']
- **l_bd** = ['business ', 'partnership', 'growth', 'strategy']
- **l_rd** = ['research' , 'r&d' , 'development', 'scien', 'technology', 'data', 'wissenschaft', 'techni']
- **l_legal** = ['legal', 'law', 'counsel', 'avvocato']
- **l_hr** = ['talent', 'recruit', 'people', 'staff', 'hr', 'human', 'humaines', 'personale', 'uman']
- **l_it** = ['syst', 'analy', 'quant' , 'softw' , 'entwick' , 'scrum', 'web', 'cdo', 'information', 'android', 'entwick', 'tech', 'stack', 'back', 'front', 'dev', 'ios']

Following the identification of the business areas, the algorithm starts the assignment of "founder" status based on a list containing pre-determined keywords:

- **l_founder** = ['found', 'gründer', 'fondateur', 'fondatrice', 'fondatore', 'business owner']

Sometimes the roles of the dataset were not in English, thus the lists contain translations of the keywords in the languages of the four different countries of the HTEVs analyzed (i.e., France, Germany, Italy, United Kingdom).

2. Assignment of CEO Status

The first standardized role to be assigned is the CEO (i.e., Chief Executive Officer). The algorithm works by identifying specific keywords to understand who is at the head of the organization. The search for a CEO only considers employees that do not belong to any Business Area. Depending on the country and on the HTEV, the CEO may have different names.

The CEO identification is split into two steps: first, the algorithm looks for keywords contained in a list called *l_ceo* which includes common terms to identify this position. If a CEO is found, the process ends. Otherwise, a flag is raised (*flag = flag + 1*) and the algorithm enters into a second step where it compares other keywords of more general meaning contained in another list called *l_ceo_2* to find a CEO.

- **l_ceo** = ['ceo', 'geschäftsführer', 'vorsitzende', 'pdg', 'présid', 'chief executive']
- **l_ceo_2** = ['presid', 'managing partner', 'dirigeant', 'executive', 'managing director', 'general manager', 'owner', 'chairman', 'président', 'directeur exécutif', 'directeur général', 'directrice générale']

Finally, the algorithm performs a check on the CEO candidates before confirming their status on the "Standardized Role" column. To avoid including also 'assistants' to the CEO or 'associates' that work in their 'office' or any other employee, one last check looking for these specific keywords is performed on each element.

3. Assignment of C-Suite Status

Having determined the CEO, the algorithm proceeds in grouping all employees by Business Area to identify who is part of the C-Suite.

Again, keywords are searched depending on the Business Area's affiliation of each employee. For some C-level roles, like CFO, General Counsel, Director of Sales, and CMO, a double-check with a second list is performed in case nobody is found as head of the department.

- **l_cfo** = ['cfo', 'chief', 'finanzvorstand', 'daf', 'direttore finanziario', 'directeur financier', 'directeur', 'directrice']
- **l_cfo_2** = ['dirett', 'head', 'manag', 'direct', 'respons',' vp', 'presid', 'chef', 'charg', 'vp', 'vice']
- **l_generalcounsel** = ['general counsel', 'commercialista']
- **l_generalcounsel_2** = ['counsel', 'manag', 'direct', 'respons', 'vp', 'presid', 'chef', 'avocat', 'avvocat']
- **l_coo** = ['coo', 'chief', 'betriebsleiter', 'chef', 'directeur', 'directrice', 'director', 'direttore']

- **l_cmo** = ['cmo', 'chief marketing officer', 'directeur', 'directrice', 'chef']
- **l_cmo_2** = ['cpo', 'chief product officer', 'head', 'chef']
- **l_ds** = ['director', 'chief', 'cso', 'cco', 'chef', 'directeur', 'directrice', 'director', 'direttore']
- **l_ds_2** = ['head', 'direct', 'respons', 'vp', 'presid', 'chef', 'lead', 'exec', 'cro']
- **l_bd** = ['business developer', 'head of business development', 'chef', 'directeur', 'directrice', 'director', 'direttore']
- **l_cto** = ['cto', 'chief', 'chef', 'directeur', 'directrice', 'director', 'direttore']
- **l_chro** = ['dirett', 'chro', 'chief', 'drh', 'responsable des ressources humaines', 'responsable ressources humaines', 'chef', 'directeur', 'directrice', 'director', 'direttore']
- **l_cio** = ['cio', 'chief', 'chef', 'direct', 'dirett', 'director', 'direttore']

4. Assignment of Middle Manager and Operator Status

Once the Chiefs of the different Business Areas have been identified, one last distinction is made between the remaining employees: whether they are operators, hence at the bottom of the hierarchy, or Middle Managers who constitute a bridge between the senior executives and the operators.

The algorithm only searches for keywords related to the Middle Manager class ("MM") while it assigns to everyone else the Operator status ("Op"). Keywords are contained in another separate list:

- **l_MM** = ['manag', 'head', 'chief', 'chef', 'chargé', 'responsable', 'vp']

Outcome examples

In this section, three examples of the standardization outcome are shown. The three HTEVs presented are of different sizes. More specifically:

- Large venture: Acticor BioTech, 41 employees.
- Medium venture: Zen Fulfillment, 21 employees.
- Small venture: Alhena, 12 employees.

In each table, the grey-highlighted columns ("Business Area", "Std Role", "Co-Founder") are the ones automatically filled by the algorithm.

The "Begin" and "End" columns were created starting from a single input column containing all the information in one string. To be clear in the outcome presentation, the column "End" is here filled with "present" if the employee is still working in that position. However, having everything in date format was necessary to perform the analyses. Thus, in the dataset

used for the analyses, those roles that are still ongoing have a date of late 2021 in the "End" column. When a cell is named "undefined" it means that the algorithm was not able to assign a Business Area or a Standardized Role to the employee.

Example: Acticor BioTech

In this French HTEV active in the healthcare sector (Table 4.10), it can be noted that there is an overlapping between CEOs. Indeed, sometimes there is a slight overlap between roles' tenure. The assumption made in these cases is that the previous occupant of the title did not update the end of the position on LinkedIn. This led the research to consider only the "Begin" time to estimate whether there is a change in the CEO role or in any other role of the C-Suite.

Business Area	LinkedIn Role	Std Role	Co-Founder	Begin	End
undefined	CEO	CEO	no	10/2020	present
undefined	CEO (Co-founder) and development coordinator	CEO	yes	01/2019	01/11/20
Finance	Head Of Finance And Administration	CFO	no	11/2014	01/06/20
IT	Analytical Project Manager	CIO	no	01/2015	01/12/15
Operations	Head of clinical operations	COO	no	01/2015	01/11/17
R&D	Directeur scientifique	CTO	no	05/2016	01/07/16
R&D	Directeur médical	CTO	no	07/2015	01/03/16
Law	Head of Regulatory Affairs	General Counsel	no	01/2019	01/03/20
Law	Head of Regulatory Affairs and Quality	General Counsel	no	02/2019	present
Finance	Finance Manager	MM Finance	no	01/2016	01/03/20
Law	Chargée d'Affaires Réglementaires et Cliniques	MM Law	no	01/2020	present
Operations	Head of Quality	MM Operations	no	04/2015	01/10/15
Operations	Quality Manager	MM Operations	no	04/2021	present
Operations	Global Head of Project Coordination	MM Operations	no	06/2020	01/07/20
R&D	Head of pharmaceutical and non-clinical development	MM R&D	no	01/2019	present
R&D	Project Manager - CMC and non-clinical development	MM R&D	no	01/2021	present
R&D	Chef de projet - développement pharmaceutique	MM R&D	no	01/2019	01/03/20
R&D	Chargée de développement pharmaceutique	MM R&D	no	06/2018	11/07/05
R&D	Assistante chargée de projet R&D	MM R&D	no	11/2018	01/01/19
Finance	Private Investor	Op Finance	no	01/01/17	01/04/20
IT	Analytical Technician	Op IT	no	01/07/19	
IT	Stagiaire en developpement d'un biologique pharamceutique et gestion de projet	Op IT	no	01/08/14	01/12/14
Law	Regulatory Affairs Manager	Op Law	no	01/04/18	01/02/19
Law	CMC et Affaires Réglementaires	Op Law	no	01/07/20	present

Marketing	Assistant communication	Op Marketing	no	01/02/16	01/02/20
Marketing	Communications Officer	Op Marketing	no	01/01/17	01/10/19
Law	Regulatory Affairs and Quality Pharmacist	Op Op Law	no	01/01/20	present
Operations	Global Clinical Operations Director	Op Operations	no	01/04/17	01/07/17
Operations	Clinical operations trainer	Op Operations	no	01/08/16	01/05/18
R&D	Scientific Advisor	Op R&D	no	01/01/21	01/12/21
R&D	Stagiaire en développement précoce : préparation de la phase clinique	Op R&D	no	01/05/15	01/05/20
R&D	Co-founder and Scientific Advisor	Op R&D	yes	01/07/14	01/09/14
undefined	Freelance Translator	undefined	no	01/07/19	present
undefined	Board Member	undefined	no	01/02/17	01/01/20
undefined	Chairman of the Board	undefined	no	01/05/14	01/07/15
undefined	CMC Adviser	undefined	no	01/01/18	01/04/19
R&D	Clinical Trial Lead	undefined	no	01/02/19	01/12/21
undefined	Office Manager	undefined	no	01/06/19	
undefined	Stagiaire	undefined	no	01/02/20	01/04/20
undefined	Executive Trial Liaison	undefined	no	01/01/19	01/09/20
undefined	Board Member	undefined	no	01/05/19	01/07/19

Table 4.10 example 1 of a data cluster taken from the employee's dataset

Zen Fulfillment example:

Zen Fulfillment, an HTEV active in the online shopping business, gives in Table 4.11 a comprehensive view of its internal organization showing the entire C-Suite and all of its middle managers and operators. From the data it can be noted the replacement of the founder-CTO with an external CTO.

A similar situation can be noted for the succession of the COO, in this case denominated as Operations manager since no other superior roles in that department was found.

Business Area	**LinkedIn Role**	**Std Role**	**Co-Founder**	**Begin**	**End**
undefined	CEO & Co-Founder	CEO	yes	01/2011	present
R&D	Chief Technology Officer	CTO	no	04/2020	present
R&D	CTO & Co-Founder	CTO	yes	01/2019	04/2020
undefined	Entrepreneur in Residence	undefined	no	04/2020	present
Finance	Finance Manager	CFO	no	06/2015	present
Operations	Operations Manager	COO	no	06/2019	04/2020

Operations	Operations Manager	COO	no	01/2020	present
IT	Senior Software Engineer	Op IT	no	01/2017	05/2019
IT	Full Stack Engineer	Op IT	no	06/2019	04/2020
Sales	Customer Representative Account Management	MM Sales	no	02/2020	present
Finance	Manager Finance and Controlling	MM Finance	no	01/2021	present
Sales	Account-Manager	MM Sales	no	01/2019	present
Sales	Customer Service Representative	Op Sales	no	01/2018	present
Sales	Customer Support	Op Sales	no	01/2017	09/2018
Finance	Finance Project Manager	MM Finance	no	01/2018	present
Operations	Operations & Supply Chain Intern	Op Operations	no	01/2018	07/2019
Marketing	Client Service & Visual Design	Op Marketing	no	01/2017	04/2018
undefined	Project Management Intern	undefined	no	08/2017	02/2018
undefined	Project Management Intern	undefined	no	04/2013	06/2019
Sales	Manager, Sales	MM Sales	no	04/2013	05/2017
IT	UI/UX Designer & Web Developer	Op IT	no	07/2014	01/2015

Table 4.11 example 2 of a data cluster taken from the employee's dataset

Alhena example:

This small HTEV active in the infrastructural business, shows in Table 4.12 a compressed organigram with five of the twelve employees belonging to the C-Suite.

Business Area	LinkedIn Role	Std Role	Co-Founder	Begin	End
undefined	CEO - Alhena Agency	CEO	no	07/2019	present
Marketing	Directeur Commercial et Marketing	CMO	no	01/2013	present
R&D	CTO	CTO	no	07/2019	present
undefined	Chief Executive Officer	CEO	no	01/2021	present
HR	Human Capital Manager	CHRO	no	05/2016	07/2016
Sales	Responsable du développement commercial	MM Sales	no	01/2020	01/2021
undefined	Socio Director	undefined	no	02/2017	01/2020
undefined	Property Manager	undefined	no	01/2021	present
Marketing	Chef de projet digital et chargée de communication	MM Marketing	no	04/2017	07/2017
undefined	Consultant & Associate	undefined	no	11/2014	06/2020
undefined	Directeur Exploitation	undefined	no	01/2016	03/2020

Table 4.12 example 3 of a data cluster taken from the employee's dataset

4.3 Methods

After an accurate description of the dataset and how it was standardized, it is opportune to introduce the variables used in the analysis and their operationalization.

Dependent Variables

CEO_turnover_. This variable measures the replacement from an outsider in the CEO position of the venture. This data was obtained through the dataset of the HTEVs' employees. This dummy variable was measured monthly, and - every month - it takes the value 1 if the venture hired an outside CEO, and 0 otherwise.

VP_turnover_. This variable measures the hiring or replacement of a VP of Sales & Marketing. This data was obtained through the dataset of the HTEVs' employees. This dummy variable was measured monthly, and - every month - it takes the value 1 if the venture hired a VP of Sales & Marketing, and 0 otherwise.

TMT_changes. This variable measures the number of changes in the C-level management. This data was obtained through the dataset of the HTEVs' employees. The variable was measured yearly, and every year it counts the number of changes in the C-level positions. If there were no C-level changes in a specific year, the variable takes the value 0.

Independent Variables

vc_invest. This variable measures whether the venture is backed by a VC. This data was obtained through the VICO dataset. This dummy variable was measured monthly, and - every month - it takes the value 1 if the venture received a VC investment - whatever the category of the VC -, and 0 otherwise.

ivc_invest. This variable measures whether the venture is backed by an Independent VC. This data was obtained through the VICO dataset. This dummy variable was measured monthly, and - every month - it takes the value 1 if the venture received an investment from an IVC, and 0 otherwise. Data about the type of VC was obtained through the VICO dataset.

other_vc_invest. This variable measures whether the venture is backed by a non-Independent VC, thus by a Public VC, a Bank-affiliated VC, or a Corporate VC. This data was obtained through the VICO dataset. In some cases, VICO dataset lacked data about the date of the first VC investment, thus Crunchbase website was used to fill these values. This dummy variable was measured monthly, and - every month - it takes the value 1 if the venture received an investment from a PVC, BVC, or a CVC, and 0 otherwise.

Control Variables

Venture Country. The 347 HTEVs analyzed are based in France, Germany, Italy, or the United Kingdom. This variable was operationalized through four dummy variables: d_country1 for France, d_country2 for Germany, d_country3 for Italy, d_country4 for United Kingdom. For each venture, the variable of the country where it is headquartered assumes 1, while the other three assume 0. Data about the country was obtained directly from the VICO dataset.

Venture Sector. The 347 HTEVs analyzed are distributed on 106 different sectors. Every sector is associated to a different dummy variable: from sector_1 to sector_106. For each venture, the variable of the sector in which it is active takes 1, while the other 105 take 0.

In the example below, the HTEV Alantaya is from France and operates in the Computer Programming sector.

	d_Country1	d_Country2	d_Country3	d_Country4	d_sector1	d_sector2	d_sector3	d_sector4	…
ALANTAYA	1	0	0	0	1	0	0	0	…
BRIDGE CONSULTING	0	0	1	0	0	1	0	0	…
…	…	…	…	…	…	…	…	…	…

The assignment of numbers to the existing sectors was done by assigning numbers starting from the most popular sector among the HTEVs available in the dataset. A comprehensive view is provided in the table below.

Dummy Variable	NACERev2corcodesdes_Orbis	Frequency	Percent	Cumulative
d_sector1	Computer programming activities	59	18.79	18.79
d_sector2	Research and experimental development	27	8,60	27.39
d_sector3	Computer consultancy activities	13	4.14	31.53
d_sector5	Engineering activities	12	3.82	35.35
d_sector6	Other software publishing	12	3.82	39.17
d_sector7	Other information technology	11	3.50	42.68
d_sector8	Business and other management consulting	9	2.87	45.54
d_sector9	Activities of holding companies	8	2.55	48.09
d_sector10	Retail sale via mail order houses	8	2.55	50.64
d_sector11	Other professional, scientific and technological activities	7	2.23	52.87
d_sector12	Activities of head offices	5	1.59	54.46
d_sector13	Manufacture of medical and dental insurance	5	1.59	56.05
d_sector14	Other business support service activities	5	1.59	57.64
d_sector15	Other personal service activities	5	1.59	59.24
d_sector16	Motion picture, video and television	4	1.27	60.51
d_sector17	Other credit granting	4	1.27	61.78
d_sector18	Web portals	4	1.27	63.06
d_sector19	Computer programming, consultancy	3	0.96	64.01
d_sector20	Manufacture of instruments and appliances	3	0.96	64.97
d_sector21	Manufacture of optical instruments	3	0.96	65.92
d_sector22	Manufacture of pharmaceutical preparatory products	3	0.96	66.88
d_sector23	Media representation	3	0.96	67.83
d_sector24	Non-specialised wholesale trade	3	0.96	68.79
d_sector25	Other human health activities	3	0.96	69.75
d_sector26	Tour operator activities	3	0.96	70.70
d_sector27	Activities of insurance agents	2	0.64	71.34
d_sector28	Advertising agencies	2	0.64	71.97
d_sector29	Installation of industrial machinery	2	0.64	72.61
d_sector30	Manufacture of communication equipment	2	0.64	73.25
d_sector31	Manufacture of electronic components	2	0.64	73.89
d_sector32	Manufacture of other electrical equip	2	0.64	74.52
d_sector33	Other information service activities	2	0.64	75.16
d_sector34	Renting and operating of own or lease	2	0.64	75.80
d_sector35	Restaurants and mobile food service	2	0.64	76.43
d_sector36	Retail sale in non-specialised stores	2	0.64	77.07
d_sector37	Technical testing and analysis	2	0.64	77.71

d_sector38	Wholesale of electronic and telecommunication	2	0.64	78.34
d_sector39	Activities of collection agencies	1	0.32	78.66
d_sector40	Agents involved in the sale of machines	1	0.32	78.98
d_sector41	Agents specialised in the sale of manufacturing machines	1	0.32	79.30
d_sector42	Artistic creation	1	0.32	79.62
d_sector43	Beverage serving activities	1	0.32	79.94
d_sector44	Business support service activities	1	0.32	80.25
d_sector45	Collection of non-hazardous waste	1	0.32	80.57
d_sector46	Computer facilities management activities	1	0.32	80.89
d_sector47	Data processing, hosting and related	1	0.32	81.21
d_sector48	Data processing, hosting and related	1	0.32	81.53
d_sector49	Development of building projects	1	0.32	81.85
d_sector50	Fund management activities	1	0.32	82.17
d_sector51	Growing of vegetables and melons	1	0.32	82.48
d_sector52	Insurance, reinsurance and pension funds	1	0.32	82.80
d_sector53	Leasing of intellectual property	1	0.32	83.12
d_sector54	Manufacture of basic pharmaceutical products	1	0.32	83.44
d_sector55	Manufacture of batteries and accumulators	1	0.32	83.76
d_sector56	Manufacture of ceramic tiles and flags	1	0.32	84.08
d_sector57	Manufacture of computers and peripherals	1	0.32	84.39
d_sector58	Manufacture of consumer electronics	1	0.32	84.71
d_sector59	Manufacture of electric motors	1	0.32	85.03
d_sector60	Manufacture of homogenised food preparation	1	0.32	85.35
d_sector61	Manufacture of irradiation	1	0.32	85.67
d_sector62	Manufacture of macaroni, noodles	1	0.32	85.99
d_sector63	Manufacture of machinery and equipment	1	0.32	86.31
d_sector64	Manufacture of machinery for textile	1	0.32	86.62
d_sector65	Manufacture of mattresses	1	0.32	86.94
d_sector66	Manufacture of other food products	1	0.32	87.26
d_sector67	Manufacture of other special-purpose	1	0.32	87.58
d_sector68	Manufacture of other technical	1	0.32	87.90
d_sector69	Manufacture of paper and paperboard	1	0.32	88.22
d_sector70	Manufacture of perfumes and toilet goods	1	0.32	88.54
d_sector71	Manufacture of plastic packing goods	1	0.32	88.85
d_sector72	Manufacture of tubes, pipes, hollow	1	0.32	89.17
d_sector73	Market research and public opinion	1	0.32	89.49
d_sector74	Non-specialised wholesale of food, beverages	1	0.32	89.81
d_sector75	Organisation of conventions and trade	1	0.32	90.13
d_sector76	Other activities auxiliary to finance	1	0.32	90.45
d_sector77	Other amusement and recreation activities	1	0.32	90.76
d_sector78	Other financial service activities	1	0.32	91.08
d_sector79	Other manufacturing	1	0.32	91.40
d_sector80	Other monetary intermediation	1	0.32	91.72
d_sector81	Other processing and preserving of frozen goods	1	0.32	92.04
d_sector82	Other publishing activities	1	0.32	92.36
d_sector83	Other telecommunications activities	1	0.32	92.68
d_sector84	Other transportation support activities	1	0.32	92.99
d_sector85	Passenger air transport	1	0.32	93.31
d_sector86	Photographic activities	1	0.32	93.63
d_sector87	Plumbing, heat and air conditioning	1	0.32	93.95
d_sector88	Private security activities	1	0.32	94.27
d_sector89	Real estate agencies	1	0.32	94.59
d_sector90	Research and experimental development	1	0.32	94.90
d_sector91	Retail sale of clothing	1	0.32	95.22
d_sector92	Retail sale of computers, peripheral	1	0.32	95.54
d_sector93	Retail sale of cosmetic and toilet	1	0.32	95.86
d_sector94	Retail sale of flowers, plants, seeds	1	0.32	96.18
d_sector95	Retail sale of sporting equipment	1	0.32	96.50
d_sector96	Satellite telecommunications activities	1	0.32	96.82
d_sector97	Scientific research and development	1	0.32	97.13
d_sector98	Support activities for petroleum	1	0.32	97.45
d_sector99	Travel agency activities	1	0.32	97.77
d_sector100	Warehousing and storage	1	0.32	98.09
d_sector101	Weaving of textiles	1	0.32	98.41
d_sector102	Wholesale of other household goods	1	0.32	98.73
d_sector103	Wholesale of wood, construction materials	1	0.32	99.04
d_sector104	Wholesale trade, except of motor vehicles	1	0.32	99.36
d_sector105	Wired telecommunications activities	1	0.32	99.68
d_sector106	Wireless telecommunications activities	1	0.32	100.00

Table 4.12 example 2 of a data cluster taken from the employee's dataset

Due to the unavailability of several data regarding the financial variables, the analysis was done both including and excluding them in order to have a more comprehensive view of the results. Also, in some cases the number of variables representing the sectors was not manageable by the statistical software, so it had to be reduced manually to a minimum of the top 40 (still more than 80% of data).

Venture Size. Size was measured by using *Sales*. *Sales* data was obtained through the Orbis dataset.

Venture Stability. Stability was measured by using *Cash*: the higher the available liquidity, the stronger the venture's financial stability. *Cash* data was obtained from the Orbis dataset.

Venture Profitability. Profitability was measured by *EBIT*. *EBIT* data was obtained from the Orbis dataset.

The financial control variables (i.e., *Sales, Cash, EBIT*) had a relevant percentage of missing datapoints. Including them in the models significantly reduced the number of observations. Therefore, the analyses are presented both with and without them, to understand their impact on the results.

The variables and measures used to elaborate the data were presented. The set of information is complete to shift to the analysis of the hypotheses, focus of the next section.

5. ANALYSIS

To validate the hypothesis stated in section 3, two different statistical models were used:

1. *Survival Model with the aid of Cox regression* was implemented to study hypotheses 1, 2, 4, 5 regarding the CEO replacement and the hiring of a VP of Sales and Marketing. In addition, a *Wald test* was included for hypotheses 4 and 5 to validate the results obtained.
2. *Negative Binomial Regression* was implemented to study hypotheses 3 and 6 regarding the number of Top Management Team Changes (TMT changes) following an equity investment of a VC investor. In addition, a *Wald test* was included for hypothesis 6 to validate the results obtained.

