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Valuation determinants of private entrepreneurial ventures at acquisition: the effects of information asymmetries and venture capital-related signals in an auction setting

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Abstract

Exit, commonly defined as the process through which the entrepreneurs leave the company they helped to create, recently gained a great deal of attention by scholars, also driven by an increase in the phenomenon in the past decades. Indeed, entrepreneurial exits have a relevant impact on the competitive forces in the industry, the founders, the people working for the company and, more generally, on the economy as a whole. Focusing specifically acquisitions as an exit strategy, academics commonly suggest for them to be modeled as auctions. Plenty of theoretical studies have been produced on the matter, yet empirical support to back their claims is lacking. Consequently, the objective of this dissertation is that of shedding more light on the topic, specifically testing the effects that the number of bidders, their information level and the signals related to the presence and relevance of venture capitalists as investors in the venture have on its exit valuation, when such exit occurs through an acquisition which is modeled as an auction. Additionally, this dissertation also investigates another understudied topic, which is the contingent effect of signals. To test the hypotheses, a sample of 1325 private European, British and Israeli entrepreneurial ventures founded between 1988 and 2017 and exited through an acquisition between 1997 and 2017 was employed. The results find no evidence on a significant relationship between the number of bidders or their information level and the exit valuation but provide proof on the relevance of signals and their contingent effects.

Keywords: acquisition, auction, information asymmetry, start-up, entrepreneurial exit, exit valuation.

Abstract - Italiano

L'exit, comunemente definita come il processo attraverso il quale gli imprenditori lasciano l'azienda che hanno contribuito a creare, ha recentemente guadagnato una grande attenzione da parte dei ricercatori, dato anche l'aumento del fenomeno negli ultimi decenni. Le exit hanno infatti un impatto rilevante sulle forze competitive, sugli imprenditori stessi, sugli impiegati dell'azienda e, più in generale, sull'economia nel suo complesso. Concentrandosi in particolare sulle acquisizioni come strategia di exit, gli accademici concordano nel modellarle come aste. Molteplici studi teorici sono stati pubblicati su questo argomento, tuttavia vi è una mancanza di supporto empirico nella letteratura. Di conseguenza, l'obiettivo di questa tesi è quello di fare più luce sull'argomento, testando in particolare gli effetti che il numero di potenziali acquirenti, il loro livello di informazione ed i segnali relativi alla presenza e rilevanza dei venture capitalist in quanto investitori nell'impresa hanno sulla sua valutazione al momento dell'exit, quando tale exit avviene attraverso un'acquisizione che viene modellata come un'asta. Inoltre, questa tesi indaga anche un altro argomento poco studiato in letteratura, ovvero l'effetto interattivo dei segnali. Per testare le ipotesi sviluppate è stato impiegato un campione di 1325 attività imprenditoriali private europee, britanniche ed israeliane fondate tra il 1988 e il 2017 e che hanno fatto una exit attraverso un'acquisizione tra il 1997 e il 2017. Il risultati ottenuti suggeriscono che non esiste una relazione significativa tra il numero di acquirenti o il loro livello di informazione e la valutazione all'exit, ma forniscono prove sulla rilevanza dei segnali e sui loro effetti contingenti.

Parole chiave: acquisizione, asta, asimmetria informativa, start-up, exit imprenditoriale, valutazione all'exit

Table of Contents

List of Tables

List of Figures

Introduction

This dissertation analyzes the effects that the number of bidders, considered both as an aggregate and distinguishing between informed and non-informed, as well as the signals related to the presence and relevance of Venture Capitalists as investors, have on the valuation at exit on the sample of private European, British and Israeli startups, when such exit occurs through an acquisition and it is modeled as an auction.

As startups gained relevance in the economy in the past two decades, more and more academics devoted their attention to the study of entrepreneurship and new venture development in all its facets. Some scholars (e.g., Reynolds and White, 1997; Korunka et al. 2003; Cardon et al., 2005) studied the entire entrepreneurial process, while others focused on specific parts of it, such as the identification of opportunities (Ardichvili et al., 2003), the start-up phase (Korunka et al., 2003) and the financing stage (Choi and Shepherd, 2004). Recently, however, a great deal of attention was given to the exit stage of an entrepreneurial venture (e.g., DeTienne, 2010). Different definitions of the event have been provided by different scholars (e.g., van Praag 2003; Bates, 2005; Stam et al., 2010), with the most commonly shared being the one given by DeTienne (2010), who describes exit as the "process by which the founders of privately held firms leave the firm they helped to create". A firm's exit is a fundamental stage in the entrepreneurial journey, as it does not only represent the end of the company's lifecycle, but it also has important implications for the competitive forces in the industry, as well as for the overall economic ecosystem in which entrepreneurial ventures operate (Albiol-Sanchez, 2016). In fact, the firm's exit has significant repercussions for the competitive balance between rival firms (Akhigbe et al., 2003; Othcere and Ip, 2006), it allows the entrepreneur to finally cash out on the value created through years of building the company (Certo et al., 2001), it enables equity

investors (e.g., Venture Capitalists) to harvest their investment, and more generally it fosters the so-called "entrepreneurial recycling process", which benefits the economy as a whole as well as its development (e.g., Mason and Harrison, 2006; Pe'er and Vertinsky, 2008; Carree et al., 2011).

Considering instead the specific exit strategy, most of the literature on the topic focuses on initial public offerings (IPOs) and mergers and acquisitions (M&As), as they are considered the two most lucrative and successful types of exit (Bayar and Chemmanur, 2011). In particular, M&As are an increasingly popular exit strategy, with the total volume of M&As globally standing at $2.8 trillion in 2020 (GlobalData, 2021), and a total of 8823 merger and acquisition deals announced in Q1 2021 alone (GlobalData, 2021). Therefore, more attention has been devoted to the topic, specifically regarding the determinants of the exit valuation. In that regard, signaling theory in the context of M&As is a widely studied topic, since there is usually an informational mismatch (asymmetry) amongst the counterparts involved in the deal (Wu et al., 2013). In order to study M&As, several academics (e.g., Fishman, 1988) developed frameworks using auction theory. Indeed, auctions and M&As share many similarities: one seller seeks the highest possible valuation for the auctioned item while prospect acquirers compete with one another to buy the item and thus have to propose better conditions than competitors (to outbid them), while simultaneously minimizing the price paid (Bulow and Klemperer, 1996). Several theoretical studies and mathematical models have been published on the matter, focusing either on the number of bidders involved in the auction (e.g., Bulow and Klemperer, 1996) or the presence of bidders holding a toehold (e.g., Ettinger, 2009; Loyola, 2021), and the respective effects on the auction's outcome and efficiency. Empirical studies are instead rather scarce, with only few scholars (Walkling and Edmister, 1985; Bradley et al., 1988) reporting relevant results on the topic and backing theoretical claims. Indeed, a clear gap in the literature exist, such as whereas theoretical and mathematical studies predict a series of effects on acquisition price resulting from competition between bidders, empirical evidence is still largely lacking. Additionally, this dissertation also intends to

test if, and how, different information levels held by potential acquirers impact the final sale price of the target company, as some theoretical studies predict (Dasgupta and Tsui, 2003; Povel and Singh 2006). Filling these gaps is relevant, as it would not just provide new evidence backing theoretical claims and create a basis for future research by other scholars, but also since it would have important implications for decision-making practitioners (e.g., entrepreneurs). Finally, this work also investigates the effect of signals, as signaling theory has been widely adopted in acquisition research (DeTienne et al., 2015). Specifically, this dissertation examines how the signal sent by a high-tech venture (target of an acquisition), by being funded by a venture capitalist (VC), is contingent to the characteristics (i.e., the level of information) of the receivers of the signal (the bidders competing to acquire the company). Indeed, the research on the contingent effect of signals is largely lacking (Wu et al., 2014) and the characteristics of the signal receiver have been largely overlooked by academics when considering the effectiveness and impact of the signal. In fact, while some academics hint at a moderating effect between the attention paid by the receiver to the signaler (Gulati and Higgins, 2003) and the signal, or by the signaling environment (Gulati and Higgins, 2003; Park and Mezias, 2005; Janney and Folta, 2006) and the signal, no research has been focused on important characteristics of the signal receiver such as their level of information (asymmetry) with the signal sender. Thus, further examining the topic holds great research and practical value.

To address the research questions and test the hypotheses, this dissertation uses a sample of 1325 private European, British and Israeli startups founded between 1988 and 2017, which exited through an acquisition between 1997 and 2017. Private companies were chosen as they are typically characterized by strong information asymmetries, thus being optimal for the purposes of this work. The data needed to perform the tests, either regarding the general characteristics of the company, the deal or the presence and characteristics of VCs, was retrieved from three different databases, namely Zephyr, Orbis and RISIS-VICO 4.0. The final sample was used to run three different multivariate linear regression models, each with increasing level of

complexity, meant to investigate the effect of different explanatory variables. Additionally, different robustness checks were performed, so to understand whether the relationships which were found were truly representative and consistent. In all the models, robust variance estimators (robust standard errors) were employed, as they are robust to heteroscedasticity and problems about normality of the residuals, and thus preferrable when this is present, as it happens in the models of this dissertation.

The results show that, first of all, the relationship between the number of bidders and the exit valuation is more complex than what is suggested by traditional economic theories. Indeed, no evidence is found supporting the idea that an increase in the number of bidders contributes linearly to a higher exit valuation. Evidence from the results further show that, whereas informed bidders have no significant effect on the sale price, non-informed bidders show a significant and negative relationship with the exit valuation, suggesting that the seller could benefit from excluding them from the auction. Interestingly, the results however show that the ratio of informed bidders over the total number of bidders taking part in an auction is significantly and positively correlated to the exit valuation, suggesting that, more than their absolute value, their proportion in the overall number of participants plays a relevant role in raising the exit value. Additionally, the results hint at the existence of a contingent effect of signals. Indeed, the marginal effect of the presence of a VC increases as the number of non-informed bidder increases, confirming the effectiveness of VCs as a signal in reducing the information asymmetry and "transforming" a non-informed bidder into an informed one. This is expected, as signals play a relevant role in alleviating information asymmetries, which are by itself high in the case of deals regarding private companies (as in the case of our sample), that do not have to disclose the same amount of information to the market as public ones. Moreover, results show that such marginal effect is reduced as the number of informed bidders increases, as expected: the value of the signal is low when the bidders are already informed and high in number (thus creating high competition and aggressive bidding behavior).

To conclude, this dissertation holds both theoretical and practical value. First, it contributes to the literature in several ways, filling important gaps regarding both auction theory and signaling theory in an M&As framework. Additionally, is so doing, this work integrates the two theories, which were previously adopted in M&As only independently one to the other. Thus, this work acts as a basis for further studies on the topic, while enriching the extant comprehension of M&As and the exit valuation. Second, it generates relevant implications for practitioners alike. Specifically, the results provide relevant insights regarding strategic decisions, such as whether to dilute their ownership to receive venture capital and which type of bidders to involve in an auction, to entrepreneurs looking to exit their venture through an acquisition.

The remainder of this dissertation is organized as follows. Chapter 1 provides and overview on the main literature available on the topic of exit, progressively entering into the context of M&As. Chapter 2 follows with the development of the hypotheses and the theoretical background. Chapter 3 represents the bulk of this dissertation, as it regards the methodology of this work. Indeed, Chapters 3.1 and 3.2 respectively describe the data gathering methodology and the sample used for the models. Chapter 3.3 provides a detailed description of the variables employed in the models, divided between dependent, independent, control and instrumental variables. Chapter 3.4 reports the descriptive statistics of the variables, Chapter 3.5 provides information on regression models and their assumptions and Chapter 3.6 presents the actual models developed to test the hypotheses and their results. Chapter 3.7 is devoted to the description of the models and results of the robustness checks performed on the models presented in Chapter 3.6. A brief overall summary of the results is provided in Chapter 3.8. In Chapter 4, the results obtained in Chapters 3.6 and 3.7 are thoroughly discussed, while the theoretical background on the unit of analysis is also reported. To conclude, Chapter 5 finalizes the dissertation by summarizing the main findings and the contribution to scholars and practitioners, and by addressing the main limitations and the possible future developments of the work.

1. Literature review

Undoubtedly, the exit is one of the most important moments in the life of a venture and of the entrepreneur founding and building it. Given the attention devoted by both scholars and policymakers on the matter, the first part of the dissertation is aimed at presenting the most important contributions on the topic. First, some definitions of exit will be provided, in order to understand the boundaries of examination; several definitions by different practitioners will be given, so to offer a complete overview on the matter. Following, the second Chapter will examine the importance and impact of a business exit for the entrepreneur, firm, industry and economy as a whole. Based on that, a description and classification of the different exit paths reported in the literature will follow. Subsequently, the exit will be framed in the more general concept of the "entrepreneurial process", by presenting the different phases -from ideation to maturity- that each venture goes through during its lifetime, and the possible exit options at each stage. The following Chapter will take into examination the drivers and factors determining a particular exit strategy. In particular, human capital attributes, investors' presence and general company's characteristics will be the focus of the Chapter. Following, the attention will be put specifically on two types of exits -initial public offerings (IPOs) and mergers and acquisitions (M&As)- and their determinants. The remaining of this first part of the dissertation will be devoted specifically to the topic of M&As, given the focus of this work on the matter. Specifically, an overview of the M&A market will be provided, followed by a brief description of the M&A process. Concluding, a throughout review of two literature streams -extremely relevant for this dissertation- will be presented. Namely, a literature review of signaling theory and auction theory, both framed in a perspective of M&As, will be provided.

1.1 Definitions of exit

Scholars devoted a great deal of attention to the concept of exit, analyzing and suggesting different definitions of the event (e.g. Wennberg, 2008; DeTienne, 2010), distinguishing between exit and failure (e.g. Bates, 2002; Cumming, 2008), and identifying the different strategies which can be pursued by the entrepreneur to exit the firm (e.g. Wennberg et al., 2011; DeTienne et al., 2015). Such strong interest in the topic has to be attributed to inevitability of the exit event: "the owners, sooner or later, will sell the company to a person or to another corporation, they will fail in managing the business shutting it down or eventually they will die, one way or another, exit they will!" (Engel, 1999). For example, Petty (1997) estimates that around 18% of the financial assets held by US households is invested in private companies founded in the 50's and 60's whose founders are contemplating -and soon will- exit. Baker and Kennedy (2002) demonstrated that exit and entry are strictly related in a continuing process: by investigating a set of 7,455 firms in the years 1963-1995, the authors show that the difference between entry and exit rate is small (on average, 6.66% vs 5.11%). Thus, "entry and exit seem to be part of a process of change in which large numbers of new firms displace large numbers of older firms without changing the total number of firms in operation at any given time by very much" (Geroski, 1995). Despite the importance of the topic and the increased number of papers published on the matter, too little research on business exit has been carried out (DeTienne and Cardon, 2012), particularly regarding mergers and acquisitions. If fact, research mostly focused on studying exit from family businesses (e.g., Bennedsen et al., 2007) and initial public offerings (e.g., Fischer and Pollock, 2004).

Before delving deeper into the importance of exit and introducing the different exit strategies that an entrepreneur can pursue, it is important to clarify the concept of exit by providing an overview of the different definitions suggested by academics. Scholars, in fact, provide different characterizations of exit depending on the focus of the analysis. Indeed, the concept can be referred to both the exit of the entrepreneur

-who leaves the firm- or exit of the venture -which exits the market (Albert and DeTienne, 2016).

The first branch of literature, as reported, focuses on the entrepreneur as the unit of analysis, following the principle of "understanding the designer of the firm to understand the design" (DeTienne, 2010). In that regard, a definition by one of the most prolific academics on the topic, DeTienne (2010), describes exit as the "process by which the founders of privately held firms leave the firm they helped to create; thereby removing themselves, in varying degree, from the primary ownership and decision-making structure of the firm". Interestingly, in this definition of exit, companies are considered as private rather than public, since in private companies the founder has (usually) relevant equity stakes (Wasserman, 2003) and, thus, has (more) control of strategic decisions such as that of the exit route (DeTienne, 2010). For example, exit can be the outcome of more attractive business opportunities that reveal to the entrepreneur (Bates, 2005). Stam et al. (2010) take instead a different perspective and define exit as "the decision to quit an entrepreneurial career" while, similarly, van Praag (2003) characterizes it as "moving out of self-employment to (un)employment".

On the other hand, as anticipated, a second stream of literature takes an entirely different perspective when defining a business exit, focusing on firm-level exit strategies. More specifically, exit can be divided into market exit, also referred to as corporate restructuring or organizational exit (Wennberg and DeTienne, 2014) and firm exit (Decker and Mellewigt, 2007). The first one regards exiting through divesture, as in the sale of business units, business lines or the entire business (Bowman and Singh, 1993). Firm exit takes instead a different meaning, as it involves shutting down operations (Decker and Mellewigt, 2007): "Entrepreneurial exit is defined as shutting down, discontinuing or quitting a business" (Hessels et al., 2011). Clearly, such exit is considered as a failure from the perspective of the entrepreneur, who has not been able to successfully run the business and is forced into bankruptcy.

1.2 The relevance of exit

A firm's exit is a peculiar moment for many reasons: first and foremost, it represents the end of the venture's lifecycle, but it also has important implications for the competitive forces in the industry, as well as for the overall economy (Albiol-Sanchez, 2016). Studying the importance of exit is relevant for two reasons: first, as we have seen, exit is inevitable (Engels, 1999) and continuous (Baker and Kennedy, 2002); second, exits have profound effects for a variety of actors (DeTienne, 2010). Assuredly, the exit does not only affect the entrepreneurial team, but generates relevant externalities at firm, industry, ecosystem and local level (Pisoni and Onetti, 2017). For example, as studied by Akhigbe et al. (2003), an exit has significant repercussions for the competitive balance between firms, as well the configuration of the local industrial fabric. In the following paragraphs, the importance and effects of exit for a variety of actors will be provided.

First, the actor primarily impacted by an exit is the founder, or the entrepreneur, of the company. The exit, if successful, is the singularity through which he can finally cash out on the value created through years of building the company, realizing some portions of the firm's wealth creation (Certo et al., 2001). In fact, it is not until the firm's stock is sold that his gains are realized: while the company (generally) creates value through its lifetime, such as in the case of profits, "a central part of the new venture value creation efforts hinges on the ability to harvest that value at some point(s) in the future" (Holmberg, 1991). However, according to Petty (1997), "from the entrepreneur's perspective, the issue of harvesting is about more than money, involving personal and nonfinancial aspects of the harvest as well''. Indeed, financial considerations are not the only drivers of business creation and, ultimately, exit. In fact, it must be noted that exit is a crucial moment from a psychological standpoint as well (DeTienne, 2010), as it means to "let go" of a "creature" -defined by Cardon et al. (2005) and Dodd (2002) as a "baby"- which has been the result of years of sacrifices as well as of time and money commitments. Still, many entrepreneurs start a new venture with the explicit goal of exiting in the future, and this is especially true

for innovative startups launched by growth-oriented entrepreneurs (Wennberg and DeTienne, 2014).

Firm-wise, the departure of the entrepreneur might have mixed effects, both positive and negative (DeTienne, 2010), with no real consensus between scholars on which effect is prevalent over the other (Rubenson and Gupta, 1996). In particular, in the case of IPOs the company can benefit from cash, resources and energy infusion (Haveman and Khaire, 2004). Moreover, the departed entrepreneur is usually replaced with skilled managers, who can bring a breath of fresh air, solve existing conflicts and revitalize processes (Guest, 1962). Furthermore, entrepreneurs might lack the skills needed to run a public company or any company above a certain size, as this task is substantially different -in terms of abilities and knowledge required- from starting a new venture (Clifford and Cavenaugh, 1985). In fact, new managers are helpful in assuring new and alternative cash sources (Boeker and Wiltbank, 2005), moving into new products and services (Aldrich, 1999) and increasing the legitimacy of the firm (DeTienne, 2010). On the other hand, the departure of the entrepreneur might also have negative effects on the firm. For example, the relationship between firms' mortality rates and founders' succession has been analyzed by Carroll (1984) and Haveman (1993), who hint to a positive relationship between the two. Moreover, scholars point out that succession "diminishes organizational performance, disrupts work routines, interrupts command, and increases employee insecurity", triggering a so called "succession crisis" (Haveman and Khaire, 2004). This is usually the consequence of the structure of entrepreneurial companies, which are typically over-depending on the key figure(s) of the entrepreneur(s) and thus have a highly centralized decision-making system, which does not bode well with a more structured, managerial approach that usually follows the post-acquisition integration (Hofer and Charan, 1984).

A firm's exit will clearly have consequences beyond the firm's boundaries. In fact, companies operate in peculiar competitive environments: industry dynamics and power relationships are indeed disrupted in the case of exit by one player, meaning that an exit of a company has profound effects on its competitors as well (Othcere

and Ip, 2006). The effects of acquisitions on rivals were studied by Othcere and Ip (2006), whose findings show that competitors of an acquired firm benefit from greater stock returns after the announcement of the deal, and also experience an increased probability of being acquired in the following year. This effect has been previously studied by Akhigbe et al. (2003) whose results hint to positive valuation effects on rival firms when a privately held company is acquired. Conversely, IPOs do not show similarly significant positive outcomes, even though they contribute to the reduction of information asymmetry at industry level for investors; furthermore, IPOs push competitors' prices up and change the competitive balance in the industry in favor of the newly public firm, which can benefit from a great deal of public recognition and awareness (Akhigbe et al., 2003).