A comprehensive framework showing the model used to validate each hypothesis is provided in Table 5.1.

	Survival Model		**Negative Binomial Regression**
Dependent Variable / Independent Variable	CEO Replacement	VP S&M Hiring	Top Management Team Changes
VC-backed *VS* non-VC-backed	Hypothesis 1	Hypothesis 2	Hypothesis 3
IVC *VS* PVC/BVC/CVC	Hypothesis 4	Hypothesis 5	Hypothesis 6

Table 5.1 Summary of analyses performed to validate each hypothesis

The following paragraphs explain how these two models were implemented.

5.1 Survival Model

Survival analysis basically consists of a time-to-event analysis. This model is often used in biomedical sciences to observe time to death either of patients or of laboratory animals. Survival analysis is also used in manufacturing industries to try to predict the breakdown time of machines. Even in social sciences, survival analysis is relevant: researchers can analyze the time to events such as marriage, the birth of children, or job changes.

There are some aspects of survival analysis data, such as censoring and non-normality, that generate issues when trying to analyze the data using traditional statistical models such as multiple linear regression. The non-normality peculiarity of the data violates the normality assumption of the most-used statistical models such as regression or ANOVA. A censored observation is defined as an observation with incomplete information. There are four different types of censoring possible: right truncation, left truncation, right censoring, and left censoring.

The analyses performed on the available data focus exclusively on right censoring. A right censored observation means that the information is incomplete because the subject did not experience an event during the time that the subject was part of the study. In this analysis, that happens when there are no CEO replacements or hiring of a VP of Sales & Marketing during the period analyzed.

The focus of survival analysis is to follow subjects over time and observe at which point in time they experience the event of interest. It often happens that the study does not span enough time to observe the event for all the subjects in the study. In the specific case of this dissertation, this could be due to a number of reasons: for instance, the HTEV is still too young, and the VC investment has arrived too recently to trigger changes in the organization, or the HTEV and the VC just did not deem necessary a change in the organigram.

The hazard rate is a crucial concept related to the survival analysis. The dataset of this dissertation is based on discrete times, measured monthly. The hazard rate represents the probability that an element of the sample - one HTEV in this case - will experience an event at time t, given that this event did not happen before. Thus, the hazard rate is just the unobserved rate at which events occur. For example, if the hazard rate was assumed to be constant over time and it was equal to 1.2, this would mean that it would be expected that 1.2 events will occur in a time interval that is one unit long. Furthermore, if a person had a hazard rate of 0,9 at time t and a second person had a hazard rate of 1,8 at time t, then the second person's risk of occurrence of the event would be twice greater at time t. Having cleared this out, the hazard rate is the key variable to check to understand the results of the survival analysis.

One last aspect to grasp is the difference between calendar time and time in the study. For each HTEV, a "time" variable is defined to track the elapsed months before the happening of the event. In practice, the "time" variable records the months elapsed from the foundation of the HTEV to the specific event, which is CEO replacement or hiring of VP of Sales & Marketing. When the event happens, there is a reset of the "time" variable that from this point on will start counting months from zero again. This element was introduced because there could be multiple CEO replacements or VP hiring. In theoretical terms, this corresponds to "multiple deaths" for the same subject of the study, and it must be considered.

Moreover, to apply the time-to-event analysis, a reshape and an information collapse were performed to convert each HTEV's organizational list from a "long" format into a "wide" one. The Orbis dataset was also transformed to have data in a monthly format.

5.1.1 Hypotheses 1 and 4: Founder-CEO replacement

To verify hypotheses 1 and 4, the hazard rate for CEO replacement in HTEVs was firstly computed with a qualitative glimpse at the cumulative hazard rate estimate, by using the Nelson-Aalen curve. Another qualitative analysis was performed calculating the hazard rate for different groups of data, in specific dividing between the periods before and after the receival of VC and by the VC type that invested.

Before the analysis, the data was re-arranged to assume an elongated shape, and new variables were created to signal the occurrence of specific events: investment from a VC, type of investor, CEO replacement (see chapter 4.3 for the operationalization of these variables).

As previously explained, HTEVs that had more than one CEO replacement during their history, are treated accordingly: when there is a CEO replacement - signaled with *ceo_turnover_* = 1 - the "time" variable restarts from zero the counting of elapsed months event, although the HTEV is the same (see Figure 5.2)

The command used in STATA to compose the survival model was ***stset*** *time, id(ID) failure(ceo_turnover_ = 1)*.

About the main variables used, *time* is the variable tracking elapsed months. Second, *id(ID)* signals the different subjects of the study (ID is a string formed by the BvdIdNumber of the HTEV plus the registered number of CEO changes so far). Lastly, *failure(ceo_turnover_ = 1)* states that the event is the replacement of the CEO.

CompanyName	year_month	time	vc_round	vc_invest	ceo_turnover_	vp_turnover_	investor_type_
ASSIST DIGITAL S.P.A.	gennaio-96	0	0	0	0	0	
ASSIST DIGITAL S.P.A.	febbraio-96	1	0	0	0	0	
ASSIST DIGITAL S.P.A.	marzo-96	2	0	0	0	0	
ASSIST DIGITAL S.P.A.	aprile-96	3	0	0	0	0	
ASSIST DIGITAL S.P.A.	maggio-96	4	0	0	0	0	
ASSIST DIGITAL S.P.A.	giugno-96	5	0	0	0	0	
ASSIST DIGITAL S.P.A.	luglio-96	6	0	0	0	0	
ASSIST DIGITAL S.P.A.	agosto-96	7	0	0	0	0	
ASSIST DIGITAL S.P.A.	settembre-96	8	0	0	0	0	
ASSIST DIGITAL S.P.A.	ottobre-96	9	0	0	0	0	
ASSIST DIGITAL S.P.A.	novembre-96	10	0	0	0	0	
ASSIST DIGITAL S.P.A.	dicembre-96	11	0	0	0	0	
ASSIST DIGITAL S.P.A.	gennaio-97	12	0	0	0	0	
ASSIST DIGITAL S.P.A.	febbraio-97	13	0	0	0	0	
ASSIST DIGITAL S.P.A.	marzo-97	14	0	0	0	0	
ASSIST DIGITAL S.P.A.	aprile-97	15	0	0	0	0	
ASSIST DIGITAL S.P.A.	maggio-97	16	0	0	0	0	
ASSIST DIGITAL S.P.A.	giugno-97	17	0	0	0	0	
ASSIST DIGITAL S.P.A.	luglio-97	18	0	0	0	0	
ASSIST DIGITAL S.P.A.	agosto-97	19	0	0	0	0	
ASSIST DIGITAL S.P.A.	settembre-97	20	0	0	0	0	
ASSIST DIGITAL S.P.A.	ottobre-97	21	0	0	0	0	

ASSIST DIGITAL S.P.A.	novembre-97	22	0	0	0	0	
ASSIST DIGITAL S.P.A.	dicembre-97	23	0	0	0	0	
ASSIST DIGITAL S.P.A.	gennaio-98	24	0	0	0	0	
ASSIST DIGITAL S.P.A.	febbraio-98	25	0	0	0	0	
ASSIST DIGITAL S.P.A.	marzo-98	26	0	0	0	0	
ASSIST DIGITAL S.P.A.	aprile-98	27	0	0	0	0	
ASSIST DIGITAL S.P.A.	maggio-98	28	0	0	0	0	
ASSIST DIGITAL S.P.A.	giugno-98	29	0	0	0	0	
ASSIST DIGITAL S.P.A.	luglio-98	30	0	0	0	0	
ASSIST DIGITAL S.P.A.	agosto-98	31	0	0	0	0	
ASSIST DIGITAL S.P.A.	settembre-98	32	0	0	0	0	
ASSIST DIGITAL S.P.A.	ottobre-98	33	0	0	0	0	
ASSIST DIGITAL S.P.A.	novembre-98	34	0	0	0	0	
ASSIST DIGITAL S.P.A.	dicembre-98	35	0	0	0	0	
ASSIST DIGITAL S.P.A.	gennaio-99	36	0	0	0	0	
ASSIST DIGITAL S.P.A.	marzo-99	37	0	0	0	0	
ASSIST DIGITAL S.P.A.	aprile-99	38	0	0	0	0	
ASSIST DIGITAL S.P.A.	maggio-99	39	0	0	0	0	
ASSIST DIGITAL S.P.A.	giugno-99	40	0	0	0	0	
ASSIST DIGITAL S.P.A.	luglio-99	41	0	0	0	0	
ASSIST DIGITAL S.P.A.	agosto-99	42	0	0	0	0	
ASSIST DIGITAL S.P.A.	settembre-99	43	0	0	0	0	
ASSIST DIGITAL S.P.A.	ottobre-99	44	0	0	0	0	
ASSIST DIGITAL S.P.A.	novembre-99	45	0	0	0	0	
ASSIST DIGITAL S.P.A.	dicembre-99	46	0	0	0	0	
ASSIST DIGITAL S.P.A.	gennaio-00	47	0	0	0	0	
ASSIST DIGITAL S.P.A.	febbraio-00	48	0	0	0	0	
ASSIST DIGITAL S.P.A.	marzo-00	49	0	0	0	0	
ASSIST DIGITAL S.P.A.	aprile-00	50	0	0	0	0	
ASSIST DIGITAL S.P.A.	maggio-00	51	0	0	0	0	
ASSIST DIGITAL S.P.A.	giugno-00	52	0	0	0	0	
ASSIST DIGITAL S.P.A.	luglio-00	53	0	0	0	0	
ASSIST DIGITAL S.P.A.	agosto-00	54	0	0	0	0	
ASSIST DIGITAL S.P.A.	**settembre-00**	**55**	**0**	**0**	**1**	**0**	
ASSIST DIGITAL S.P.A.	ottobre-00	0	0	0	0	0	
ASSIST DIGITAL S.P.A.	novembre-00	1	0	0	0	0	
ASSIST DIGITAL S.P.A.	dicembre-00	2	0	0	0	0	
ASSIST DIGITAL S.P.A.	gennaio-01	3	0	0	0	0	
ASSIST DIGITAL S.P.A.	febbraio-01	4	0	0	0	0	
ASSIST DIGITAL S.P.A.	marzo-01	5	0	0	0	0	
ASSIST DIGITAL S.P.A.	aprile-01	6	0	0	0	0	
ASSIST DIGITAL S.P.A.	maggio-01	7	0	0	0	0	

Table 5.2 example of survival model set for CEO replacement

A Cox regression model was set to verify the validity of the hypotheses tested on the survival model. Since the standard errors may not be completely homoscedastic, a clustering of errors was performed to assure that this issue could be considered. From a practical point of view, this simply consisted in inserting the option *vce(cluster BvdIdNumber)* after the command for the Cox regression.

Although both hypotheses 1 and 4 both tested the CEO replacement by using the survival model, they differed in the independent variable analyzed. Hypothesis 1 studied the differential effect caused by being VC-backed or non-VC-backed. Hypothesis 4 studied the differential effect caused by being financed from an IVC or other types of VCs (i.e., PVC, BVC, CVC). Thus, the H4 outcome consists of two hazard rates (i.e., IVC investment VS investment from another type of VC). To validate if the difference of the two hazard rates is statistically significant, a Wald test was performed. In case of an acceptable p-value, this test allows to reject the null hypothesis which advocates that the two coefficients are equal, and to confirm the original hypothesis.

The results of these analyses are studied in section 6 to understand whether there is a statistically acceptable correlation between the CEO replacement and the entry of a VC investor (i.e., H1) or the type of the VC investor (i.e., H4).

5.1.2 Hypotheses 2 and 5: VP of Sales & Marketing hiring

The process followed to analyze hypotheses 2 and 5 followed the same steps as the one implemented for H1 and H4. The variable associated with the failure event in the survival model (i.e., hiring of a VP of Sales & Marketing) was *vp_turnover_* (see paragraph 4.3 for further information.

As with the CEO replacement analysis, in the figure below it can be seen that when a VP of Sales & Marketing is hired or replaced - signaled with *vp_turnover_* = 1 - the "time" variable restarts from zero the counting of elapsed months event, although the HTEV is the same. The command used in STATA to compose the survival model was ***stset*** *time, id(ID) failure(vp_turnover_ = 1).*

About the variables used, *time* is the variable tracking elapsed months Second, *id(ID)* signals the different subjects of the study (ID is a sting formed by the BvdIdNumber of the startup plus the registered number of VP of Sales & Marketing changes so far). Lastly, *failure(vp_turnover_ = 1)* states that the event is the hiring or replacement of the VP of Sales & Marketing.

In this specific example, it can also be noted that the HTEV hired a VP of Sales & Marketing - which happened in August 2013 - after the investment in December 2009 of an Independent VC (IVC).

CompanyName	year_month	time	vc_round	vc_invest	ceo_turnover_	vp_turnover_	investor_type_
ASSIST DIGITAL S.P.A.	maggio-09	0	0	0	0	0	
ASSIST DIGITAL S.P.A.	giugno-09	1	0	0	0	0	
ASSIST DIGITAL S.P.A.	luglio-09	2	0	0	0	0	
ASSIST DIGITAL S.P.A.	agosto-09	3	0	0	0	0	
ASSIST DIGITAL S.P.A.	settembre-09	4	0	0	0	0	
ASSIST DIGITAL S.P.A.	ottobre-09	5	0	0	0	0	
ASSIST DIGITAL S.P.A.	novembre-09	6	0	0	0	0	
ASSIST DIGITAL S.P.A.	**dicembre-09**	**7**	**1**	**1**	**0**	**0**	**1**
ASSIST DIGITAL S.P.A.	gennaio-10	8	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	febbraio-10	9	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	marzo-10	10	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	aprile-10	11	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	maggio-10	12	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	giugno-10	13	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	luglio-10	14	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	agosto-10	15	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	settembre-10	16	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	ottobre-10	17	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	novembre-10	18	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	dicembre-10	19	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	gennaio-11	20	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	febbraio-11	21	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	marzo-11	22	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	aprile-11	23	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	maggio-11	24	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	giugno-11	25	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	luglio-11	26	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	agosto-11	27	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	settembre-11	28	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	ottobre-11	29	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	novembre-11	30	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	dicembre-11	31	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	gennaio-12	32	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	febbraio-12	33	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	marzo-12	34	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	aprile-12	35	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	maggio-12	36	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	giugno-12	37	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	luglio-12	38	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	agosto-12	39	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	settembre-12	40	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	ottobre-12	41	0	**1**	0	0	**1**

ASSIST DIGITAL S.P.A.	dicembre-12	42	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	gennaio-13	43	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	febbraio-13	44	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	marzo-13	45	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	aprile-13	46	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	maggio-13	47	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	giugno-13	48	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	luglio-13	49	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	**agosto-13**	**50**	**0**	**1**	**0**	**1**	**1**
ASSIST DIGITAL S.P.A.	settembre-13	0	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	ottobre-13	1	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	novembre-13	2	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	dicembre-13	3	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	gennaio-14	4	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	febbraio-14	5	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	marzo-14	6	0	**1**	0	0	**1**
ASSIST DIGITAL S.P.A.	aprile-14	7	0	**1**	0	0	**1**

Table 5.3 example of survival model set for the hire of a VP of Sales & Marketing

The process to conduct the analyses was the same as for hypotheses 1 and 4. A Cox regression model was set to verify the validity of the hypotheses tested on the survival model. Following the same reasoning of H1 and H4, hypothesis 2 studied the differential effect caused by being VC-backed or non-VC-backed, while hypothesis 5 studied the differential effect caused by being financed from an IVC or other types of VCs (i.e., PVC, BVC, CVC). As for H4, a Wald test was performed to statistically validate the difference among the two hazard rates related to the H5 survival model.

The results of these analyses are studied in section 6 to understand whether there is a statistically acceptable correlation between the hiring of a VP of Sales & Marketing, and the entry of a VC investor (i.e., H2) or the type of the VC investor (i.e., H5).

5.2 Negative Binomial Regression model

Negative binomial regression is used for modeling count variables, usually for over-dispersed count outcome variables. A negative binomial distribution is a discrete probability distribution that models the number of successes in a sequence of independent and identically distributed Bernoulli trials before a specified and non-random number of failures – denoted r – occurs.

5.2.1 Hypotheses 3 and 6: Top Management Team changes

The negative binomial regression was implemented to validate hypotheses 3 and 6. Although both hypotheses 3 and 6 both tested the TMT changes by using the negative binomial regression, they differed in the independent variable analyzed. Hypothesis 3 studied the differential effect in terms of TMT changes caused by being VC-backed or non-VC-backed. Instead, hypothesis 6 studied the differential effect in terms of TMT changes caused by being financed from an IVC or other types of VCs (i.e., PVC, BVC, CVC). Chapter 4.3 provides more information about the operationalization of the variables included in the analysis.

To check the validity of H3 and H6, the results to focus on are the sign and values of the coefficients, and their related p-value (see Section 6 for the results).

6. RESULTS & DISCUSSION

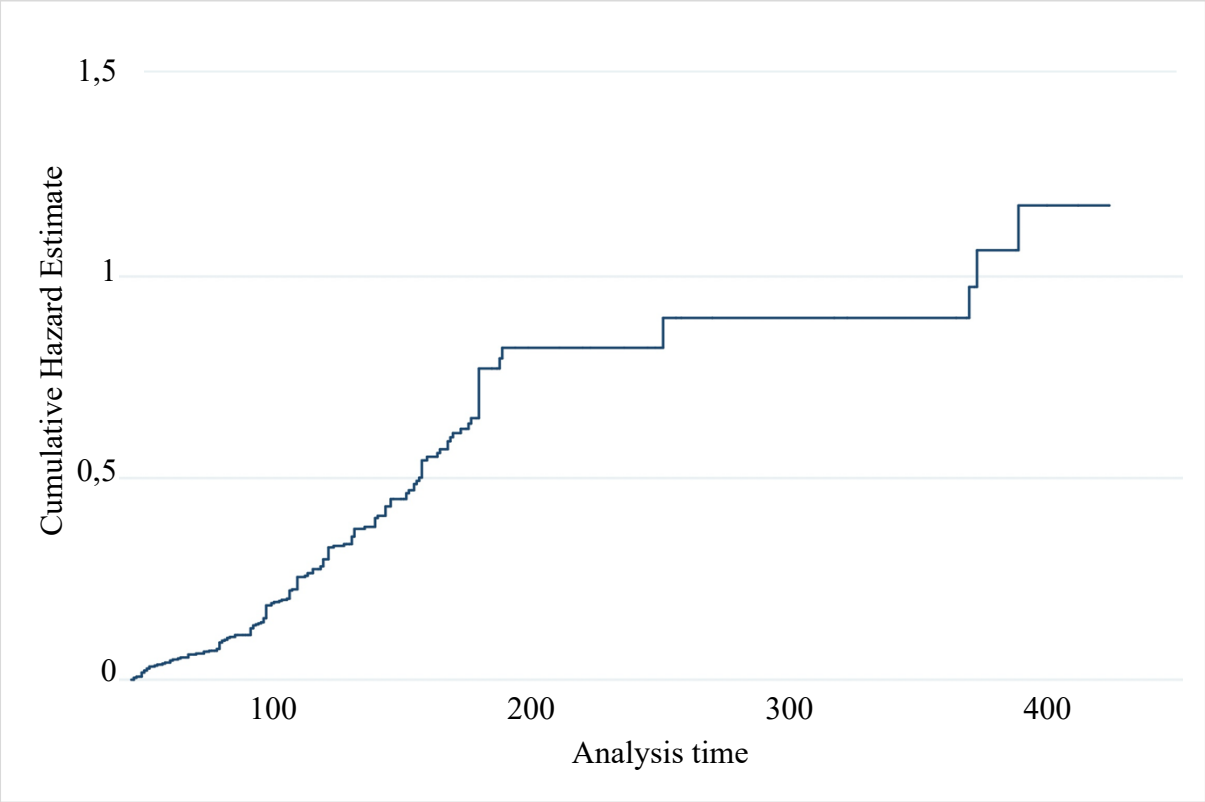
This section aims at presenting, both through qualitative and quantitative arguments, the results obtained from the analyses previously described.

For each of the hypotheses 1, 2, 4, and 5 - studied through the survival model -, a graph shows the cumulative hazard rate over time. This allows giving a more intuitive feel of the results' variability encountered across time.

Finally, every model was studied both with and without financial control variables, and the results of each model are presented through a relative table.

6.1 CEO replacement

The first step consisted in computing the Nelson-Aalen cumulative hazard estimate (Graph 6.1).



Graph 6.1 CEO replacement - Nelson-Aalen cumulative hazard estimate

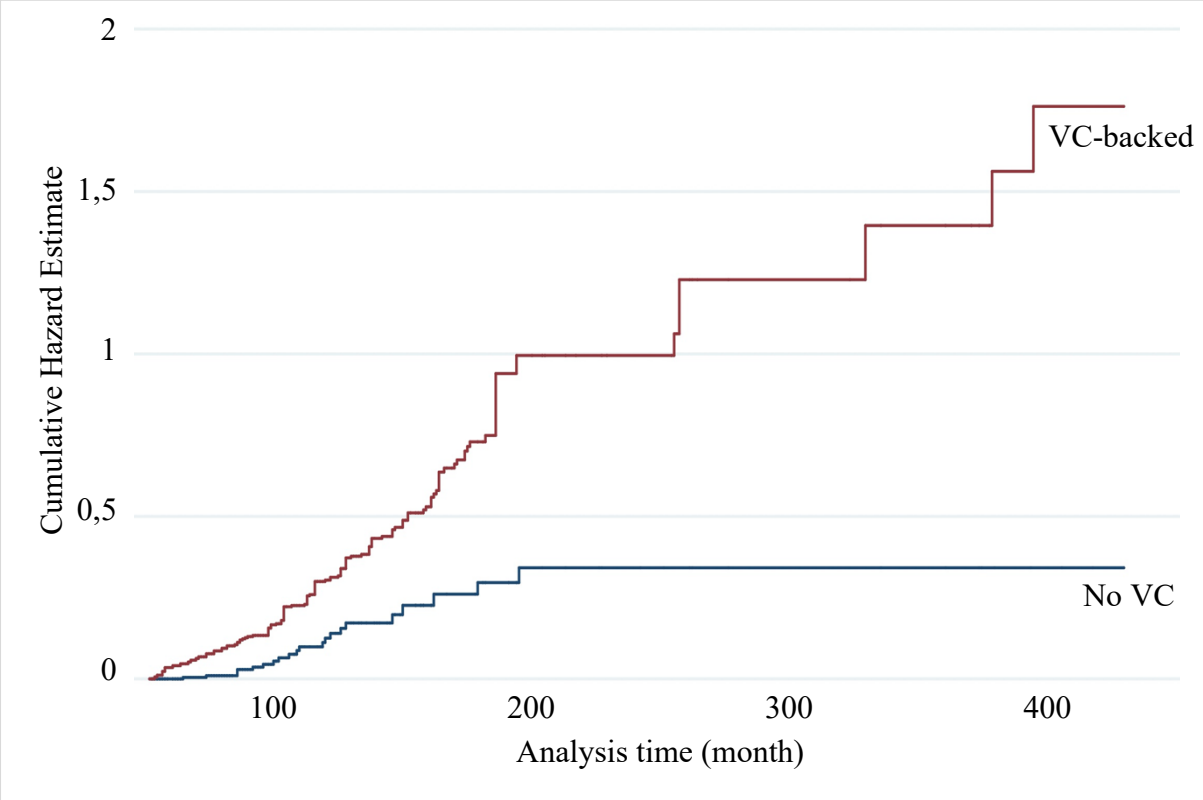
In Graph 6.1, it can be observed the average probability and speed of having a CEO replacement across the life of the HTEVs. In the survival model, the time was measured in months. The curve shows an increasing trend. The following paragraphs focus on studying

whether this trend is emphasized by the entry of a VC investor, and which type of investor has the strongest effect.

6.1.1 Hypotheses 1: influence of VC investment on CEO replacement

Graph 6.2 represents the illustrative results of the survival model analyzing the probability of a CEO replacement comparing VC-backed HTEVs and non-VC-backed ones. The difference between the two curves is evident, in favor of VC-backed ventures. It is relevant to remember that all the HTEVs analyzed received a VC investment sooner or later. Hence, the analysis focused on the periods before and after the VC investment. The time horizon considered was from the founding year of each HTEV to the present year (i.e., 2021).

The cumulative hazard estimates show that the HTEVs that received a VC investment tend to be subject to a higher risk of replacing the CEO.



Graph 6.2 CEO replacement: VC-backed VS non-VC-backed - Nelson-Aalen Cumulative Hazard estimates

Then, a Cox regression was needed to validate the correlation between CEO replacement and VC investment. As previously mentioned, each study was divided into two parts: one without financial variables and one including them. This is due to the high number of missing observations after implementing financial variables.

As it can be seen in table 6.2, there is a strong correlation, hence, the model is validated. In particular, the hazard rate is above 1, the standard error does not have a relevant impact on the result, and the p-value equal to 0% confirms the validity of the results from a statistical standpoint. Thus, results demonstrate significant support for hypothesis 1, and it is acceptable to suppose that VC-backed HTEVs are subject to a greater probability (i.e., around 7 times higher) of replacing the CEO if compared to the base case of not receiving any investment from VCs.

After having inserted the financial control variables, the results changed: although the number of observations decreased, the hazard ratio increased sensibly, and the p-value remained in a statistically acceptable range at 0%. Also in this case, hypothesis 1 finds support in the analysis.

The decrease in the number of observations is mainly due to the scarce availability of financial data which, in this case, is an integrating control variable of the model. By studying the impact of the financial control variables, no relevant evidence emerges due to both unacceptable p-values and hazard ratios close to 1.

	Results					**Results with Financial Control Variables**			
Independent Variables	*Coeff*	*Std. Err.*	*p-value*	***	**Independent Variables**	*Coeff*	*Std. Err.*	*p-value*	***
vc_invest	7.0109480	3.2469970	0.00000%	***	vc_invest	65.24945	71.29751	0.0000%	***
Control Variables					**Control Variables**				
d_Country*		yes			Cash	0.9996461	0.0002332	12.9000%	
d_sector*		yes			Sales	1.00003	0.0000296	30.4000%	
					EBIT	0.9999674	0.0001491	82.7000%	
					d_Country*		yes		
					d_sector*		yes		
No. of subjects =	27670				Number of obs	4713			
No. of failures	163				No. of failures =	14			

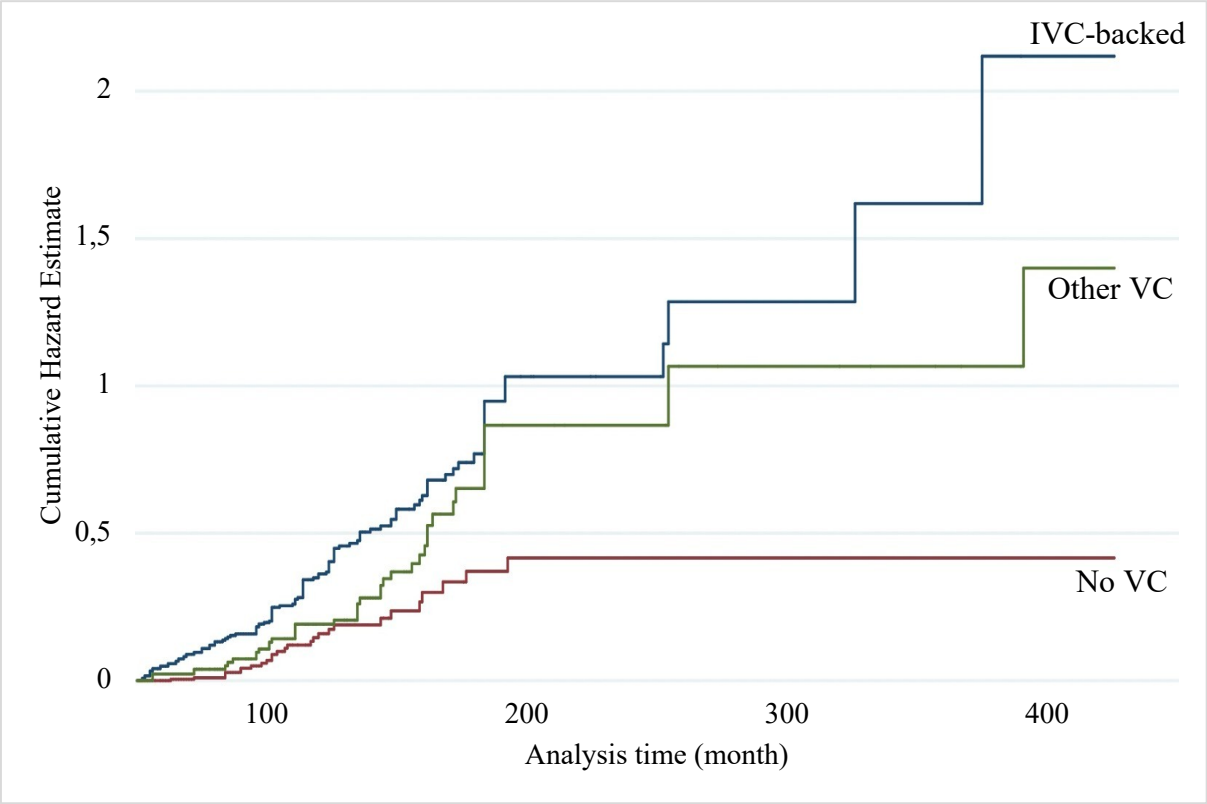
Table 6.3 Cox regression results for hypothesis 1

Looking at the results as a whole, it can be concluded that both the probability and speed of replacing the CEO increase after a VC investment if compared to the case where there is no investment from any VCs. This supports hypothesis 1. As already introduced in Chapter 3.1, VCs know that an external CEO can bring managerial experience, industry-specific expertise, a strong network to exploit to find and hire additional managers. Therefore, VCs lead "their" ventures to replace the CEO with an outsider. Moreover, hiring an experienced CEO provides a signal of high-quality governance from the VC.

To recap, these results validate hypothesis 1, which confirms the findings of Hellmann et al., (2002) concerning CEO replacement and actualizes them to the present day (i.e., 2021) and the different geographical contest (i.e., Europe) since their analyses involved USA-based HTEVs in the early 2000s.

6.1.2 Hypotheses 4: influence of investor type on CEO replacement

Graph 6.4 illustrates the results coming from the survival model related to H4. This hypothesis goes to a deeper level of hypothesis 1 by analyzing the differential effect caused by different types of VC. In practice, the curve related to the VC-backed ventures of Graph 6.4 is here divided in two: the blue curve represents IVC-backed companies, while the green one illustrates the behavior of the ventures financed by other types of VCs. The difference among the cumulative hazard rate estimates is lighter than in the previous case, although it appears that, overall, IVC-funded HTEVs have a greater hazard rate.



Graph 6.4 CEO replacement: analysis by investor type - Nelson-Aalen Cumulative Hazard estimates

To back up the hypothesis from a statistical point of view, a Cox regression followed by a Wald test was performed.

From the results of the Cox regression, the probability for HTEVs to experience a CEO replacement is around 5 times higher after the VC investment when the investor is an

Independent VC, while it increases by 3,5 time for other investors. The Wald test shows a statistically acceptable p-value (i.e., around 8%), which rejects the null hypothesis that the two ratios coming from the Cox regression are equal. Therefore, the results are statistically significant and acceptable, and hypothesis 4 is confirmed.

When the financial data is inserted as control variables, the p-value assumes a statistically unacceptable value for the independent variable *other_vc_invest,* while it remains acceptable for *ivc_invest*. In this direction, the hazard ratio related to IVC-backed ventures strongly increases if compared to the model without the financial control variables. Nevertheless, also the relative standard error is much higher, and the results of this model seem not to be significant. This may be explained by the much-reduced number of observations: only 17% of the observations registered in the previous model.

The financial control variables in this case seem to have an acceptable p-value for Cash and Sales, but they tend to not influence the probability of CEO replacement - hazard ratios close to 1.

	Results					**Results with Financial Control Variables**			
Independent Variables	*Coeff*	*Std. Err.*	*p-value*	***	**Independent Variables**	*Coeff*	*Std. Err.*	*p-value*	***
ivc_invest	4.8950730	1.7987360	0.00000%	***	ivc_invest	101.0565	111.5455	0.000%	***
other_vc_invest	3.5896150	1.3784830	0.10000%	***	other_vc_invest	2.938003	3.578211	37.6000%	
Control Variables					**Control Variables**				
d_Country*		yes			Cash	101.05650	111.54550	0.000%	***
d_sector*		yes			Sales	2.93800	3.57821	37.6000%	
					EBIT	0.99960	0.00022	6.900%	*
					d_Country*		yes		
					d_sector*		yes		
Wald test p-value	7.95000%	*			Wald test p-value	2.120000%	**		
Number of obs	27670				Number of obs	4713			
No. of failures	163				No. of failures	14			

Table 6.5 Cox regression results for hypothesis 4

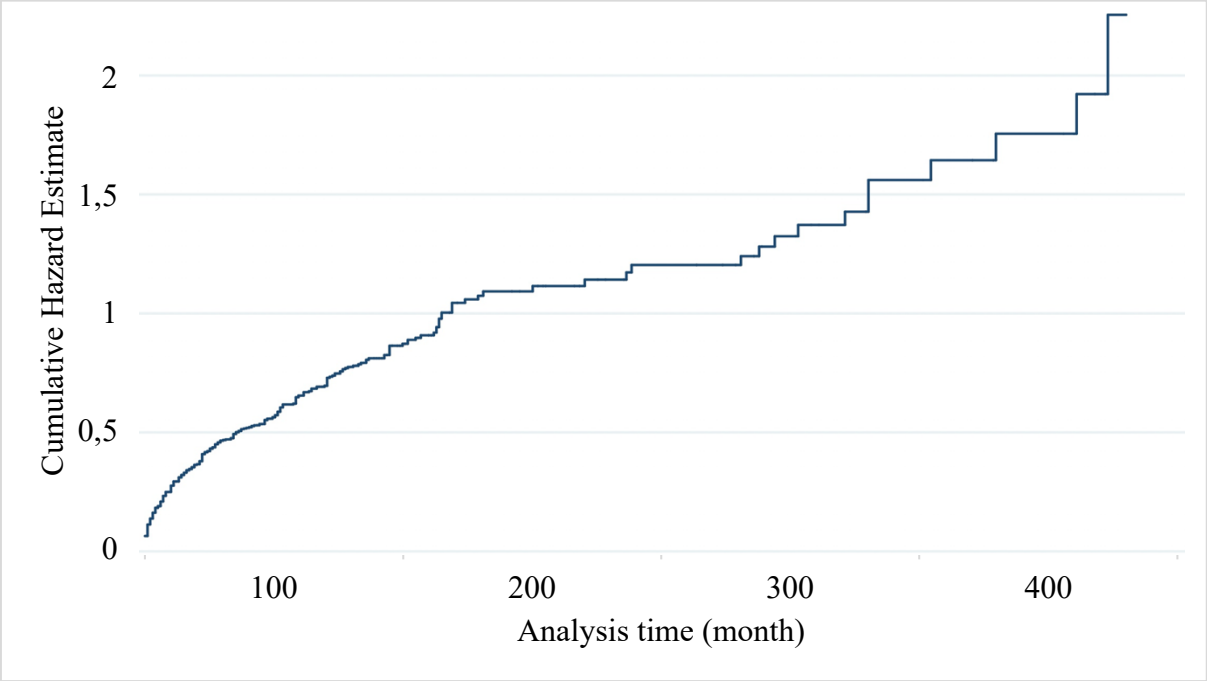
Overall, the model including all the observations - without financial control variables is more precise and reliable. Following this, hypothesis 4 finds support in the results. IVC-backed HTEVs tend to be more likely and faster in replacing the CEO if compared to HTEVs backed by other types of VCs. Indeed, IVCs are the only VCs totally focused on prioritizing venture's growth and better economic performance in the short term. Indeed, PVCs have the same goal, but they tend to do changes at a slower pace given their tendency towards longer investment durations. On the other side, CVCs and BVCs have different objectives: respectively, acquiring the venture's innovation, and increasing the demand for the financial services offered by the parent bank.

However, even if hypothesis 4 is validated, the results seem weaker than hypothesis 1. This may be explained by the fact that, even if VCs have different objectives, these are still interconnected. For instance, to improve the innovation acquired by a CVC, the HTEV needs more people and resources, thus the venture must grow. This may lead the CVC to replace the CEO. The same can happen for a BVC-backed venture: to increase the demand for the parent bank's financial services, the BVC may push the HTEV to replace the CEO with an outsider with higher skills to manage the venture's stability - a higher probability of complying with lending requirements -, and venture's growth – a higher size means a higher amount of financing needed from the parent bank -.

To summarize, hypothesis 4 finds support in the analysis: different types of VCs have different objectives, and IVC-backed HTEVs are the most likely and fastest in replacing the CEO. Nevertheless, the results are weaker due to the interconnection of the objectives associated to the different types of VCs.

6.2 Hiring of a VP of Sales & Marketing

As done with CEO replacement, first the Nelson-Aalen cumulative hazard estimate was computed. The graph can be seen below and shows an increasing trend at the progressing of time which - as in the previous hypotheses - is measured in elapsed months.



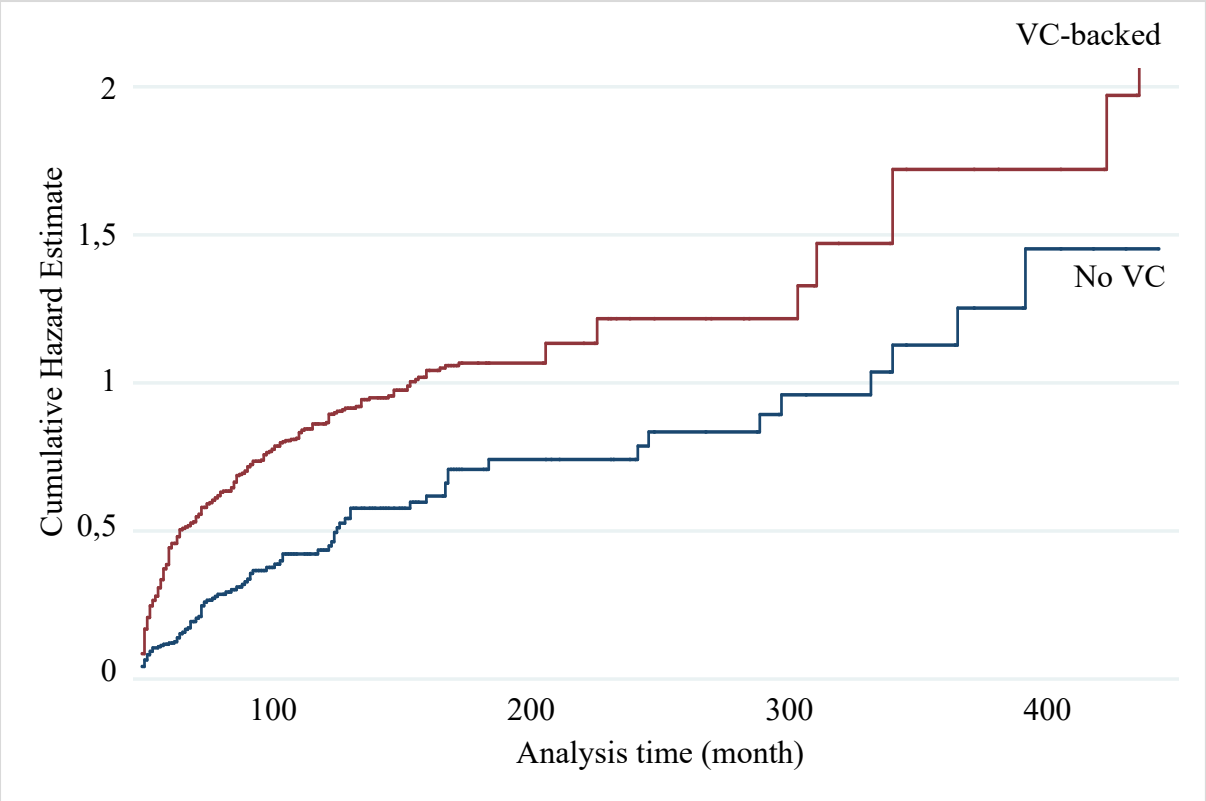
Graph 6.6 VP of Sales & Marketing: Nelson-Aalen Cumulative Hazard estimate

Compared to the hazard estimate curve of CEO replacement, the hazard rate can reach higher levels. This could be explained by the minor impact that a replacement or hiring of a VP of Sales & Marketing has on a company compared to a CEO turnover.

6.2.1 Hypotheses 2: influence of VC investment on VP of Sales & Marketing hiring

The graph below illustrates the difference between hazard rates for the hiring of a VP of Sales & Marketing when dividing between HTEVs that have already received VC investment and those that have not received it yet. Again, it is relevant to remember that all the HTEVs analyzed received a VC investment sooner or later. Hence, the analysis focused on the periods before and after the VC investment. The time horizon considered was from the founding year of each HTEV to the present year (i.e., 2021).

By looking at the separate curves, it could be seen that the VC-backed HTEVs are associated with a higher risk of hiring a VP of Sales & marketing. However, the difference seems to be smaller than in the case of hypothesis 1, though it remains visually evident.



Graph 6.7 VP of Sales & Marketing: VC-backed VS non-VC-backed - Nelson-Aalen Cumulative Hazard estimates

As in the case of hypothesis 1, a Cox regression model was run to validate hypothesis 2. The results were statistically acceptable - 0% p-value - and significant - reasonable hazard

ratios and standard errors -. Indeed, after a VC investment, the probability of hiring a VP of Sales & Marketing is 3.5 times higher.

The regression model was also run including the financial variables. In this case, the results appeared not to be statistically strong as in the previous iteration. This was due to a significantly lower number of observations related to the incompleteness of the available financial data.

The hazard ratio, however, remains above 1 confirming the hypothesis and the financial control variables seem to not influence in a major way the hiring of a VP of Sales & Marketing.

	Results					**Results with Financial Control Variables**			
Independent Variables	*Coeff*	*Std. Err.*	*p-value*	***	**Independent Variables**	*Coeff*	*Std. Err.*	*p-value*	***
vc_invest	3.5089500	0.7315566	0.00000%	***	vc_invest	1.662862	0.8245409	30.50000%	
Control Variables					**Control Variables**				
d_Country*		yes			Cash	1.000005	0.000026	85.000%	
d_sector*		yes			Sales	1.000011	0.00000819	19.1000%	
					EBIT	1.000072	0.0000829	38.7000%	
					d_Country1		yes		
					d_sector*		yes		
Number of obs	21018				Number of obs	3737			
No. of failures	279				No. of failures	38			

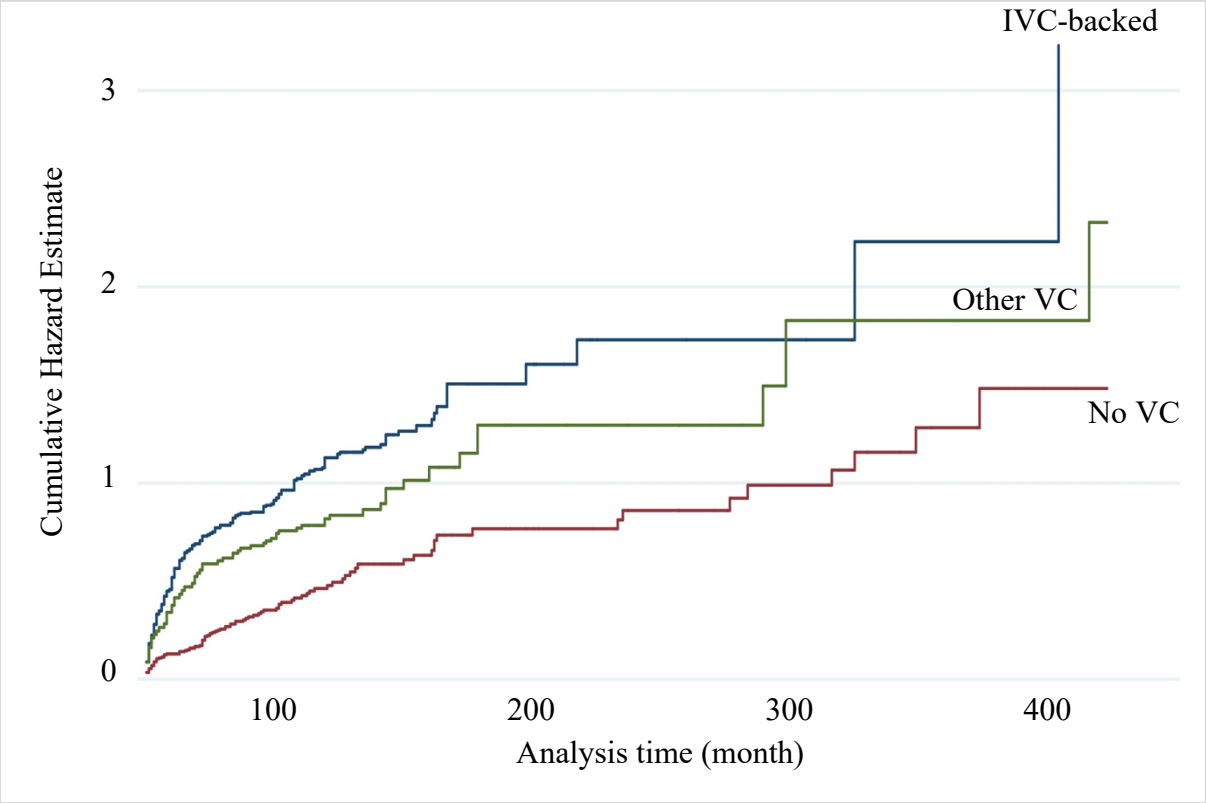
Table 6.8 Cox regression results for hypothesis 2

Overall, the model without the financial control variables is associated with reliable and significant results that support hypothesis 2. Considering this outcome, the theory coming from Hellmann et al., (2002) is validated: VC-backed ventures are subject to higher probability and speed in hiring a VP of Sales & Marketing. Indeed, *Sales & Marketing* is one of the key functions to professionalize before and after the market launch (see Chapter 3.1). The venture is young and needs to spread market awareness about the product/service offering. VCs have experience in this process and have the money and better connections to hire a specialized VP of Sales & Marketing.

To recap, these results validate hypothesis 2, which confirms the findings of Hellmann et al., (2002) concerning the hiring of a VP of Sales & Marketing and actualizes them to the present day (i.e., 2021) and the different geographical contest (i.e., Europe) since their analyses involved USA-based HTEVs in the early 2000s.

6.2.2 Hypotheses 5: influence of investor type on VP of Sales & Marketing hiring

Graph 6.9 illustrates the results coming from the survival model related to H5. This hypothesis goes to a deeper level of hypothesis 2 by analyzing the differential effect caused by different types of VC. In practice, the curve related to the VC-backed ventures of Graph 7.XX is here divided in two: the blue curve represents IVC-backed companies, while the green one illustrates the behavior of the ventures financed by other types of VCs. The difference among the cumulative hazard rate estimates is lighter than in the previous case, although there is a light overlapping and position exchange between IVCs and other VCs. Overall, it appears that IVC-funded HTEVs have a slightly greater hazard rate.



Graph 6.9 VP of Sales & Marketing: analysis by investor type - Nelson-Aalen Cumulative Hazard estimates

To fully demonstrate the validity of the hypothesis from a statistical point of view, a Cox regression followed by a Wald test was performed.

From the results of the Cox regression, it emerges a statistically acceptable result with p-values equal to 0 for both independent variables. However, the hazard ratio of the variable *ivc_invest* is slightly lower than that of *other_vc*_invest which contradicts hypothesis 5.

The results obtained from the Wald test did not allow to reject the null hypothesis.