Exits are also important at the whole economy level, since they are the driver of the so-called "entrepreneurial recycling process": ideally, the cash-out for the entrepreneur should be significant enough that he has a high enough fortune which allows him not to work again, and thus be able to engage in the creation of new ventures (Colin and Brown, 2013). Clearly, this implies that the company is not sold prematurely, but only after a certain amount of value has been created, usually after several rounds of financing. Colin and Harrison (2006), by analyzing five case studies of Scottish technology-based firms, demonstrated that entrepreneurs, after cashing out on the company they built, usually devote their time to new business activities, effectively becoming serial entrepreneurs. This was later confirmed by Albiol-Sanchez (2016), who used an international sample of 41 countries for the period 2002–2007 to prove that, indeed, a positive and significant relationship between business exit rates and future entrepreneurship exists. These positive effects are not limited to the single key figure(s) (the entrepreneur/founding team), but rather extend to other people within the exited organization (Colin and Harrison, 2006). In fact, various mechanisms exist by which wealth is shared with several people at the moment of liquidation, mainly in the form of buy-out of share options or option schemes, but also as gifts from the entrepreneur(s). These mechanisms ensure that employees and management get a

financial reward from the takeover or IPO. Apart from creating and supporting new ventures, neo exited entrepreneurs might engage in philanthropic activities (Acs and Phillips, 2002). Last, the cashed-out entrepreneur might even carry out investing activities, acting as a business angel (e.g., Wetzel, 1983; Gaston, 1989; Mason and Harrison, 1994) and investing part of his new fortune to support other entrepreneurs and their companies (Hindle and Wenban, 1999; Mason and Harrison, 2006). Entrepreneurial recycling, however, should not be considered only in financial terms. As a matter of fact, an exited entrepreneur might reinvest his skills, knowledge and company building expertise to support other ventures or benefit the local economic development (Colin et al., 2006), for example acting as an advisor or mentor. In fact, as Timmons (1999) states, "a majority of highly successful entrepreneurs seem to accept a responsibility to renew and perpetuate the system that has treated them so well". Even if the business is unsuccessful and must be closed, though, entrepreneurial recycling can take part in the form of release of talent and knowledge into the ecosystem, with former managers or employees starting their own ventures or joining senior position in existing companies (Colin and Brown, 2013). Assuredly, a business exit releases resources into the economy, indirectly creating new entry opportunities (Pe'er and Vertinsky, 2008; Carree et al., 2011). Lastly, successful exits benefit the entrepreneurial and startups environment, since if the exit is successful then external equity investors, such as business angels and venture capitalists generate positive returns on their investments which can be, in turn, reinvested into new entrepreneurial projects, creating a virtuous circle.

1.3 Types of exits: classification and description

Entrepreneurs can choose a wide variety of exit paths when leaving the company (Wennberg et al., 2007) since the needs for an exit may vary according to the situation (Holtz-Eakin et al., 1994; Hellmann and Puri, 2002). The exit strategy that the entrepreneur selects is crucial, since different exit types are linked to different complexity and risk levels and, consequently, potential (financial) rewards (DeTienne

and Cardon, 2012). Birley and Westhead (1993), in one of the first papers on the matter, analyzed 10348 companies advertised for sale in the Financial Times to understand possible exit routes. Their study suggested five different options that entrepreneurs might pursue to exit their company, namely: sale to an independent party, sale to another business, sale to the management or employees, public quotation, and liquidation. Mitchell (1984), later supported by Gimeno (1997) and Van Witteloostuijn (1998), already differentiated firm sale from liquidation. Building on the work of Birley and Westhead (1983), Petty (1997) also adds transfer to family members as a possible exit strategy. However, scholars have not yet focused their attention on what are the drivers behind the choice of exit (Storey et al., 2005). Sometimes sales might be driven entirely by the desire to partially recover prior investments, as in the case of the sale of an unprofitable firm (Van Witteloostuijn, 1998). However, this case is still not the worst-case scenario, which is actually the one of bankruptcy, in which the losses incurred by investors is greater (Van Witteloostuijn, 1998). Ultimately, it is possible to state that:

1. Sale and liquidation strategies have two distinct meanings.
2. Exit through sale or liquidation can happen either in a situation of gain or loss (Wennberg et al., 2010).
3. Both sale and liquidation are a representation of poor performance if the outcome is that of only partially recouping investments, yet liquidation is considered as the poorest performing of the two (Wennberg et al., 2010).

Based on these three statements, Wennberg et al. (2010) developed a classification framework of exit strategies based on two different dimensions:

1) *Performance*, which can be below (low financial performances, resulting in overall losses) or above (high financial performances, in the case of financial gain) a certain threshold, which is defined through prospect theory; and

2) *Exit route*, which can either follow a sale or a liquidation; the distinction is clear: while, in the case of sale, the company lives on and continues to carry out operations, in the case of liquidation the business is closed, the company ceases to exist and all assets are sold to repay creditors and owners (Wennberg et al., 2010).

Based on these two dimensions, Wennberg et al. (2010) identified four possible exit strategies that entrepreneurs can pursue:

1. *Harvest Sale* of a profitable business; in the case of a harvest sale, the entrepreneur sells his shares and ceases to be a majority shareholder. In this way, he realizes a financial gain, harvesting some value from the investment (Petty, 1997) while the company continues its operations. This option is generally reserved to high performing firms.

2. *Distress Sale*; if a firm under financial distress is sold, we refer to it as a "distress sale" (Wennberg et al., 2010); indeed, firms are not only sold for financial gains and value extraction: in the case of insolvency and potential bankruptcy, or when the company is poorly performing, a preferred alternative is that of selling the business, in what Van Witteloostuijn (1998) refers to as a "flight from loss".

3. *Harvest Liquidation* of a profitable business; liquidation happens when a company is terminated and its value gets redistributed between creditors and owners; more in detail, if the terminated company was a profitable one, then we talk about "harvest liquidation" (Wennberg et al., 2010). Entrepreneurs usually liquidate firms for a variety of reasons, such as the need for a career change, desire for retirement, or personal reasons such as divorce (Wennberg et al., 2010). Liquidation is simple, fast and thus preferable by entrepreneurs seeking expediency or by founders who believe that the firm does not have relevant or up-to-date technology (Wennberg et al., 2010).

4. *Distress Liquidation*; distress liquidation refers to the liquidation of a distressed firm, which is a firm that is not profitable and risks insolvency and, thus, bankruptcy. Liquidation, rather that filing for bankruptcy, might be preferred by entrepreneurs, given the negative connotation of failure related to bankruptcy (Pretorius and Le Roux, 2007): through a liquidation, instead, assets are sold, and creditors (partially) repaid (Thorburn, 2000).

Performance: / **Exit route:**	**High**	**Low**
Sale	*Harvest Sale*	*Distress Sale*
Liquidation	*Liquidation*	*Distress Liquidation*

Table 1: Taxonomy of exit routes (Wennberg et al., 2010)

Another comprehensive literature contribution, beside Wennberg's one, was performed by DeTienne et al. (2015). According to their classification, we can identify three main categories of exit: financial harvest strategies, stewardship exit strategies and voluntary cessation exit strategies.

Financial harvest strategies include both acquisitions and IPOs. Babich and Sobel (2004) demonstrated that, while riskier and more complex, acquisitions and IPOs are the most financially rewarding strategies. This was later supported by Cumming (2008) and Poulsen and Stegemoller (2008), whose work suggested that acquisitions and IPOs alike are the most lucrative for both investors and founders, implying that entrepreneurs driven mainly by financial considerations are more likely to pursue financial harvesting strategies. In particular, as noted by Haunschild (1994), entrepreneurs might want to seek acquisitions due to the premiums they receive when the company is sold. This was later supported by Bernard and Kaplan (2006), who showed that in years 2006 and 2007, exit through acquisition was indeed a lucrative strategy, since transaction multiples where at their highest given that demand for acquisitions far exceeded their supply. While, as suggested by Poulsen and Stegemoller

(2008), IPOs and acquisitions "are comparable, since they represent significant shifts in ownership structure, a channel for raising capital, and a means of liquidation for owners", the motivations between going for an acquisition against an IPO are several, but mainly driven by financial considerations. In fact, while in the case of a sale the entrepreneur cashes out on its work and leaves the company for good, in the case of IPOs the main goal is that of generating funds for the company so to use them for its growth, meaning that the entrepreneurs are usually retained to some capacity (DeTienne and Cardon, 2012). Indeed, in the case of an IPO the newly public company raises capital by selling shares in the stock market to the general public. Instead, in the case of an acquisition, the company is sold to another firm (usually a public company), which purchases all outstanding shares (Poulsen and Stegemoller, 2008), meaning that the entrepreneur can liquidate all his shares and cash-out faster. Regarding this first category of exit strategies, DeTienne at al. (2015) demonstrated that companies with larger founding teams are more likely to pursue them, since more economic compensation needs to be created in order to satisfy each founding member's financial goals. Assuredly, literature shows that it is almost physiological for companies with bigger founding teams to pursue either IPOs or acquisitions, given the enhanced ability of such ventures to achieve higher growth rates (Friar and Meyer, 2003), receive funds from Venture Capitalists (Beckman et al., 2007) and appear more innovative (Aldrich and Kim, 2007).

Stewardship exit strategies are instead "pro-social and pro-organizational strategies which allow the founders to have influence over the future and long-term viability of the firm" (DeTienne et al., 2015). These strategies give entrepreneurs autonomy, freedom and independence (Hackman and Oldham, 1976) in deciding the successor who will "take care of their baby" (DeTienne et al., 2015). In fact, if autonomy is sought after by the entrepreneur when creating a venture, he is more likely to choose this exit path (DeTienne et al., 2015). Additionally, this set of strategies is usually prioritized by those entrepreneurs whose primary motivation is the wellbeing of the organization itself and of all the individuals that are part of it (Hernandez, 2012),

rather than his personal financial gains (Miller et al., 2012). This category includes family business succession, employee buy-out and independent sale. In the case of family succession, the entrepreneur leaves his stakes to one or more family members, usually his children. Is this way, wealth is passed on -even though few firms make it into the third generation according to DeTienne et al. (2014)- and the entrepreneur himself can still be engaged in the firm through family ties. As per the National Center for Employee Ownership (NCEO) (2009), an employee buyout refers to "the purchase of a majority interest (at least 50%) of a firm in which most or all employees of the firm are able to participate", such as in the case of single purchases, employee stock ownership plans (ESOPs), or numerous successive purchases over several years. Last, the entrepreneur might also want to pursue and independent sale. This usually happens in the low-end market and it is a rather straightforward, easy and simple exit strategy, which usually involves the use of a business broker. As stated by Tom West, founder and former president of The International Business Brokers Association (IBBA), ''the average price of a business that sells today goes for about $250,000 not including inventory or real estate''. The broker acts as an intermediary, finding an interested buyer (DeTienne and Cardon, 2012) for the entrepreneur's firm. Since the entrepreneur does not have to waste many resources, this exit strategy is low risk: in fact, it is the broker who actively searches for a buyer, and, in case of no sale, has lost time.

Finally, the last category in the classification by DeTienne at al. (2015) includes less successful, lower risks exit strategies, defined by the scholars as *voluntary cessation exit strategies*. In these cases, the entrepreneur decides to liquidate the assets of the company since they have served their purpose, which is usually that of generating an additional income stream for the founder (DeTienne at al., 2015). These exit strategies are quite common and are usually seen with a positive connotation (Bates, 2002; Headd, 2003) and not as failures. Quite different is the case of bankruptcy, in which the entrepreneur has little to no choice. Bankruptcy, however, should not be considered as a proper exit strategy: it happens when creditors cannot be repaid since the sale

procedures are lower than existing liabilities (Balcaen et al. 2012), meaning that creditors are only partially repaid as a consequence (Schary, 1991).

1.4 Entrepreneurial process and exit

After defining the concept of exit, understanding its importance, and illustrating the possible exit routes that the entrepreneur might follow, it is important to comprehend when the entrepreneur might exit his venture. In fact, exit can potentially happen at any moment of the life of the company, for reasons which are controlled or not by the entrepreneur. Indeed, entrepreneurs might be driven by different motives to exit during the existence of the company (DeTienne, 2010). First, however, the concept of entrepreneurial process is briefly introduced.

The set of processes ranging from the company conception to its exit is defined as "entrepreneurial process" (Reynolds and White, 1997). Reynolds and White (1997) identified four different stages of the entrepreneurial process, namely conception, gestation, infancy and adolescence. Brockner et al. (2004) include more stages, suggesting that the entrepreneurial process might consist of any of the following phases: idea generation, idea screening, procuring necessary resources, proving the business model, rollout, maturity, renewal and growth, and decline. Similarly, the process might be compared to that of parenting, an activity which includes conception, gestation, infancy, toddlerhood, childhood, growth, and maturity (Cardon et al., 2005). Others, such as Korunka et al. (2003), suggest that the process is shorter, perduring only from the "birth" of the entrepreneur to the founding of a new venture. Similarly, Bygrave and Hofe (1992) define it as "all the functions, activities, and actions associated with the perceiving of opportunities and the creation of organizations to pursue them". Conversely, DeTienne (2010) defends the thesis that the process is over only when the entrepreneur exits the company. In the light of this idea, the following Chapter is going to analyze exit options along four stages of the entrepreneurial process as suggested by DeTienne (2010), namely conception and gestation, infancy, adolescence and maturity.

In the *conception and gestation* stage the company does not exist yet, since the entrepreneur is only considering the idea of new venture creation by identifying opportunities (Gaglio and Katz, 2001) and understanding whether to commit time and resources (Reynolds and White, 1997). This first stage can either be "forced" by the entrepreneur -who actively searches for new opportunities (Fiet, 2002)- or by external circumstances (Wong et al., 2005), but it can also happen spontaneously, as in the case in which the entrepreneur coincidentally identifies an opportunity he was not seeking (DeTienne, 2010). In this phase, the reasons for exit can be trifold, and all lead to the same result: the idea is abandoned and the entrepreneurial process is terminated. First, the entrepreneur might identify more enticing alternative opportunities (Maertz and Campion, 2004), such as a different venture, a new job or the possibility to expand his education. Alternatively, the entrepreneur might realize that the chances that he will be "able to achieve their goals and values in the future at their current organization" (Maertz and Champion, 2004) are slim, given for example that alternative products already exist, or that market demand for the product/service he is thinking of building is low. Last, too much external pressure by family and friends might push the entrepreneur to abandon the creation of a new venture (Maertz and Champion, 2004).

Infancy starts when an idea has been found and the company is effectively established. In this stage the venture requires a significant amount of attention from the entrepreneur, since it could be subject to liability of newness (Stinchcombe, 1965) and liability of smallness (Aldrich and Auster, 1986), given the limited resources available to the firm (DeTienne, 2010). During this phase the commitment of the entrepreneur is of paramount importance, since he can positively imprint the company (Boeker, 1988), effectively developing an exit strategy right from the beginning and setting different exit paths, thus increasing the likelihood of a successful exit in the future. At this stage, DeTienne (2010) suggests that exit motivations are of two types: voluntary disbanding and failure. Voluntary disbanding forces are similar to the ones described in the first phase: individuals have not fully committed (psychologically and resource-wise) to the new venture and might start to understand the hurdles of an

entrepreneurial career, comparing them to more attractive alternatives, especially if they realize that a similar product already exists or that the technology is unachievable. On the other hand, failure relates to the closure of the business due to poor financial performances. Quite interestingly, voluntary exits represent the bulk of exits in this phase (McGrath, 2006), since only twenty-five percent of exits are due to poor financial performance (McGrath, 2006).

Should the company survive the first two stages, it enters *adolescence*, during which the primary objective is that of achieving growth (Reynolds and White, 1997) in terms of resources, sales, employees and market share (Bamford et al., 2004). At the same time, the venture becomes a more formal and structured organization, with defined rules and procedures (Lynall et al., 2003). As the company grows in size and gains legitimacy, exit options increase, since the firm becomes attractive for players such as strategic buyers and private equity (PE) firms (DeTienne, 2010); moreover, IPO becomes an alternative to be considered as well, even if this strategy is usually contemplated as an engine for further growth rather than a liquidity strategy (DeTienne, 2010). The drivers of exit might be various but, ultimately, they can be categorized in voluntary and forced. Regarding the latter, exit might be forced by other stakeholders of the company, such as external investors. In fact, during the lifecycle of the company, the entrepreneur might have obtained capital, much needed to survive and grow, in exchange for a portion of equity. This might have happened multiple times through several rounds of funding, resulting in a very diluted ownership for the entrepreneur (DeTienne, 2010). A diluted founder has less decisional power and autonomy, and ultimately might be forced to succumb to decisions imposed by others, such as venture capitalists who want to cash out on their investments. On the other hand, the entrepreneur might deliberately decide to exit the business, in which case the exit strategy depends on economic expectations (DeTienne, 2010) and the interest on the future of the venture (Minor, 2003).

Last, as the company grows it reaches *maturity*, a point in which it becomes very bureaucratic, where relationships become hierarchical, and jobs and procedures

are formalized (Lester et al., 2003). Usually, at this point, the entrepreneur has already exited the firm (Haveman and Khaire, 2004) through one of the strategies described above -namely sale to a firm or individual, IPO or management buy-out (DeTienne, 2010)- usually to pursue alternative opportunities. By this stage, the company is financially solid, so exiting though failure is an unlikely possibility: bankruptcy is indeed lower than in any other phase of the entrepreneurial process (Altman, 1993).

1.5 Drivers of exit strategy and valuation

Having defined the possible exit paths and how these might change along the company's lifecycle, it is important to address the drivers pushing the entrepreneur for a specific exit strategy. The characteristics of the founder, of the founding team and of the venture more in general have a profound influence on the exit strategy followed and, ultimately, on the valuation achieved (Colombo and Grilli, 2005). The most influential factors driving an exit strategy regard the company's human capital (specifically the skills, experience, education and knowledge possessed by the entrepreneur), the company's characteristics (number of employees and founding team size) and the presence of external equity investors (Wennberg et al., 2010; DeTienne and Cardon, 2012). Specifically, regarding human capital, its effect on entrepreneurial ventures have been widely studied by academics, basing their work on the seminal paper by Becker (1964), who uses economic logic to suggest that individuals make their choices -career wise (e.g., between employment and self-employment)- in an attempt to maximize their wealth. In the following, a brief review of the literature, mainly based on the works of Wennberg et al. (2010) and DeTienne and Cardon (2012) is presented.

1.5.1 Entrepreneurial and industry experience and exit

It is not clear whether entrepreneurial experience positively correlates to entrepreneurial continuation, as evidence is mixed (Wennberg et al., 2010). Using a sample of 11361 founders, Taylor (1999) found a negative correlation between previous business experience and exit likelihood. On the other hand, Jørgensen (2005) shows, using a dataset of 31.000 Danish entrepreneurs, that prior entrepreneurial experience

increases the likelihood of exit. Quite interestingly, studies by Brüderl et al. (1992), Gimeno et al. (1997) and Van Praag (2003) suggest that no relationship of statistical significance exists between prior business experience and exit. Scholars, however, seem to agree that an entrepreneur must possess some fundamental skills and knowledge in order to successfully launch and grow a company (Starr and Bygrave, 1992; Politis, 2005). Moreover, past entrepreneurial experience can be a great predictor of fundraising success: VCs tend to favor entrepreneurs with prior experience in their investments (Tyebjee and Bruno, 1984), since they are considered to be more able in building high growth (Colombo and Grilli, 2005), high return ventures (Tyebjee and Bruno, 1984). Moreover, entrepreneurs who successfully exited in the past can also tap into a greater amount of personal financing (Wright and Westhead, 1998). DeTienne and Cardon (2012) examined how experience relates to exit strategy, finding out that an entrepreneurial background positively correlates to an IPO exit strategy and, to a lesser extent, to an acquisition strategy. Moreover, the authors showed that entrepreneurial experience significantly and negatively relates to less successful strategies, namely independent sales and liquidation strategies, as it might be expected. The previously mentioned Wennberg et al. (2010) also find similar results: employing a database of 1735 Swedish ventures, the authors prove that entrepreneurs with prior relevant experience are more likely to exit through a harvest sale.

On the other hand, Lee and Lee (2014), examining the relationship between the entrepreneur's human capital and exit, found out that industry experience has no significant effect on the success of the exit. According to the authors, industry experience is not fundamental when it comes to later stages of the firm, while it can prove critical in seeking opportunities and surviving the first stages of the venture. Conversely, DeTienne and Cardon (2012) hypothesized that industry experience is linked to goal-setting behaviors not meant to maximize economic returns, but rather focused on reputational factors or the wellbeing of the people of the organization. The authors suggest that such objectives drive the founder to exit the firm through strategies which do not maximize his gains, such as employee buyouts. Basing their

work on a set of 1334 US-based firms, the authors show that, indeed, industry experience is positively related to an employee buyout exit strategy, but find no relationship between industry experience and the likelihood of exiting through an independent sale.

1.5.2 Age of the entrepreneur and exit

Age is another important factor to keep into consideration when evaluating exit motivations: literature of human capital productivity (Harada, 2004) and lifetime risk preferences (Morin and Suarez, 1983) hint to the fact that older entrepreneurs should be more likely to exit. Yet again, evidence appears mixed: on one side, studies by Holtz-Eakin et al. (1994), Taylor (1999) and Bates (1990) show that older entrepreneurs are more likely to exit, while research by Gimeno et al. (1997) and Van Praag (2003) indicates the opposite. Basing their work on prospect theory and Becker's (1965) economic theory of time allocation, Wennberg at al. (2010) state that, ceteris paribus all other variables, age is a determinant of likelihood of exiting through a harvest sale. Moreover, the authors point out that age is a double-edged sword: if some facets of human capital (e.g., experience) tend to grow over time, others (e.g., stamina) are greatly reduced. This means that older entrepreneurs have lower incentives to pursue exit strategies that require high firm's performances (such as IPOs) as opposed to younger founders (DeTienne and Cardon, 2012). As a matter of fact, DeTienne and Cardon (2012), using a sample of 1334 firms from the 2002 Dun and Bradstreet directory, prove that age is positively related to a liquidation strategy, while its impact on family succession is more limited. Still, it is natural to assume that younger entrepreneurs are less likely to pursue family succession strategies, as it is improbable that their children are old (and skilled) enough to successfully run the firm (DeTienne and Cardon, 2012).

1.5.3 Education and exit

Scholars (e.g., Ferrante, 2005) have already proved the importance of literacy and education as tools for successful entrepreneurship. Several studies show that higher

levels of education correlate to higher probability that a person is involved in more entrepreneurial activity (Kim et al., 2006; Global Entrepreneurship Monitor, 2007). Moreover, Robinson and Sexton (1994) show that education benefits the success of the company as well, to an extent in which it is even more relevant than prior experience in ventures founding. The authors are echoed by other scholars (e.g., Gimeno et al., 1997), which prove the strong and positive relationship between firms' financial performance and education, demonstrating that less educated founders build less successful firms. Moreover, education proves important when it comes to fundraising success (Bates, 1990) and, later, firm's growth (Cooper et al., 1994). Since more educated entrepreneurs are also more confident in themselves and their capability to achieve high-performance goals (Arenius and DeClerq, 2005), it seems natural to assume that people with higher levels of education are more likely to choose more financially successful strategies, such as IPOs.

Yet again, scholars do not seem to have a consensus of the effect of education on the exit of the venture. Some studies suggest that higher education decreases the probability of exit (Bates, 1990; Brüderl et al., 1992), while other indicate that education increases it (Taylor, 1999) or provide non-significant results (Arum and Muller, 2004). For example, Lee and Lee (2014), using a sample of 318 US-based startup that exited between 2005 and 2011, found out that education is not significantly correlated to exit success. Previously cited DeTienne et al. (2012) report a positive and significant relationship between more financially successful exit strategies (IPO and acquisition) an education, and a negative relationship when the exit strategy considered is family succession.

1.5.4 Team size and exit

Regarding the effect of team size on exit, little literature is available on the matter. Teams of people can bring experience, network contacts and complementary skills to the venture (Brush et al., 2001) leading to believe that financial considerations are amongst their main drivers for funding and exiting a business, whereas single individuals prefer autonomy and thus pursue a career lifestyle venture (Carter et al.,

2003). Based on such statement, it is reasonable to say that harvest exit strategies are more likely to be explicitly sought after by teams rather than individuals (DeTienne and Wennberg, 2014). In fact, if each individual of the founding team has an equity stake in the venture, in order for the efforts and hurdles of years of company-building to be repaid, the exit must not only be successful, but generate high enough returns to satisfy all the members. Logically, this consideration hints to the fact that large teams are more prone to pursue financially rewarding exit strategies, namely IPOs and M&As. DeTienne et al. (2015) employ a set of 1500 two-to-five-year-old firms from the 2005 Dun and Bradstreet directory to investigate if any relationship between team size and exit strategy exists. The authors find that, indeed, the size of the founding team negatively correlates to stewardship exit strategies (family succession, independent sale or employee buyout). Conversely, team size correlates positively, albeit not significantly, to financial harvest strategies (IPOs and M&As). Last, the authors find no relationship between team size and voluntary cessation strategies.

1.5.5 Number of employees and exit

Employees are not only relevant stakeholders of a venture but are instrumental for the company's success. It is thus straightforward to think that, when entrepreneurs evaluate exit strategies, the number of employees in the organization has a relevant weight in the final decision, since different types of exit can impact employees differently. For example, voluntary cessation strategies imply that the company is disbanded, and all its workers left to seek employment. Consequently, founders of larger firms need to keep into account more stakeholders in their exit strategy evaluation and will focus more on the wellbeing of the organization and its people (DeTienne et al., 2015), even if this is conflicting with personal interests (Davis et al., 1997). Support to this statements is provided by the previously mentioned DeTienne et al. (2015), who find that the number of employees negatively and significantly correlates to voluntary cessation and stewardship exit strategies.

1.5.6 Presence of external investors: influence of venture capitalists on exit

It is not uncommon for the entrepreneur to seek external financing through the lifecycle of the firm in order to propel growth, drive innovation or simply survive. Fundraising can happen at any stage, either in the form of debt financing or through the issuing of new shares. In the following Chapter, the focus is put on equity investors -namely Business Angels (BAs), Venture Capitalists and Private Equity funds (PEs)- as, at some point in the life of the venture they funded, they will need to liquidate their shares and cash out on their investments. More specifically, the attention will be put on the second category -VCs- as they represent the most interesting type of equity investors for this dissertation: their contribution is not only confined to the provision of capital, but extends to reputational capital, advice and mentoring of the startups in their portfolio (Espenlaub et al., 2014).

VCs play a central role for the development and renewal of national economies (Gompers and Lerner, 2001), taking bold bets by investing in high-risk, high-reward ventures (Felix et al., 2012). The exit process starts early at the investment stage -in which VCs select ventures according to the possible exit opportunities-, goes on with the value addition stage -in which VCs bring their knowledge and assistance to the funded firms- and concludes with the actual exit stage -when VCs, hopefully, cash back on their investments. A study carried out by the European Private Equity and Venture Capital Association (EVCA) found out that 94.5% of VC-backed startups could not exit had they not received VC funding (EVCA, 2002). Moreover, exit is of paramount importance for VC firms and the survival and growth of the VC industry as a whole (Gompers and Lerner, 2001), as it allows VCs to cash out on their bets, recover investments are realize gains to distribute to limited partners. Additionally, successful exits are good signals of the quality of the VC firm, and thus reduce investors' skepticism for follow-on rounds (Black and Gilson, 1998). Still, many of the firms VCs finance do not make it to exit stage (intended as either M&A or IPO) and those who do, do not necessarily generate high-enough returns. Consequently, VCs clearly care

about the exit strategy pursued by their portfolio companies and can influence it to best fit their interests. Proof of this statement is provided by Cumming (2008), who employs a set of 223 entrepreneurial firms financed by 35 VC funds from eleven European countries to investigate the relationship between VC contracts and exits. The author shows that VCs increase the likelihood of acquisitions by 30% when they have contractual control rights, including drag-along rights, board control, and the power to replace the founder. As per Cumming (2008), there is a "positive association between acquisitions and the use of VC veto and control rights, particularly the right to replace the founding entrepreneur as CEO". Additionally, Cumming's (2008) findings suggest that control rights are more likely to be connected with an exit through IPO or write-off.

Regarding their influence on exit strategy, academics already produced evidence of the preference of VCs for IPOs, as these are considered to be the most successful exit strategy (Black and Gilson, 1998) since they are the most financially rewarding (Cumming, 2008; Espenlaub et al., 2014), followed by M&As (Black and Gilson, 1998). Quite interestingly, though, the National Venture Capital Association (NVCA) reports that, in the 11 years period from 2000 to 2011, more VC-backed firms exited through acquisitions than IPOs. In 2010 alone, the total value of acquired firms stood at $18.31 billion in value, compared to only $7.02 billion of the firms that went public. This seems rather counterintuitive, since academics (Brau et al., 2003) have already reported "valuation premiums" of IPOs over acquisitions. Still, IPOs and mergers preferences appear to be "cyclical": as an example, Ball et al. (2011) report that IPOs exits by high-tech VC-backed firms were quite frequent during the five-year period from 1995 to 2000, as it was a "hot issue period" for the tech sector, whereas during the financial collapse of 2008 only 5% of VC-funded startups chose that strategy. This leads to believe that VC firms tend to push companies to follow the exit strategy which can maximize their return on investment, basing their choice on market conditions. Ball et al. (2011) employ a sample of 8163 firms which exited through IPO (3477 observations) or acquisition (4686 observations) in the 30-year period from 1978 to 2009 and find

evidence that VCs' exit preference is indeed influenced by market conditions, seemingly creating patterns of pseudo-market timing.

1.5.7 Exit determinants: M&As versus IPOs

Regarding exit, academics greatly focused on two exit strategies available to the entrepreneur, namely IPO and acquisition (Shepherd and Zacharakis, 2001), since both options are indeed highly financially attractive for both the entrepreneur and its venture (Bayar and Chemmanur, 2011). Given the focus of this dissertation on the topic of acquisitions, and M&As specifically, it is important to understand the different factors driving one choice of exit over the other. A brief overview of the literature is provided, using the comprehensive work by Brau et al. (2003) as a basis. The authors identify four categories of factors influencing the exit strategy between IPO and M&A, namely: industry-related factors, market timing factors, deal-specific factors and demand for funds factors.

1.5.7.1 Industry related factors

The first macro category encompasses the level of concentration in the industry, the type of industry and the financial leverage level in the industry. The authors suggest that firms in highly concentrated industries are more likely to follow an IPO strategy, since there is little space for consolidation if the firms operating in the market are already few (Brau et al., 2003). Moreover, acquisitions become difficult due to strict antitrust regulations if the industry is concentrated. However, small firms operating in highly concentrated industries may suffer from competition by bigger rivals, so acquisitions become attractive (Sharma and Kesner, 2017). Indeed, should the company go public, it would have to rely entirely on its own resources to compete in the market, but only late-stage firms with a robust and viable business model are likely to succeed alone in the market competition (Bayar and Chemmanur, 2011). On the other hand, highly fragmented industries are ideal for consolidation and takeovers to take place (Brau et al., 2003).

The type of industry in which a company is operating can also affect its exit route: some industries gain more interest from the public markets and investors seeking

opportunities for big returns on their investment. Specifically, Brau et al. (2003) suggest that if the company exploring exit belongs to high-tech industries, it will be more likely to capitalize on market enthusiasm for such sectors and thus exit through an IPO rather than a takeover. The industry proposed by the authors was, as the time of their study, incredibly "hot", and later resulted in the dotcom bubble. Thus, it should be noted that the link between industry and public interest indeed exists but evolves over time. Regardless, other authors argue that factors such as loss of confidentiality may drive companies away from public markets (Yosha, 1995; Maksimovic and Pichler, 2001) in favor of acquisitions, since the premiums paid for companies operating in "hot" industries (such as high-tech was in the 2000s) are significantly larger than those paid to non-high-tech targets (Kohers and Kohers, 2000).

Last, the financial leverage of a company can either receive a positive or negative scrutiny from public markets investors: the higher the debt, the higher the risk, so when it comes to IPOs, firms belonging to highly leveraged industries usually suffer from underpricing (Brau et al., 2003). In such cases, takeovers seem more attractive opportunities.

1.5.7.2 Market timing factors

Public markets regularly go through "hot issue" periods (Ritter, 1984). When such periods take place, information asymmetry tends to be lower than average and investor sentiment is overly optimistic (Brau et al., 2003). Thus, companies exiting through IPOs can benefit from greater public capital raises. On the other hand, ventures will not likely issue stock if information asymmetries are high, as in periods of industry or economic contractions (Mitchell and Mulherin, 1996), preferring the M&A route. There is indeed evidence suggesting that IPOs and M&As tend to occur in negatively correlated clusters (Mitchell and Mulherin, 1996), depending on whether there is an "hot issue period" or not.

1.5.7.3 Deal specific factors

This category includes firm size, insider ownership and insider liquidity. Since IPOs represent a sunk cost for firms that want to go public (Ritter, 1987; Pagano and

Roell, 1998), if firms are too small, pursuing that path could prove too expensive and, ultimately, not worth it (Brau et al., 2003). Moreover, as previously stated, small firms face greater difficulties when competing as stand-alones in the market, so their success is not ensured.

Secondly, the exit strategy can be influenced by the firm's cap table and, specifically, by the post-exit ownership structure that the entrepreneur/funding team seeks. In fact, acquisitions paid in cash allow for full divesture and thus represent the most dramatic shift in ownership, whereas acquisitions paid in acquirer's equity allow for partial and indirect retention of ownership (Brau et al., 2003). On the other hand, changes are not dramatic in the case of IPOs, as founders divest their stakes slowly over time (e.g., Rydqvist and Hogholm, 1995; Bebchuk and Zingales, 1999).

Last, the liquidity objectives of the entrepreneur or funding team play a significant role in determining the exit route. If the goal is that of completely cashing out on the value built through the years, then the preferred exit strategy is that of exiting through an acquisition via a cash offer (Brown et al., 2000), whereas partial sales or IPOs are fitting choices when the entrepreneur seeks smaller liquidity events (Brau et al., 2003).

1.5.7.4 Funding demand factors

If a company needs capital for new investments and expansion, it will be more sensible for it to go public rather than be acquired. During IPOs, companies can raise huge amounts of capital, much needed for innovation and growth activities. As a matter of fact, scholars already proved that the most important factor pushing firms to go public is the possibility to raise funds (Lowry and Schwert, 2000). Yet, if a privately held venture is acquired by a publicly traded firm it can benefit from the financial resources and access to the public markets of the parent company. However, public companies usually resort to debt to fund acquisitions, and if interest rates are high, firms might be discouraged to engage in takeovers. Still, debt could also be employed by private firms to fuel new growth. As Myers and Majluf (1984) suggest, however, debt is not a viable and attractive option after a certain point: in fact, if a venture is

already highly leveraged, it is more convenient for it to raise funds by issuing shares of its stock. On the basis of these arguments, the logical conclusion is that in periods of high interest rate more IPO activity will be experienced, even though firms going public may suffer from lower capitalization (Brau et al., 2003).

1.6 Growing relevance of M&As: an overview

Mergers and Acquisitions are becoming increasingly relevant for the economy, as deals have vastly grown in volume and value over the last decades. Thus, a brief overview of this phenomenon and its importance is provided, so to better appreciate the relevance of this dissertation.

The total volume of M&As globally stood at $2.8 trillion in 2020 (GlobalData, 2021), slightly less than 2019's total volume due to the effect of the Covid-19 pandemic. According to GlobalData (2021), a total of 8823 merger and acquisition deals were announced in Q1 2021 alone, a growth of 48% with respect to the same period in the year before. The increased availability of capital provided by Special Purpose Acquisition Companies (SPACs) coupled with the inflows supplied by PE and growing hunger for acquisitions by corporate players, enabled transactions to reach a record of $1Tn per quarter over the twelve months between summer 2020 and summer 2021 (PWC, 2021). In particular, SPACs fueled further growth of "megadeals" (deals valued at over $5Bn), taking part in a quarter of them. PWC (2021) estimates that almost 400 SPACs, with a combined capital of $1Tn, have yet to find a target, and that the majority of them will complete a merger by the end of 2022. On the other hand, PE also cut a higher share of total deals, taking part in 39% of M&As transactions in the first half of 2021, compared to 19% in 2019 (PWC, 2021). Jeff Black, partner at Mercer, confirms that "private equity firms have nearly $2 trillion in dry powder and there is a similar amount of cash on the balance sheets of the S&P 500. Combine the financial means to do deals with the need to readjust business models to the post-pandemic world, and you'll find organizations increasingly interested in their M&A options". Even though so called "megadeals" catch the attention of the general public, acquisitions on

a smaller scale still dominate the market (Mason and Harrison, 2006). Moreover, small and medium enterprises (SMEs) are equally involved on "both sides of the table", as they are both targets and acquirers (Cosh and Huges, 1994).

Focusing on deals between a corporate player and a private firm, M&As are important for both the acquirer and the acquired company. Regarding the former, particularly for companies competing in aging and mature markets, M&As become a means through which they can get into new markets and gain access to customers, suppliers, knowledge and existing government relationships of the target firm (Hitt et al., 2012). Moreover, acquisitions allow to exploit new opportunities as well as achieve strategic renewal (e.g., Higgins and Rodriguez, 2006; Ransbotham and Mitra, 2010).

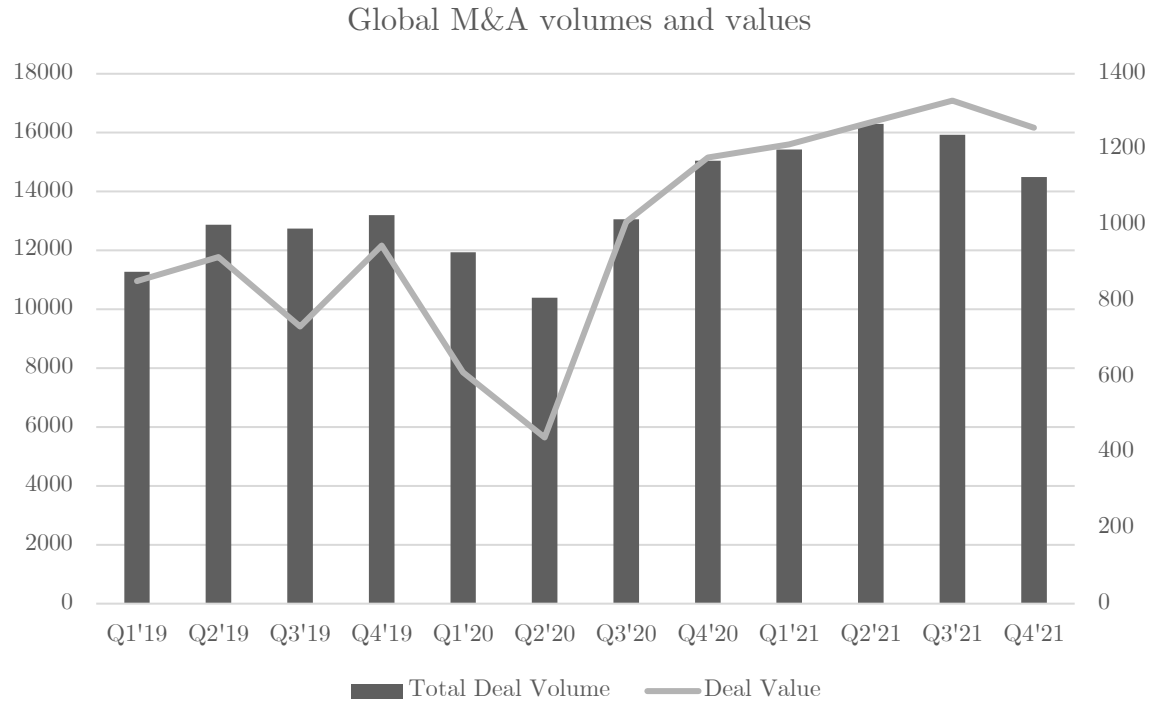

Figure 1: global M&A deal volumes and values (Sources: Refinitiv, Dealogic and PwC analysis 2021).

Other reasons pushing firms to acquire private ventures regard the pursuit of economies of scale, market power, risk reduction, synergies, and legal and tax benefits (Haspeslagh and Jemison, 1991; Hitt et al., 2012). For example, an incumbent might seek building synergies with a target by taking over a company with a similar product line and customer base. In this way, the incumbent can experience a faster inorganic growth and an increased product market performance by leveraging the competences,

know-how and assets of the target firm (Puranam and Srikanth, 2007). Moreover, as stated, the goal of an acquirer could be that of internalizing capabilities and knowledge of the target firm to propel (stagnant) innovation, meaning that acquisitions have great success when they target firms with complementary resources (King et al., 2003; Makri et al., 2010). In that regard, Baumol (2004) argues that while internal R&D is useful for incremental innovations, companies also need to complement it with technologies and patents developed by younger entrepreneurial firms. For example, Rossi et al. (2015) point out that biotech companies frequently resort to M&As to overcome R&D problems and changing regulations, as well as to maintain market relevance and fast-track growth.

Taking instead the perspective of the target, M&As are particularly useful in highly R&D-driven markets (such as the high-tech one), in which firms need to continuously invest to stay relevant and competitive (Lehmann et al., 2012). Regardless, having the support of a solid, mature company is important for new ventures and their survival (Bayar and Chemmanur, 2011). Such support would be missing in the case of an IPOs, since the newly public firm would find itself competing against all the incumbents in the market without any kind of assistance.

1.6.1 The M&A process

Having understood the growing relevance of M&As and their importance for both targets and acquirers, the following paragraph is aimed at providing an overview of the M&A process so to have a general understanding of it, using the paper by Boon and Mulhering (2009) as a guideline.

M&As are mostly private processes, either started by the management of the target firm -who is exploring strategic alternatives -or by the prospect acquirers- who show interest in the target and directly contact its upper management. Considering the latter, it is not infrequent for acquirers to leverage on "bear hug letters", which are communications intended to intimidate the target with threats of hostile takeovers in the case of no response. Regardless, as soon as the deal is initiated, the target contacts both financial (investments banks) and legal (law firms) advisors, in order to properly

define the sale strategy and the number of bidders to involve. For example, sale strategies vary from controlled sales (in which few, selected bidders are invited) to auctions with large number of potential buyers, but can even include negotiations with one single interested firm. Several papers have been published on studying the occurrence of different sales strategies. For example, Andrade et al. (2001) employed a sample of US transactions between public companies over the period 1973-1998 and reported that the average number of bidders per deal is around 1.1. Focusing again on US deals, Betton et al. (2009) further demonstrated that most of the bids (62.4%) in their sample of 1353 acquisition tenders between 1971 and 1990 were not challenged by any rival. Moeller et al. (2007) provided further evidence on that by showing that only 4.19% out of 4,322 deals announced by US companies between 1980 and 2002 involved competition by rival bidders. In their study on 35727 deals between 1980 and 2005, Betton et al. (2008) discovered that a staggering 94.7% of takeovers were single bid contests and just 3.4% were multiple bid contests with rival bidders, while 1.8% were multiple bid contests by a single bidder. On the other hand, Boone and Mulherin (2008) discovered that around half of the deals in their 308 takeovers samples from the 1990s involve multiple bidders. More specifically, the authors reported that, on average, 13.81 prospect bidders were contacted, 5.77 signed a confidentiality agreement, 1.51 submitted a private written bid and 1.23 publicly announced a formal bid. Since, as reported, competition appears to be rather low in tender offers, Aktas et al. (2011) investigated the reasons and effect of this phenomenon. The authors framed acquisitions as a two-stage model: first, a potential acquirer is contacted and a one-on-one negotiation between target a prospect acquirer takes place, concluding with a take-it-or-leave-it offer; should the negotiations fail, the deal enters the second stage, in which the target organizes an auction and rival bidders enter the process. Thus, according to their model, negotiations occur "under the threat (or in the looming shadow) of an auction" (Aktas et al., 2011). Going back to the M&A process and considering its legal aspects, potential bidders are usually required to sign confidentiality and standstill agreements, since they are provided non-public

information about the target such as R&D projections, sales numbers and customers contracts. This information is important for potential acquirers in order to evaluate the target and start the due diligence process before submitting bids. Based on the outcome of the due diligence process, potential bidders might sign letters of intent: those who show the most interest in the target are usually provided with further elements for more in-depth due diligence. For example, they might be invited for conversations with employees or on-site visits. Based on this additional data, prospective acquirers submit their bids, on which the target selects the best offers and asks for a final submission. Prospects' goal is that of avoiding acquisition premiums, which are defined as the difference between the true value of a target and what it is paid for it. Such premiums are, as we will see, heavily influenced by information asymmetries, which can be leveraged on by the target to maximize his payoff. Nonetheless, bidders submit a bid using the knowledge and information at their disposal to evaluate the target and minimize the premium paid. The highest bidder wins the auction, and a contract between the winner and the target is signed. Such contracts regard general information on the merger (price, payment method, etc.) as well as protection devices for the bidder. After that, the acquisition becomes of public knowledge and, should it be approved by antitrust regulators, it can successfully come to an end.