The model was also implemented considering financial control variables. As in the previous cases, the number of observations decreased due to the extensive lack of financial

data. Nevertheless, results unexpectedly improved. The p-values remained in an acceptable range and the hazard ratios of *ivc_invest* were significantly higher. Moreover, the hazard ration associated with the variable *other_vc_invest* is significantly lower than 1, meaning that the investment from a non-IVC investor would significantly lower the probability of hiring a VP of Sales & Marketing. Results acceptability was confirmed by the Wald test.

	Results					**Result with Financial Control Variables**			
Independent Variables	*Coeff*	*Std. Err.*	*p-value*	***	**Independent Variables**	*Coeff*	*Std. Err.*	*p-value*	***
ivc_invest	3.2382310	0.7064838	0.00000%	***	ivc_invest	2.424123	1.159205	6.400%	*
other_vc_invest	3.7318020	0.8975233	0.00000%	***	other_vc_invest	0.2408716	0.1584064	3.000%	**
Control Variables					**Control Variables**				
d_Country*		yes			Cash	1.00001	0.00003	83.600%	
d_sector*		yes			Sales	1.00001	0.00001	10.200%	
					EBIT	1.00009	0.00008	29.000%	
					d_Country*		yes		
					d_sector*		yes		
Wald test p-value	48.89000%	***			Wald test p-value	00.13000%	***		
Number of obs	21018				Number of obs	3739			
No. of failures	279				No. of failures	38			

Graph 6.10 Cox regression results for hypothesis 5

Since the first regression model - without financial data - is more statistically reliable than the second one, due to the much higher number of observations, hypothesis 5 cannot be confirmed. The results from the second model show that IVC-backed HTEVs may be associated with a higher likeliness and speed of hiring a VP of Sales & Marketing if compared to HTEVs backed by other types of VCs. Indeed, IVCs tend to accelerate the process of professionalization of HTEVs to rapidly achieve growth and better performances. However, for the same considerations presented discussing the results of hypothesis 4 (see paragraph 6.1.2), also other types of VCs may have interconnected objectives to IVCs' ones. This could bring all VCs to hire a VP of Sales & Marketing at the same pace.

To sum up, hypothesis 5 cannot be validated but, nonetheless, results suggest that there could be a correlation. Further research, based on larger and richer datasets, should try to establish whether a correlation - between being IVC-backed and more frequent hiring of VP of Sales & Marketing - actually exists.

6.3 Top Management Team Changes

The changes in the TMT were studied in the same instances as in previous paragraphs but with a different regression model, in the attempt to validate hypotheses 3 and 6.

6.3.1 Hypotheses 3: influence of VC investment on TMT Changes

Due to a flat likelihood function, the considered sectors had to be reduced to just the top 40, which restricted the number of observed groups to 310 HTEVs (i.e., around 90% of the initial sample). As for the previous analyses, the model is time-based, but in this case, the variables' behavior was analyzed year by year, and not monthly. Table 6.11 reports the results. On average, the model observed the TMT changes over 9 years for each HTEV, with a minimum of one year (i.e., the youngest HTEV of the database) to a maximum of 32 years (i.e., the oldest HTEV of the database).

As introduced in section 5, to test hypotheses 3 and 6 a negative binomial regression model was used. The coefficient of the independent variable *vc_invest* is positive and its p-value is 0%, which supports the hypothesis that TMT changes are enhanced by a VC entry.

Another regression model was run to include the financial control variables. Also in this case, the main reason why the number of observations and groups was significantly lower is due to the lack of financial data. Moreover, even here, the number of sectors had to be reduced to 40 to avoid a flat likelihood function.

Table 6.11 shows that the results are still statistically strong and confirm H3, as well as in the previous model. The coefficient of *vc_invest* is still positive, although reduced when compared to the previous model.

Looking at the coefficients referring to the available financial data, Sales is the only coefficient with a statistically acceptable p-value, but the relative coefficients - also the EBIT and Cash ones - are close to zero, meaning that no relevant correlations could be found between VC entry and increase of TMT changes.

	Results					**Results with Financial Control Variables**			
Independent Variables	*Coeff*	*Std. Err.*	*p-value*	***	**Independent Variables**	*Coeff*	*Std. Err.*	*p-value*	***
vc_invest	1.6446030	0.1062779	0.000%	***	vc_invest	1.1016530	0.1922320	0.000%	***
Control Variables					**Control Variables**				
d_Country*		yes			EBIT	-0.0000126	0.0000115	27.500%	
d_sector*		yes			Sales	0.0000063	0.0000030	3.500%	**
					Cash	-0.0000085	0.0000086	32.700%	
					d_Country*		yes		
					d_sector*		yes		
Number of obs	2.859				Number of obs	642			
Number of groups	310				Number of groups	136			

Graph 6.11 Negative Binomial regression results for hypothesis 3

Overall, the two models both support hypothesis 3. TMT changes tend to increase after VC entry. Thus, H3 is validated. HTEVs can take advantage from making changes to the TMT

and VCs know it. Indeed, hiring C-level managers bring several benefits: stronger managerial and industry-specific skills, networks of the new TMT members (e.g., potential clients, investors, additional managers). Furthermore, the VC, having an active role in the organization of the TMT, provides a signal of involvement and quality of the venture to the market.

To recap, hypothesis 3 finds support in the results: VC-backed companies tend to make more TMT changes than non-VC-backed companies. This result extends the findings of Boeker et al., (2005), also bringing them into the present European context.

6.3.2 Hypotheses 6: influence of investor type on TMT changes

To test this last hypothesis, the negative binomial regression model was applied with a change to the primary independent variables: *vc_invest* was replaced by *ivc_invest* and *other_vc_invest*.

The results seem to be in contrast with the stated hypothesis since the coefficient of *ivc_invest* was slightly lower than that associated with *other_vc_invest*. Moreover, p-values associated with the two coefficients were 0%, making these statistically acceptable. However, after running a Wald test, the p-value was 24.04% which did not allow to reject the null hypothesis. Hence, based on this regression model, hypothesis 6 does not find support in this analysis.

The regression model was then computed including the financial control variables. Results were not significantly altered, and the evidence emerged is still contrasting with the original hypothesis. However, also in this case, the Wald test gave a p-value of 71.85% which made the analysis invalid.

	Results					**Results with Financial Control Variables**			
Independent Variables	*Coeff*	*Std. Err.*	*p-value*	***	**Independent Variables**	*Coeff*	*Std. Err.*	*p-value*	***
ivc_invest	1.6105100	0.1101932	0.0000%	***	ivc_invest	1.0831740	0.1989678	0.0000%	***
other_vc_invest	1.7189640	0.1237999	0.0000%	***	other_vc_invest	1.1494260	0.2332688	0.0000%	***
Control Variables					**Control Variables**				
d_Country*		yes			Cash	-0.0000085	0.0000086	32.500%	
d_sector*		yes			Sales	0.0000063	0.0000030	3.700%	**
					EBIT	-0.0000132	0.0000116	25.600%	
					d_Country*		yes		
					d_sector*		yes		
Wald test p-value	24.0500%				Wald test p-value	71.85000%			
Number of obs	2.859				Number of obs	642			
Number of groups	310				Number of groups	136			

Graph 6.12 Negative Binomial regression results for hypothesis 6

In conclusion, hypothesis 6 cannot be confirmed since both regression models gave results that were statistically unacceptable.

The results of hypothesis 4 confirmed that IVC-backed companies tend to replace the CEO more and faster if compared to non-VC-backed companies. The CEO role is one of the positions analyzed in hypothesis 6, but H6 was not validated. Thus, IVCs tend to have a higher impact than other types of VCs only for what concerns the change of the CEO, but not at the whole TMT-level. This may be explained by the fact that the CEO is the head of the venture, thus she must manage the whole venture, no matter the venture's sector. On the other side, the tasks related to other C-level roles (e.g., CTO, COO), being more specific and operational, depend on the venture's sector, and each HTEV is subject to different dynamics which make hard to find common trends regarding TMT changes.

To sum up, hypothesis 6 does not find support in the analysis, and further research should be conducted to understand if some correlations exist between the number of TMT changes associated with a specific HTEV, and the relative type of VC investor.

7. EXPLORATIVE SECTION

This final section focuses on providing further insights about the organization of HTEVs. Section 3, 5 and 6 were aimed at validating/rejecting *predictive* theories about the impact of VCs on HTEVs' organizational structure. Instead, the *explorative section* has the objective of providing empirical evidence about how European HTEVs tend to approach the organizational dimensions analyzed in the theoretical background: hierarchy, functional concentration, individual functional specialization, and formalization.

7.1 Main evidence about functional concentration

Task allocation is a fundamental organizational dimension to design (see paragraph 2.2.6), and it can be discussed in two different instances: functional concentration and individual functional specialization. The first relates to the number of employees working for every single function, and it is empirically analyzed in this paragraph.

For each HTEV of the dataset, only data regarding *current* employees were considered. Then, a separation between Business Areas was performed to understand the average concentration in each department (see results in Graph 7.1 and Table 7.2).

On average, the top-four business areas count for most of the workforce: more than 70%. Sales and Marketing have more than 40% of the total number of employees with a slightly higher concentration in Sales. This can be explained by the fact that new ventures need to create brand and product awareness in the market, thus a strong commercial and marketing force to launch their offerings is a must-have.

Since the pool of HTEVs is made of ventures active in High-tech Industries, it also makes sense that the IT and R&D functions represent one-third of the total workforce (i.e., around 33%), divided almost equally among them. Ceteris paribus, the more R&D resources for a HTEV, the higher the probability that the venture can develop innovative and competitive products. The same could be said about the IT department: information systems and digitalization allows new ventures to be more efficient and reach a higher customer base, especially if they are active in the platform business or similar.

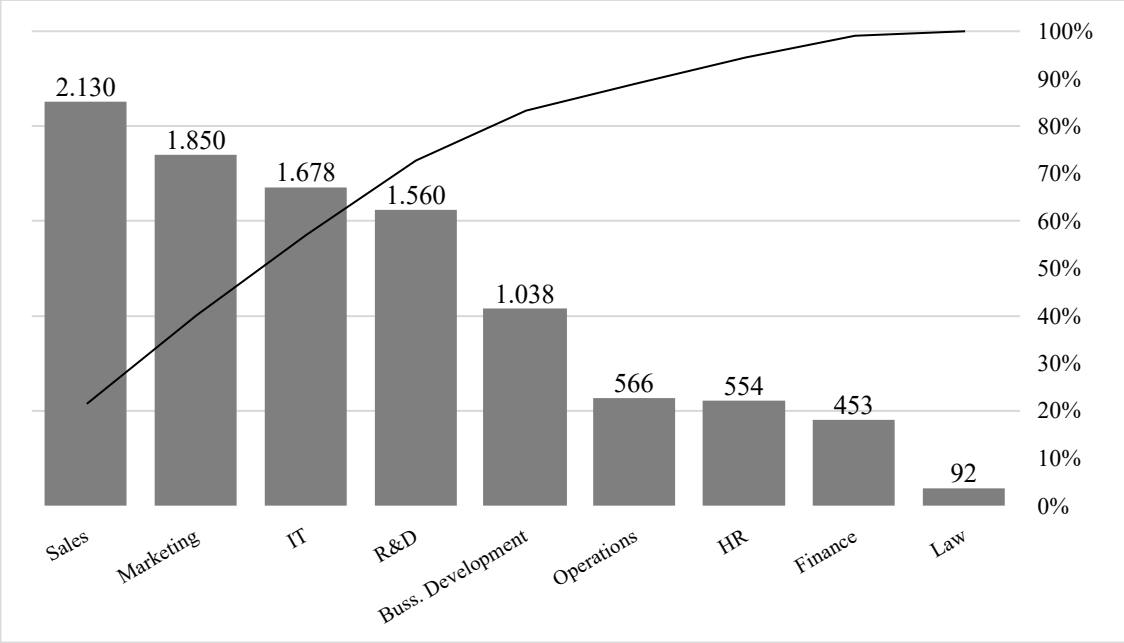
Going to a country-level, for French HTEVs, R&D is the business function with the lowest concentration - that is the highest number of employees - with 30% of the workforce allocated to it. This may be explained by the fact that most of the French HTEVs is active in the *research and experimental development* sector. On the other side, the R&D function of

Italian HTEVs counts less than 7% of the workforce. This confirms the expectations since Italian HTEVs are mostly active in computer programming, and manufacturing.

In synthesis, Sales, Marketing, R&D, and IT have on average a low functional concentration. It is not by random that Sales & Marketing are the closest functions to the customer, and R&D and IT are the closest ones to technological innovation developments. New ventures must understand customers' needs and develop technologies through an iterative process that matches the technological resources available with the requests from the market. Focusing on these business functions, new ventures can develop innovative offerings that could lead to stimulating the growth of their businesses.

Business Development represents the Median of this distribution with 10.5% of the workforce. In this business function, employees are focused on growing the business, also by interacting with the Sales area to gather information about customers and competitors.

Finally, Operations, HR, and Finance departments count for roughly 5% of the total employees. This means that we have a high functional concentration that allows for more efficiency, and fewer coordination costs which makes sense since the flow of ideas may be considered less important than in business areas like R&D.



Graph 7.1 Business area concentration among all HTEVs (#employees by function | %)

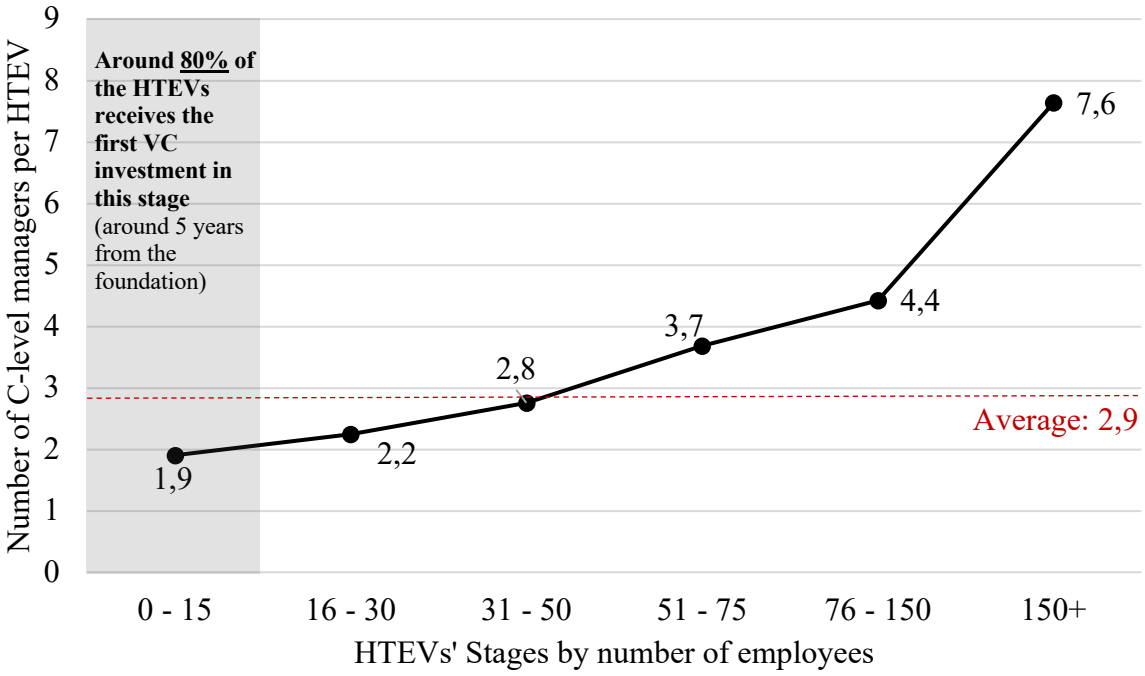
7.2 C-suite role formalization and functional specialization

As introduced in the theoretical background, formalization is a key organizational dimension for HTEVs. It brings pros like higher legitimacy and transparency from the investors' standpoint or better coordination within the venture. However, formalization is time and money consuming, and may also reduce the flexibility of the HTEV, which is the major advantage against established players. Thus, HTEVs should adopt the right trade-off of formalization.

Role formalization is the first step in this direction. The analyzed HTEVs tend to assign to each employee a specific role within the venture, easily detectable by the name of the position. This helps all the stakeholders involved in the HTEVs' functioning. From an internal perspective, *within the venture* everyone knows who is accountable for specific tasks, easing the coordination in the communication and the resources management. From an external perspective, role formalization enhances HTEV's reputation by increasing the transparency between the venture and the market. First, the *investors* can have a clear impression of the venture's structure and its organizational strategy. Second, job seekers can easily understand what a specific position involves, making the process of finding the right talents easier.

Typically, the C-level positions are the first roles to be formalized: the founders split among them the main areas and tasks to address (see paragraph 2.2.2). The dataset on the HTEVs' employees shows that the number of C-level managers grows with the total number of employees. Graph 7.2 was built by considering the actual status (i.e., 2021) of the 347 HTEVs analyzed. In the first size stage - until 15 employees -, the ventures tend to have around two C-level managers. Then, this number significantly grows with the size of the workforce: three C-level managers when the venture counts around 40 employees, four once reached 100 employees, and eight C-level figures for the largest ventures - more than 150 employees -.

Finally, all the HTEVs of the dataset are VC-backed, thus each venture receives a VC investment sooner or later. Based on this, more than 80% of the 347 HTEVs receives the first VC investment within 5 years from the foundation (see Graph 4.5). Moreover, HTEVs on average count about 15 employees after 5 years. These data points lead to deduct that - on average - VCs invest in HTEVs when they still have two C-level managers.



Graph 7.2 Number of C-level managers per HTEV related to overall number of employees

Another evidence relates to the types of C-level roles formalized by HTEVs. Most of the HTEVs tends to converge on a list of standard roles, especially concerning the C-level team (i.e., TMT). Graph 7.3 - also based on a snapshot of the ventures as of January 2021 - focuses on this list of standard roles, showing the percentage of ventures adopting a specific C-level role.

The CEO (i.e., Chief Executive Officer) is at the lead of the C-level management team and the whole venture (see Paragraph 2.2.4), thus he/she is the *first* to be responsible of the venture's results. Therefore, the expectations are that the CEO is the most-adopted position by new ventures. The 109% data point related to the CEO position confirms these expectations meaning that *all* the ventures have at least one CEO, and some of them have even two Co-CEOs.

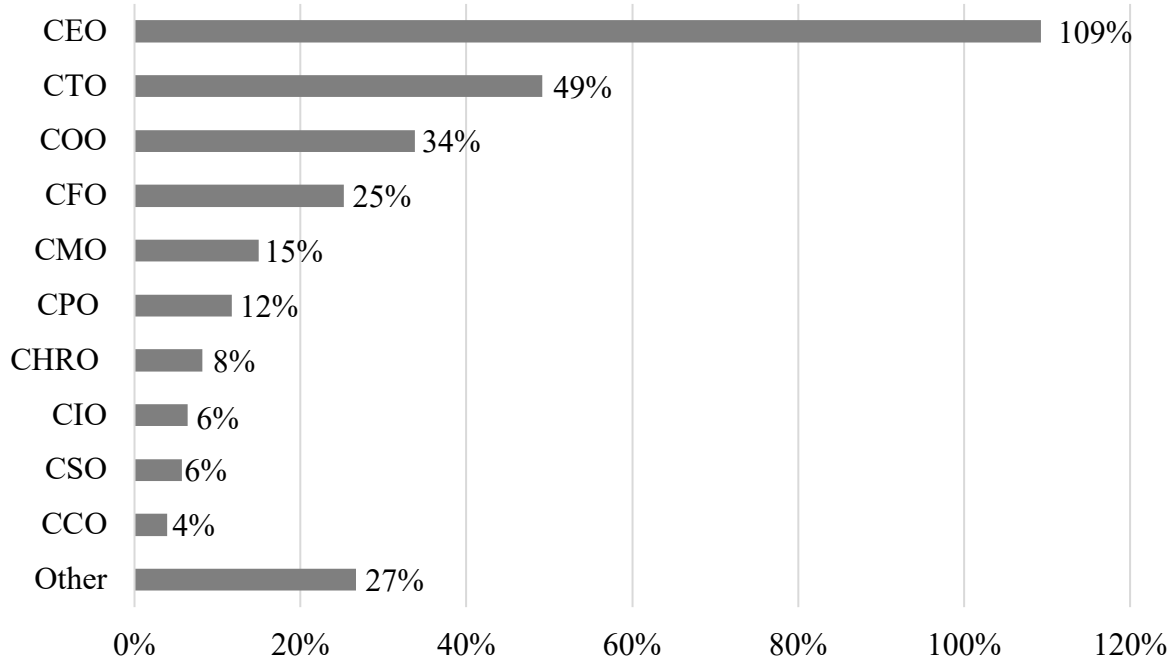
The second most common position is the CTO (i.e., Chief Technology Officer): the leader of what concerns the development of the new technology offered by the venture. Around half of the HTEVs adopts this position. Given that the sample is composed of ventures active in the High-tech sector, also this trend is in line with expectations.

The COO (i.e., Chief Operations Officer) is - on average - the third role to be included in the C-level teams. About one-third of the ventures has a COO, who must manage the daily

operation of the firm. Then, the CFO (i.e., Chief Financial Officer) is responsible for the financial affairs of the venture and is adopted by one fourth of the ventures.

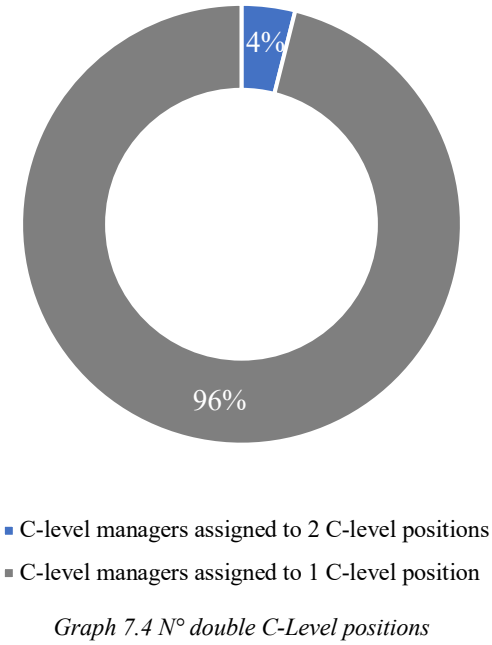
Going down the ranking, other relevant C-level positions are the CMO (i.e., Chief Marketing Officer), CPO (i.e., Chief Product Officer), CHRO (i.e., Chief Human Resources Officer), CIO (i.e., Chief Information Officer), CSO (i.e., Chief Strategy Officer), and CCO (i.e., Chief Commercial Officer). Each of these managers is the person in charge for the relative venture's function. The *Other* section includes several C-level roles that are not generally common, being tailored to the specific venture's business.

Combining the results from Graph 7.3 and Graph 7.4, it is possible to conclude that - on average –, at the time of foundation, the venture formalizes one or two C-level managers: the first role tends to be the CEO, the second one is typically the CTO or the COO, also depending on the specific venture's business.



Graph 7.3 Average presence of C-level managers per HTEV (Sample 347 HTEVs, 829 C-level positions)

Finally, this C-level analysis allowed to identify a relevant insight about individual functional specialization: only 4% of the C-level managers within the sample is covering two C-level roles simultaneously. Therefore, the probability of being the person in charge for more than one venture's function is significantly low. Of course, sometimes the allocation to more functions may be adopted but not formalized in the Manager's position. What is possible to deduct is that, at least from an external standpoint to the venture, there is a high tendency towards individual functional specialization in the HTEVs' world. From a role formalization perspective, HTEVs try to allocate people to specific business areas to let them specialize and being accountable for specific tasks.



Graph 7.4 N° double C-Level positions

Furthermore, low-size ventures - less than 15 employees - are more time-constrained and they also have few human resources to cover all the business areas. Expectations were that the 4% related to managers allocated to double C-level roles were working in very small ventures, but no evidence was found on this.