To conclude this first part of the dissertation, two topics to which academics devoted a lot of attention to need to be addressed -from and M&A perspective-, as they constitute the backbone of this dissertation. Specifically, signaling theory in M&As will be introduced first, followed by an overview of how the use of auction theory is commonly applied by academics as a setting to model acquisitions.

1.7 Signaling theory

Signaling theory dates back to the works of Spence (1974) and other academics (e.g., Ross, 1977), who studied the effects of information asymmetries between two or more parties involved in a transaction. Before delving deep into the topic, it is

important to note that information asymmetry can be related to two distinct concepts (Stiglitz, 2000). First, it can be used in relation to the notion of "quality", according to which the problem of asymmetries arise when one party cannot discern the quality of the counterpart. Conversely, information asymmetry can also be referred to the level of ambiguity about the intentions and opportunistic behaviors of the different parties involved in a transaction, which results into a "moral hazard problem" (Elitzur and Gavious, 2003). In this dissertation, signaling theory has been employed to investigate the effects, on target's price discounting, of the uncertainty experienced by bidders in evaluating the quality of a target during acquisitions due to information asymmetries, without considering the implications of moral hazard.

To understand signaling theory, it is useful to first introduce the work by Spence (1974). The Nobel-winning scholar was the first to investigate the topic in his seminal paper, in which he studied how firms are affected by information asymmetries when hiring employees. Spence (1974) stated that, if productive employees are not able to signal their quality to employers -who should in turn be able to distinguish more efficient from less efficient workers- then they will receive the same wages as the less productive employees. Moreover, credibility problems arise in the moment in which employees are capable to disclose their abilities, since there is a natural propensity of revealing (false) positive information to benefit from the better offer. Consequently, Spence (1974) suggests that a credible means through which employees can communicate their capabilities to employers is that of using education achievements, which are positively related to productivity. Additionally, the author points out that the higher the cost borne by less productive employees to pursue education, the stronger the signal sent by more productive employees, who are able to better differentiate themselves. To generalize the concept, Kirmani and Rao (2000) provide an example in which two types of companies exist, one being high quality and the other being low quality. Whereas the quality of a company is unknown to people who are external to the organization (such as investors, suppliers, customers), it is well known within the boundaries of the firm. Clearly, this setting presents a problem of

information asymmetry, but each firm has the possibility of sending signals regarding its true value to the market, and receive a payoff from doing so. Specifically, the higher quality firms will receive a payoff A if they signal their quality, or a payoff B if they do not. Similarly, the lower quality firms will receive a payoff C if they signal their quality, or a payoff D if they do not. Kirmani and Rao (2000) point out that it makes sense for the high-quality firms to send a signal only when A $>$ B and D $>$ C. Indeed, in that case low quality firms have no incentive of sending any signal, so a separating equilibrium in which outsiders are able to discern between the two types of firms is created. Conversely, if both companies benefit from sending the signal (that is, A $>$ B and C $>$ D), then outsiders are not able to distinguish between the two firms and a pooling equilibrium is reached.

In order to fully understand signaling theory, three different concepts have to be defined, namely: signal, signaler and receiver. A throughout description of the three notions will be provided in the following paragraphs.

In general terms, a *signaler* can be identified with either a person, a product or a company (Connelly et al., 2011), depending on the stream of literature taken into consideration. For example, in organizational behavior and human resource management studies the perspective taken is that of the individual, so that the signalers can either be recruiters (Ehrhart and Zeigert, 2005), managers (Ramaswami et al., 2010), or employees (Hochwater et al., 2007). Strategy studies consider instaed firms (Basdeo et al., 2006), products (Chung and Kalnins, 2001) or key company's figures such as managers (Carter, 2006) or directors (Kang, 2008) as signalers. Last, scholars from the entrepreneurial studies commonly agree that only startups leaders should be categorized as signalers (Bruton et al., 2009), even though some academics also suggested to include individual entrepreneurs (Elitzur and Gavious, 2003) and franchisors (Michael, 2009). Often times, signalers engage in "cheating" behaviors by sending misleading and false information into the market in order to prevail against other signalers and to be perceived as superior by receivers (Johnstone and Grafen, 1993). However, such behaviors consequently generate trustworthiness problems for all

the signalers involved. Indeed, a signal is only useful to the receiver when it truly reflects the sought-after quality of the signaler (also called signal fit) and when the deceiving behavior is low. In order to make a signal reliable, scholars suggest that it should be costly to be produced (Connelly et al., 2011), so that only high-quality companies are able to bear the costs to show their true quality reliably and credibly (Ndofor and Levitas, 2004).

Similarly to the signalers, *receivers* can be identified with a variety of different players depending on the specific perspective adopted. Indeed, entrepreneurship researchers consider existing and prospect investors as receivers, distinguishing between private (e.g., Busenitz et al., 2005) and public (e.g., Cohen and Dean, 2005) investors. On the other hand, strategy studies also include other stakeholders in the definition, for example taking into account consumers, competitors and employees (Basdeo et al., 2006). Regardless, it is important to state that the effectiveness of a signal is heavily influenced by the characteristics of the receiver (Connelly et al., 2011). Indeed, if there is no fit, meaning that the signal regards information not sought after by the receiver, or if the receiver does not know how to capture and interpret the signals, then the whole signaling process is futile. Moreover, signals are not always captured by receivers since the latter are not continuously monitoring the environment: clearly, a signal can only be effective if the receiver is paying attention. Interestingly, receivers who have been able to collect and effectively use a signal to drive an informed choice are expected to also pay attention to similar signals in the future (Cohen and Dean, 2005). Additionally, once a signal is effectively received, it is also important that the receiver is able to correctly interpret it. Indeed, different receivers give different signals different degrees of importance as well as different meanings (Branzei et al., 2004), so often times signals are distorted and their meanings "diverge from the original intent of the signaler" (Branzei et al., 2005).

Last, *signals* are "observable proxies used by the signalers to communicate with and deliver to receivers" (Shimizu and Uchida, 2018). In order to be effective, scholars (e.g. Connelly et al., 2011) noted that a signal must be:

1. *Observable*, meaning that the receivers must be able to notice the signal (Connelly et al., 2011); some academics also referred to observability with terms such as "clarity" (Warner et al., 2006), "intensity" (Gao et al., 2008), or "quality" (Kao and Wu, 1994).
2. *Costly*, so that only high-quality signalers can afford to produce or imitate a signal, effectively generating a separating equilibrium (Kirmani and Rao, 2000); indeed, signals' cost should prevent dishonest signalers from producing them.
3. *Consistent*, both with the true quality of the sender and the interest of the receiver (Connelly et al., 2011), especially when multiple signals are sent at the same time; indeed, apart from reflecting the true quality of the signaler, the signal must be important to the receiver, meaning that there must be a "fit".

The effectiveness of a signal can be enhanced by raising its frequency (Janney and Folta, 2003), as the dynamic environment in which firms operate, characterized by always-changing information, pushes signalers to repeatedly send the signal in order to differentiate themselves (Janney and Folta, 2003).

1.7.1 Signaling theory in M&As

As previously introduced, the M&A process undergoes an evaluation phase in which each bidder needs to put a price on the target company. If all prospect acquirers possess the same information and have equal availability to it, the deal is efficient and there is no room for misinterpretation or error (Wu et al., 2014). This, however, is fairly rare in practice. There is usually a (informational) mismatch amongst bidders and between bidders and targets, which might lead to the possibility of overbidding (paying premiums for the target company). In order to reduce information asymmetries, target companies can send signals to prospect buyers, thus diminishing adverse selection.

Signaling theory has already been studied in relation to IPOs. In fact, if ventures are not able to provide signals of their quality, they are forced to underprice their

shares, since public investors would have no means of distinguishing good (valuable) firms from bad (non-valuable) firms (Keasey and McGuinness, 2008). It is then beneficial for firms going public to reduce information asymmetries by sending signals of their quality, so to get a fair valuation in the moment of IPO, minimizing the "money left on the table". While the literature on the topic of signals in IPOs is abundant, fewer scholars focused on M&As and on understanding if some well-established signals in the IPO context can have the same implications in M&As. Obviously, there are substantial differences between the two exit events, so results should be expected to differ. Indeed, whereas in IPOs the company is open to receive funds from a multitude of investors, in M&As there is a single match between a target and an acquirer. Moreover, M&A deals are usually different from one another since the final valuation depends on the prospect's future expectations (e.g., of synergies) and the pre-deal characteristics. Indeed, the presence of potential synergies (Leung and Kwok, 2018) and strategic fit between the two companies (Bauer and Matzler, 2013) greatly influences the overall success of the deal by generating value for both the target and the acquirer, should the assets be combined in a merger. Asymmetries are greater when the prospect buyer operates in a different industry or is located far away geographically, leading those companies to be more sensitive and responsive to signals (Reuer et al., 2012). For example, Grote and Umber (2006) suggest the costs associated with due diligence are inversely related to the proximity between buyers and sellers, implying that closer prospect buyers benefit from an informational advantage with respect to further ones. Especially in these cases, sending signals helps reducing adverse selection (Ragozzino and Reuer, 2011). In M&As, disclosing specific information reduces the cost incurred to select and assess the value of exchange partners (Pollock and Gulati, 2007), but it also increases the target's payoff by reducing the price discounting which would otherwise happen in the case of asymmetric information (Reuer et al., 2012). Indeed, signals mitigate adverse selection and risks for buyers (Spence, 1974) and improve sellers' payoff, but they also boost target firms' credibility and legitimacy (Bergh and Gibbons, 2011). Some signals on which entrepreneurial ventures can

leverage on have been identified by scholars, such as possessing prominent boards of directors (Certo et al., 2001) or top managers (Lester et al., 2006), insider ownership (Filatotchev and Bishop, 2002), interorganizational ties (Park and Mezias, 2005), management stability (Perkins and Hendry, 2005) or intellectual property (Warner et al., 2006). In the case of high-tech ventures, an important signal that a firm can leverage on is the presence of previous investors (Wu and Reuer, 2021). In fact, receiving funding by other companies or investors (such as VCs) is a positive signal that indicates that the company is a profitable investment, which thereby reduces the extent to which a prospect buyer should rely on other signals (e.g., performance) to overcome the information asymmetry (Colombo, 2021). The existence of alliances and exchange partners produces similar effects (Wu and Reuer, 2021), since they indicate that the firms' resources and capabilities are in demand by other organizations (Jensen and Zajac, 2004). Both type of signal work under the premise that both investors and partners need to carry out extensive due diligence and screening process to select appropriate partners. Clearly, the more prominent the investor or exchange partner, the stronger the signal (Wu and Reuer, 2021). Sending signals, however, might not necessarily be effective if the receiver is not able to correctly interpret them. Indeed, the fact that a signal is publicly available to all prospective acquirers does not mean that all of them will pick it up and act on it (Pollock and Gulati, 2007). Moreover, it might happen that the value of a target relies on intangibles assets such as human capital or brand equity, in which case it might be challenging to correctly interpret its valuation (Wu et al., 2014), but also to send a signal in the first place. In that sense, acquirers with previous M&A experience are better equipped to receive and act on signals (Barkema and Schijven, 2008). For example, Aktas et al. (2011) suggests that CEOs come to be better bidders by improving in capturing and learning from the signals they receive. Additionally, more experienced firms rely more on their knowledge in the field rather than depend on signals about performance in their decisions (Wu and Reuer, 2021). Last, it is important to note that information asymmetries also influence the method of payment of the deal. Specifically, equity is used by prospect

buyers if they perceive that the target firm's share are overpriced, whereas cash payments are employed when acquirers feel that the target is undervalued (Leland and Pyle, 1977; Myers and Majluf, 1984).

1.8 Auction theory

Auctions have been used as methods for exchange for thousands of years. There is documented evidence of the use of auctions in ancient Babylon and Rome, where lenders utilized them as tools to dispose of confiscated assets of delinquent debtors (Paseda, 2021). Today, auctions are still widely adopted mechanisms for the exchange of a very large variety of commodities (Cassady, 1967). Therefore, it comes at no surprise that scholars have been rather prolific on the topic, producing abundant literature by analyzing different settings and several possible auctions' scenarios. Indeed, the procedure in which an auction is carried out heavily influences the outcome for both sellers and bidders, mainly regarding the winning price. According to the literature, auctions can be classified according to two different criteria:

1. *Openness of the auction* (public versus private); if a player's bid is publicly observable by all the other players, the auction is defined as open, otherwise it is defined as sealed-bid. In the first case, multiple bids can be placed subsequently, whereas in the second case only one bid can be placed by each player, and all players must submit their bids at the same time (Vickrey, 1961).
2. *Price evolution* over time (ascending versus descending); in ascending auctions the price starts at a low value and increases with each new bid, whereas in the descending auction the price starts at a high value, and it is decreased until one bidder decides to purchase the item (Chen et al., 2011).

Based on these dimensions, four types of auctions -best-known and most-used by scholars in their studies (Krishna, 2010)- can be identified: English, Dutch, First-Price, and Vickrey.

A *first-price* auction is sealed, meaning that the bidders submit their bids without knowing the offers made by others. The bidder offering the highest amount is declared as winner and pays the price of his bid, or "first price". The problem faced by the bidders is that of being outbid by other players and thus losing the tender (Costa Filho et al., 2016). Consequently, in a private value setting, the best strategy for bidders is that of submitting a bid equal to their own personal valuation of the object.

The *Vickrey* auction, name after William Vickrey, who wrote the seminal (1961) paper on auctions, is also known as second-price auction. It is again a sealed-bid auction in which all bidders independently place their bids. Even in this case the winner is the one offering the highest value, however the price he has to pay is equal to the second highest bidder's bid, or "second price". This strategy is optimal for players aiming to bid their true values independently from other bidders' moves (Klemperer, 1999).

The *English* auction -also called ascending bid, open or oral auction- is possibly the most-know format (Menezes and Monteiro, 2005), as well as the simplest (Vickrey, 1961). It is used, for example, for the sale of precious or rare items such as fine art, cars or real estate (Menezes and Monteiro, 2005). In this case, the auctioneer starts the auction with an initial low price for the auctioned item. Bidders place their bids at increments suggested by the auctioneer, and the winner is declared when no bidder is willing to increase his bid above the highest standing bid. In a private value setting it then makes sense to stay in the auction until the price reaches the personal value attributed to the object, when it makes no more difference between winning and losing. This means that, as in the second price sealed-bid auction, in a private value setting (or if there are only two bidders) each bidder only tenders his true value, and the winner wins the item at the second player's price (Klemperer, 1999). For this reason, the ascending auction is sometimes referred to as an "open second-price auction". This type of auction might give rise to cheating behavior from the auctioneers, who might employ "dummy bids", which are bids placed by the (undercover) auctioneer or seller themselves with the specific goal of increasing the price of the object. Other mechanisms, such as a minimum reservation price or the possibility of negotiations

with the winner, can be also set up to protect the seller of the item. Regardless, this setting is the most commonly used by scholars in their models (e.g., Fishman, 1988; Ravid and Spiegel, 1999), since its equilibrium is easy to identify and study (Vickrey, 1961). Moreover, there is no legal impediment to the revision of the bids placed by bidders, who can bid in whatever order they prefer (Ravid and Spiegel, 1999). Last, as Loyola (2012) points out, in some specific markets the BoD of the selling firm is legally obliged to maximize the value of the firm: since ascending auction ensure that the highest bid is accepted, such law is easily respected (Loyola, 2012). Another particular type of English auction, called the Japanese auction, is often employed by theorists and scholars (Klemperer, 1999). In this model, the prices raise gradually, without "jumps", and bidders gradually leave the auction with no possibility of ever be let back in.

Last, the *Dutch* auction, or descending bid auction, dates back to the 1600s, when it was employed in the Netherlands for the sale of tulips bulbs. It works in the opposite way of the English auction. The auctioneer starts the auction at a high price, lowering it continuously until one bidders accepts it, winning the auction at the current valuation of the item. This is strategically equivalent to a first price sealed-bid auction, since the bidder willing to pay the highest is the one winning the item (Klemperer, 1999), and also because the optimal strategy for each bidder is to only accept the price if it reaches their personal valuation of the object. In fact, Dutch auctions are also referred to as "first-price open bid auctions".

To conclude, it is important to note that an auction can either encompass the sale of a single item or of multiple items. In the latter case, there are many possible settings in which a sale can happen: for example, items can be sold sequentially or in a combinatorial auction, in which combination of objects are sold at the same time (Menezes and Monteiro, 2005). Clearly, studying such settings is more complex. However, the sale of a firm falls into the simplest case, as it involves the sale of a single object through an English auction, for which it is easier to identify equilibriums (Vickrey, 1961).

1.8.1 Auctions: an increasingly popular selling strategy

The goal of a selling firm is that of maximizing the outcome of the sale, which equates to finding the acquirer willing to pay the highest price (Povel and Singh, 2006). One way to conduct a sale is that of engaging in negotiations with several prospect buyers in order to understand the terms and conditions of the acquisition, so to evaluate its outcome and financial payoff. However, target firms can also opt to engage prospect buyers in auctions, an increasingly popular strategy for selling the firm (Povel and Singh, 2006). In that regard, several academics developed frameworks to study acquisitions using auction theory. For example, Fishman (1988) suggests that bidding contests are similar to English auctions, with the main difference that whereas an auction for a real estate or art piece usually lasts few minutes, takeovers can take up to several months. With more investigation it is possible to find, in fact, some similarities between a traditional auction and a venture acquisition: first, prospect acquirers compete with one another to buy the target company and thus have to propose better conditions than competitors, just like bidders have to outbid one another in a tender contest; second, in many countries the Board of Directors (BoD) has the "fiduciary obligation to accept the highest offer" (Espen Eckbo, 2009), just like auctioneers must accept the highest bid; last, acquisitions are usually one-time events (at most, they happen few times), in the same fashion that auctions for an object only happen once or few times in the lifecycle of the item. Given the relevance of the topic on this dissertation, it is important to provide an overview of the different works developed by academics on the subject. In fact, these studies provide a theoretical background for the development of the hypotheses reported in Chapters 2.1 and 2.2. Indeed, auctions are not only increasingly popular in M&As, but there is an abundance of research on the topic, with scholar focusing on different aspects of auctions (e.g., the fact that bidders possess some equity in the target firm) or simply employing auctions as models for acquisitions (e.g., Povel and Singh, 2006; Ettinger, 2009).

Before delving into the works of scholars on the topic, it is important to introduce two models used to study bidding behavior, namely the independent private

values (IPV) and common value (CV) frameworks. In common value auctions all bidders have the same perception of the value of the auctioned item (in our case, the target firm), which however it is not known when bids are submitted (Giliberto and Varaiya, 1989). Still, each bidder receives private information signals, related to the object value, from his competitors, thereby generating a potential adverse selection problem on top of the strategic problems intrinsic in auctions (Kagel and Levin, 1993). On the other hand, in an IPV auction each prospect knows the value of the auction object for himself, which is given by its personal evaluation, but has no clue on the value that other prospect bidders place into it (Giliberto and Varaiya, 1989). This means that, in this case, each valuation is independent from that of the other bidders since it is based solely on the knowledge and capabilities of each prospect acquirer (Athey and Segal, 2013). After this brief introduction, the different streams of literature focused on the topic of auctions in relation to M&As will be reviewed.

A first stream of literature focuses specifically the level of information each bidder possesses with regard to the target. Information clearly influences the perception of the value of the firm for a prospect buyer: not all bidders, however, are equally informed (Povel and Singh, 2006). For example, prospects operating in the same industry of the target have better knowledge to properly evaluate the target's operations and competitiveness. Less informed bidders can make less informed decisions: consequently, they fear the winner's curse (Povel and Singh, 2006), which is what happens when the value of the auctioned object is overestimated by bidders when uncertainty is high, and thus the winner is "cursed" by having paid more that the object's true worth (Giliberto and Varaiya, 1989). Dasgupta and Tsui (2003) devote their attention to this specific topic, investigating the effect of bidders' information heterogeneity on the outcomes of matching auctions. In a matching auction a specific bidder is asked to submit its bid first, and then if it is matched by a second bidder, the latter is declared the winner, but if this does not occur, then the first bidder wins the auction. The authors argue that if the bidders are heterogeneous information-wise, employing strategies which treat them symmetrically is not convenient for the target.

Instead, it makes sense to "guide the narrative" by using a precise order of moves. The authors show that, indeed, to maximize the sale valuation, the strongest bidder (the more informed one) should be asked to submit its bid first. Povel and Singh (2006) also support such argument, stating that the payoff-maximizing strategy is that of a stick-and-carrot mechanism aimed at the most informed bidder. The "carrot" regards the promise of increase likelihood of winning the auction should the bidder reveal high signals (and consequently high valuation); the stick works in the opposite way: if the most informed bidder's signals and valuation are low, it will have lower chances to win the auction and the firm will be most likely sold to the less informed bidder (Povel and Singh, 2006). By doing this, the more informed bidder fears losing the deal, so it would rather have a lower rent (difference between price paid and real valuation) than no rent at all. The higher the asymmetry between bidders, the more this strategy pays off for the target firm, even though the threat of selling to the less informed bidders has to sometimes be executed (Povel and Singh, 2006).