7.3 Board of Directors as a key step to enhance formalization

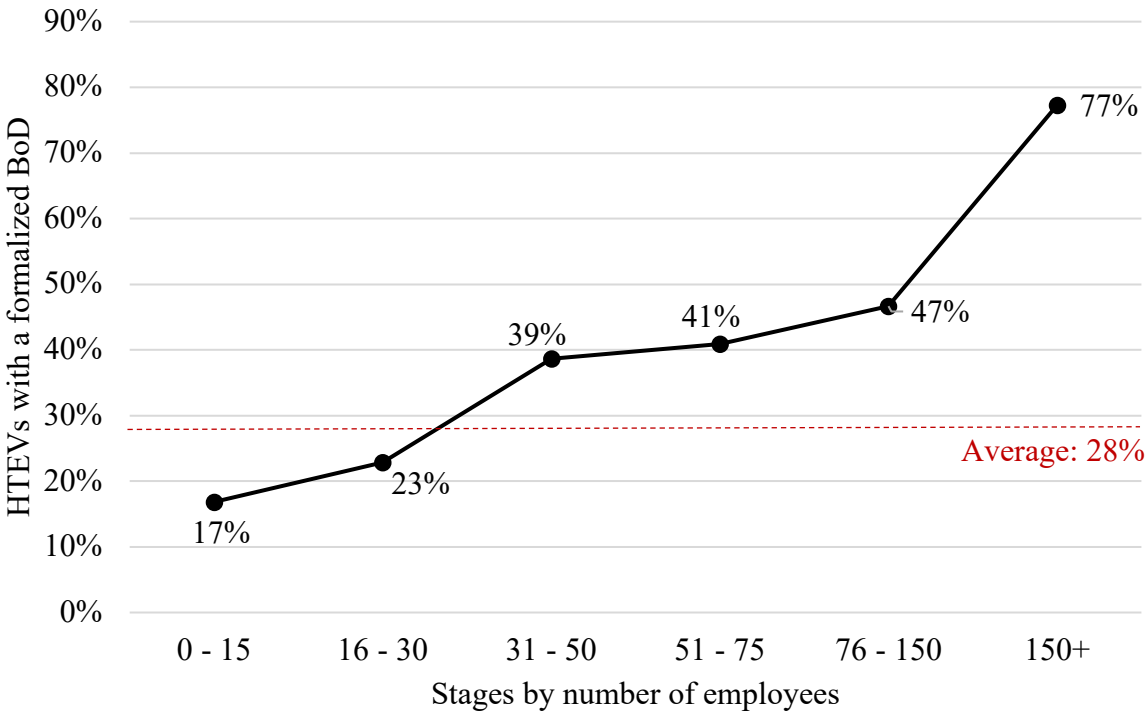
After role formalization, the creation of a Board of Directors (BoD) is the second key step (towards formalization) that was possible to analyze through the data collected. As introduced in the theoretical background, the BoD consists of a team created to control that the venture is pursuing the shareholders' interests. Therefore, it should be composed of both internal and external members combining:

- Venture's chief managers: they manage and operate the venture's strategy. High knowledge of internal practices.
- Venture's shareholders: venture's owners. Some of them can coincide with the venture's chief managers, while some others are external investors (e.g., VCs, business angels).
- External advisors: they are appointed by shareholders to judge every situation with an external and impartial perspective. Moreover, they typically have high know-how in the

venture's industry or best practices and can provide valuable advice on how the venture should face specific strategic options. Given their expertise, their participation in the venture's BoD can even bring a signal of quality to other external stakeholders.

Typically, it seldom happens that every TMT member and shareholder is appointed as a Board member. Instead, there is a selection of some representatives: for instance, the CEO to include the managerial perspective, one VC director to include the investor perspective, a university professor to include a valuable and impartial perspective.

Considering the 347 HTEVs analyzed, about 30% of them have a formalized BoD. Moreover, as shown by Graph 7.5, HTEVs with larger dimensions create and develop formalized BoDs at higher rates. 3 out of 4 HTEVs with more than 150 employees have a formalized BoD, which means that, in these HTEVs, it is around 5 times more likely to have a BoD than small ventures - less than 15 employees -.



Graph 7.5 HTEVs with a formalized Board of Directors by number of employees (%)

It is reasonable to associate this strong trend with the consequences of being a larger venture. The higher the number of employees, the higher the funds collected, the more consolidated the business model, the larger the turnover, etc. All these effects bring to higher complexity that results in higher chances of creating inefficiencies and making wrong or opportunistic decisions. This implies the need for a standardization of the processes at any level, and - for the managerial level - the formalization of a Board of Directors is a crucial step in this direction.

8. CONCLUSION

To summarize all the analyses, Table 8.1 reports a synthesis of the results obtained. The baseline hypotheses H1, H2 and H3 result valid and statistically significant. Regarding the new hypotheses, H4 can also be validated, while H5 and H6 do not find support in the results.

#	Hypothesis	Result	Result with Financial var.	Model used
1	VC-backed HTEVs are more likely and faster to replace the CEO with an outsider if compared to non-VC-backed HTEVs.	Valid	Valid	Survival Model, Cox Regression
2	VC-backed HTEVs are more likely and faster to hire a VP of Sales & Marketing if compared to non-VC-backed HTEVs.	Valid	Valid	Survival Model, Cox regression
3	VC-backed HTEVs make more changes to their Top Management Team if compared to non-VC-backed HTEVs.	Valid	Valid	Negative binomial regression
4	HTEVs backed by IVCs (or syndicates led by IVCs) are more likely and faster to replace the CEO with an outsider if compared to HTEVs backed by PVCs, CVCs or BVCs (or syndicates led by PVCs, CVCs, or BVCs).	Valid	Valid, with reserves	Survival Model, Cox regression
5	HTEVs backed by IVCs (or syndicates led by IVCs) are more likely and faster to hire a VP of Sales & Marketing if compared to HTEVs backed by PVCs, CVCs, or BVCs (or syndicates led by PVCs, CVCs, or BVCs).	Invalid	Valid, but low number of observations	Survival Model, Cox regression
6	HTEVs backed by IVCs (or syndicates led by IVCs) make more changes to their Top Management Team if compared to HTEVs backed by PVCs, CVCs, or BVCs (or syndicates led by PVCs, CVCs, or BVCs).	Invalid	Invalid	Negative binomial regression

Graph 8.1 Synthesis of results obtained from the analyses

Results confirmed that VC-backed ventures are associated with a higher likeliness of replacing the CEO, hiring a VP of Sales & Marketing, and making more Top Management Team changes rather than non-VC-backed ventures. Going deeper, results also showed that IVC-backed companies tend to replace the CEO with higher probability and at a higher pace if compared to ventures backed by other types of VCs.

Shifting to the empirical evidence collected through the explorative section, some key findings in organizational theory were obtained from the internally developed employees' dataset. First, it was discovered that Sales & Marketing and R&D represent the business areas with the lowest individual functional concentration. This seems coherent with the definition of the high-tech industries where HTEVs are active. Such industries, indeed, are characterized by high velocity in the product release rate and need a substantial salesforce and R&D department to create and market new products at sustained pace. Moreover, while analyzing the formalization level adopted by these HTEVs, it emerged that the number of executives in the

C-Suite increases in relation to the number of employees, and VC investors enter the entrepreneurial venture when it has on average two C-Suite managers. In addition, empirical evidence showed a correlation between employees' number and the presence of a Board of Directors.

The analyses and evidence emerged from this dissertation have some limitations, mostly linked to the nature of the datasets and classification algorithm used.

Starting from VICO's dataset, the selected data only contained VC-backed companies, and the analyses completed to validate hypotheses 1, 2 and 3 compared the periods before and after the VC investment. Therefore, these analyses cannot be considered a difference-in-difference method.

For the ORBIS dataset, problems were encountered due to several missing financial variables that did not allow to obtain stable and acceptable results when inserting them as control variables in regression models. This limitation is partially overcome thanks to the setting of two parallel regression models, one containing them, the other not. In this way it was easier to have a more comprehensive view on the regression's results.

Regarding the employees' dataset, it should be noted that data was taken from LinkedIn where people are free to insert any title for any company with little surveillance from the social network.

Moreover, the algorithm considers a standard organizational chart derived from late 1990s IBM's organigram which may not be commonly adopted HTEVs, especially when they are at their very early stages of life.

Also, the algorithm tried to associate to each HTEV at least a CEO and some other relevant C-level roles even in cases where the specific denominative words were not present in the venture under study. This may have generated a small error of denomination of certain roles in the dataset which, after a manual quality check, was determined to be small in comparison to the existing HTEVs present.

Finally, other limitations concern that HTEVs were only taken from only four European countries, hence, the analysis may not be fully representative for the whole Europe. In addition, data about HTEVs present in the VICO dataset were recorded 2019, while data about employees were extracted until 2021. This means that some young ventures that strongly grew in the last two years may be already considered as established firms.

These limitations and the multiple organizational dimensions not analyzed in this dissertation leave a great space for further research.

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10. APPENDIX

Cox regression on hypothesis 1

Cox regression -- Breslow method for ties						
No. of subjects =	499			Number of obs	27670	
No. of failures	163			Wald chi2(65)	37293.78	
Log likelihood =	-804.77009			Prob > chi2	0.0000	
Time at risk	38,619					
_t	**Haz. Ratio**	**Std. Err.**	**z**	**P > |z|**	**[95% Conf. Interval]**	
vc_invest	7.0109480	3.2469970	4.21	0.0000	2.8285100	17.3778400
d_Country1	1.566116	0.4223812	1.66	0.096	0.9231137	2.657008
d_Country2	0.9304794	0.285305	-0.23	0.814	0.5101643	1.697084
d_Country3	0.750181	0.3655517	-0.59	0.555	0.2886613	1.949591
d_Country4	1	(omitted)				
d_sector1	5.94E+10	3.01E+10	48.88	0	2.20E+10	1.61E+11
d_sector2	4.36E+10	2.47E+10	43.26	0	1.44E+10	1.32E+11
d_sector3	5.10E+10	2.65E+10	47.36	0	1.84E+10	1.41E+11
d_sector4	3.15E+10	1.67E+10	45.61	0	1.12E+10	8.91E+10
d_sector5	5.70E+10	2.87E+10	49.18	0	2.13E+10	1.53E+11
d_sector6	4.67E+10	2.25E+10	50.97	0	1.82E+10	1.20E+11
d_sector7	5.02E+10	2.62E+10	47.24	0	1.81E+10	1.40E+11
d_sector8	3.22E+10	2.40E+10	32.47	0	7.48E+09	1.39E+11
d_sector9	5.54E+10	3.13E+10	43.77	0	1.83E+10	1.68E+11
d_sector10	4.39E+10	2.22E+10	48.55	0	1.63E+10	1.18E+11
d_sector11	2.42E+10	1.56E+10	37.08	0	6.83E+09	8.55E+10
d_sector12	3.90E+10	2.82E+10	33.65	0	9.42E+09	1.61E+11
d_sector13	7.10E+10	4.31E+10	41.17	0	2.16E+10	2.33E+11
d_sector14	2.19E+11	1.59E+11	35.96	0	5.27E+10	9.08E+11
d_sector15	2.85E+10	1.77E+10	38.7	0	8.41E+09	9.64E+10
d_sector16	7.97E+10	3.98E+10	50.31	0	3.00E+10	2.12E+11
d_sector17	2.05E-09	.	.	.	.	.
d_sector18	4.63E+10	2.84E+10	40.09	0	1.39E+10	1.54E+11
d_sector19	5.45E+11	3.37E+11	43.67	0	1.62E+11	1.83E+12
d_sector20	1.75E+11	1.05E+11	43.05	0	5.38E+10	5.68E+11
d_sector21	2.98E-09	.	.	.	.	.
d_sector22	2.98E-09	.	.	.	.	.
d_sector23	1.17E+10	.	.	.	.	.
d_sector24	1.48E-09	.	.	.	.	.
d_sector25	3.05E+10	3.12E+10	23.61	0	4.11E+09	2.26E+11
d_sector26	2.16E-09	.	.	.	.	.
d_sector27	4.00E+10	2.33E+10	41.93	0	1.28E+10	1.25E+11
d_sector28	1.68E-09	.	.	.	.	.
d_sector29	1.19E+11	6.05E+10	50.09	0	4.38E+10	3.22E+11
d_sector30	1.76E-08	.	.	.	.	.
d_sector31	4.13E+10	3.52E+10	28.66	0	7.76E+09	2.20E+11
d_sector32	3.46E-09	.	.	.	.	.
d_sector33	3.76E+11	1.78E+11	56.11	0	1.48E+11	9.53E+11
d_sector34	2.64E+10	1.38E+10	46	0	9.50E+09	7.34E+10
d_sector35	7.79E+10	5.10E+10	38.34	0	2.16E+10	2.81E+11
d_sector36	2.96E-09	.	.	.	.	.
d_sector37	6.11E+10	4.78E+10	31.78	0	1.32E+10	2.83E+11
d_sector38	8.07E+10	8.94E+10	22.68	0	9.21E+09	7.07E+11
d_sector39	3.12E+10	1.68E+10	44.99	0	1.09E+10	8.94E+10

d_sector40	3.52E-08	.	.	.	.	.
d_sector41	2.22E-09	.	.	.	.	.
d_sector42	7.05E+10	5.47E+10	32.15	0	1.54E+10	3.23E+11
d_sector43	2.22E-09	.	.	.	.	.
d_sector44	6.01E-09	.	.	.	.	.
d_sector45	1.47E+11	1.13E+11	33.36	0	3.25E+10	6.67E+11
d_sector46	8.53E+10	4.11E+10	52.31	0	3.32E+10	2.19E+11
d_sector47	5.17E+10	3.04E+10	41.97	0	1.63E+10	1.64E+11
d_sector48	1.32E+11	7.71E+10	43.96	0	4.22E+10	4.14E+11
d_sector49	5.36E-09	.	.	.	.	.
d_sector50	1.30E+11	6.07E+10	54.69	0	5.18E+10	3.24E+11
d_sector51	4.16E-09	.	.	.	.	.
d_sector52	1.76E+11	2.41E+11	18.87	0	1.19E+10	2.59E+12
d_sector53	3.60E+10	1.59E+10	55.09	0	1.52E+10	8.55E+10
d_sector54	3.14E+10	1.38E+10	54.77	0	1.32E+10	7.45E+10
d_sector55	7.65E+10	8.46E+10	22.67	0	8.77E+09	6.68E+11
d_sector56	4.81E-09	.	.	.	.	.
d_sector57	2.68E+11	1.24E+11	56.74	0	1.08E+11	6.65E+11
d_sector58	5.74E-09	.	.	.	.	.
d_sector59	3.77E+10	1.66E+10	55.21	0	1.59E+10	8.94E+10
d_sector60	2.73E-09	.	.	.	.	.
d_sector61	3.07E+10	1.35E+10	54.66	0	1.29E+10	7.29E+10
d_sector62	3.73E+10	1.64E+10	55.22	0	1.57E+10	8.84E+10
d_sector63	7.33E+10	3.69E+10	49.71	0	2.73E+10	1.96E+11
d_sector64	4.53E+10	2.12E+10	52.37	0	1.81E+10	1.14E+11
d_sector65	3.77E+10	1.78E+10	51.63	0	1.49E+10	9.49E+10
d_sector66	2.37E+11	1.22E+11	50.7	0	8.60E+10	6.51E+11
d_sector67	5.25E-09	.	.	.	.	.
d_sector68	6.24E-09	.	.	.	.	.
d_sector69	4.98E-09	.	.	.	.	.
d_sector70	5.04E-09	.	.	.	.	.
d_sector71	4.20E+10	1.98E+10	51.72	0	1.66E+10	1.06E+11
d_sector72	5.66E+10	2.72E+10	51.57	0	2.21E+10	1.45E+11
d_sector73	5.82E-09	.	.	.	.	.
d_sector74	7.64E+10	3.49E+10	54.83	0	3.12E+10	1.87E+11
d_sector75	5.21E-09	.	.	.	.	.
d_sector76	5.34E-09	.	.	.	.	.
d_sector77	3.96E+11	2.09E+11	50.53	0	1.41E+11	1.12E+12
d_sector78	8.30E+10	3.83E+10	54.53	0	3.36E+10	2.05E+11
d_sector79	1.57E-08	.	.	.	.	.
d_sector80	1.05E-08	.	.	.	.	.
d_sector81	2.51E-08	.	.	.	.	.
d_sector82	1.28E+11	6.21E+10	52.81	0	4.96E+10	3.31E+11
d_sector83	9.44E+10	4.41E+10	54.05	0	3.77E+10	2.36E+11
d_sector84	1.45E-08	.	.	.	.	.
d_sector85	1.11E-08	.	.	.	.	.
d_sector86	1.31E+11	6.31E+10	52.98	0	5.07E+10	3.37E+11
d_sector87	2.66E+11	1.39E+11	50.48	0	9.59E+10	7.40E+11
d_sector88	1.66E-08	.	.	.	.	.
d_sector89	1.57E-08	.	.	.	.	.
d_sector90	1.07E-08	.	.	.	.	.
d_sector91	3.83E+11	2.02E+11	50.45	0	1.36E+11	1.08E+12
d_sector92	6.07E+11	3.44E+11	47.9	0	2.00E+11	1.84E+12
d_sector93	1.57E-08	.	.	.	.	.
d_sector94	1.54E+11	7.91E+10	50.28	0	5.66E+10	4.22E+11
d_sector95	1.28E+11	6.10E+10	53.53	0	5.01E+10	3.26E+11
d_sector96	9.55E+11	5.78E+11	45.6	0	2.92E+11	3.13E+12
d_sector97	1.53E-08	.	.	.	.	.

d_sector98	1	(omitted)				
d_sector99	1	(omitted)				
d_sector100	1	(omitted)				
d_sector101	1	(omitted)				
d_sector102	1	(omitted)				
d_sector103	1	(omitted)				
d_sector104	1	(omitted)				
d_sector105	1	(omitted)				
d_sector106	1	(omitted)				

Cox regression on hypothesis 1 with financial control variables

Cox regression -- Breslow method for ties						
No. of subjects =	133			Number of obs	4,713	
No. of failures =	14			Wald chi2(65)	189676.18	
Log likelihood =	-21.61673			Prob > chi2	0.0000	
Time at risk	5,754					
_t	**Haz. Ratio**	**Std. Err.**	**z**	**P > |z|**	**[95% Conf. Interval]**	
vc_invest	65.2494500	71.2975100	3.82	0.0000	7.6643680	555.4915000
Cash	0.999646	0.0002332	-1.52	0.129	0.9991891	1.000103
Sales	1.00003	0.0000296	1.03	0.304	0.9999724	1.000089
EBIT	0.9999674	0.0001491	-0.22	0.827	0.9996752	1.000260
d_Country1	0.1064855	0.0988885	-2.41	0.016	0.0172511	0.657301
d_Country2	2.29E+01	6.92E+01	1.03	0.301	6.10E-02	8.58E+03
d_Country3	1.00E+00	(omitted)				
d_Country4	1.00E+00	(omitted)				
d_sector1	2.90E+00	3.49E+00	0.89	0.375	2.75E-01	3.06E+01
d_sector2	1.74E+01	2.38E+01	2.09	0.037	1.19E+00	2.54E+02
d_sector3	5.73E-16	8.54E-16	-23.55	0	3.09E-17	1.06E-14
d_sector4	4.88E-16	7.86E-16	-21.91	0	2.08E-17	1.14E-14
d_sector5	2.93E+00	4.38E+00	0.72	0.473	1.56E-01	5.50E+01
d_sector6	1.00E+00	(omitted)				
d_sector7	4.74E-11	1.43E-10	-7.9	0	1.30E-13	1.73E-08
d_sector8	8.47E-16	9.60E-16	-30.64	0	9.20E-17	7.80E-15
d_sector9	7.77E-02	1.77E-01	-1.12	0.261	9.03E-04	6.68E+00
d_sector10	9.46E-16	1.54E-15	-21.22	0	3.87E-17	2.31E-14
d_sector11	2.69E-15	3.80E-15	-23.77	0	1.70E-16	4.28E-14
d_sector12	1.90E-16	2.73E-16	-25.28	0	1.15E-17	3.15E-15
d_sector13	1.00E+00	(omitted)				
d_sector14	3.90E+00	3.499179	1.52	0.129	0.6728654	22.62684
d_sector15	1.16E-15	2.03E-15	-19.67	0	3.77E-17	3.57E-14
d_sector16	4.39E-09	.	.	.	.	.
d_sector17	4.25E-18	9.26E-18	-18.34	0	5.91E-20	3.05E-16
d_sector18	1.00E+00	(omitted)				
d_sector19	1.99E+02	320.9775	3.28	0.001	8.383003	4710.888
d_sector20	1.26E-24	4.01E-24	-17.3	0	2.47E-27	6.42E-22
d_sector21	1.00E+00	(omitted)				
d_sector22	1.00E+00	(omitted)				
d_sector23	1.00E+00	(omitted)				
d_sector24	1.00E+00	(omitted)				
d_sector25	4.59E+02	1208.381	2.33	0.02	2.625058	80151.64
d_sector26	4.64E-15	7.23E-15	-21.17	0	2.18E-16	9.85E-14
d_sector27	1.00E+00	(omitted)				
d_sector28	2.20E-26	3.60E-26	-36.1	0	8.91E-28	5.44E-25

d_sector29	1.26E-17	1.62E-17	-30.28	0	1.01E-18	1.56E-16
d_sector30	1.00E+00	(omitted)				
d_sector31	2.36E-17	3.80E-17	-23.78	0	1.01E-18	5.54E-16
d_sector32	1.00E+00	(omitted)				
d_sector33	1.00E+00	(omitted)				
d_sector34	5.51E-15	9.90E-15	-18.29	0	1.63E-16	1.86E-13
d_sector35	1.00E+00	(omitted)				
d_sector36	6.00E-15	1.03E-14	-19.14	0	2.10E-16	1.72E-13
d_sector37	1.00E+00	(omitted)				
d_sector38	1.00E+00	(omitted)				
d_sector39	1.00E+00	(omitted)				
d_sector40	1.86E-15	2.80E-15	-22.54	0	9.77E-17	3.56E-14
d_sector45	1.47E+11	1.13E+11	33.36	0	3.25E+10	6.67E+11
d_sector46	8.53E+10	4.11E+10	52.31	0	3.32E+10	2.19E+11
d_sector47	5.17E+10	3.04E+10	41.97	0	1.63E+10	1.64E+11
d_sector48	1.32E+11	7.71E+10	43.96	0	4.22E+10	4.14E+11
d_sector49	5.36E-09	.	.	.	.	.
d_sector50	1.30E+11	6.07E+10	54.69	0	5.18E+10	3.24E+11
d_sector51	4.16E-09	.	.	.	.	.
d_sector52	1.76E+11	2.41E+11	18.87	0	1.19E+10	2.59E+12
d_sector53	3.60E+10	1.59E+10	55.09	0	1.52E+10	8.55E+10
d_sector54	3.14E+10	1.38E+10	54.77	0	1.32E+10	7.45E+10
d_sector55	7.65E+10	8.46E+10	22.67	0	8.77E+09	6.68E+11
d_sector56	4.81E-09	.	.	.	.	.
d_sector57	2.68E+11	1.24E+11	56.74	0	1.08E+11	6.65E+11
d_sector58	5.74E-09	.	.	.	.	.
d_sector59	3.77E+10	1.66E+10	55.21	0	1.59E+10	8.94E+10
d_sector60	2.73E-09	.	.	.	.	.
d_sector61	3.07E+10	1.35E+10	54.66	0	1.29E+10	7.29E+10
d_sector62	3.73E+10	1.64E+10	55.22	0	1.57E+10	8.84E+10
d_sector63	7.33E+10	3.69E+10	49.71	0	2.73E+10	1.96E+11
d_sector64	4.53E+10	2.12E+10	52.37	0	1.81E+10	1.14E+11
d_sector65	3.77E+10	1.78E+10	51.63	0	1.49E+10	9.49E+10
d_sector66	2.37E+11	1.22E+11	50.7	0	8.60E+10	6.51E+11
d_sector67	5.25E-09	.	.	.	.	.
d_sector68	6.24E-09	.	.	.	.	.
d_sector69	4.98E-09	.	.	.	.	.
d_sector70	5.04E-09	.	.	.	.	.
d_sector71	4.20E+10	1.98E+10	51.72	0	1.66E+10	1.06E+11
d_sector72	5.66E+10	2.72E+10	51.57	0	2.21E+10	1.45E+11
d_sector73	5.82E-09	.	.	.	.	.
d_sector74	7.64E+10	3.49E+10	54.83	0	3.12E+10	1.87E+11
d_sector75	5.21E-09	.	.	.	.	.
d_sector76	5.34E-09	.	.	.	.	.
d_sector77	3.96E+11	2.09E+11	50.53	0	1.41E+11	1.12E+12
d_sector78	8.30E+10	3.83E+10	54.53	0	3.36E+10	2.05E+11
d_sector79	1.57E-08	.	.	.	.	.
d_sector80	1.05E-08	.	.	.	.	.
d_sector81	2.51E-08	.	.	.	.	.
d_sector82	1.28E+11	6.21E+10	52.81	0	4.96E+10	3.31E+11
d_sector83	9.44E+10	4.41E+10	54.05	0	3.77E+10	2.36E+11
d_sector84	1.45E-08	.	.	.	.	.
d_sector85	1.11E-08	.	.	.	.	.
d_sector86	1.31E+11	6.31E+10	52.98	0	5.07E+10	3.37E+11
d_sector87	2.66E+11	1.39E+11	50.48	0	9.59E+10	7.40E+11
d_sector88	1.66E-08	.	.	.	.	.
d_sector89	1.57E-08	.	.	.	.	.

d_sector90	1.07E-08	.	.	.	.	.
d_sector91	3.83E+11	2.02E+11	50.45	0	1.36E+11	1.08E+12
d_sector92	6.07E+11	3.44E+11	47.9	0	2.00E+11	1.84E+12
d_sector93	1.57E-08	.	.	.	.	.
d_sector94	1.54E+11	7.91E+10	50.28	0	5.66E+10	4.22E+11
d_sector95	1.28E+11	6.10E+10	53.53	0	5.01E+10	3.26E+11
d_sector96	9.55E+11	5.78E+11	45.6	0	2.92E+11	3.13E+12
d_sector97	1.53E-08	.	.	.	.	.
d_sector98	1	(omitted)				
d_sector99	1	(omitted)				
d_sector100	1	(omitted)				
d_sector101	1	(omitted)				
d_sector102	1	(omitted)				
d_sector103	1	(omitted)				
d_sector104	1	(omitted)				
d_sector105	1	(omitted)				
d_sector106	1	(omitted)				

Cox regression on hypothesis 2

Cox regression -- Breslow method for ties						
No. of subjects	630				Number of obs	21018
No. of failures	279				Wald chi2(73)	35395.97
Time at risk	33486				Prob > chi2	0.0000
Log likelihood	-1,418.8007					
_t	**Haz. Ratio**	**Std. Err.**	**z**	**P > |z|**	**[95% Conf. Interval]**	
vc_invest	3.5089500	0.7315566	6.02	0.0000	2.3319330	5.2800530
d_Country1	0.5472918	0.1596529	-2.07	0.0390	0.3089664	0.9694528
d_Country2	0.2926879	0.0916276	-3.92	0.0000	0.1584643	0.5406026
d_Country3	0.3142147	0.113611	-3.2	0.001	0.154688	0.6382583
d_Country4	1	(omitted)				
d_sector1	1.09E+11	3.04E+11	9.15	0	4.74E+08	2.53E+13
d_sector2	1.23E+11	3.43E+11	9.19	0	5.31E+08	2.87E+13
d_sector3	6.48E+10	1.80E+11	8.96	0	2.80E+08	1.50E+13
d_sector4	1.68E+10	4.79E+10	8.23	0	6.16E+07	4.55E+12
d_sector5	9.45E+10	2.62E+11	9.11	0	4.10E+08	2.18E+13
d_sector6	8.91E+10	2.43E+11	9.24	0	4.24E+08	1.87E+13
d_sector7	7.64E+10	2.14E+11	8.96	0	3.17E+08	1.84E+13
d_sector8	8.47E+10	2.37E+11	9.01	0	3.56E+08	2.02E+13
d_sector9	9.41E+10	2.64E+11	9	0	3.83E+08	2.31E+13
d_sector10	7.04E+10	1.96E+11	8.96	0	2.98E+08	1.67E+13
d_sector11	6.64E+10	1.87E+11	8.83	0	2.63E+08	1.68E+13
d_sector12	1.38E+09	.	.	.	.	.
d_sector13	1.09E+11	2.99E+11	9.24	0	4.95E+08	2.38E+13
d_sector14	3.11E+11	8.82E+11	9.34	0	1.20E+09	8.05E+13
d_sector15	3.35E+10	9.72E+10	8.36	0	1.14E+08	9.87E+12
d_sector16	3.13E+11	8.59E+11	9.64	0	1.44E+09	6.80E+13
d_sector17	1.46E-09	.	.	.	.	.
d_sector18	1.34E+11	3.68E+11	9.34	0	6.20E+08	2.90E+13
d_sector19	7.90E+10	2.16E+11	9.2	0	3.77E+08	1.66E+13
d_sector20	2.61E-08	.	.	.	.	.
d_sector21	6.51E+09	1.01E+10	14.49	0	3.06E+08	1.38E+11
d_sector22	1.79E-10	.	.	.	.	.
d_sector23	4.31E+10	1.14E+11	9.24	0	2.38E+08	7.78E+12

d_sector24	1.11E+10	2.39E+10	10.71	0	1.61E+08	7.61E+11
d_sector25	1.92E+10	5.54E+10	8.19	0	6.63E+07	5.54E+12
d_sector26	1.73E+11	4.82E+11	9.29	0	7.38E+08	4.05E+13
d_sector27	1.87E+10	5.32E+10	8.3	0	7.01E+07	4.97E+12
d_sector28	1.50E-09	.	.	.	.	.
d_sector29	5.12E+10	1.45E+11	8.68	0	1.96E+08	1.34E+13
d_sector30	5.57E+10	1.53E+11	8.99	0	2.54E+08	1.22E+13
d_sector31	6.81E+10	1.96E+11	8.68	0	2.44E+08	1.90E+13
d_sector32	7.68E+09	1.98E+10	8.81	0	4.86E+07	1.21E+12
d_sector33	2.09E+11	5.68E+11	9.59	0	1.01E+09	4.31E+13
d_sector34	3.68E+10	1.03E+11	8.69	0	1.53E+08	8.88E+12
d_sector35	5.65E-09	.	.	.	.	.
d_sector36	8.65E-08	.	.	.	.	.
d_sector37	3.42E+11	9.60E+11	9.46	0	1.39E+09	8.40E+13
d_sector38	2.05E+11	5.84E+11	9.17	0	7.83E+08	5.39E+13
d_sector39	8.87E+10	2.49E+11	8.97	0	3.59E+08	2.19E+13
d_sector40	7.06E+11	1.96E+12	9.82	0	3.04E+09	1.64E+14
d_sector41	9.63E+10	2.72E+11	8.96	0	3.81E+08	2.44E+13
d_sector42	3.77E-09	.	.	.	.	.
d_sector43	3.30E+10	9.64E+10	8.3	0	1.08E+08	1.01E+13
d_sector44	5.04E+10	1.38E+11	8.99	0	2.33E+08	1.09E+13
d_sector45	8.61E+10	2.44E+11	8.87	0	3.31E+08	2.24E+13
d_sector46	6.05E+10	1.83E+11	8.19	0	1.59E+08	2.30E+13
d_sector47	1.44E+11	3.94E+11	9.4	0	6.80E+08	3.06E+13
d_sector48	8.60E+10	2.54E+11	8.51	0	2.62E+08	2.83E+13
d_sector49	9.22E-09	.	.	.	.	.
d_sector50	1.02E+11	2.77E+11	9.29	0	4.85E+08	2.13E+13
d_sector51	1.26E-09	.	.	.	.	.
d_sector52	4.56E+11	1.31E+12	9.31	0	1.61E+09	1.29E+14
d_sector53	2.26E-08	.	.	.	.	.
d_sector54	2.32E-09	.	.	.	.	.
d_sector55	9.17E+10	2.70E+11	8.56	0	2.83E+08	2.97E+13
d_sector56	3.29E+11	9.15E+11	9.55	0	1.43E+09	7.61E+13
d_sector57	8.99E+10	2.45E+11	9.26	0	4.32E+08	1.87E+13
d_sector58	2.39E-08	.	.	.	.	.
d_sector59	1.36E+11	3.71E+11	9.42	0	6.58E+08	2.82E+13
d_sector60	6.47E-09	.	.	.	.	.
d_sector61	7.83E+10	2.14E+11	9.18	0	3.71E+08	1.65E+13
d_sector62	5.65E-09	.	.	.	.	.
d_sector63	1.16E-08	.	.	.	.	.
d_sector64	9.46E+10	2.64E+11	9.04	0	3.96E+08	2.26E+13
d_sector65	5.85E+10	1.63E+11	8.87	0	2.45E+08	1.40E+13
d_sector66	1.05E+11	2.91E+11	9.14	0	4.53E+08	2.42E+13
d_sector67	1.39E-08	.	.	.	.	.
d_sector68	2.50E+11	6.81E+11	9.62	0	1.19E+09	5.24E+13
d_sector69	4.58E+10	1.25E+11	9	0	2.18E+08	9.62E+12
d_sector70	1.14E+11	3.18E+11	9.16	0	4.91E+08	2.67E+13
d_sector71	1.86E+11	5.19E+11	9.31	0	7.89E+08	4.39E+13
d_sector72	7.61E+10	2.13E+11	8.96	0	3.17E+08	1.83E+13
d_sector73	1.49E-08	.	.	.	.	.
d_sector74	6.00E-09	.	.	.	.	.
d_sector75	3.98E-07	.	.	.	.	.
d_sector76	4.28E-09	.	.	.	.	.
d_sector77	3.55E+11	9.85E+11	9.58	0	1.54E+09	8.17E+13
d_sector78	5.79E-08	.	.	.	.	.
d_sector79	3.22E+11	8.93E+11	9.55	0	1.40E+09	7.39E+13
d_sector80	8.04E+10	2.24E+11	9.01	0	3.41E+08	1.90E+13
d_sector81	9.74E-09	.	.	.	.	.

d_sector82	8.13E+10	2.27E+11	9.01	0	3.45E+08	1.92E+13
d_sector83	1.49E+11	4.07E+11	9.44	0	7.16E+08	3.11E+13
d_sector84	1.18E-08	.	.	.	.	.
d_sector85	1.31E+11	3.64E+11	9.18	0	5.55E+08	3.08E+13
d_sector86	3.04E+11	8.48E+11	9.49	0	1.29E+09	7.16E+13
d_sector87	1.52E+11	4.21E+11	9.28	0	6.59E+08	3.49E+13
d_sector88	3.56E+11	9.87E+11	9.59	0	1.55E+09	8.15E+13
d_sector89	1.44E+11	3.99E+11	9.26	0	6.25E+08	3.30E+13
d_sector90	6.07E-07	.	.	.	.	.
d_sector91	1.49E+11	4.14E+11	9.27	0	6.48E+08	3.43E+13
d_sector92	2.97E+11	8.24E+11	9.52	0	1.29E+09	6.82E+13
d_sector93	1.52E-08	.	.	.	.	.
d_sector94	3.71E+11	1.03E+12	9.61	0	1.62E+09	8.48E+13
d_sector95	2.52E-09	.	.	.	.	.
d_sector96	6.84E-08	.	.	.	.	.
d_sector97	1.29E+11	3.57E+11	9.22	0	5.60E+08	2.96E+13
d_sector98	1	(omitted)				
d_sector99	1	(omitted)				
d_sector100	1	(omitted)				
d_sector101	1	(omitted)				
d_sector102	1	(omitted)				
d_sector103	1	(omitted)				
d_sector104	1	(omitted)				
d_sector105	1	(omitted)				
d_sector106	1	(omitted)				

Cox regression on hypothesis 2 with financial control variables

Cox regression -- Breslow method for ties						
No. of subjects	190				Number of obs	3737
No. of failures	38				Wald chi2(73)	2851196.97
Time at risk	5463				Prob > chi2	0.0000
Log likelihood	-110.2455					
_t	**Haz. Ratio**	**Std. Err.**	**z**	**P > |z|**	**[95% Conf. Interval]**	
vc_invest	1.6628620	0.8245409	1.03	0.3050	0.6291908	4.3947080
Cash	1.000005	0.000026	0.19	0.8500	0.9999539	1.000056
Sales	1.000011	8.19E-06	1.31	0.1910	0.9999947	1.000027
EBIT	1.000072	0.0000829	0.86	0.387	0.9999091	1.000234
d_Country1	2.301334	1.682402	1.14	0.254	0.5491674	9.643945
d_Country2	5.75E-14	6.55E-14	-26.8	0	6.19E-15	5.35E-13
d_Country3	1.00E+00	(omitted)				
d_Country4	1.00E+00	(omitted)				
d_sector1	1.91E+10	2.44E+10	18.54	0	1.57E+09	2.34E+11
d_sector2	5.16E+10	5.98E+10	21.28	0	5.32E+09	5.01E+11
d_sector3	2.10E+10	2.40E+10	20.85	0	2.25E+09	1.96E+11
d_sector4	2.04E-04	2.09E-04	-8.3	0	2.74E-05	1.52E-03
d_sector5	3.73E+10	4.64E+10	19.56	0	3.25E+09	4.28E+11
d_sector6	1.00E+00	(omitted)				
d_sector7	4.34E+10	5.39E+10	19.74	0	3.81E+09	4.94E+11
d_sector8	1.16E+10	1.64E+10	16.43	0	7.31E+08	1.84E+11
d_sector9	3.63E+10	5.23E+10	16.91	0	2.17E+09	6.08E+11
d_sector10	4.76E+10	6.97E+10	16.77	0	2.69E+09	8.41E+11
d_sector11	1.11E+10	1.43E+10	18.04	0	9.03E+08	1.38E+11
d_sector12	9.96E-07	1.73E-06	-7.98	0	3.34E-08	2.97E-05

d_sector13	1.00E+00	(omitted)				
d_sector14	5.87E+10	7.88E+10	18.49	0	4.24E+09	8.14E+11
d_sector15	4.51E-03	5.48E-03	-4.45	0	4.17E-04	4.87E-02
d_sector16	7.94E+10	1.15E+11	17.36	0	4.66E+09	1.35E+12
d_sector17	7.02E+10	1.13E+11	15.48	0	2.97E+09	1.66E+12
d_sector18	1.00E+00	(omitted)				
d_sector19	3.23E-04	0.0005187	-5.01	0	0.0000139	0.0075124
d_sector20	1.00E+00	(omitted)				
d_sector21	5.01E-25	5.92E-25	-47.4	0	4.96E-26	5.07E-24
d_sector22	2.48E-23	2.90E-23	-44.51	0	2.51E-24	2.46E-22
d_sector23	1.00E+00	(omitted)				
d_sector24	3.03E-12	2.90E-12	-27.77	0	4.66E-13	1.97E-11
d_sector25	4.51E+10	.	.	.	.	.
d_sector26	5.32E-03	9.74E-03	-2.86	0.004	1.47E-04	1.92E-01
d_sector27	1.00E+00	(omitted)				
d_sector28	4.79E-26	6.74E-26	-41.46	0	3.04E-27	7.54E-25
d_sector29	5.40E-06	9.15E-06	-7.16	0	1.96E-07	1.49E-04
d_sector30	1.17E+00	1.03E+00	0.18	0.857	2.08E-01	6.59E+00
d_sector31	9.93E+10	1.26E+11	19.96	0	8.26E+09	1.19E+12
d_sector32	1.00E+00	(omitted)				
d_sector33	1.00E+00	(omitted)				
d_sector34	9.38E-03	1.14E-02	-3.85	0	8.70E-04	1.01E-01
d_sector35	1.00E+00	(omitted)				
d_sector36	9.87E-04	1.75E-03	-3.91	0	3.07E-05	3.17E-02
d_sector37	1.00E+00	(omitted)				
d_sector38	1.00E+00	(omitted)				
d_sector39	1.00E+00	(omitted)				
d_sector40	2.02E+11	3.64E+11	14.41	0	5.86E+09	6.95E+12
d_sector41	1.00E+00	(omitted)				
d_sector42	1.00E+00	(omitted)				
d_sector43	4.64E-03	7.83E-03	-3.18	0.001	1.70E-04	1.27E-01
d_sector44	2.12E-02	3.93E-02	-2.08	0.038	5.57E-04	8.06E-01
d_sector45	7.29E-06	1.28E-05	-6.75	0	2.35E-07	2.26E-04
d_sector46	1.07E+11	1.56E+11	17.47	0	6.21E+09	1.86E+12
d_sector47	1.00E+00	(omitted)				
d_sector48	7.47E-03	0.0129765	-2.82	0.005	0.0002479	0.2249973
d_sector49	3.29E-03	7.51E-03	-2.5	0.012	3.73E-05	2.89E-01
d_sector50	1.00E+00	(omitted)				
d_sector51	1.00E+00	(omitted)				
d_sector52	3.18E+11	4.27E+11	19.75	0	2.30E+10	4.41E+12
d_sector53	1.00E+00	(omitted)				
d_sector54	1.00E+00	(omitted)				
d_sector55	8.59E-03	0.0128406	-3.18	0.001	0.0004594	0.1607241
d_sector56	1.00E+00	(omitted)				
d_sector57	1.00E+00	(omitted)				
d_sector58	3.67E-04	1.05E-03	-2.75	0.006	1.31E-06	1.02E-01
d_sector59	1.00E+00	(omitted)				
d_sector60	7.09E-05	0.0001078	-6.28	0	3.59E-06	0.0013985
d_sector61	1.00E+00	(omitted)				
d_sector62	1.00E+00	(omitted)				
d_sector63	1.00E+00	(omitted)				
d_sector64	4.21E+10	4.55E+10	22.64	0	5.07E+09	3.50E+11
d_sector65	2.17E+10	2.42E+10	21.36	0	2.45E+09	1.93E+11
d_sector66	1.00E+00	(omitted)				
d_sector67	8.55E+10	1.80E+11	11.94	0	1.37E+09	5.33E+12
d_sector68	1.00E+00	(omitted)				
d_sector69	1.00E+00	(omitted)				
d_sector70	1.00E+00	(omitted)				

d_sector71	9.27E+10	1.03E+11	22.65	0	1.04E+10	8.24E+11
d_sector72	5.53E-05	0.0000822	-6.6	0	3.00E-06	0.0010181
d_sector73	1.00E+00	(omitted)				
d_sector74	1.00E+00	(omitted)				
d_sector75	1.00E+00	(omitted)				
d_sector76	1.00E+00	(omitted)				
d_sector77	1.00E+00	(omitted)				
d_sector78	1.00E+00	(omitted)				
d_sector79	1.00E+00	(omitted)				
d_sector80	3.47E-03	4.85E-03	-4.05	0	2.23E-04	5.38E-02
d_sector81	1.00E+00	(omitted)				
d_sector82	6.93E-05	1.00E-04	-6.62	0	4.07E-06	1.18E-03
d_sector83	1.00E+00	(omitted)				
d_sector84	1.00E+00	(omitted)				
d_sector85	5.67E-03	9.49E-03	-3.09	0.002	2.13E-04	1.51E-01
d_sector86	1.55E-02	2.53E-02	-2.55	0.011	6.30E-04	3.81E-01
d_sector87	1.00E+00	(omitted)				
d_sector88	1.00E+00	(omitted)				
d_sector89	1.00E+00	(omitted)				
d_sector90	1.00E+00	(omitted)				
d_sector91	1.00E+00	(omitted)				
d_sector92	1.00E+00	(omitted)				
d_sector93	1.00E+00	(omitted)				
d_sector94	1.00E+00	(omitted)				
d_sector95	1	(omitted)				
d_sector96	1	(omitted)				
d_sector97	1	(omitted)				
d_sector98	1	(omitted)				
d_sector99	1	(omitted)				
d_sector100	1	(omitted)				
d_sector101	1	(omitted)				
d_sector102	1	(omitted)				
d_sector103	1	(omitted)				
d_sector104	1	(omitted)				
d_sector105	1	(omitted)				
d_sector106	1	(omitted)				

Negative Binomial regression on hypothesis 3

Random-effects negative binomial regression				Number of obs		2.859
Group variable: id				Number of groups		310
Random effects u_i ~ Beta				**Obs per group:**		
Log likelihood	-2,599.9299			min		1
Wald chi2(44)	344.44			avg		9.2
Prob > chi2	0.0000			max		32
tmt_changes	**Coef.**	**Std. Err.**	**z**	**P > |z|**	**[95% Conf.**	**Interval]**
vc_invest	1.6446	0.1063	15.4700	0.0000	1.4363	1.8529
d_Country1	-0.3630	0.1396	-2.6000	0.0090	-0.6367	-0.0893
d_Country2	-0.7639	0.1335	-5.7200	0.0000	-1.0255	-0.5023
d_Country3	-1.3842	0.1995	-6.9400	0.0000	-1.7751	-0.9933
d_Country4	0.0000	(omitted)				
d_sector1	0.1007	0.1356	0.7400	0.4570	-0.1650	0.3664
d_sector2	0.1661	0.2288	0.7300	0.4680	-0.2823	0.6145
d_sector3	-0.1324	0.2204	-0.6000	0.5480	-0.5645	0.2996

d_sector4	-0.1235	0.2315	-0.5300	0.5940	-0.5772	0.3302
d_sector5	0.3319	0.2186	1.5200	0.1290	-0.0966	0.7603
d_sector6	0.0515	0.2411	0.2100	0.8310	-0.4211	0.5241
d_sector7	0.1012	0.2522	0.4000	0.6880	-0.3931	0.5955
d_sector8	-0.0277	0.2507	-0.1100	0.9120	-0.5192	0.4637
d_sector9	0.1533	0.2730	0.5600	0.5740	-0.3818	0.6883
d_sector10	-0.5336	0.2906	-1.8400	0.0660	-1.1032	0.0359
d_sector11	-0.4065	0.3760	-1.0800	0.2800	-1.1434	0.3304
d_sector12	-0.4784	0.3578	-1.3400	0.1810	-1.1797	0.2229
d_sector13	0.3282	0.3106	1.0600	0.2910	-0.2805	0.9369
d_sector14	0.2364	0.3490	0.6800	0.4980	-0.4476	0.9204
d_sector15	0.9711	0.4447	2.1800	0.0290	0.0995	1.8428
d_sector16	0.6168	0.3714	1.6600	0.0970	-0.1111	1.3447
d_sector17	-25.8416	102,988.8000	0.0000	1.0000	-201,880.3000	201,828.6000
d_sector18	0.2154	0.3513	0.6100	0.5400	-0.4732	0.9040
d_sector19	1.1972	0.6387	1.8700	0.0610	-0.0546	2.4490
d_sector20	1.1646	0.6288	1.8500	0.0640	-0.0678	2.3970
d_sector21	0.7213	0.7518	0.9600	0.3370	-0.7522	2.1948
d_sector22	-0.0500	0.7865	-0.0600	0.9490	-1.5915	1.4914
d_sector23	-1.0950	0.6787	-1.6100	0.1070	-2.4253	0.2352
d_sector24	-0.6888	0.7860	-0.8800	0.3810	-2.2292	0.8517
d_sector25	-0.2415	0.4237	-0.5700	0.5690	-1.0719	0.5889
d_sector26	-0.5377	0.4085	-1.3200	0.1880	-1.3383	0.2629
d_sector27	-25.3653	132,783.5000	0.0000	1.0000	-260,276.3000	260,225.6000
d_sector28	0.2646	0.4047	0.6500	0.5130	-0.5286	1.0579
d_sector29	-0.0240	0.6752	-0.0400	0.9720	-1.3473	1.2993
d_sector30	-0.3462	0.5584	-0.6200	0.5350	-1.4407	0.7483
d_sector31	-1.1259	0.7741	-1.4500	0.1460	-2.6430	0.3912
d_sector32	-0.3007	0.5665	-0.5300	0.5960	-1.4110	0.8097
d_sector33	0.6311	0.6213	1.0200	0.3100	-0.5866	1.8488
d_sector34	-0.5177	0.6012	-0.8600	0.3890	-1.6961	0.6607
d_sector35	0.1663	0.5056	0.3300	0.7420	-0.8247	1.1572
d_sector36	0.2888	0.7823	0.3700	0.7120	-1.2444	1.8221
d_sector37	-0.3437	0.5959	-0.5800	0.5640	-1.5117	0.8243
d_sector38	-0.0622	0.4963	-0.1300	0.9000	-1.0350	0.9106
d_sector39	1.3294	0.4620	2.8800	0.0040	0.4238	2.2350
d_sector40	-0.6462	0.6002	-1.0800	0.2820	-1.8225	0.5301
_cons	0.1505	0.2559	0.5900	0.5560	-0.3510	0.6520
/ln_r	3.063243	0.2243246			2.623575	3.502911
/ln_s	1.392362	0.182872			1.033939	1.750784
r	21.39684	4.799837			13.78492	33.212
s	4.024342	0.7359396			2.812121	5.759116
LR test vs. pooled: chibar2(01)			85.51	Prob >= chibar2		0.000