A second stream of literature focuses on the study of the effects of so-called "toeholds" in bidding behavior and auctions outcomes. It is quite frequent -and well documented- that bidders taking part in acquisition auctions already possess some shares in the target company, defined as a toehold. Betton and Eckbo (2000) show that in almost one third of the cases (36%), a bidder possesses a toehold of at least 10%. Their study considers 1353 tenders over the period 1971-1990 and reveals that the average toehold size is equal to 14.57%. Clearly, having a toehold on the target company unquestionably influences the bidders' behavior and motivations during the bidding process (Ettinger, 2009). As a matter of fact, given the importance of the subject, academics focused thoroughly on the effects of possessing equity in the target company prior to takeovers on acquisitions outcomes. Obviously, winning bidders with a toehold need to buy fewer shares in the target venture, since they already possess some, lowering their overall acquisition costs (Ettinger, 2009). On the other hand, should a prospect bidder with a toehold lose, it would still get a payoff since it would have to sell his shares (Loyola, 2012). Different studies already provided evidence that

toeholds increase bidders' chances of winning takeover battles (Walkling 1985; Betton and Eckbo, 1997). In fact, toeholders have incentives to bid aggressively, making non-toeholders more conservative in ascending auctions (Bulow et al., 1999). Previously mentioned Dasgupta and Tsui (2003) provide proof that bidders with toeholds are more aggressive in their bids. So, if bidders are heterogeneous (that is, their toeholds are sufficiently asymmetric and significant) it makes sense for targets to engage in matching auctions and ask the bidder with the biggest toehold to bid first. The authors note that the expected sale price grows as toeholds become more asymmetric, since the bigger the toehold, the higher the incentive for the first bidder to offer high valuations. Loyola (2012) employs a two-stage model to investigate the effect of toeholds. Specifically, the scholar assumes two companies competing for a firm, both of which have a toehold and a different perception of the target. Thus, the independent private value framework is used. In the model, bidder one has a toehold bigger than bidder two, and is consequently defined as "aggressive bidder". In the first stage, the target makes a take-it-or-leave-it to bidder one, who either accepts or declines: should he accept, then the deal is concluded. Instead, in case of rejection, negotiations move to the second stage, in which the target make a new take-it-or-leave-it offer to bidder two, who either accepts or rejects the offer. Should he accept, the company is sold; otherwise, the company remains unsold. The author states that it is optimal for the seller to set the price offered to the first bidder to be higher than the price offered to the second bidder, effectively discriminating against the stronger bidder as in the case of Povel and Singh (2006). Similarly, Ettinger (2009) also studies the effect of toeholds on auctions outcomes under the premise of the independent private value framework. The academic models the auction as a two-stage game in which two risk-neutral bidders compete, each with their own valuation for the target, which is not known to the other; one prospect acquirer (bidder one) also owns a minority stake in the target. The first stage regards the decision whether to take part in the auction or not: differently from Loyola (2012), participating in this game involves paying a sunk cost higher than zero, for example in the form of mobilization of top management or involvement of legal and

financial advisors. If the bidders decide to participate, an ascending auction starts. The price grows gradually with each bid, and a winner is selected when the other player decides to withdraw from the auction. The key finding is that the bidder with no toehold (bidder 2) is deterred from taking part in the auction altogether and never participates. The intuition is that the toeholder will try to drive the price upward since, in case of loss of the auction, its payoff would still be great (Ettinger, 2009). Since entry is costly, participating would always have a negative payoff for the second bidder, which then decides not to take part in the auction in the first place. The implication is that the target, in order to maximize its payoff, should lower participation costs as much as possible, so to attract more bidders and induce competition amongst them. It is in fact known that low competition negatively effects the sale price (Vickrey, 1961). On that regard, it is important to anticipate the study by Bulow and Klemperer (1996), which will be reported in Chapter 2.1, as it provides evidence on the effect of the number of bidders on the exit valuation. The scholars investigate whether it is more profitable to sell a company with an auction with no reserve price or with an optimally structured negotiation with one less bidder. To answer the question, Bulow and Klemperer (1996) developed a mathematical model in which the expected revenue for the target is a function of the value of the firm's assets and of the signals that the bidders receive. The authors find that the "expected revenue from an absolute English auction with N+1 bidders exceeds expected revenue from an English auction with N bidders followed by a take-it-or-leave-it offer to the last remaining bidder". This result is rather robust, as it holds true under both common value and private value auctions, and it means that it is convenient for a target to devote resources to extend the pool of bidders participating in the auction. Indeed, should a target be approached by an acquirer, if at least one extra prospect acquirer is expected to be interested, then the seller should not engage in private negotiations, but rather initiate an auction (Bulow and Klemperer, 1996). A direct consequence of the findings is that under no circumstance a target should agree to any type of lock-up agreement, as it would limit the possibility to have additional bidders (Bulow and Klemperer, 1996).

To conclude, the last stream of literature reviewed in this dissertation takes the perspective of incumbents. Some scholars (Becker et al., 2016) suggest that several firms deliberately pursue a "born-to-be-sold" strategy, in which the goal driving the creation of the new venture is that of building a disruptive company to later sell to incumbents. Assuredly, it is not uncommon for incumbents to purchase high-growth yet unprofitable firms: to support such argument, Becker et al. (2016) cite some examples such as Instagram (acquired by Facebook for $1Bn), Tumblr ($1.1Bn acquisition from Yahoo) and YouTube ($1.65Bn takeover by Google). According to the authors, these types of startups enter the market with a better (and usually free) product or service, and quickly capture market share posing a threat for incumbents. Despite the low or negative profitability, little to no revenues, few tangible assets and uncertainty about future financials, incumbents are driven to engage in competitive and costly bids to acquire them in order to propel their own growth (Becker et al., 2016). Quite interestingly, these high-growth, highly unprofitable ventures would have a hard time surviving for a long time in the market, since their business model requires burning a lot of cash. This implies that, should no incumbent acquire them, they would simply have to exit the market since they would lack the resources to keep competing (Becker et al., 2016). Ignoring the startups, however, might not be a viable option for all incumbents, since smaller ones would be more threatened by the new players. If just one incumbent shows interest in a takeover, it initiates a chain of interest from several other players, which results in competitive bidding. Moreover, to ensure that incumbents engage in competitive bidding behaviors, the startups diffuse noisy signals about their value with the intent of fueling interest in incumbents and drive bids to higher valuations.

1.8.1.1 Auction price determinants in M&As

Academics have greatly investigated the factors influencing the final sale price of an auctioned object. Two of them, in particular, are of interest for this dissertation, as they will be the basis of the hypotheses' development and thus will be discussed in detail in Chapter 2. Specifically, these factors regard:

1. The number of bidders (e.g., Vickrey, 1961); and
2. The level of information of the bidders (e.g., Dasgupta and Tsui, 2003; Povel and Singh, 2006).

Additionally, even if outside the scope of this dissertation, there are three additional factors, whose effects on targets' final sale price has been studied by scholars, which are worth mentioning.

First, as already introduced in Chapter 1.8.1, the presence of a toehold in the target company creates asymmetries between bidders, generating peculiar bidding behaviors. While most of the firms which ending up purchasing a target do not have any toeholds (Poulsen and Jarrell, 1986; Bradley et al. 1988; Jennings and Mazzeo 1993), there are clear benefits for the bidding firms in owning shares in the venture they want to take over on. First, a toehold discourages rival bidders (Ravid and Spiegel, 1998), and secondly it forces the other players to bid higher for the target. Moreover, toeholds also increase "aggressive behaviors" on the part of the toeholder (Dasgupta and Tsui, 2003), which can be leveraged on by the seller to maximize its payoff (Dasgupta and Tsui, 2003). However, Hounwanou (2018) suggests that if bidders with low valuations have a toehold in a target, the probability that the prospect acquirer with the highest valuation will not take part in the auction is non-zero, and that such probability is directly proportional to the size of the toehold possessed by the other bidders. Hounwanou (2018) explains the phenomenon by stating that taking part in a tender contest is costly (i.e., because of due diligence activities), so prospect acquirers need to evaluate the potential profits: if they are negative, as it might happen if other firms hold a toehold, the company will not take part in the auction.

Secondly, it should come at no surprise that the specific type of auction influences the final sale price (Vickrey, 1961). Several scholars, however, studied the combined effect of auction type and information asymmetries amongst bidders. Milgrom and Weber (1982) find that, in the case in which bidders' signals are affiliated, that is when "a high value of one bidder's signal makes high values of other bidders' signals more likely" (Milgrom and Weber, 1982), the highest prices are obtained with

ascending (English) auctions, followed by sealed-bid second-price auctions and first-price auctions. Klemperer (1999) suggests that first-price or ascending auctions might be more profitable than other alternatives. While the vast number of possible asymmetries make it difficult to generalize a model, Maskin and Riley (1985) report that "roughly speaking, the sealed-bid auction generates more revenue than the open [second-price] auction when bidders have distributions with the same shape (but different supports), whereas the open auction dominates when, across bidders, distributions have different shapes but approximately the same support". Regardless, M&As are usually modelled with an English auction, es explained in Chapter 2.1.

Last, it is worth mentioning the effect that the target's competitors have -on the winning bid's value- when taking part in the tender contest. Ding et al. (2013) model a horizontal acquisition as an auction in a Cournot oligopoly in which bidders privately know the synergies created through the (possible) merger; in that scenario, each bid affects rivals' beliefs and, thus, their bidding behavior. Indeed, the non-winners can benefit from positive externalities if the synergies between the winner and the target are low, whereas they are subject to negative externalities when these synergies are high. Pagnozzi and Rosato (2016) focus instead on acquisitions carried out by a company deciding to enter in a new market. In their setting, firms are modeled as asymmetric, with different expected synergies and competing in a Cournot oligopoly. The authors state that, should externalities be high between the new entrant and the target, then the incumbents (i.e., rival firms of the target) would suffer from negative externalities, which would drive them to bid higher in order to prevent entry.

2. Hypotheses and theoretical background

Having provided a comprehensive overview on the literature available on the topics of signaling theory and auction theory in the perspective of M&As, this Chapter is devoted to defining the objectives of this dissertation. Specifically, the following Chapter is divided in two parts, according to the two main theoretical backgrounds on which the hypotheses tested in this dissertation are based on. In particular, the first part of this Chapter focuses on the existing literature on auction theory, on which two hypotheses are derived: first, that there is a positive relationship between the number of bidders and the target's price; second, that this effect is further reinforced by the presence of informed bidders. On the other hand, the second part of this Chapter addresses the use of signals in corporate takeovers, focusing specifically on the effects that the presence of VCs has on the target's valuation when an acquisition is modeled as an auction.

2.1 Positive correlation between the number of bidders and the exit valuation

Since competition is common to all auction settings, the relationship between the number of bidders and the auctioned item's price has been greatly studied by scholars, as it seems spontaneous to think of it having a relevant effect of the seller's revenue. Intuitively, an increase in competition, measured in the number of bidders, should drive more aggressive bidding, so that as the number of bidders grows, the price of the auctioned item approaches towards efficiency price (Amaral et al., 2012). This intuition, common to both private-value auctions and common value auctions, is called the "competition effect" (Amaral et al., 2012). Since each bidder, if rational, would try

to maximize his rent (the difference between the price paid and the true value of the firm), in case of little or no competition (only one bidder), there is no incentive for a prospect buyer to offer more than the minimum: in this case, all the profits would be made by the buyer himself (McAfee and McMillan, 1987). On the other hand, in the hypothetical case in which the number of bidders approaches infinite, the winning bid would be the one maximizing the seller's payoff, who would make all the profits (Holt, 1979). Indeed, when the number of bidders grows, the winner's curse effects become more severe (Milgrom, 1989), meaning that it is more likely for the winner to overpay for the auctioned item and for his profits to be negative. This is especially true for common value auctions, since being the winner means being more optimistic on the value of the auction object than all the other bidders (Haile et al., 2003). The more the bidders, the worst the "news" for the winner, since it implies that he must have been more over-optimistic that all of the competition (Milgrom, 1981). In this regard, it is worth mentioning the work by Bazernab and Samuelson (1983), who investigate the effect of the number of bidders on the winner's curse in an experimental test. First, the authors show that, while the bidder's value estimates are normally distributed -with mean equal to the real value of the auctioned item-, the distribution of tenders is skewed to the left, meaning that bidders discount the value of the object when making offers. Still, winning bids would often times include a premium on the real value of the object. The authors suggest two explanation to the phenomenon: first, bidders fail to understand that if they think that their bid can win the auction, then their offer is probably overpriced compared to the real value of the object, and thus they should lower their bid; second, the authors suggest that the competition has an effect on the winner's curse, as the presence of more bidders means that it is more likely that some of them will be amongst those in the extreme right tail of the estimate curve, and will consequently drive bids up. Again, the authors show that bidders do not correct their estimates based on these consideration. Indeed, bidders commonly reason as follows: "I will have to bid closer to the real value (my estimate) if I am going to win the auction with so many bidders." (Bazernab and Samuelson, 1983). However, other

scholars (e.g., Gilley and Karels, 1981; Hong and Shum, 2002) suggest that competition could also have the opposite effect: as the winner's curse become more severe, bidders with less information could underprice the target as a protection mechanism. In that way, the effects of competition offset each other (Pinkse and Tan, 2005).

Academics, focusing on a variety of different sectors, have already investigated the effects of competition on the seller's payoff. For example, Amaral et al. (2012) employ a database of 80 calls for tender offers on London's bus contracts between May 1999 and May 2008 and find that the payoff (measured as cost of service, so that the lower the cost, the higher the payoff) for the seller (in this case, the municipality) becomes higher as the number of bidders increase. Gómez-Lobo and Szymanski (2001) obtain similar results when investigating the relationship between cost of service for U.K. local authorities' refuse collection contracts and the number of bidders. Hungria-Gunnelin (2013) employs a sample of 512 deal prices for condominium sales in Stockholm and finds that there is a significant positive relationship between the number of bidders and the sale's price. Studying instead eBay auctions, Bapna et al. (2007) use a random sample of 1009 tenders to investigate the effect of number of bidders on the current price of the auctioned object. Unsurprisingly, the scholars found that more bidders led to more competition, with the effect of increasing the final item's price. Interestingly enough, in their setting the authors discover that the relationship between the number of bidders and the current price is strongest in the middle of the auction, explaining the phenomenon with the presence of "evaluators". These are participants who are only placing one bid, although higher than average, translating in a stronger price increase per bidder (Bapna et al., 2007). Furthermore, the scholars suggest that, despite the number of bidders being positively associated with the current price, this effect is mitigated for high starting prices of the auctioned object. Saidi and Mardsen (1990) examine the effect of number of bids and number of bidders with respect to the winning bids' price in a common value auction setting of the outer continental (OCS) offshore oil lease market. Using data over the 1954-1977 period, the authors discover that when competition is fiercer, the winning bid price per acre is

higher (the relationship is positive and significant). On the other hand, Athias and Nunez (2009), in their study on bidding behavior in the case of toll road concession contract auctions, show that when competition increases, bidders tend to bid less aggressively. Focusing instead more broadly on auctions, Kagel and Levin (1993) show empirically that in the case of first price auctions, when the number of bidders doubled from 5 to 10, the bids and winning prices increased.

Considering instead the studies focused specifically on the effect of the number of bidders on M&As' final valuation price, the literature is quite scarce, with few scholars devoting attention to the topic. Walkling and Edmister (1985) are amongst the first to study the phenomenon. Using a sample of 158 takeover cash offers filed with the Securities and Exchange Commission between the beginning of 1972 and the end of 1977, the authors find that, in the 19 offers in which two or more bidders competed for a target, bid premiums were 30% higher. Further proof is provided by Bradley et al. (1988), who studied the influence of the number of bidder on targets' payoff using a sample of 236 tender contests occurred between 1963 and 1984. The scholars identify two types of possible auctions: single-bidder, in which there is only one acquirer, and multi-bidder, in which multiple prospect acquirers compete to win the tender. Their analysis shows that in multi-bidder contests the payoff for the target's shareholders is higher than in a single-bidder scenario, to a point at which the winner pays a price that makes the deal unprofitable to him.

Last, different mathematical models explaining the effect of the number of bidders on the final acquisition price were developed by scholars (Vickrey, 1961; Bulow and Klamperer, 1996). In Vickrey's (1961) simplest model, the homogeneous rectangular case, all individual valuations v_i for the N bidders are drawn from an interval (0, 1). Under the assumption that bidder's gains are represented by a linear utility function, there is a unique equilibrium strategy for which each bidder's bid b_i is equal to:

$$b_i = \frac{N-1}{N} v_i \tag{2.1}$$

Consequently, the expected winning price, in the case of first and second price auction (Vickrey, 1961), would be:

$$p = \frac{N-1}{N+1} \tag{2.2}$$

Since the first derivative of the price is always positive for every possible value of N, the conclusion is that competition has the effect of driving more aggressive bids and, consequently, drive up the final sale price. Bulow and Klamperer (1996), already mentioned in Chapter 1.8.1, prove with a different mathematical model that it is always favorable for a target to add an additional bidder in the auction.

To conclude, whereas mathematical studies seem to suggest that an increase in competition positively affects the final valuation of a target, practical evidence is still scarce. As reported, results from studies unrelated to corporate takeovers seem to further back that claim, but there is too little proof from practical studies focused specifically on M&As. Consequently, the first hypothesis that this dissertation will test is aimed specifically at shedding more light on this topic. Hence, the hypothesis is the following:

H0: *the exit valuation is positively correlated with the number of bidders*

2.2 Positive correlation between the number of informed bidders and the exit valuation

When multiple acquirers compete for a target, it is very likely that not all of them possess the same information (Povel and Singh, 2006). Moreover, the information possessed by the target differs from that possessed by acquirers. This is referred to as "information asymmetry": one entity in the transaction has more and superior information than the others, leading to inefficient outcomes (Akerlof, 1970). Obviously, this asymmetry goes both ways: if, on one hand, the target has relevant private information on its human capital, key technologies, brand equity, growth projections, relationships with other firms and customers and, consequently, knows well its intrinsic value, on the other hand the acquirers have their personal information on the possible

synergies and business potential that can arise from the takeover. Scholars already found that high levels of information asymmetries between management and investors prevent the former to convey the intrinsic value of the company to the latter (Chae et al. 2014), who then underprice the venture's equity (Glosten and Milgrom, 1985). In this regard, Cheng et al. (2016) investigate how takeovers influence information asymmetries amongst participants in the public market, starting from the hypothesis that a public firm is discounted by investors due to information asymmetry. This discount is seen by an informed acquirer as a good opportunity so, to ensure the success of the acquisition, it offers a premium over the current price. This is obviously attractive for the target, which is not able to effectively display its true value to capital markets (Cheng et al., 2016). The authors then employ a sample of 1612 acquisitions of listed companies occurred between 1986 and 2006 and confirm their predictions: target's information asymmetry is significantly and positively correlated to the bid premium (computed as the first derivative of the ratio between the price paid by the informed buyer and the market price of the target). This positive association is further reinforced in periods of "merger waves", in which acquirers tend to bid more aggressively (Cheng et al., 2016). This is also supported by Zhu and Jog (2009), who find a positive correlation between acquisition premium (measured as the cumulative abnormal returns of the target firm's stock from four weeks before to two days after to the takeover announcement date) and their proxy of information asymmetry (the idiosyncratic risk of the target firm's stock). Indeed, if acquirers are not able to retrieve the necessary information (i.e., technology, growth prospects, human capital, brand and key customers and partners) to evaluate the target, then the winner's curse, or risk of overpaying, is a likely possibility. Since acquirers cannot distinguish "lemons from peaches" (good deals from bad deals; Akerlof, 1970) having no means of understanding the value, quality and resources of the target firm, the whole M&A process becomes inefficient. Moreover, the post-merger integration and performance can present problems as well (Hennart and Reddy, 1997). Scholars suggest that acquirers, in order to reduce asymmetries, tend to take over firms which are former

alliance partners (e.g., Porrini, 2004), geographically close (Chakrabarti and Mitchell, 2013), or linked through common clients (Rogan and Sorenson, 2014), auditors (Cai et al., 2016), or social connections between managers and directors (e.g., Ishii and Xuan, 2014).

Despite the results of the studies mentioned above, there seems to be an agreement by scholars studying asset pricing on the fact that information asymmetries reduce asset prices (e.g., Easley and O'Hara, 2004) since prospect buyers bid less in order to reduce the risk of overpaying, therefore reducing the profit for the seller (Povel and Singh, 2006). Hendricks and Porter (1988) suggest that informed bidders in sealed-bid auctions are able to win the auctions at lower prices since they drive away less-informed bidders. In English auctions the effect is instead mixed and depends on the extent of information asymmetry around the auctioned object. Crook et al. (2017) state that, whereas "in the presence of low cross-sectional dispersion in information across bidders, uninformed bidders are unconcerned with the winner's curse and place high bids, driving up the asset's price", "in the presence of high cross-sectional dispersion in information, the winner's curse discourages uninformed traders from bidding, lowering the asset's price". In the case of M&As, which are frequently compared to English auctions (Fishman, 1998), Dionne et al. (2015) suggest that informed bidders' effect on acquisition premium is mixed and dependent on the extent of information asymmetry. The authors discovered that the premiums paid are lower when the target has high information asymmetry and there are informed bidders involved in the auction. This is due to the fact that uninformed bidders are well aware of their information deficit, so in order to avoid the winner's curse, they tend to bid lower, allowing the more informed bidder to win an auction paying a lower premium. Moreover, if the common knowledge of the target does not differ to much from private knowledge (information asymmetry is low), Dionne et al. (2015) state that informed bidders have little advantages over uniformed ones and that the latter tend to bid more aggressively.