Negative Binomial regression on hypothesis 3 with financial control variables

Random-effects negative binomial regression				Number of obs		642
Group variable: id				Number of groups		136
Random effects u_i ~ Beta				**Obs per group:**		
Log likelihood	-606.59397			min		1
Wald chi2(44)	83.43			avg		4.7
Prob > chi2	0.0000			max		10
tmt_changes	**Coef.**	**Std. Err.**	**z**	**P > |z|**	**[95% Conf. Interval]**	
vc_invest	1.101653	0.192232	5.7300	0.0000	0.7249	1.4784
EBIT	0.0000	0.0000	-1.0900	0.2750	0.0000	0.0000
Sales	6.31E-06	2.99E-06	2.11	0.035	4.56E-07	0.0000122
Cash	-8.45E-06	8.63E-06	-0.98	0.327	-0.0000254	8.46E-06
d_Country1	0.9882759	0.2338927	4.2300000	0.0000000	0.5298546	1.4466970
d_Country2	0.7057707	0.4078044	1.7300000	0.0840000	-0.0935111	1.5050530
d_Country3	0.0000000	(omitted)				
d_Country4	0.0000000	(omitted)				
d_sector1	0.4065254	0.2679536	1.5200000	0.1290000	-0.1186539	0.9317048
d_sector2	0.3785477	0.3154053	1.2000000	0.2300000	-0.2396354	0.9967309
d_sector3	0.0887203	0.3270699	0.2700000	0.7860000	-0.5523248	0.7297655
d_sector4	0.0749063	0.2847040	0.2600000	0.7920000	-0.4831033	0.6329159
d_sector5	0.5775545	0.3106647	1.8600000	0.0630000	-0.0313371	1.1864460
d_sector6	-26.0541200	913769.4000000	0.0000000	1.0000000	-1790981.0000000	1790929.0000000
d_sector7	0.5791188	0.3498641	1.6600000	0.0980000	-0.1066022	1.2648400
d_sector8	-0.0482706	0.4078424	-0.1200000	0.9060000	-0.8476271	0.7510859
d_sector9	0.3011323	0.3604088	0.8400000	0.4030000	-0.4052559	1.0075200
d_sector10	-0.2552258	0.5842222	-0.4400000	0.6620000	-1.4002800	0.8898287
d_sector11	-0.4265175	0.8138128	-0.5200000	0.6000000	-2.0215610	1.1685260
d_sector12	-0.0758864	0.4799166	-0.1600000	0.8740000	-1.0165060	0.8647328
d_sector13	0.0000000	(omitted)				
d_sector14	0.5536147	0.3777070	1.4700000	0.1430000	-0.1866774	1.2939070
d_sector15	0.8240838	0.6215616	1.3300000	0.1850000	-0.3941546	2.0423220
d_sector16	-0.4717641	0.9766220	-0.4800000	0.6290000	-2.3859080	1.4423800
d_sector17	-26.7869600	462731.7	0.0000000	1.0000000	-906964.2000000	906910.7000000
d_sector18	0.0000000	(omitted)				
d_sector19	1.0088180	0.7292929	1.3800000	0.1670000	-0.4205702	2.4382050
d_sector20	-0.0187443	0.6957811	-0.0300000	0.9790000	-1.3824500	1.3449620
d_sector21	2.0305930	0.5735434	3.5400000	0.0000000	0.9064685	3.1547170
d_sector22	0.0651701	0.8338783	0.0800000	0.9380000	-1.5692010	1.6995420
d_sector23	0.0000000	(omitted)				
d_sector24	0.0805659	0.7233638	0.1100000	0.9110000	-1.3372010	1.4983330
d_sector25	0.5396037	0.4480053	1.2000000	0.2280000	-0.3384707	1.4176780
d_sector26	0.0000000	(omitted)				
d_sector27	-26.1388800	288592.2000000	0.0000000	1.0000000	-565,657	565604.2
d_sector28	0.8372437	0.6196730	1.3500000	0.1770000	-0.3772931	2.0517800
d_sector29	0.4189336	0.6601565	0.6300000	0.5260000	-0.8749492	1.7128170
d_sector30	-0.3300229	0.8048922	-0.4100000	0.6820000	-1.9075830	1.2475370
d_sector31	0.0000000	(omitted)				
d_sector32	-0.2108365	0.6268590	-0.3400000	0.7370000	-1.4394580	1.0177840
d_sector33	0.0000000	(omitted)				
d_sector34	-26.2377800	396363.4	0.0000000	1.0000000	-776884.3	776,832
d_sector35	0.0000000	(omitted)				
d_sector36	0.7957108	0.7011540	1.1300000	0.2560000	-0.5785258	2.1699470
d_sector37	0.0000000	(omitted)				
d_sector38	0.0000000	(omitted)				
d_sector39	1.6827850	0.5376181	3.1300000	0.0020000	0.6290724	2.7364970

d_sector40	0.0000000	(omitted)				
_cons	-0.1163377	0.8770652	-0.1300000	0.8940000	-1.8353540	1.6026780
/ln_r	4.429831	0.7237489			3.011309	5.848353
/ln_s	2.078238	0.5731211			0.9549418	3.201535
r	83.91724	60.73501			20.31398	346.6629
s	7.990381	4.579456			2.598519	24.57022
LR test vs. pooled: chibar2(01)			5.08	Prob >= chibar2		0.012

Cox regression on hypothesis 4

Cox regression -- Breslow method for ties						
No. of subjects	499.0				Number of obs	27,670.0
No. of failures	163.0				Wald chi2(66)	27,321.2
Log likelihood	-807.1				Prob > chi2	0.0000
Time at risk	38,619.0				**Wald test p-value**	0.0795
_t	**Haz. Ratio**	**Std. Err.**	**z**	**P > |z|**	**[95% Conf. Interval]**	
ivc_invest	4.895073	1.798736	4.320000	0.0000	2.382199	10.058670
other_vc_invest	3.589615	1.378483	3.330000	0.0010	1.691101	7.619494
d_Country1	1.628532	0.423135	1.880000	0.0610	0.978660	2.709945
d_Country2	0.965267	0.283376	-0.120000	0.9040	0.542948	1.716077
d_Country3	0.667674	0.320036	-0.840000	0.3990	0.260950	1.708327
d_Country4	1	(omitted)				
d_sector1	5.55E+10	2.88E+10	47.74	0	2.01E+10	1.53E+11
d_sector2	3.75E+10	2.13E+10	42.93	0	1.23E+10	1.14E+11
d_sector3	3.95E+10	2.17E+10	44.52	0	1.35E+10	1.16E+11
d_sector4	2.46E+10	1.38E+10	42.72	0	8.21E+09	7.38E+10
d_sector5	4.64E+10	2.49E+10	45.75	0	1.62E+10	1.33E+11
d_sector6	3.87E+10	1.98E+10	47.82	0	1.43E+10	1.05E+11
d_sector7	4.37E+10	2.31E+10	46.37	0	1.55E+10	1.23E+11
d_sector8	2.71E+10	2.22E+10	29.42	0	5.48E+09	1.34E+11
d_sector9	5.48E+10	3.41E+10	39.73	0	1.62E+10	1.86E+11
d_sector10	4.12E+10	2.12E+10	47.47	0	1.50E+10	1.13E+11
d_sector11	2.01E+10	1.33E+10	35.82	0	5.49E+09	7.36E+10
d_sector12	3.04E+10	2.16E+10	33.92	0	7.54E+09	1.23E+11
d_sector13	6.23E+10	3.86E+10	40.14	0	1.85E+10	2.10E+11
d_sector14	1.82E+11	1.27E+11	37.07	0	4.62E+10	7.17E+11
d_sector15	2.23E+10	1.41E+10	37.5	0	6.40E+09	7.73E+10
d_sector16	6.52E+10	3.22E+10	50.43	0	2.48E+10	1.72E+11
d_sector17	1.66E-09	.	.	.	.	.
d_sector18	3.71E+10	2.51E+10	36.06	0	9.90E+09	1.39E+11
d_sector19	3.53E+11	2.08E+11	45.04	0	1.11E+11	1.12E+12
d_sector20	1.19E+11	6.93E+10	43.74	0	3.79E+10	3.73E+11
d_sector21	1.99E-09	.	.	.	.	.
d_sector22	2.37E-09	.	.	.	.	.
d_sector23	1.16E+10	.	.	.	.	.
d_sector24	1.18E-09	.	.	.	.	.
d_sector25	2.36E+10	2.46E+10	22.95	0	3.07E+09	1.82E+11
d_sector26	1.69E-09	.	.	.	.	.
d_sector27	3.68E+10	2.15E+10	41.58	0	1.17E+10	1.16E+11
d_sector28	1.85E-09	.	.	.	.	.
d_sector29	9.37E+10	5.02E+10	47.21	0	3.28E+10	2.67E+11

d_sector30	9.37E-09	.	.	.	.	.
d_sector31	3.92E+10	3.58E+10	26.69	0	6.53E+09	2.35E+11
d_sector32	2.71E-09	.	.	.	.	.
d_sector33	2.41E+11	1.16E+11	54.44	0	9.37E+10	6.19E+11
d_sector34	2.01E+10	1.08E+10	44.08	0	7.01E+09	5.78E+10
d_sector35	9.11E+10	6.11E+10	37.63	0	2.45E+10	3.39E+11
d_sector36	3.00E-09	.	.	.	.	.
d_sector37	4.56E+10	3.77E+10	29.72	0	9.04E+09	2.30E+11
d_sector38	8.46E+10	9.54E+10	22.33	0	9.30E+09	7.70E+11
d_sector39	2.43E+10	1.39E+10	41.78	0	7.92E+09	7.46E+10
d_sector40	2.27E-08	.	.	.	.	.
d_sector41	2.14E-09	.	.	.	.	.
d_sector42	6.42E+10	4.71E+10	33.89	0	1.52E+10	2.71E+11
d_sector43	5.92E-09	.	.	.	.	.
d_sector44	5.34E-09	.	.	.	.	.
d_sector45	1.29E+11	1.03E+11	31.89	0	2.67E+10	6.20E+11
d_sector46	6.63E+10	3.37E+10	49.07	0	2.45E+10	1.79E+11
d_sector47	4.36E+10	2.52E+10	42.41	0	1.40E+10	1.35E+11
d_sector48	1.10E+11	7.24E+10	38.79	0	3.06E+10	3.99E+11
d_sector49	6.48E-09	.	.	.	.	.
d_sector50	1.04E+11	5.30E+10	49.86	0	3.84E+10	2.83E+11
d_sector51	3.29E-09	.	.	.	.	.
d_sector52	1.32E+11	1.82E+11	18.54	0	8.81E+09	1.98E+12
d_sector53	2.79E+10	1.33E+10	50.27	0	1.09E+10	7.11E+10
d_sector54	2.46E+10	1.18E+10	49.88	0	9.60E+09	6.29E+10
d_sector55	7.24E+10	7.53E+10	24.04	0	9.42E+09	5.56E+11
d_sector56	3.65E-09	.	.	.	.	.
d_sector57	2.13E+11	1.07E+11	51.91	0	7.95E+10	5.70E+11
d_sector58	5.85E-09	.	.	.	.	.
d_sector59	3.88E+10	1.77E+10	53.31	0	1.58E+10	9.50E+10
d_sector60	2.07E-09	.	.	.	.	.
d_sector61	2.48E+10	1.18E+10	50.21	0	9.73E+09	6.30E+10
d_sector62	3.84E+10	1.76E+10	53.28	0	1.57E+10	9.42E+10
d_sector63	7.69E+10	4.03E+10	47.76	0	2.75E+10	2.15E+11
d_sector64	3.39E+10	1.68E+10	48.84	0	1.28E+10	8.96E+10
d_sector65	2.85E+10	1.43E+10	48.16	0	1.07E+10	7.60E+10
d_sector66	1.81E+11	9.92E+10	47.32	0	6.19E+10	5.30E+11
d_sector67	3.98E-09	.	.	.	.	.
d_sector68	4.80E-09	.	.	.	.	.
d_sector69	3.91E-09	.	.	.	.	.
d_sector70	3.81E-09	.	.	.	.	.
d_sector71	4.31E+10	2.15E+10	49.23	0	1.63E+10	1.14E+11
d_sector72	4.39E+10	2.24E+10	48.05	0	1.62E+10	1.19E+11
d_sector73	4.39E-09	.	.	.	.	.
d_sector74	7.88E+10	3.74E+10	52.95	0	3.11E+10	2.00E+11
d_sector75	3.97E-09	.	.	.	.	.
d_sector76	4.19E-09	.	.	.	.	.
d_sector77	4.27E+11	2.38E+11	48	0	1.43E+11	1.28E+12
d_sector78	6.54E+10	3.26E+10	49.98	0	2.46E+10	1.74E+11
d_sector79	1.20E-08	.	.	.	.	.
d_sector80	7.90E-09	.	.	.	.	.
d_sector81	2.21E-08	.	.	.	.	.
d_sector82	1.01E+11	5.19E+10	49.22	0	3.67E+10	2.76E+11
d_sector83	7.66E+10	3.87E+10	49.62	0	2.85E+10	2.06E+11
d_sector84	1.49E-08	.	.	.	.	.
d_sector85	1.06E-08	.	.	.	.	.
d_sector86	4.84E+11	2.62E+11	49.79	0	1.68E+11	1.40E+12
d_sector87	2.10E+11	1.17E+11	47.01	0	7.10E+10	6.24E+11

d_sector88	1.64E-08	.	.	.	.	.
d_sector89	1.20E-08	.	.	.	.	.
d_sector90	1.03E-08	.	.	.	.	.
d_sector91	4.13E+11	2.30E+11	47.97	0	1.39E+11	1.23E+12
d_sector92	4.81E+11	2.91E+11	44.37	0	1.47E+11	1.58E+12
d_sector93	1.20E-08	.	.	.	.	.
d_sector94	1.63E+11	8.76E+10	48.14	0	5.71E+10	4.67E+11
d_sector95	9.91E+10	5.02E+10	50	0	3.67E+10	2.67E+11
d_sector96	5.25E+11	2.94E+11	48.28	0	1.76E+11	1.57E+12
d_sector97	1.18E-08	.	.	.	.	.
d_sector98	1	(omitted)				
d_sector99	1	(omitted)				
d_sector100	1	(omitted)				
d_sector101	1	(omitted)				
d_sector102	1	(omitted)				
d_sector103	1	(omitted)				
d_sector104	1	(omitted)				
d_sector105	1	(omitted)				
d_sector106	1	(omitted)				

Cox regression on hypothesis 4 with financial control variables

Cox regression -- Breslow method for ties						
No. of subjects		133		Number of obs		4713
No. of failures		14		Wald chi2(31)		176065.36
Log pseudolikelihood		-20.004212		Prob > chi2		0.0000
Time at risk		5754		**Wald test p-value**		0.0212
_t	**Haz. Ratio**	**Std. Err.**	**z**	**P>z**	**[95% Conf.**	**Interval]**
ivc_invest	101.0565000	111.545500	4.18	0.0000	11.614860	879.26
other_vc_invest	2.9380030	3.578211	0.88	0.376	2.70E-01	31.97
Cash	0.9996034	0.0002178	-1.82	0.069	0.9991766	1.0000
EBIT	1.000007	0.000114	0.07	0.948	0.9997839	1.0002
Sales	1.0000410	0.0000249	1.65	0.099	0.9999923	1.0001
d_Country1	0.1468	0.1618724	-1.74	0.082	0.0169115	1.2744
d_Country2	211.1281	629	1.8	0.072	0.6139467	72,604
d_Country3	1.00E+00	(omitted)				
d_Country4	1.0000000	(omitted)				
d_sector1	7.3459580	9.3977850	1.56	0.119	0.5985418	90.1576000
d_sector2	18.6610100	22.6319700	2.41	0.016	1.732219	201.0331000
d_sector3	0	0	-26.76	0	0	0
d_sector4	2.67E-16	3.52E-16	-27.18	0	2.01E-17	3.55E-15
d_sector5	1.53E+00	2.14E+00	0.31	1	9.91E-02	2.37E+01
d_sector6	1	(omitted)				
d_sector7	2.66E-12	6.10E-12	-11.6	0	2.94E-14	2.40E-10
d_sector8	5.35E-16	6.74E-16	-27.9	0	4.52E-17	6.33E-15
d_sector9	2.09E-01	2.87E-01	-1.14	0	1.41E-02	3.09E+00
d_sector10	3.77E-16	5.84E-16	-22.93	0	1.81E-17	0
d_sector11	6.93E-15	1.16E-14	-19.44	0	2.59E-16	1.85E-13
d_sector12	6.85E-17	1.14E-16	-22.35	0	2.62E-18	1.79E-15
d_sector13	1.00E+00	(omitted)				
d_sector14	3	2	1.6	0.109	0.7958566	10
d_sector15	0	0	-27.58	0	6.50E-17	0
d_sector16	9.53E-10	.	.	.	.	.
d_sector17	5.27E-19	1.51E-18	-14.69	0	1.92E-21	1.45E-16

d_sector18	1.00E+00	(omitted)				
d_sector19	247.6812	314.7032	4.34	0	20.52856	2988.325
d_sector20	0	0	-23.52	0	0	1.16E-23
d_sector21	1.00E+00	(omitted)				
d_sector22	1	(omitted)				
d_sector23	1	(omitted)				
d_sector24	1	(omitted)				
d_sector25	536.5588	1094.866	3.08	0.002	9.833588	29276.73
d_sector26	0	0	-20.97	0	8.58E-17	4.78E-14
d_sector27	1.00E+00	(omitted)				
d_sector28	8.67E-26	1.31E-25	-38.33	0	4.54E-27	1.66E-24
d_sector29	8.93E-18	1.05E-17	-33.34	0	8.88E-19	8.98E-17
d_sector30	1.00E+00	(omitted)				
d_sector31	9.68E-18	1.19E-17	-31.85	0	8.68E-19	1.08E-16
d_sector32	1.00E+00	(omitted)				
d_sector33	1	(omitted)				
d_sector34	2.98E-15	4.51E-15	-22.07	0	1.53E-16	5.81E-14
d_sector35	1.00E+00	(omitted)				
d_sector36	4.35E-15	6.45E-15	-22.3	0	2.38E-16	7.96E-14
d_sector37	1.00E+00	(omitted)				
d_sector38	1	(omitted)				
d_sector39	1	(omitted)				
d_sector40	1.26E-15	2.13E-15	-20.36	0	4.65E-17	3.43E-14

Cox regression on hypothesis 5

Cox regression -- Breslow method for ties						
No. of subjects	630.0				Number of obs	21,018.0
No. of failures	279.0				Wald chi2(74)	40,013.5
Log likelihood	-1419.177				Prob > chi2	0.0000
Time at risk	33,486.0				**Wald test p-value**	0.4889
_t	**Haz. Ratio**	**Std. Err.**	**z**	**P > |z|**	**[95% Conf. Interval]**	
ivc_invest	3.238231	0.706484	5.390000	0.0000	2.111550	4.966085
other_vc_invest	3.731802	0.897523	5.480000	0.0000	2.329158	5.979133
d_Country1	0.567783	0.165195	-1.950000	0.0520	0.321017	1.004238
d_Country2	0.278862	0.084370	-4.220000	0.0000	0.154120	0.504570
d_Country3	0.307075	0.110996	-3.270000	0.0010	0.151205	0.623623
d_Country4	1	(omitted)				
d_sector1	1.19E+11	3.38E+11	9.01	0	4.64E+08	3.07E+13
d_sector2	1.26E+11	3.58E+11	9	0	4.84E+08	3.29E+13
d_sector3	6.89E+10	1.96E+11	8.78	0	2.62E+08	1.81E+13
d_sector4	1.73E+10	5.04E+10	8.07	0	5.64E+07	5.28E+12
d_sector5	9.78E+10	2.77E+11	8.94	0	3.80E+08	2.51E+13
d_sector6	9.53E+10	2.66E+11	9.07	0	4.04E+08	2.25E+13
d_sector7	7.71E+10	2.20E+11	8.8	0	2.89E+08	2.05E+13
d_sector8	1.03E+11	2.94E+11	8.87	0	3.80E+08	2.78E+13
d_sector9	1.00E+11	2.88E+11	8.82	0	3.62E+08	2.79E+13
d_sector10	6.99E+10	1.98E+11	8.81	0	2.71E+08	1.80E+13
d_sector11	6.58E+10	1.89E+11	8.68	0	2.37E+08	1.83E+13
d_sector12	1.30E+09	.	.	.	.	.
d_sector13	1.17E+11	3.28E+11	9.07	0	4.73E+08	2.88E+13
d_sector14	3.42E+11	9.89E+11	9.17	0	1.17E+09	9.98E+13
d_sector15	3.55E+10	1.05E+11	8.2	0	1.07E+08	1.18E+13
d_sector16	3.27E+11	9.16E+11	9.47	0	1.35E+09	7.90E+13

d_sector17	1.96E-09	.	.	.	.	.
d_sector18	1.48E+11	4.14E+11	9.16	0	6.01E+08	3.62E+13
d_sector19	8.27E+10	2.30E+11	9.03	0	3.53E+08	1.94E+13
d_sector20	3.43E-08	.	.	.	.	.
d_sector21	7.06E+09	1.13E+10	14.12	0	3.03E+08	1.64E+11
d_sector22	2.23E-10	.	.	.	.	.
d_sector23	4.13E+10	1.11E+11	9.09	0	2.13E+08	8.01E+12
d_sector24	1.21E+10	2.68E+10	10.47	0	1.57E+08	9.30E+11
d_sector25	2.05E+10	6.05E+10	8.04	0	6.26E+07	6.69E+12
d_sector26	1.79E+11	5.09E+11	9.11	0	6.81E+08	4.71E+13
d_sector27	1.97E+10	5.70E+10	8.18	0	6.71E+07	5.76E+12
d_sector28	6.79E-10	.	.	.	.	.
d_sector29	5.49E+10	1.59E+11	8.52	0	1.86E+08	1.62E+13
d_sector30	5.29E+10	1.48E+11	8.81	0	2.18E+08	1.28E+13
d_sector31	7.39E+10	2.17E+11	8.53	0	2.36E+08	2.32E+13
d_sector32	7.18E+09	1.87E+10	8.7	0	4.31E+07	1.20E+12
d_sector33	2.18E+11	6.05E+11	9.4	0	9.40E+08	5.05E+13
d_sector34	3.89E+10	1.11E+11	8.52	0	1.42E+08	1.06E+13
d_sector35	6.97E-09	.	.	.	.	.
d_sector36	1.14E-07	.	.	.	.	.
d_sector37	3.91E+11	1.13E+12	9.27	0	1.38E+09	1.10E+14
d_sector38	2.06E+11	5.95E+11	9.04	0	7.26E+08	5.87E+13
d_sector39	9.92E+10	2.85E+11	8.81	0	3.55E+08	2.77E+13
d_sector40	7.73E+11	2.20E+12	9.64	0	2.95E+09	2.03E+14
d_sector41	9.78E+10	2.80E+11	8.83	0	3.55E+08	2.69E+13
d_sector42	5.00E-09	.	.	.	.	.
d_sector43	3.29E+10	9.77E+10	8.15	0	9.74E+07	1.11E+13
d_sector44	5.45E+10	1.53E+11	8.81	0	2.22E+08	1.33E+13
d_sector45	9.76E+10	2.84E+11	8.7	0	3.27E+08	2.91E+13
d_sector46	6.29E+10	1.94E+11	8.05	0	1.47E+08	2.69E+13
d_sector47	1.56E+11	4.37E+11	9.22	0	6.50E+08	3.76E+13
d_sector48	8.77E+10	2.63E+11	8.39	0	2.43E+08	3.17E+13
d_sector49	4.20E-09	.	.	.	.	.
d_sector50	1.11E+11	3.11E+11	9.1	0	4.66E+08	2.65E+13
d_sector51	1.75E-09	.	.	.	.	.
d_sector52	4.97E+11	1.46E+12	9.18	0	1.58E+09	1.57E+14
d_sector53	2.95E-08	.	.	.	.	.
d_sector54	3.28E-09	.	.	.	.	.
d_sector55	9.06E+10	2.73E+11	8.37	0	2.46E+08	3.34E+13
d_sector56	3.80E+11	1.08E+12	9.36	0	1.43E+09	1.01E+14
d_sector57	9.82E+10	2.74E+11	9.07	0	4.15E+08	2.33E+13
d_sector58	3.18E-08	.	.	.	.	.
d_sector59	1.32E+11	3.66E+11	9.27	0	5.91E+08	2.97E+13
d_sector60	3.19E-09	.	.	.	.	.
d_sector61	8.19E+10	2.28E+11	9.02	0	3.48E+08	1.92E+13
d_sector62	7.13E-09	.	.	.	.	.
d_sector63	5.45E-09	.	.	.	.	.
d_sector64	1.00E+11	2.86E+11	8.85	0	3.66E+08	2.73E+13
d_sector65	6.20E+10	1.77E+11	8.68	0	2.27E+08	1.69E+13
d_sector66	1.18E+11	3.37E+11	8.96	0	4.48E+08	3.13E+13
d_sector67	7.43E-09	.	.	.	.	.
d_sector68	2.75E+11	7.68E+11	9.42	0	1.15E+09	6.58E+13
d_sector69	5.04E+10	1.41E+11	8.82	0	2.10E+08	1.21E+13
d_sector70	1.32E+11	3.77E+11	8.98	0	4.93E+08	3.55E+13
d_sector71	1.72E+11	4.85E+11	9.15	0	6.74E+08	4.37E+13
d_sector72	8.04E+10	2.30E+11	8.77	0	2.93E+08	2.21E+13
d_sector73	2.17E-08	.	.	.	.	.
d_sector74	7.44E-09	.	.	.	.	.

d_sector75	2.17E-07	.	.	.	.	.
d_sector76	5.94E-09	.	.	.	.	.
d_sector77	3.58E+11	1.01E+12	9.44	0	1.43E+09	8.97E+13
d_sector78	7.55E-08	.	.	.	.	.
d_sector79	3.71E+11	1.06E+12	9.36	0	1.40E+09	9.81E+13
d_sector80	8.52E+10	2.43E+11	8.81	0	3.16E+08	2.30E+13
d_sector81	1.37E-08	.	.	.	.	.
d_sector82	8.58E+10	2.45E+11	8.82	0	3.19E+08	2.31E+13
d_sector83	1.62E+11	4.53E+11	9.25	0	6.85E+08	3.85E+13
d_sector84	1.52E-08	.	.	.	.	.
d_sector85	1.21E+11	3.41E+11	9.03	0	4.74E+08	3.08E+13
d_sector86	7.97E+11	2.26E+12	9.66	0	3.07E+09	2.07E+14
d_sector87	1.74E+11	4.97E+11	9.1	0	6.60E+08	4.61E+13
d_sector88	3.63E+11	1.02E+12	9.45	0	1.45E+09	9.09E+13
d_sector89	1.66E+11	4.72E+11	9.08	0	6.27E+08	4.39E+13
d_sector90	7.43E-07	.	.	.	.	.
d_sector91	1.50E+11	4.22E+11	9.14	0	6.00E+08	3.74E+13
d_sector92	3.42E+11	9.73E+11	9.33	0	1.29E+09	9.04E+13
d_sector93	2.20E-08	.	.	.	.	.
d_sector94	3.78E+11	1.06E+12	9.47	0	1.51E+09	9.42E+13
d_sector95	3.39E-09	.	.	.	.	.
d_sector96	3.44E-08	.	.	.	.	.
d_sector97	1.48E+11	4.22E+11	9.04	0	5.61E+08	3.92E+13
d_sector98	1	(omitted)				
d_sector99	1	(omitted)				
d_sector100	1	(omitted)				
d_sector101	1	(omitted)				
d_sector102	1	(omitted)				
d_sector103	1	(omitted)				
d_sector104	1	(omitted)				
d_sector105	1	(omitted)				
d_sector106	1	(omitted)				

Cox regression on hypothesis 5 with financial control variables

Cox regression -- Breslow method for ties						
No. of subjects	190.0				Number of obs	3,739.0
No. of failures	38.0				Wald chi2(74)	41,332.3
Log likelihood	-10,701,139				Prob > chi2	0.0000
Time at risk	5,463.0				**Wald test p-value**	0.0013
_t	**Haz. Ratio**	**Std. Err.**	**z**	**P > |z|**	**[95% Conf. Interval]**	
ivc_invest	2.424123	1.159205	1.850000	0.0640	0.949541	6.188646
other_vc_invest	0.240872	0.158406	-2.160000	0.0300	0.066375	0.874115
Cash	1.000006	0.000029	0.210000	0.8360	0.999949	1.000063
Sales	1.000014	0.000008	1.640000	0.1020	0.999997	1.000030
EBIT	1.000087	0.000082	1.060000	0.2900	0.999926	1.000248
d_Country1	4.190207	2.504685	2.4	0.017	1.29847	13.52194
d_Country2	1.01E-13	1.20E-13	-25.18	0	9.79E-15	1.03E-12
d_Country3	1.00E+00	(omitted)				
d_Country4	1.00E+00	(omitted)				
d_sector1	1.41E+14	1.76E+14	26.05	0	1.21E+13	1.63E+15
d_sector2	3.50E+14	4.03E+14	29.12	0	3.68E+13	3.34E+15
d_sector3	1.02E+14	1.21E+14	27.1	0	9.86E+12	1.05E+15
d_sector4	4.65E+00	4.87E+00	1.47	0.142	5.98E-01	3.62E+01

d_sector5	1.55E+14	1.99E+14	25.41	0	1.24E+13	1.92E+15
d_sector6	1.00E+00	(omitted)				
d_sector7	6.92E+14	8.98E+14	26.35	0	5.45E+13	8.80E+15
d_sector8	4.70E+13	7.53E+13	19.65	0	2.04E+12	1.09E+15
d_sector9	3.35E+14	4.98E+14	22.51	0	1.82E+13	6.17E+15
d_sector10	2.35E+14	3.59E+14	21.66	0	1.18E+13	4.69E+15
d_sector11	8.09E+13	1.19E+14	21.86	0	4.58E+12	1.43E+15
d_sector12	1.09E-02	1.92E-02	-2.56	0.01	3.43E-04	3.44E-01
d_sector13	1.00E+00	(omitted)				
d_sector14	3.78E+14	4.91E+14	25.85	0	2.97E+13	4.82E+15
d_sector15	7.33E+00	9.04E+00	1.61	0.106	6.53E-01	8.22E+01
d_sector16	5.48E+14	7.76E+14	23.98	0	3.42E+13	8.79E+15
d_sector17	3.84E+14	7.51E+14	17.18	0	8.34E+12	1.77E+16
d_sector18	1.00E+00	(omitted)				
d_sector19	5.32E-01	0.842377	-0.4	0.69	0.0239551	11.83191
d_sector20	1.00E+00	(omitted)				
d_sector21	1.29E-17	4.69E-17	-10.71	0	1.05E-20	1.60E-14
d_sector22	2.24E-19	8.20E-19	-11.71	0	1.70E-22	2.95E-16
d_sector23	1.00E+00	(omitted)				
d_sector24	1.47E-04	4.53E-04	-2.86	0.004	3.42E-07	6.28E-02
d_sector25	2.00E+14	.	.	.	.	.
d_sector26	2.16E+00	3.94E+00	0.42	0.673	6.06E-02	7.71E+01
d_sector27	1.00E+00	(omitted)				
d_sector28	1.30E-16	4.83E-16	-9.87	0	9.12E-20	1.86E-13
d_sector29	1.29E-01	2.15E-01	-1.23	0.218	5.02E-03	3.34E+00
d_sector30	1.51E+06	3.33E+06	6.47	0	2.03E+04	1.13E+08
d_sector31	7.90E+14	9.56E+14	28.35	0	7.38E+13	8.47E+15
d_sector32	1.00E+00	(omitted)				
d_sector33	1.00E+00	(omitted)				
d_sector34	1.40E+01	1.70E+01	2.17	0.03	1.29E+00	1.52E+02
d_sector35	1.00E+00	(omitted)				
d_sector36	2.64E+01	4.57E+01	1.89	0.059	8.88E-01	7.85E+02
d_sector37	1.00E+00	(omitted)				
d_sector38	1.00E+00	(omitted)				
d_sector39	1.00E+00	(omitted)				
d_sector40	1.85E+15	3.35E+15	19.42	0	5.33E+13	6.43E+16
d_sector41	1.00E+00	(omitted)				
d_sector42	1.00E+00	(omitted)				
d_sector43	8.82E+01	1.46E+02	2.71	0.007	3.45E+00	2.26E+03
d_sector44	4.23E-01	7.81E-01	-0.47	0.641	1.14E-02	1.57E+01
d_sector45	1.45E+01	2.53E+01	1.54	0.124	4.79E-01	4.42E+02
d_sector46	5.80E+14	8.01E+14	24.61	0	3.87E+13	8.69E+15
d_sector47	1.00E+00	(omitted)				
d_sector48	4.11E+00	7.082686	0.82	0.412	0.1401523	120.4783
d_sector49	3.55E+01	8.49E+01	1.49	0.136	3.27E-01	3.86E+03
d_sector50	1.00E+00	(omitted)				
d_sector51	1.00E+00	(omitted)				
d_sector52	3.42E+15	4.62E+15	26.43	0	2.41E+14	4.85E+16
d_sector53	1.00E+00	(omitted)				
d_sector54	1.00E+00	(omitted)				
d_sector55	3.17E+01	54.83515	2	0.046	1.069815	939.9737
d_sector56	1.00E+00	(omitted)				
d_sector57	1.00E+00	(omitted)				
d_sector58	1.62E+01	4.80E+01	0.94	0.347	4.88E-02	5.37E+03
d_sector59	1.00E+00	(omitted)				
d_sector60	3.14E+00	4.91E+00	0.73	0.463	1.47E-01	6.71E+01
d_sector61	1.00E+00	(omitted)				
d_sector62	1.00E+00	(omitted)				

d_sector63	1.00E+00	(omitted)				
d_sector64	1.62E+14	1.82E+14	29.16	0	1.80E+13	1.46E+15
d_sector65	6.25E+13	7.38E+13	26.94	0	6.20E+12	6.31E+14
d_sector66	1.00E+00	(omitted)				
d_sector67	2.36E+15	5.08E+15	16.41	0	3.44E+13	1.62E+17
d_sector68	1.00E+00	(omitted)				
d_sector69	1.00E+00	(omitted)				
d_sector70	1.00E+00	(omitted)				
d_sector71	3.05E+15	4.17E+15	26.03	0	2.08E+14	4.46E+16
d_sector72	1.54E+01	23.36498	1.8	0.072	0.7811935	302.424
d_sector73	1.00E+00	(omitted)				
d_sector74	1.00E+00	(omitted)				
d_sector75	1.00E+00	(omitted)				
d_sector76	1.00E+00	(omitted)				
d_sector77	1.00E+00	(omitted)				
d_sector78	1.00E+00	(omitted)				
d_sector79	1.00E+00	(omitted)				
d_sector80	3.82E+00	5.41E+00	0.95	0.344	2.38E-01	6.14E+01
d_sector81	1.00E+00	(omitted)				
d_sector82	2.63E+01	3.91E+01	2.2	0.028	1.43E+00	4.85E+02
d_sector83	1.00E+00	(omitted)				
d_sector84	1.00E+00	(omitted)				
d_sector85	1.01E+01	1.71E+01	1.35	0.176	3.56E-01	2.84E+02
d_sector86	8.50E+00	1.42E+01	1.28	0.2	3.23E-01	2.24E+02
d_sector87	1.00E+00	(omitted)				
d_sector88	1.00E+00	(omitted)				
d_sector89	1.00E+00	(omitted)				
d_sector90	1.00E+00	(omitted)				
d_sector91	1.00E+00	(omitted)				
d_sector92	1.00E+00	(omitted)				
d_sector93	1.00E+00	(omitted)				
d_sector94	1.00E+00	(omitted)				
d_sector95	1	(omitted)				
d_sector96	1	(omitted)				
d_sector97	1	(omitted)				
d_sector98	1	(omitted)				
d_sector99	1	(omitted)				
d_sector100	1	(omitted)				
d_sector101	1	(omitted)				
d_sector102	1	(omitted)				
d_sector103	1	(omitted)				
d_sector104	1	(omitted)				
d_sector105	1	(omitted)				
d_sector106	1	(omitted)				

Negative Binomial regression on hypothesis 6

Random-effects negative binomial regression				Number of obs		2.859
Group variable: id				Number of groups		310
Random effects u_i ~ Beta				**Obs per group:**		
Log likelihood	-25,999,299			min		1
Wald chi2(44)	345,31	Wald test p-value	0.2405	avg		9.2
Prob > chi2	0.0000			max		32
tmt_changes	**Coef.**	**Std. Err.**	**z**	**P > |z|**	**[95% Conf. Interval]**	

ivc_invest	1.610510	0.110193	14.6200	0.0000	1.3945	1.8265
other_vc_invest	1.7190	0.1238	13.8900	0.0000	1.4763	1.9616
d_Country1	-3.72E-01	1.40E-01	-2.66	0.008	-6.45E-01	-0.0978316
d_Country2	-7.93E-01	1.36E-01	-5.85	0	-1.059086	-5.28E-01
d_Country3	-1.3844520	0.1994323	-6.9400000	0.0000000	-1.7753330	-0.9935723
d_Country4	0.0000000	(omitted)				
d_sector1	0.0965841	0.1354856	0.7100000	0.4760000	-0.1689628	0.3621311
d_sector2	0.1655446	0.2288941	0.7200000	0.4700000	-0.2830795	0.6141688
d_sector3	-0.1134560	0.2207609	-0.5100000	0.6070000	-0.5461395	0.3192275
d_sector4	-0.1132866	0.2312787	-0.4900000	0.6240000	-0.5665845	0.3400114
d_sector5	0.3445981	0.2188851	1.5700000	0.1150000	-0.0844088	0.7736050
d_sector6	0.0503005	0.2402306	0.2100000	0.8340000	-0.4205428	0.5211438
d_sector7	0.0904101	0.2521824	0.3600000	0.7200000	-0.4038583	0.5846784
d_sector8	-0.0350702	0.2502470	-0.1400000	0.8890000	-0.5255453	0.4554049
d_sector9	0.1464959	0.2730083	0.5400000	0.5920000	-0.3885905	0.6815823
d_sector10	-0.5631921	0.2920405	-1.9300000	0.0540000	-1.1355810	0.0091969
d_sector11	-0.4131311	0.3771704	-1.1000000	0.2730000	-1.1523720	0.3261094
d_sector12	-0.5066520	0.3581161	-1.4100000	0.1570000	-1.2085470	0.1952427
d_sector13	0.3359573	0.3097765	1.0800000	0.2780000	-0.2711935	0.9431081
d_sector14	0.2464457	0.3475811	0.7100000	0.4780000	-0.4348006	0.9276920
d_sector15	1.0009040	0	2.2500000	0.0250000	0.1285020	1.8733050
d_sector16	0.6188378	0.3700683	1.6700000	0.0940000	-0.1064827	1.3441580
d_sector17	-25.8504700	103271.6000000	0.0000000	1.0000000	-202434.5000000	202382.8000000
d_sector18	0.2318183	0.3508244	0.6600000	0.5090000	-0.4557849	0.9194216
d_sector19	1.2047290	0.6382924	1.8900000	0.0590000	-0.0463013	2.4557590
d_sector20	1.1758890	0.6282423	1.8700000	0.0610000	-0.0554431	2.4072220
d_sector21	0.7114023	0.7529824	0.9400000	0.3450000	-0.7644161	2.1872210
d_sector22	-0.1082914	0.7874379	-0.1400000	0.8910000	-1.6516410	1.4350580
d_sector23	-1.1601970	0.6800441	-1.7100000	0.0880000	-2.4930590	0.1726647
d_sector24	-0.6680368	0.7856288	-0.8500000	0.3950000	-2.2078410	0.8717673
d_sector25	-0.2117132	0	-0.5000000	0.6180000	-1.0430550	0.6196282
d_sector26	-0.5535285	0.4084625	-1.3600000	0.1750000	-1.3541000	0.2470433
d_sector27	-25.4243200	132259.4000000	0.0000000	1.0000000	-259249.1000000	259198.3000000
d_sector28	0.2974962	0.4055187	0.7300000	0.4630000	-0.4973058	1.0922980
d_sector29	-0.0677953	0.6750884	-0.1000000	0.9200000	-1	1.255354
d_sector30	-0.3563109	0.5596141	-0.6400000	0.5240000	-1.4531340	0.7405126
d_sector31	-1.1854430	0.7750678	-1.5300000	0.1260000	-2.7045480	0.3336623
d_sector32	-0.2794915	0.5649060	-0.4900000	0.6210000	-1.3866870	0.8277039
d_sector33	0.6298892	0.6215063	1.0100000	0.3110000	-0.5882408	1.8480190
d_sector34	-0.5264647	0.6024998	-0.8700000	0.3820000	-1.7073430	0.6544132
d_sector35	0.2162611	0.5070915	0.4300000	0.6700000	-0.7776201	1.2101420
d_sector36	0.2197025	0.7834398	0.2800000	0.7790000	-1.315811	2
d_sector37	-0.3978188	0.5972052	-0.6700000	0.5050000	-1.5683200	0.7726820
d_sector38	-0.0325273	0.4966608	-0.0700000	0.9480000	-1.0059650	0.9409100
d_sector39	1.3671790	0.4631163	2.9500000	0.0030000	0.4594876	2.2748700
d_sector40	-0.6369388	0.6012759	-1.0600000	0.2890000	-1.8154180	0.5415402
_cons	0.1612215	0.2558065	0.6300000	0.5290000	-0.3401501	0.6625930
/ln_r	2,931,059	.2137614			2,512,094	3,350,024
/ln_s	1,326,764	.1823825			.9693008	1,684,227
r	1,874,747	4,007,487			1,233,073	2,850,341
s	3,768,827	.687368			2,636,101	5,388,284
LR test vs. pooled: chibar2(01)			144.5	Prob >= chibar2		0.000

Negative Binomial regression on hypothesis 6 with financial control variables

Random-effects negative binomial regression				Number of obs		642
Group variable: id				Number of groups		136
Random effects u_i ~ Beta				**Obs per group:**		
Log likelihood	-606.52929			min		1
Wald chi2(44)	83.62	Wald test p-value	0,7185	avg		4.7
Prob > chi2	0.0000			max		10
tmt_changes	**Coef.**	**Std. Err.**	**z**	**P > |z|**	**[95% Conf. Interval]**	
ivc_invest	1.083174	0.198968	5.4400	0.0000	0.6932	1.4731
other_vc_invest	1.1494	0.2333	4.9300	0.0000	0.6922	1.6066
Cash	-8.47E-06	8.61E-06	-0.98	0.325	-2.53E-05	8.40E-06
Sales	6.25E-06	2.99E-06	2.09	0.037	3.88E-07	1.21E-05
EBIT	-0.0000132	0.0000116	-1.1300000	0.2560000	-0.0000359	0.0000096
d_Country1	0.9788097	0.2354450	4.1600000	0.0000000	0.5173460	1.4402730
d_Country2	0.6787505	0.4139786	1.6400000	0.1010000	-0.1326327	1.4901340
d_Country3	0.0000000	(omitted)				
d_Country4	0.0000000	(omitted)				
d_sector1	0.3989195	0.2686856	1.4800000	0.1380000	-0.1276946	0.9255336
d_sector2	0.3827257	0.3151033	1.2100000	0.2250000	-0.2348653	1.0003170
d_sector3	0.1047828	0.3298233	0.3200000	0.7510000	-0.5416589	0.7512246
d_sector4	0.0892528	0.2873872	0.3100000	0.7560000	-0.4740158	0.6525214
d_sector5	0.6020792	0.3180781	1.8900000	0.0580000	-0.0213423	1.2255010
d_sector6	-23.1526400	215951.2000000	0.0000000	1.0000000	-423279.7000000	423233.4000000
d_sector7	0.5639595	0.3523017	1.6000000	0.1090000	-0.1265391	1.2544580
d_sector8	-0.0389329	0.4071956	-0.1000000	0.9240000	-0.8370217	0.7591559
d_sector9	0.3049381	0.3605323	0.8500000	0.3980000	-0.4016921	1.0115680
d_sector10	-0.2450229	0.5846915	-0.4200000	0.6750000	-1.3909970	0.9009514
d_sector11	-0.3957480	0.8170376	-0.4800000	0.6280000	-1.9971120	1.2056160
d_sector12	-0.0858550	0	-0.1800000	0.8580000	-1.0258190	0.8541087
d_sector13	0.0000000	(omitted)				
d_sector14	0.5671173	0.3791390	1.5000000	0.1350000	-0.1759815	1.3102160
d_sector15	0.8417922	0.6229126	1.3500000	0.1770000	-0.3790941	2.0626790
d_sector16	-0.4526510	0.9766635	-0.4600000	0.6430000	-2.3668760	1.4615740
d_sector17	-23.9098100	109437.9	0.0000000	1.0000000	-214518.2000000	214470.3000000
d_sector18	0.0000000	(omitted)				
d_sector19	1.0228240	0.7300066	1.4000000	0.1610000	-0.4079630	2.4536100
d_sector20	-0.0025334	0.6966856	0.0000000	0.9970000	-1.3680120	1.3629450
d_sector21	2.0410370	0.5737656	3.5600000	0.0000000	0.9164769	3.1655970
d_sector22	0.0164923	1	0.0200000	0.9840000	-1.6382710	1.6712550
d_sector23	0.0000000	(omitted)				
d_sector24	0.0990641	0.7248714	0.1400000	0.8910000	-1.3216580	1.5197860
d_sector25	0.5575225	0.4504997	1.2400000	0.2160000	-0.3254408	1.4404860
d_sector26	0.0000000	(omitted)				
d_sector27	-23.3057600	68339.0100000	0.0000000	1.0000000	-133965.3000000	133918.7000000
d_sector28	0.8569161	0.6217910	1.3800000	0.1680000	-0.3617718	2.0756040
d_sector29	0.3785255	0.6689020	0.5700000	0.5710000	-0.9324983	1.6895490
d_sector30	-0.3180223	0.8054635	-0.3900000	0.6930000	-1.8967020	1.2606570
d_sector31	0.0000000	(omitted)				
d_sector32	-0.1937479	0.6281061	-0.3100000	0.7580000	-1.4248130	1.0373170
d_sector33	0.0000000	(omitted)				
d_sector34	-23.3465700	92848.96	0.0000000	1.0000000	-182004.0000000	181957.3000000
d_sector35	0.0000000	(omitted)				
d_sector36	0.7600372	0.7081032	1.0700000	0.2830000	-0.6278196	2.1478940

d_sector37	0.0000000	(omitted)				
d_sector38	0.0000000	(omitted)				
d_sector39	1.7039860	0.540134	3.1500000	0.0020000	0.6453427	2.7626290
d_sector40	0	(omitted)				
_cons	0	0.8830799	-0.12	0.905	-1.835641	2
r	1,874,747	4,007,487			1,233,073	2,850,341
s	3,768,827	.687368			2,636,101	5,388,284
LR test vs. pooled: chibar2(01)			144.5	Prob >= chibar2		0.000