Collecting the information needed to correctly evaluate the target can be a

costly task, which in some cases can easily exceed the tens of millions of dollars (Dastidar and Zaheer, 2010). Yet, despite their best efforts to reduce uncertainty, companies are still subject to information asymmetries. Several types of information asymmetries have been identified by academics, however the focus in this dissertation is put on the asymmetries arising as a result from the distance between targets and bidders, as measured by the following three dimensions:

1. Geographical distance;
2. Cultural distance;
3. Industry distance.

Considering the first dimension, an extensive body of literature shows that geographical closeness engenders information advantages for equity investments. Even though scholars suggest that the impact of geographical distance should reduce as telecommunications, IT and transportation systems improve (Grosse and Trevino, 1996), academics commonly agree that information asymmetry is less acute in local (domestic) investments compared to international counterparts (Buchner et al. 2018). For example, Teo (2009) uses a sample of Asian-focused funds to prove that those hedge funds which are geographically present in the location of their investments outperform those who are not. Coval and Moskowitz (2001) report an additional 2.67% improvement in fund manager's returns when they invest in local companies, which the authors define as firms within 100 kilometers from the fund's headquarters. This hints to the fact that fund managers are able to exploit local knowledge and information when investing in geographically proximate companies, probably due to better monitoring capabilities or by having access to "soft information", which is information available only in the proximity of the target venture (Coval and Moskowitz, 2001). Taking the perspective of M&As, proximity to the acquirer is favorable for target companies, since they can benefit from "both higher abnormal announcement returns and better post-acquisition operating performance than of those of distant acquirers" (Kang, 2008). However, Crook et al. (2017) found the opposite: using a sample of 4251 M&A deals between 1985 and 2014 in which both targets and acquirers are

headquartered in the USA, the scholars demonstrate that geographical distance significantly influences acquisition premiums. Focusing on the pharmaceutical industry, Schildt and Laamanen (2006) investigate a sample of 167 acquisitions between 1991 and 1996 and discover that geographical closeness influences the probability of acquisitions. On a similar idea, Cai and Tian (2010) studied whether the location of the target firm influences the likelihood of becoming a target for an acquisition, finding that firms located in cities have higher chances of receiving takeover offers and completing a deal compared to rural counterparts. The authors motivate the finding by explaining that urban firms have lower information asymmetries and better management policies with respect to non-urban counterparts. It is also clear that acquirers prefer targets which are geographically close (Grote and Umber, 2006) for a variety of reasons. First, it is possible for an acquirer to obtain so-called "soft information" to better evaluate the target if this is placed in its proximity (Grote and Umber, 2006); more generally, the whole process of information collection is cheaper and easier. Consequently, the more distant the acquirer is, the higher the probability of suffering from adverse selection. So, in order to reduce such risk, acquirers tend to discount the valuation of the target (Ragozzino and Reuer, 2011). Close acquirers, instead, are better positioned to collect, analyze and act on information, so they can outbid competitors while still being profitable (Chakrabarti and Mitchell, 2013). Second, it should not be forgotten that higher post-acquisition costs arise as the distance between the two counterparts grows: indeed, monitoring, integration and transportation costs are lower (Grote and Umber, 2006) for geographically close firms.

Taking the perspective of industry affinity, it is evident that an acquirer belonging to the same industry of the target will suffer from lower information asymmetries. Indeed, having expertise in the industry in which the target operates is a necessary condition to correctly evaluate its resources, suppliers, buyers and management competences (Montgomery and Hariharan, 1991). Indeed, it would be problematic for a target to communicate its value, quality and credibility to acquirers who operate in distant industries even if it was willing to do so (Ravenscraft and

Scherer, 1987), as they would lack the knowledge needed to properly evaluate the target's information. Since a firm might be acquired by a variety of different players, this type of "distance-based" asymmetry can vary a lot. In the most extreme case, a venture might be bought by the (top) management itself, which declares its interest in taking over the firm (Povel and Singh, 2006). In this case, the information asymmetry is at its lowest possible level, as managers are well aware of growth prospects, suppliers and buyers' relationships and industry's environment. Thus, in this scenario the valuation is rather fair and precise. Moving instead outside the boundaries of the firm, it is possible to classify the other prospect acquirers into two categories: strategic buyers and financial buyers (Gorbenko and Malenko, 2014). The first type of buyers encompasses all those companies seeking operational synergies and opportunities for integration from the takeover, and consequently include competitors, suppliers, and even customers. Regardless of the actual type, given that these players belong to the same industry, they are expected to have and act on relevant information on the target, meaning that they should be able to correctly assess its economic valuation (Wu et al., 2014). On the other hand, financial buyers relate to all those players targeting firms with low valuations with the intent of purchasing and reorganizing them to improve the operations and generate high-cash flows (Gorbenko and Malenko, 2014), with the end goal of either re-selling the company or taking it public. Thus, financial buyers generally include equity investors such as PE and VC firms, who consider each target as a potential company in a managed portfolio of investments. Despite not having the same industry experience as strategic buyers, they add value to the target by providing strategic and managerial expertise and by restructuring the venture. It is a commonly shared view that "strategic buyers have traditionally had the advantage over private equity funds, particularly in auctions, because strategic buyers could pay more because of synergies generated from the acquisition that would not be enjoyed by a fund", as per Mark E. Thompson and Michael J. O'Brien, PE practitioners. Indeed, even if strategic buyers are not able to achieve the synergies that they were willing to pay a premium for, they could still implement the same improvements financial bidders would

(Gorbenko and Malenko, 2014). As a matter of fact, Gorbenko and Malenko (2014) show that there is indeed a gap, regarding the optimal valuation and the maximum valuation for which they are willing to pay, between the two type of buyers: 14.9% for strategic buyers versus 7.8% for financial buyers respectively. However, the authors also note that the two groups usually aim for different types of ventures: whereas financial bidders seek poorly performing firms to restructure and resell, strategic bidders seek companies with which synergies can be built.

Last, differences in culture might reduce the quantity, quality and credibility of the information available (Dastidar and Zaheer, 2010), further exacerbating uncertainty and information asymmetries and making cross-borders M&As a difficult task (Dikova et al., 2009). In a way, cultural distance is related to geographical distance since, as Schildt and Laamanen (2006) note, "country borders often represent changes in language, newspapers, and TV channels, as well as reporting practices and governmental regulations". Moreover, different countries have different legal, accounting and tax regulations (e.g., Datta and Puia, 1995). The concept of cultural distance is related to the notion of national culture, defined as "the collective programming of the mind distinguishing the members of one group or category of people from others" (Hofstede, 1980). National culture heavily influences organizational cultures (Schneider and Meyer, 1991), leading to assume that the bigger the cultural gap, the stronger the differences between firms (Kogut and Singh, 1988). Indeed, it might be difficult for a prospect acquirer to fully understand the operations, business practices and organizational characteristics of a target when the two firms are culturally distant (Beugelsdijk and Frijns, 2010). Cultural distance was found to be related to difficulties in the negotiation process and usually results in lower information sharing (Li et al., 2014), conflicts (e.g., Brouthers and Brouthers, 2001), trust deficits (Very and Schweiger, 2001), deal abandonment (Jemison and Sitkin, 1986) and post-acquisition and integration problems (Boateng et al., 2019). Overall, as anticipated, cultural distance generates information asymmetries (Reddy and Fabian, 2020) and increases both transaction (Li et al., 2014) and agency (Buchner et al., 2018) costs. As

an example, scholars have showed that takeovers in Europe in which a target and acquirer belong to two distinct countries result in considerable integration and post-acquisition hurdles (Vaara, 2002). Lim et al. (2016) instead investigate the effects of cultural distance on premiums paid in M&As by studying a database of 1690 transactions occurred between 1990 and 2009 and involving 45 countries as deal counterparts from US-based acquirers and targets. The authors find no relationship of statistical significance when employing the full dataset. Quite interestingly, however, they find that the relationship is asymmetric in the case in which a US-based company bids for an international firm compared to when an international firm bids for a US-based venture. Specifically, in the former case the relationship is statistically significant and negative, whereas in the latter case the relationship is statistically significant and positive. This was previously discovered by Hope et al. (2011), who analyzed 3806 takeover deals occurred in the years 1990-2007 between a bidder headquartered in a developing country and a target headquartered in a developed country, finding proof that firms in developing countries tend to bid higher to win the target when compared to those in developed countries. These results indicate that the common view employed in previous literature suggesting that cultural distance is symmetrical between two countries might be over simplistic, and that not considering that the cultural distance actually depends on the acquirers' perceptions (Lim et al., 2016) might be faulty. Regardless, it is very important to include cultural distance considerations in the development of the models used in the dissertation, as employing geographical distance alone may not be enough to fully seize the liability of foreignness, or the "additional costs that multinational enterprises have to face relative to their indigenous competitors when operating in foreign markets" (Denk et al., 2012).

To summarize, geographically, culturally or industry close acquirers should be better positioned to evaluate the real quality of a potential target and, consequently, submit bids which reflect its true value. Indeed, they can gather more and better information, thus reducing the risk for the winner's curse and consequently manage to outbid uninformed bidders (Povel and Singh, 2006). However, Wu et al. (2014) suggest

the opposite, stating that closer (more informed) acquirers drive the prices up by submitting higher bids, consequently increasing their likelihood of winning the auction and improving the target's payoff. This might be due to the fact that the higher potential profits arising from lower post-acquisition integration and monitoring costs further pushes acquirers to seek control over local companies, in a phenomenon called "home bias" (Grote and Umber, 2006).

Before concluding the Chapter with the hypothesis deriving from the above-mentioned considerations, there is one last dimension of "level of information" worth mentioning, albeit unrelated with any concept of "distance", namely the acquisition experience of the bidder. Academics have contrasting views on whether, and under what circumstances, prior M&A experience favors bidders (Ragozzino and Reuer, 2011), yet plenty of evidence exists in favor of the positive effect that previous M&A experience has on the acquisition success. Power (1982) discovered that it can predict the success of future acquisitions, while Paine and Power (1984) proposed that the management of the acquiring firm needs to have some acquisitions under their belt for an acquisition to conclude successfully. Directors with past M&A experience are better at their monitoring and advising role and can thus prevent management from making wrong decisions (Kroll at al., 2008; McDonald et al., 2008; Field and Mkrtchyan, 2017), while also helping them in the negotiations (Oehmichen et al., 2021). Moreover, bidders with prior M&A experience have lower integration issues and are more capable at identifying the target's key resources and capabilities for potential synergies and value creation (Hitt et al., 2001; Hayward, 2002). Additionally, experience allows the managers of a potential bidder to acquire and assess information of the target more effectively and efficiently (Heil and Robertson, 1991; Bingham et al., 2007). Indeed, experienced managers are more aware of the adverse selection risk and its implications, a pressing issue especially in the case of high-tech ventures, and thus they are also more sensitive and better able to perceive the signals sent by targets (Cuypers et al., 2017). On the other hand, inexperienced firms might not be familiar with the M&A process and thus lack the ability and elements needed to understand the complexities

of an acquisition (Nadolska and Narkema, 2007) and correctly evaluate the target firm (Gada, 2018). This is particularly true for cross-border M&As, in which acquirers face more issues in spotting synergies with targets (Reuer et al., 2004) and suffer from a higher integration failure rate due to cultural differences (Dikova et al., 2013). Indeed, some academics have suggested M&A experience as a remedy for wide cultural gaps between acquirers and targets (Boateng et al., 2019), since experienced acquirers become less sensitive to cultural shocks (Du and Boateng, 2015). Indeed, Boateng et al. (2019) show that firms with more experience in M&As have both the tangible and intangible assets needed to overcome cultural differences and create value for the acquirer. Thus, it can be stated that acquirers with prior M&A experience are better able to assess the true value of a target given their superior ability in perceiving and assessing signals, thus being better informed.

To conclude, the empirical and theoretical evidence on the effect of the level of information of bidders on the auctioned item's price is limited and often contrasting. For that reason, this dissertation wants to contribute to the literature by shedding more light on the topic. Consequently, the second hypothesis that is going to be tested is the following:

H1: *the exit valuation is positively correlated with the number of informed bidders*

2.3 The presence of external equity investors

High-tech startups, and startups more in general, are highly innovative firms with high-growth potential, generally considered to be the driving force behind the future growth of any economy (Bhide, 1994). To start a new business, invest in R&D to develop a new technology, launch a new product or create a new market, a significant amount of financial resources is needed, especially since the company is not and will not be profitable for an extended amount of time, and thus incapable of sustaining itself (Berger and Udell, 1998). This initial capital needed to kickstart a venture generally comes from the entrepreneur himself, who bootstraps the company by investing his personal savings (Bruno and Tyebjee, 1985; Freear and Wetzel, 1990;

Bollingtoft et al., 2003), or from so-called 3Fs -which stands for "friends, family, and fools" (Manolova et al., 2006)- who invest their own savings. Indeed, less than 1% of startups receive funding from business angels or VCs (Oranburg, 2016), with most of the funding coming directly from the entrepreneur himself (Manigart and Struyf, 1997; Guidici and Paleari, 2000). This is especially true for firms with high technological content: scholars have shown that technologically complex companies suffer more from persistent financial constraints when compared to ventures based on less complex technologies (Westhead and Storey, 1997). As anticipated, high uncertainty, information asymmetries and agency costs make access to funding a difficult task. Indeed, high-tech startups suffer from several difficulties in raising funds, especially in the first stages, as they mostly rely on intangible assets, which are not easily identified and evaluated by VCs or BAs (Brierley, 2001), who cannot truly grasp the risks related to their investment (Bollingtoft et al., 2003). Moreover, banks are also an unfeasible solution for high-tech startups, at least in the early stages, since they lack the assets needed to collateralize any loan (Hogan and Hutson, 2005). Fortunately, the problems of uncertainty and information asymmetries tend to fade with time. Indeed, despite internal sources of funding being the primary channel for investments in the first years of the company, as the venture grows (between 2 and 9 years from the founding of the venture), the entrepreneur starts to rely on external sources -both equity based and debt based- to finance the firm (Flick et al., 1998). In fact, as expected, along the lifecycle of the startup, different players are involved in the different investment rounds. Particularly important are both BAs and VCs, who can provide not just money, but industry expertise, managerial knowledge and support to improve the firm's chances of survival (Busenitz et al., 2004; Shane, 2008). Moreover, both BAs and VCs provide and important certification effect, both for future investors (Drover et al., 2017) and prospect acquirers (Ragozzino and Blevins, 2015). Still, in this dissertation, the focus is put on venture capitalists, whose effects on the growth, success and exit valuation of a startup are the most dramatic.

2.3.1 Venture capital affiliation

Venture capital is defined as "independent and professionally managed, dedicated pools of capital that focus on equity or equity-linked investments in privately held, high growth companies" (Gompers, 2007). Traditionally, the role of VCs has always been considered that of providing startups with capital not available through traditional channels (i.e., banks). However, this would be a short-sighted view of the true value that VCs bring to their portfolio of companies. Indeed, VCs provide strategic help in many areas. For example, they promote breakthrough innovation (Ferrary and Granovetter, 2009), help transitioning an entrepreneurial venture to a more structured and professionally managed company (Zider, 1998), and are generally involved in a set of value-adding activities such as mentoring, providing (strategic) feedback and coaching (Busenitz et al., 2004), especially if involved in the company's Board of Directors (Fried and Hisrich, 1995). Indeed, VCs support less-knowledgeable entrepreneurs in defining strategic plans and in carrying out key activities such as managerial recruitment, marketing, or financing (Sapienza et al., 1996; Sørensen, 2007). They also give startups access to their network of experts, advisors, customers, suppliers, bankers, alliance partners and other companies in order to help entrepreneurs to find complementary resources and skills (Colombo et al., 2006), and to effectively overcome hurdles (Hochberg et al., 2007). Most importantly, VCs are deeply involved in monitoring activities, since not only they are paid by investors to monitor their investments (Sahlman, 1990), but also since the general partners (the managers of the fund) invest personally in the fund itself, and moreover a relevant part of their compensation is tied to the fund's performance (Gifford, 1997). For that reason, in order to reduce agency risks, they set realistic milestones and deadlines for their invested companies (Sapienza and Gupta, 1994). It comes at no surprise, then, that VC-backed ventures have been found to outperform non-VC-backed counterparts (Bertoni et al., 2013) and achieve higher exit valuations (Ivanov and Xie, 2010).

Consequently, the role of VCs also indirectly becomes that of a "badge of quality" of the company. Indeed, VCs leverage on their reputation to signal the quality of the

venture to potential investors (in the case of IPOs) and prospect acquirers (in the case of M&As). Since VCs rely heavily of their network to screen ventures (Cumming and Dai, 2010) and very unlikely commit money if a company is not referred from a trusted informant (Fiet, 1995), prospect acquirers can therefore be more confident in the quality of the venture they seek to take over. Indeed, the extensive due diligence process carried out by VCs, aimed at screening out startups that are speculative or are lack attractive future financial prospects (Gulati and Higgins, 2003) in order to protect their reputational capital, signals that ventures who receive financial backing from VCs are high quality ones.

Besides the VC-affiliation and badge of quality per se, Ragozzino and Blevins (2015) suggest that companies affiliated with VCs can send multiple signals to the market, namely regarding the prominence of the VCs, the number of VCs invested in the company, the timing of their first investment, the total amount invested, and the duration of their investment. Clearly, the most prominent VCs are able to scout the best investments, financing early the most promising ventures. Manigart et al. (2002) employed a sample of 656 Belgian VC-backed startups and discovered that receiving financing from highly regarded VCs is more important than simply receiving venture capital. Other scholars suggest that more reputable VCs reduce time to IPO (Chang, 2004), increase the likelihood that the companies they back go public (Sørensen, 2007) or generally lead to faster and more profitable exit (Nahata, 2008). The favorable perception that potential acquirors have towards VC-backed ventures also tends to grow as the number of VCs affiliated with them increases (Ragozzino and Blevins, 2015), as the signal sent to the market is strengthened. The time at which a venture receives VC funds also sends a relevant signal to the market. Indeed, when first launched, startups experience extreme levels of uncertainty regarding their business model feasibility, financial performances and, more generally, their future. Given that the adverse selection problem is at its highest in the first stages of the venture, if a firms is able to receive VC capital, then it sends a strong signal to the market. Indeed, the "younger the new venture, the more valuable the signal offered by its affiliation

with a VC, because the information asymmetry problem tends to be most severe at the onset of the entrepreneurial cycle." (Ragozzino and Blevins, 2015). The duration of the investment is also a relevant signal. As a matter of fact, VCs may use subsequent capital infusions as a means of control and monitoring over the company; consequently, a long-time presence of VCs is interpreted by prospect acquirers as a need for the VCs to exert control over founders due to managerial problems (Ragozzino and Blevins, 2015). Last, the amount of capital commitment is another strong signal which is sent to the market. Indeed, VC funds have limited capital which has to be wisely allocated to different ventures. Consequently, the more the capital invested into a venture, the stronger (and costlier) the signal sent to the market, as it means that the venture receiving financing is the best possible allocation of the VC's funds due to its high quality. Additionally, heavily invested ventures also benefit from stronger commitment by VCs, who are more involved in assisting the firm in key activities such as hiring, marketing, operations or strategic planning (Ragozzino and Blevins, 2015). These signals are observable to prospect acquirers, but are also costly for entrepreneurs, as they have to sell their shares at a discount (10% to 14% of the value of the company) to signal their financial potential (Hsu, 2004), as posited by signaling theory (Connelly et al., 2011). Clearly, the cost of sending the signals strengthens their effectiveness.

Despite the common agreement by scholars on the positive effect of VC affiliation on startups' performances and valuations, Masulis and Nahata (2011) use empirical data to show that VC association is not necessarily beneficial to the exit valuation. In fact, the scholar suggest that acquirers of private firms do not rely on certifications by VCs or other intermediaries, since they have access to proprietary information about the targets and would rather rely on it. The authors also provide evidence that VCs acts as matchmakers for their firms by leveraging on their networks, yet this proves unfavorable for the target company. This seems rather counterintuitive, given that the network on which VCs can leverage on should create more competitive bids, which should translate into lower acquirer announcement effects. Yet, as the authors show, VC-backed firms' acquisitions translate in higher acquirer announcement

returns, which the authors explain with the presence of possible conflicts of interest between VCs and other target investors, including the entrepreneurs themselves. Indeed, we need to remember the nature of VCs investments and their funds: VCs have a window of time in which they need to make investments and liquidate them. This clearly puts pressure on them to divest their assets when the lifecycle of the fund approaches its end, and Masulis and Nahata (2011) show that, indeed, target companies backed by venture funds which are close to their liquidation typically receive significantly lower takeover premia. Furthermore, as previously outlined, if relationships (in this case direct financial ties) exist between the VC-backed target and the acquiring company, then the target company might expect to suffer from lower takeover premia.

Despite the findings of Masulis and Nahata (2011), most scholars agree on the beneficial effect of VC affiliation on startups' exit likelihood and valuation. In particular, in this dissertation both the presence of VCs and their prominence will be considered as explanatory variables of the exit valuation.

2.4 Interactive effects between signals and bidders' characteristics

As reported in the above Chapters, it is in the best interest of target companies to send signals to potential acquirers in order to reduce information asymmetries, lessen risk aversion and minimize the offer price discount, so to maximize the exit valuation. However, signals might have different effects when they are contingent to other variables. For example, in the case in which a target is young the uncertainty on its quality is higher (Stuart et al., 1999), thus a signal can have a stronger impact on potential acquires when compared to the same signal sent by a more established firm, for which the risk of adverse selection is much lower as it already has a track record of financial performances, which makes information asymmetry much lower. This means that a signal can mitigate uncertainty in different measures depending on other variables, leading to the idea that a signal is weaker and the discount on information

asymmetry is smaller when bidders are already well informed and can thus more clearly evaluate a target. Still, the contingent effect of signals is an understudied topic, as reported by Wu et al. (2014). In fact, there is a lack of empirical evidence on the above statement. Some proof have already been provided in Chapter 2.3.1, regarding VCs affiliation and how receiving venture capital can send different (stronger) signals contingent to a variety of variables related to the investment. Additionally, Colombo et al. (2019) provide an example of the contingent effect of signals focusing on the specific case of biotech firms going public. The authors discover that a IPO-ing biotech company affiliated with a renowned science-focused university sends a stronger signal to the public markets when the reputation (science wise) of the employees working for the firm is lower.

Therefore, by generalizing on the idea that signals are contingent to other variables, this dissertation aims at testing the following hypotheses:

H2: *the effect of the signal is larger if the number of non-informed bidders is larger*

H3: *the effect of the signal is smaller if the number of informed bidders is larger*

3. Methodology

Having defined the hypotheses that this dissertation intends to test, this Chapter addresses the dissertation's methodology. In particular, the first two Chapters are meant to provide a complete overview of the data used to run the models, as well as its collection process. More specifically, Chapter 3.1 provides an exhaustive description of the data collection process, while in Chapter 3.2 the final sample's characteristics are presented and analyzed. Chapter 3.3 is focused on a thorough description of the variables employed in the models, distinguished between dependent, independent, control and instrumental. The descriptive statistics of the variables and an introduction to regression models follow in Chapter 3.4 and 3.5 respectively. Chapter 3.6 focuses on the regression models and the results, while Chapter 3.7 addresses the robustness checks. To conclude, and overall summary of the results obtained through the models is provided in Chapter 3.8.

3.1 Data gathering methodology

This dissertation uses a sample of private European, British and Israeli startups founded between 1988 and 2017 which exited through an acquisition between 1997 and 2017. The specific information needed to study the hypotheses presented in Chapter 2 relates to two different areas:

1. General information about the company (e.g., country, industry, location, financials, etc.) and the deal (year, value, etc.);
2. Specific information about the presence or absence of VCs as investors in the venture, and their characteristics (e.g., exits).

The final sample size, for which all relevant information could be retrieved, consists of 1325 entrepreneurial ventures, from now on defined as targets.

All the information needed, either regarding the general characteristics of the company, the deal or the presence of VCs and their attributes, was retrieved from three distinct databases: Zephyr, Orbis and RISIS-VICO 4.0. Zephyr is a database which has information on M&As, IPOs, VC and PE deals, and all the rumors related to such deals. Currently, Zephyr contains information on more than 1.8 million deals and their related rumors, and adds more than 100.000 transactions to the database each year. More specifically, Zephyr was used to retrieve data about the value of the deal and the percentage of the equity acquired, which allows to compute the total valuation of the firm. Additionally, the final equity stake was necessary, as only the deals in which this variable was higher than 50% were considered. Orbis is a database which, as Zephyr, is developed by Bureau van Dijk. As of 2022, it contains information on about 400 million companies globally. It aggregates information from more than 160 separate providers, integrating them with Bureau van Dijk sources. RISIS-VICO 4.0 is a European-funded database, part of the RISIS project. In addition to accounting information, VICO 4.0 tracks the investment history of more than 24,200 VC-backed start-ups funded after 1988, from 27 European countries, the United Kingdom and Israel. It represents the most complete and detailed longitudinal data infrastructure on the European VC market. Last, the A.CRE[1] Excel add-in, coupled with a Google API[2], was used in order to retrieve the coordinates of the geographic location of the companies in the sample based on their addresses.

The initial database consisted of 7892 deals, but some of them had to be excluded as it was not possible to retrieve the necessary information. Specifically, 68 ventures and/or their respective bidders lacked the information on their headquarter address, needed in a second step as explained later, so they were discarded. Additionally, 69 deals had to be removed since either the target or the acquirer belonged to a country for which the KSI index for cultural distance, as explained later, was not computable. One target lacked information on the industry of operation, as no NACE code was available; since this information is necessary, that specific deal had to

[1] https://www.adventuresincre.com/geocoding-excel-add-in/

[2] https://developers.google.com/maps/documentation/geocoding/overview

be discarded. Furthermore, 1298 additional deals were discarded as they were lacking the codes needed to univocally identify either the target or the acquirer between the three databases, fundamental to collect all the different data needed. Out of the 6456 remaining deals, only 1534 transactions had complete information on the deal and the target's financials (i.e., price paid, acquired stake, completion date, total assets, etc.), crucial for the computation of the dependent variable in the models of the dissertation. After removing 209 deals regarding the acquisition of public companies, the final sample of 1325 entrepreneurial ventures was used as targets to run the different models. Overall, using the three databases, it was possible to retrieve all the information relevant to this dissertation: general information on both targets and acquirers (company name, primary and secondary NACE codes, address, etc.), financials (total assets, cash and cash equivalents, etc.), information about the deal (valuation, completion date, stake, etc.), information about VC affiliation (presence or absence of VCs, prominence of VCs, etc.) and other general information (market sentiment at the moment of the deal, etc.)

Having collected the full information needed for the scope of the dissertation, the following step was that of defining the number of bidders for each target company. A potential bidder is defined as a company, taken from the list of the 6456 acquirers, simultaneously respecting the following conditions:

i. It performed an acquisition of a company belonging to the same industry of the target which is being evaluated; **and**
ii. Such acquisition happened in the same year in which the target being evaluated was acquired.

The second condition indicates that the acquiror is active in the M&A space in a certain period of time. Specifically, an acquiror is considered active if it acquired a company in the same year in which the target being evaluated was bought.

On the other hand, the first condition's discrimination was performed on the basis of the NACE (which stands for "Nomenclature des Activités Économiques dans la Communauté Européenne", or "Nomenclature of Economic Activities") code. It is a

standard statistical classification system developed in 1970 by the European Union, which has been continuously updated since. The codes provide a framework for the collection and presentation of a wide range of statistics in economic fields, based on economic activity. As of 2022, the standard used is the one defined by the Revision 2, which was adopted starting from December 2006. Thus, this dissertation will employ such classification for its scope. The NACE code is divided into a hierarchical structure with four possible levels. The highest-level categories are called sections and are identified by an alphabetical letter. Following, the first two numerical digits specify the division, the third digit indicates the group, and the fourth digit signifies the class. For the objective of this thesis, only the division (thus, the first two digits of the code) was considered to define the belonging to a particular industry, following what other scholars did in their studies (e.g., Puziak, 2017; De Lange and Merlevede, 2020; Ferris et al., 2021). Consequently, a potential acquirer for a target is a firm which made an acquisition, in the same year in which a target has been acquired, of another firm belonging to the same industry of the target, identified by the first two digits of the NACE code.

Having defined the number of bidders for each target company, it was necessary to classify them into two categories based on their level of information. Specifically, they had to be categorized either into informed or non-informed according to four proxies of information asymmetry, namely geographical, cultural and industry distance between the target and bidder, as well as acquisition experience of the bidder, as explained in Chapter 2.2. Consequently, the first step was that of obtaining the target and bidder's address using the Orbis and Zephyr databases. If no information was available (down to city level), then the company was removed from the sample. Subsequently, the address was converted into geographical coordinates. To do so, A.CRE, an Excel add-in leveraging a Google Map Geocoding API, was used. The add-in works by integrating custom formulas which receive as input an address and auto populate the cell with either the latitude or longitude. Once the geographical

coordinates were obtained, the computation of the distance between each target and its potential bidder was done with Stata.

Clearly, the distance for all the bidders located in continents different from Europe (e.g. North America or South-East Asia) came to be rather large, even in the thousands of kilometers. This means that, according to the geographical distance alone, such acquirers would have to be classified as non-informed which, clearly, is not correct as it might not properly reflect reality. In order to account for this issue, a different measure of distance was defined, based on the fact that an acquirer might have already performed acquisitions, in the past, in countries geographically close the target. The underlying reasoning is that, should the bidder have carried out an acquisition of a venture headquartered in an area near the target in consideration, then its reach (network, contacts, etc.) would extend until that area, reducing the information asymmetries. This new measure of distance, defined as "adjusted distance", required two steps:

1. First, using Zephyr, it was necessary to retrieve the list of all the companies acquired by a potential bidder, for each bidder of every target in the sample. Such list contained all the acquisitions completed in the five-year period before the target of the sample was acquired.
2. For each of the deals found in step 1, the geographic information (address) of each acquired company in the list was downloaded from Orbis. Similarly to what was carried out for the original bidders and targets, the geographic information was translated into coordinates, which were used to compute the distance between the target and the bidder's acquired company.

Based on this data, the adjusted distance between a bidder and a target was defined as the minimum distance between either the target of the sample and the bidder's headquarters, or the target of the sample and any of the previously identified companies acquired by the bidder in consideration.

This adjusted distance, computed for each of the 6456 deals, was then used in order to define a threshold through which to discriminate between geographically close and geographically distant bidders. As a threshold, it was decided to take the median value of the 6456 deals, equal to 704.6km. Consequently, all bidders for which the distance was above the threshold were considered as far from the target; conversely, those whose distance was lower than the threshold were considered as geographically close.

Considering instead the cultural distance, the proxy employed in this dissertation is the Kogut and Singh Index, also known as KSI (Kogut and Singh, 1988), widely used by academics in literature. The index is obtained by computing the arithmetic average of the variance-corrected squared differences along the different dimensions of cultural distance (Kogut and Singh, 1988), as in the hereby reported formula:

$$KSI_{jk} = \sum_{i=1}^{n} \frac{\left[\frac{(I_{ij} - I_{ik})^2}{V_i}\right]}{n} \tag{3.1}$$

where KSI_{jk} is the cultural distance between country j and country k, I_{ij} and I_{ik} are the values for the i^{th} cultural dimension for countries j and k, V_i is the variance of the i^{th} cultural dimension and n is the number of cultural dimensions.

The cultural dimensions employed by Kogut and Singh (1988) were based on the four dimensions of cultural distance proposed by Hofstede (1980), namely power distance, individualism versus collectivism, masculinity versus femininity and uncertainty avoidance. In a more recent paper, Hofstede (2015) complemented the four dimensions he suggested in 1980 by introducing two additional dimensions, namely long-term orientation versus short-term orientation and indulgence versus restraint.

In order to compute the cultural distance, it was first necessary to identify all the countries in which both targets and bidders involved in the 6456 deals are headquartered in. In total, 60 countries have been identified. In the original database the total number of different countries was 71 but for 11 of them (namely Bermuda,

British Virgin Islands, Cayman Islands, Curaçao, Cyprus, Gibraltar, Liechtenstein, Monaco, Oman, Papua New Guinea and Qatar) the information on cultural distance was not available, as Hofstede does not provide it. For that reason, all deals in which either the target or the acquirer are headquartered in one of those countries had to be removed from the list of observations. For the remaining 60 countries in the 6456 deals, the information needed was downloaded from Hofstede's websites[1,2], updated as of November 2021. Taking the most updated values of Hofstede's dimensions, rather than the ones at the time of the deal, is consistent with other research by scholars (e.g., Čuhlová, 2016). Indeed, there is evidence suggesting that the values of the Hofstede's dimensions are constant over time and, more specifically, that the cultural distances between countries tends to be stable (Beugelsdijk et al., 2015). Using the dimensions downloaded from Hofstede's websites, the KSI between each of the 60 countries considered was computed. Similarly for the geographical index, an adjusted measure was calculated, defined as the minimum KSI between either the target of the sample and the bidder, or the target of the sample and any of the previously identified companies acquired by the bidder in consideration. As the threshold for closeness, the median value of the 6456 deals, equal to 1.44, was chosen, so that every bidder whose distance from the target is below that value can be considered as culturally close.

Regarding instead the industry distance (or product-market domains overlap), it was decided to employ a market relatedness index. The index was created based on the works by Porrini (2004) and Puranam et al. (2006), and was constructed considering the number of 2, 3 or 4 digits of the NACE codes common to both the target and the bidder, divided by the total number of NACE codes assigned to the target company. Thus, three different indexes were defined, and after careful consideration and testing, it was decided to employ the one considering 4 digits of the NACE codes, as it creates a more stringent requirement. Once again, the index was computed similarly to the KSI and geographical distance, using an "adjusted" measure. Differently from the previous two cases, the highest value of the market relatedness

[1] https://www.hofstede-insights.com/product/compare-countries/

[2] https://geerthofstede.com/

index between the target of the sample and the potential acquiror or the target of the sample and any of the previously identified companies acquired by the acquiror in consideration was selected. Indeed, the higher the index, the more the industry (product-market overlap) affinity, which translates in a better understanding of the operations, business practices and markets of the target. As for the previous two measures, the median (equal in this case to 0.5) was set as a threshold, meaning that all bidders whose market relatedness index with the target is higher than the median can be considered as "close" to the industry of the target; conversely, those with a market relatedness index lower than the median can be considered as "far" from the industry of the target.

Last, regarding acquisition experience, it was decided to consider whether the potential acquiror previously carried out acquisitions of ventures operating in the same industry of operation of the target or not. For this reason, the acquisition experience is "framed" from an industry relatedness standpoint as well. A bidder was considered experienced if it acquired at least one company operating in the same industry as the target (i.e., the acquired company shares the same 4 digits of the NACE codes of the target) in the 5 years prior to the acquisition date of the target in consideration.

Since all dimensions regarding the level of information have been defined, a bidder is categorized as informed if the following conditions are respected:

1. It is geographically close to the target; this translates to the bidder being closer than the median of the adjusted geographical distances, or 704.6 kilometers; **and**
2. It is culturally close to the target; this translates to the bidder having a lower KSI than the median of the KSI indexes, or 1.44;

Or, alternatively:

1. It is close to the target from an industry standpoint; this translates to the "adjusted" market relatedness index between target and bidder being higher than the median value, or 0.5; **or**

2. It has relevant past M&A experience in the same industry of the target, which translates with the bidder having performed at least one acquisition of a company operating in the same industry of the target in the 5 years prior to the acquisition completion of the target.

The rationale behind this discriminating conditions is that a bidder needs to be geographically close to the target in order to be able to retrieve relevant and detailed information about it. Still, to properly evaluate and make informed decisions on the collected information, it also needs to be culturally close. On the other hand, if the bidder is close from an industry point of view, or if it has previously carried out acquisitions in the same industry as the target, then it is well-skilled in collecting, evaluating and acting on information, making informed decisions and correctly evaluating the target. The theoretical reasons backing these arguments have been described in Chapter 2.2.

3.2 Database description

As stated, the above-mentioned process allowed to create a database with 1325 targets, each linked to at least one acquiror (in that specific case, the real one), according to two different criteria, as described in Chapter 3.1. This Chapter is devoted to a throughout analysis of the characteristics of said sample.

Examining the geographical placement of the target companies in the sample, all but seven are headquartered in a European country or the United Kingdom. In fact, the only companies not located in Europe or U.K. are located in Israel. Most of the targets in the sample are based in the United Kingdom, followed by France and Germany. Regarding the geographical area, it was decided to include six dummy variables to identify the location of acquired firms. Specifically, the distinction was made between firms located in the UK (594 firms), in France (147 firms), in Germany (147 firms), in Northern Europe (156 firms; headquartered in Denmark, Sweden, Finland, and Norway), in Southern Europe (95 firms; located in Spain, Italy and Portugal) or in Benelux (90 firms; based in Belgium, Netherland and Luxembourg).

The baseline was given by firms located in other countries (96 firms). A more detailed breakdown of the number of targets per country is provided in Table 4.

Since the industry in which a company operates in is expected to affect its exit valuation, it was decided to categorize targets into five macro-sectors so to control for possible effects in the regression models. Figure 2 shows the distribution of targets across industries according to the first digit of the NACE code.

Figure 2: Distribution of targets for each first digit of the NACE code

Thus, five macro industries were identified, based on the classification suggested by Colombo and Montanaro (2020), who base their work on the Eurostat indicators on High-tech industry and Knowledge-intensive services[3]. Specifically, the macro-classes (summarized in Table 2) are the following:

1. *LifeScience-Biotech:* it includes all the targets of the sample with any of the following first two digits of the NACE code: 21, 26, 72 75, 86 or 87.
2. *High-Knowledge-Intensive Services:* this class comprises all the targets that fit into high-tech or knowledge intensive industries; the classification is based on the Eurostat indicators on High-tech

[3] https://ec.europa.eu/eurostat/cache/metadata/Annexes/htec_esms_an3.pdf

industry and Knowledge-intensive services. Targets from either Life Sciences or Biotech industries are excluded as they fall in the previous class.

3. *High-Tech Manufacturing:* it comprises all the targets of the sample belonging to high-tech or medium high-tech manufacturing industries; again, targets from either Life Sciences or Biotech industries are excluded.
4. *Software:* within this class fall all the targets belonging to the software industry, identified by the following 4-digit NACE codes: 5820, 5821, 5829, 6200, 6201, 6202, 6203, 6209.
5. *Other:* all the targets not belonging to any of the above class are placed into this class.

Macro-industry	***Number of targets***	***Percentage of targets***
High-Knowledge-Intensive Services	*401*	*30.26%*
High-tech manufacturing	*82*	*6.19%*
LifeScience Biotech	*254*	*19.17%*
Software	*311*	*23.47%*
Other	*277*	*20.91%*
Total	***1325***	***100%***

Table 2: Distribution of targets of the sample for the five macro-industries

Deepening the analysis on the characteristics of the deals, some interesting insights emerged. First, out of 1325 targets, 517 (39%) were VC-backed at the time of the acquisition. More specifically, 120 targets received funding from highly reputable VCs, while 397 by lowly reputable VCs. A detailed definition of the discrimination between highly and lowly reputable VCs is provided in Chapter 3.3.3.2. At the time of acquisition, on average, a company is around 9 years old, which is consistent with worldwide data about startups' acquisitions. Indeed, 37% of startups exiting by acquisition are between 5 and 10 years old, while the 28% is between 10 and 15 years

old (Statista, 2018). Interestingly, the companies acquired on the most recent years are, on average, older than the others. Taking instead the perspective of the targets of the sample, the average deal value is €175.1M, while the average book value of the assets is €110.9M. As noticeable, both for 2000 and 2004 the average deal value (and average total assets for 2004 only) widely differ from the average, due to some mega-deals having a considerable impact. Interestingly, despite the high number of deals during the 2007-2008 financial crisis, it is possible to notice that both the average deal value and total assets of target companies are rather low. Table 3 provides additional information on the above-summarized considerations on the company and deal, showing a breakdown by year of acquisition.

Deal year	***Number of targets***	***% of targets***	***Number VC-backed targets***	***Average target age (years)***	***Average deal value (€k)***	***Average total assets (€k)***
1997	*1*	*0.08%*	*0*	*7.00*	*171,374.7*	*539,783.9*
1998	*4*	*0.30%*	*0*	*7.75*	*37,420.1*	*155,306.2*
1999	*4*	*0.30%*	*1*	*7.00*	*32,266.8*	*6,371.5*
2000	*15*	*1.13%*	*6*	*3.93*	*2,448,901.6*	*296,851.8*
2001	*18*	*1.36%*	*9*	*5.00*	*17,836.0*	*21,253.3*
2002	*18*	*1.36%*	*7*	*4.22*	*106,304.1*	*82,356.8*
2003	*20*	*1.51%*	*8*	*5.45*	*215,617.9*	*25,245.7*
2004	*46*	*3.47%*	*25*	*6.15*	*1,277,032.4*	*810,138.5*
2005	*65*	*4.91%*	*33*	*7.28*	*114,765.1*	*120,195.0*
2006	*91*	*6.87%*	*28*	*6.63*	*199,068.1*	*46,282.8*
2007	*99*	*7.47%*	*38*	*8.16*	*46,810.9*	*24,132.8*
2008	*85*	*6.42%*	*29*	*9.15*	*38,253.8*	*16,634.0*
2009	*59*	*4.45%*	*25*	*7.92*	*102,841.9*	*275,211.6*
2010	*97*	*7.32%*	*37*	*8.59*	*66,515.1*	*57,912.0*
2011	*93*	*7.02%*	*31*	*7.78*	*51,371.2*	*25,527.9*
2012	*85*	*6.42%*	*19*	*9.99*	*73,817.1*	*373,628.3*

2013	*101*	*7.62%*	*35*	*9.45*	*70,885.8*	*38,735.6*
2014	*113*	*8.53%*	*47*	*10.30*	*118,102.2*	*54,104.8*
2015	*128*	*9.66%*	*60*	*10.52*	*116,344.6*	*60,184.5*
2016	*102*	*7.70%*	*47*	*10.92*	*134,939.4*	*56,974.7*
2017	*81*	*6.11%*	*32*	*13.01*	*288,142.9*	*79,076.7*
Total	***1325***	***100.00%***	*//*	***8.94***	***175,099.6***	***110,971.2***

Table 3: Breakdown of targets' figures per year

Considering instead the number of bidders linked to each target, the analysis shows that, on average, they are 41; out of those, 28 are considered informed. As it is possible to notice, both the average number of bidders and average number of informed bidders tend to be at the highest for France, Germany and Northern Europe, hinting at the fact that the market for acquisitions is more active.

Country	***Number of targets***	***Percentage***	***Average number of bidders***	***Number of informed bidders***
UK	*594*	*44.83%*	*37.69*	*28.32*
France	*147*	*11.09%*	*52.37*	*37.17*
Germany	*147*	*11.09%*	*43.50*	*32.78*
Northern Europe	*156*	*11.77%*	*46.35*	*29.67*
Southern Europe	*95*	*7.17%*	*38.39*	*25.96*
Benelux	*90*	*6.79%*	*32.43*	*21.59*
Other	*96*	*7.25%*	*37.77*	*23.40*
Total	***1325***	***100%***	***41***	***28***

Table 4: Breakdown of the number of bidders for each macro-area

3.3 Definition of the variables

Having defined the hypotheses that this dissertation aims at testing and having illustrated the data collected for this scope, this Chapter describes the variables -

categorized into dependent, independent, control and instrumental- used to run the different models.

3.3.1 Dependent variable

As discussed in the literature review, many studies on the theme of entrepreneurial exit focus on the determinants that could affect the exit strategy, adopting a discrete output variable which value changes according to the strategy pursued (e.g., Bates, 2002; Wennberg et al., 2007; Cumming, 2008; Bayar and Chemmanur, 2011). This approach, however, cannot be applied to this dissertation, as the only strategy considered in this study is the corporate takeover. Consequently, the selection of the dependent variable takes inspiration by a different stream of literature, which considers the exit valuation -either in absolute or relative terms- as the dependent variable. Amongst the academics using valuation in absolute terms, it is worth mentioning Bayar and Chemmanur (2011), Nadeau (2011) and Bowman and Singh (1993), who consider the total valuation at exit; Brau et al. (2010) and Nelson (2003), who employ instead the valuation premium; and Gompers and Learner (2000), who use the pre-money valuation. Despite the abundance of literature produced using absolute measures for the valuation, this dissertation takes the approach used by the second stream of literature, employing a relative measure of the valuation and specifically Tobin's Q, an indicator of the company's future expectations (Colombo et al., 2019). Being a relative value, the advantage of this indicator is that it allows to compare ventures widely differing in size. Tobin's Q, computed as the ratio between the exit valuation and the total value of the assets, has been vastly employed in previous literature (Adams and Ferreira, 2009; Bebchuck et al., 2009; Sheikh, 2018), particularly to measure firm value related to corporate governance (e.g., Agrawal and Knoeber, 1996; Barnhard and Rosenstein, 1998; Erickson et al., 2005; El-Faitouri, 2014; Li and Zaiats, 2018). In this dissertation, however, Tobin's Q was computed as the sum of the exit valuation (i.e., the ratio between the deal value and acquired stake) and the book value of assets less the book value of common stock, over the book value

of assets. Moreover, after a throughout analysis of the data distribution, the natural logarithm of Tobin's Q (*Ln_ TobinQ*) was chosen as the dependent variable.

Clearly, to compute *Ln_ TobinQ* it was first necessary to collect the information on the exit valuation, the book value of common stock and the total assets value for all the ventures in the sample. Moreover, the whole company valuation had to be computed by dividing the acquisition value by the percentage of shares bought in the takeover, since in many cases it did not amount to 100%. Additionally, by analyzing the distribution of the data, it was deemed useful to winsorize the variable at 1% level.

3.3.2 Control variables

There are a number of variables, hereby reported, which can be related to the firm's valuation at acquisition. However, since their study is outside the scope of this dissertation, they have been employed as control variables to ensure the validity of the study by limiting the influence of confounding variance.

Company_ Age: this variable defines the age of the startup at the moment of the acquisition, and it has been computed as natural logarithm of the difference between the acquisition year and the startup's founding year, plus one. Age is a proxy of the company's maturity, which influences the way it carries out innovation (Acemoglu and Cao, 2015). Age has been vastly used by scholars as a control variable, despite academics reporting conflicting findings on its effects: while some researchers suggest that age is linked to lower innovation capabilities (Balasubramanian and Lee, 2008), others state the opposite (Whiters et al., 2019) and claim that older firms can signal more complete products and technologies. Ultimately, there is not an univocal agreement of whether it has a positive or negative impact on the exit value (e.g., Nelson, 2003; Boeker and Wiltbank, 2005; Wennberg et al., 2010; Balcaen et al., 2011; DeTienne and Cardon, 2012; Anderson et al., 2017).

Geographical area – 6 dummies: these control variables are meant to account for the specific effects that the conditions of local markets and economic environments of a certain country can have on the venture and, specifically, its valuation, as stated by

some scholars (Gupta and Sapienza, 1992; Soreson and Stuart, 2001). As reported in Chapter 3.2, the ventures' countries of origin have been categorized into seven macro-areas, namely "UK", "France", "Germany", "Northern Europe", "Southern Europe", "Benelux" and "Others". Accordingly, six dummy variables are needed in order to keep trace of such information: *Geo_UK*, *Geo_Germany*, *Geo_France*, *Geo_NorthernEurope*, *Geo_SouthernEurope* and *Geo_Benelux*, each taking the value of 1 if the startup is headquartered in the country or set of countries related to the dummy and 0 otherwise. It was decided to exclude the dummy related to "Others" in order to avoid multicollinearity issues.

Industry classification – 4 dummies: this set of variables is meant to account for industry-specific characteristics that may have an impact on the target firm's exit value (Ragozzino and Reuer, 2007). As previously illustrated in Chapter 3.2, the ventures in the sample have been divided into five macro-industries according to their classification through the first two numbers of the NACE code. Therefore, four dummies have been created (*Ind_HighKnowledgeIntServices, Ind_Software Ind_HighTechManufacturing* and *Ind_LifedcienceBiotech*). Clearly, the variables assume value 1 if the company belongs to the industry to which the variable refers to, and 0 otherwise. As in the case of the geographical area dummies, the dummy related to industry "Other" was left out to avoid multicollinearity problems.

TotalAssets: computed as the natural logarithm of the company's Total Assets at the year of the acquisition, the scope of this variable is to account for the firm's dimension, and it is rather frequently employed in entrepreneurial studies as a control variable (e.g., Ragozzino and Reuer, 2007; Balcaen et al., 2011; Bayar and Chemmanur, 2012; Dang et al., 2018).

AcqMarketSentiment: computed as the sum of the number of acquisitions of companies located in Europe, U.K. and Israel in the same year in which a target was acquired, this variable was included to control for the acquisition market sentiment in the year of a deal. Indeed, in periods in which the market is flourishing and it is very

active for M&As, it can be expected that a target will experience higher exit valuations, whereas a bursting market for M&As is expected to negatively influence the exit value.

ProbAcquisition: the sample employed in this dissertation only includes ventures that have been acquired; so, this variable was introduced in order to control for the effects that the probability of being acquired has on the valuation. Using the Heckman correction model (Heckman, 1979; Maddala, 1983), a random sample of 1325 ventures (not acquired) was selected, so that they were similar to the 1325 target firms employed in the sample used for this dissertation. The coupling was done according to the nearest-neighbor propensity score matching technique, based on country dummies, industry dummies (using the first 2 digits of the NACE code), size (measure, as mentioned, with total assets) and year of foundation. Subsequently, in order to predict whether a firm was acquired during the 1997-2017 period, a probit regression was run, using the combined sample of both acquired and non-acquired ventures. Subsequently, the variable *ProbAcquisition* was computed, as the inverse Mills' Ratio using the first stage regression.

MediaCoverage: the idea behind this control variable is that a target which received more media coverage is expected to get a higher exit valuation. To account for that, this variable is computed as the total number of news articles written about the target from the year of its foundation to the year of the acquisition (source: LexisNexis). Additionally, in the models this variable was introduced in its quadratic form, as it was discovered to better reflect its relationship with the exit value.

Accounting Debt: it is computed as the natural logarithm of the sum of long and short-term debt of the target in the year before the acquisition; controlling for the debt level is important since, as anticipated, firms with high debt levels are likely to be perceived as more risky, especially when there is a high level of information asymmetry, and could thus be undervalued.

Method of Payment – 4 Dummies: to account for the effects of the method of payment employed in a deal, four dummy variables were employed to capture whether the payment was done through cash (*Payment_ Cash*), shares (*Payment_ Shares*), earn-

out (*Payment_ Earn-out*), deferred payment (*Payment_ Deferred*). The dummy regarding other payment methods (*Payment_ Other*) was excluded from the models in order to avoid multicollinearity issues.

Cash and cash equivalents: this variable is measured as the natural logarithm of the accounting value of cash and cash equivalents in the year before the acquisition. A company with high cash and cash equivalents is more valuable than a cash-strapped counterpart.

Domestic - dummy: this variable was employed to address the effect of the differences between domestic and cross border acquisitions. Indeed, it is expected that domestic acquisitions regards deals with lower value, as they probably involve smaller players. Therefore, this variable takes the value of 1 if the real acquiror was headquartered in the same country of the target venture, and 0 otherwise.

Toehold - dummy: to control the effect of a bidder possessing a toehold on the exit valuation, this dummy variable was introduced. Indeed, it has been already reported by scholars that toeholders display more aggressive bidding behavior (Dasgupta and Tsui, 2003), which can ultimately drive the valuation up. Therefore, this dummy takes the value of 1 if the real acquirer possessed some equity in the target prior to the acquisition, and 0 otherwise.

3.3.3 Independent variables

It is possible to classify the independent variables employed in this dissertation into two categories, namely variables related to the number of bidders and variables related to the presence of external equity investors.

3.3.3.1 Number of bidders

N_ Bidders: as explained in Chapter 2.1, the number of bidders is expected to have a positive effect on the valuation (Vickrey, 1961). Therefore, this variable measures the number of bidders associated with each target according to the procedure explained in Chapter 3.1. In order to reduce the effect of outliers, the variable has been winsorized at 5% level.

N_Informed: it represents the total number of informed bidders for a certain target of the sample. To be considered informed, a bidder has to respect the conditions explained in Chapter 3.1. As reported in Chapter 2.2, informed bidders do not discount information asymmetries in their bids, so they should drive valuations up (Wu et al., 2014), hence the need to keep track of this information. In order to reduce the effect of outliers, this variable has been winsorized at 5% level as well.

N_Non_Informed: this variable is used to keep track of the number of non-informed bidders associated to each target company in the sample. In other words, it is computed as the difference between *N_Bidders* and *N_Informed*. Contrary to informed bidders, non-informed bidders discount the information asymmetry in the offer price (Wu et al., 2014), meaning that their effect in driving valuation up is expected to be less significant with respect to informed bidders. Consistently with the previous two variables, it has been winsorized at 5% level in order to reduce the effect of outliers.

3.3.3.2 External equity investors

VC_Backed - dummy: this dummy variable tracks whether the target has been backed by a VC firm (value equal to 1) or not (value equal to 0). VCs play an important role in the lifecycle of startups, and academics commonly agree that VC-backed companies perform better than non-VC-backed companies, since VCs provide mentoring, coaching and other value-adding activities that improve the firms' performances (Croce, et al., 2013; Bernstein, et al., 2016). VC firms positively affect their portfolio firm in terms of growth (Nanda et al., 2017), innovation effort (Wright and Robbie, 1998), efficiency (Croce et al., 2013), internal organization (Hellmann and Puri, 2002) and, ultimately, achievement of successful exit (Wright and Robbie, 1998).

VC_High - dummy: this dummy variable is used to identify if at least one of the VCs backing the venture is highly reputable or not; consequently, it takes value 1 if this is true, zero otherwise. To classify a VC as highly or lowly reputable, an indicator of its "quality" was employed. First, for each VC that invested in a target company in a given calendar year, it was necessary to compute the number of successful exits (IPOs

or acquisitions), in the previous five years with respect of the year of investment in the target company. Then, such value was normalized dividing it by the number of successful exits of all VCs of the sample in the same period. Consequently, a VC is categorized as highly reputable in a given calendar year if the value of the above computed ratio in that year falls in the 25 percentile of the distribution. Thus, this variable takes value of one if the target firm was backed by one or more VC considered highly reputable in one or more years prior to the acquisition. Discriminating between prominent versus non prominent VCs is important since VCs, apart from influencing the venture's success through their strategic help, also act as certification signals. Indeed, successful VC firms are very selective in their investments and place a lot of importance in their reputation, thus when scouting ventures they only target deals which are likely to positively affect it (Carter et al., 1998; Colombo et al., 2019).

VC_Low - dummy: this dummy variable plays the opposite role of *VC_High*, keeping track of whether a company is backed by VCs that cannot be defined as prominent. Consistently with *VC_High*, it takes value 1 if the company is backed by a non-prominent VC. This variable is introduced since weak equity investors are expected to have a weaker certification effect for the targets of the sample.

3.3.4 Instrumental variable

Several scholars have pointed out the existence of an endogeneity problem with VC financing (e.g., Kortum and Lerner, 2000; Colombo and Montanaro, 2020), so it was deemed useful to study this phenomenon to provide additional evidence to existing studies. To do so, the instrumental variable *Dist_Closest_VC_hub* was introduced, computed as the minimum distance of the target from the closest venture capital hub. As proxies, the first ten European VC Hubs identified by Colombo et al. (2019) were employed, namely Inner London, Île de France, Oberbayern, Stockholm, Helsinki-Uusimaa, Hovedstaden, Noord-Holland, Darmstadt, Rhône-Alpes and Köln.

3.4 Descriptive statistics

Before delving into the details of the models, a brief description of the distribution of the data is provided. In particular, Table 5 summarizes the descriptive statistics for the explained variable, explanatory variables and control variables employed in the models, reporting the mean, median, standard deviation, first and third quartiles, kurtosis and skewness.

Starting with the dependent variable, which is the Tobin's Q in the natural logarithm form, it appears that the distribution is not symmetric. Indeed, the light skewness (1.510), paired with the fact that the mean is higher than the median, signals that the distribution is skewed to the right. Moreover, the rather high standard deviation (1.204) suggests great variability and spread of the observations. This is backed by the high level of kurtosis (6.134), which indicates a long distribution with "fat" tails.

Moving to the independent variables, it is noticeable that the distribution of *N_Bidders* is also asymmetric and specifically skewed to the right, since the skewness is equal to 1.133. This is also hinted by the wide gap between the mean (40.542) and the median (20). The high standard deviation (43.46) is an additional signal of the presence of long tails: indeed, the number of bidders ranges from 1 to 136. Similar considerations can be drawn for both *N_Informed* and *N_Non_Informed*, with the difference of these two having higher skewness (1.283 and 1.277 respectively) and kurtosis (3.221 and 3.662 respectively), the latter hinting at longer distributions with "fatter" tails.

Considering instead the second type of explanatory variables, accounting for the presence of VCs and their relevance, it is possible to notice that the majority of targets did not receive VC funding prior to being acquired (only 517 out of 1325 did), as the mean of the dummy *VC_Backed* is 0.390. Additionally, most (397 out of 517) of the VCs can be considered as lowly reputable, as showed by the mean (.299) of the *VC_Low* dummy.

Regarding the first set of control variables, the dummies for the geographical area, it is clear that the majority of companies are headquartered in the United Kingdom (594), since the related dummy has the highest mean, standard deviation and third quartile values. As noticeable, the same number of targets are headquartered in Germany and France (all the descriptive statistics are the same), while the descriptives for the dummy regarding the Benelux area signal that the least amount of targets are headquartered in that area.

Likewise, the dummies regarding the industry of operation of the target show that the industry distribution is highly heterogeneous. In fact, most of the companies operate in the High Knowledge Intensive Services industry, as signaled by the mean, standard deviation and third quartile of *Ind_ HighKnowledgeIntServices*, the highest of the group of dummies. All the other dummies have 1st, 2nd or 3rd quartile equal to 0, with the least amount of targets operating in the High-Tech Manufacturing industry (mean of 0,0619).

Regarding the target's age, computed in the natural logarithm form, mean (2.148) and median (2.197) are very close, suggesting a quite symmetrical distribution of observations, characterized by a slight left skewness (-0,537).

Similarly, considering the total assets in the natural logarithm form, which is the variable controlling for the company's size, it again appears that the distribution is rather symmetric, as the mean (8.709) and the median (8.644) are very close. Moreover, similarly to the target's age, the distribution is slightly skewed to the left with long and fat tails, as the skewness and kurtosis are equal to -0.247 and 4.902 respectively.

The variable controlling for the acquisition market sentiment in the year of the deal has a mean (511.654) comparable to the median (540), but presents a rather high standard deviation (154.365). This suggests that the distribution is skewed to the left (since the skewness is equal to -0.589) and presents long and fat tails (as the kurtosis is equal to 3.110).

The variable accounting for the probability of being acquired is skewed to the right (as the median is higher than the mean, and the skewness is equal to 1.213) and presents fat tails (since the kurtosis is equal to 6.315).

The variable controlling for media coverage presents extremely fat tails and a long distribution, as displayed by the extreme values of kurtosis (67.474) and standard deviation (796.824); indeed, its values range between 0 and 9835. Moreover, as suggested by the acute difference between the mean (241.351) and median (25.5), as well as by the high skewness (7.247), the distribution is skewed to the right.

The variable controlling for the accounting debt (in the natural logarithm form) is symmetrically distributed, given that the mean and the median are very close (8.031 and 8.201 respectively). The distribution is however skewed to the left (since the skewness is equal to -0.707). The standard deviation is rather high (2.597), which paired with the high kurtosis (4.992) indicates that the distribution has long and fat tails.

The dummies controlling for the payment type for the acquisition show that the "other" category is the most prevalent, as it has the highest mean (0.452). The second most frequent type of payment is the one regarding cash, which occurred in 36.07% of the observation in the sample. The least used payment type regards deferred payments, only employed in around 3.24% of the cases.

Considering instead the variable regarding the cash and cash equivalents of the target (in natural logarithm form), it is possible to state that the distribution is not symmetrical, since the mean (3.330) and median (5.713) differ greatly. Indeed, the distribution is skewed to the left, as signaled by the skewness (-0.931). The standard deviation is rather high (5.83) and indicates the presence of long tails.

To conclude with the control variables, the analysis shows that around half of acquisition are domestic (the mean of the dummy *Domestic* is 0.494). Moreover, only few targets (around 3.24%) were bought by companies who had a toehold prior to the acquisition, as signaled by the mean (0.324) of the dummy *Toehold*.

Variable Name	***Mean***	***Std. Dev***	***1st Quartile***	***Median***	***3rd Quartile***	***Skewness***	***Kurtosis***
			Dependent Variable				
TobinQ (Ln)	*1.556553*	*1.204090*	*0.7352239*	*1.292169*	*2.074468*	*1.510508*	*6.134227*
			Independent Variables				
N_Bidders	*40.54264*	*43.46623*	*8*	*20*	*63*	*1.133529*	*2.878372*
N_Informed	*28.43774*	*33.68429*	*4*	*12*	*42*	*1.283552*	*3.221487*
N_Non_Informed	*10.95774*	*11.59050*	*2*	*7*	*16*	*1.277621*	*3.662630*
VC_Backed	*0.390189*	*0.487977*	*0*	*0*	*1*	*0.450238*	*1.202714*
VC_High	*0.090566*	*0.287100*	*0*	*0*	*0*	*2.853288*	*9.141252*
VC_Low	*0.299623*	*0.458266*	*0*	*0*	*1*	*0.874833*	*1.765333*
			Control Variables				
Geo_UK	*0.4483019*	*0.497508*	*0*	*0*	*1*	*0.247514*	*0.207907*
Geo_France	*0.1109434*	*0.314181*	*0*	*0*	*0*	*2.477578*	*7.138393*
Geo_Germany	*0.1109434*	*0.314181*	*0*	*0*	*0*	*2.477578*	*7.138393*
Geo_NorthernEurope	*0.1177358*	*0.322417*	*0*	*0*	*0*	*2.372138*	*6.627037*
Geo_SouthernEurope	*0.0716981*	*0.258085*	*0*	*0*	*0*	*3.320332*	*12.02460*
Geo_Benelux	*0.0679245*	*0.251711*	*0*	*0*	*0*	*3.434399*	*12.79510*
Geo_OtherCountries	*0.0724528*	*0.259334*	*0*	*0*	*1*	*3.298514*	*11.88020*
Ind_HighKnowledgeIntServices	*0.3026415*	*0.459575*	*0*	*0*	*1*	*0.859199*	*1.738222*

Ind_HighTechManufacturing	*0.061887*	*0.241041*	*0*	*0*	*0*	*3.636551*	*14.22451*
Ind_LifescienceBiotech	*0.191698*	*0.393785*	*0*	*0*	*0*	*1.566428*	*3.453697*
Ind_Software	*0.234717*	*0.423982*	*0*	*0*	*0*	*1.251861*	*2.567156*
Ind_Other	*0.209057*	*0.406788*	*0*	*0*	*0*	*1.430981*	*3.047706*
Company_Age (Ln)	*2.147979*	*0.573988*	*1.791759*	*2.197225*	*2.564949*	*-0.536506*	*3.279893*
TotalAssets (Ln)	*8.709890*	*2.214982*	*7.515407*	*8.644297*	*9.987902*	*-0.247694*	*4.902245*
AcqMarketSentiment	*511.6543*	*154.3658*	*407*	*540*	*629*	*-0.589632*	*3.110126*
ProbAcquisition	*0.664746*	*0.450819*	*0.202470*	*0.781105*	*0.911997*	*1.213590*	*6.315689*
MediaCoverage	*241.3517*	*796.8242*	*3*	*25.5*	*147*	*7.246701*	*67.47405*
DebtAccounting (Ln)	*8.031438*	*2.597047*	*6.834586*	*8.201259*	*9.558043*	*-0.707272*	*4.992019*
Payment_Cash	*0.360755*	*0.480401*	*0*	*0*	*1*	*0.579923*	*1.336311*
Payment_Deferred	*0.032453*	*0.177266*	*0*	*0*	*0*	*5.277073*	*28.84749*
Payment_Earn-out	*0.094340*	*0.292411*	*0*	*0*	*0*	*2.775638*	*8.704167*
Payment_Liabilities	*0.059623*	*0.236876*	*0*	*0*	*0*	*3.719618*	*14.83555*
Payment_Other	*0.452830*	*0.497958*	*0*	*0*	*1*	*0.189525*	*1.035920*
Cash&Equivalent (Ln)	*3.330366*	*5.831186*	*0.877811*	*5.712898*	*7.366581*	*-0.930910*	*2.328118*
Domestic	*0.494284*	*0.494284*	*0*	*0*	*1*	*0.310076*	*1.096147*
Toehold	*0.032453*	*0.177266*	*0*	*0*	*0*	*5.277073*	*28.84749*

Table 5: Descriptive statistics

3.5 Regression and tests

To test the hypotheses and investigate the relationship between the dependent variable, chosen as the startup's natural logarithm of Tobin's Q, and the set of independent variables described in Chapter 3.3.3, a multiple linear regression model was used. Mathematically, the relationship between the dependent variable and the n independent variables is defined by the following formula:

$$y_i = \beta_0 + \sum_{j=1}^{n} \beta_j * X_{ij} + \varepsilon_i \quad (3.2)$$

where y_i is the dependent (explained) variable for the ith observation, β_0 is the intercept of the model, X_{ij} corresponds to the jth independent (or explanatory) variable of the model (j = 1 to n) for the ith observation, β_j is the coefficient of the jth variable and ε_i is the random error with expectation 0 and variance σ^2. This last variable ε_i accounts for possible "noise", capturing all the alternative elements influencing the dependent variable other than the explanatory variables.

Initially, the methodology employed was that of the ordinary least squares (OLS) regression, in which the relationship between dependent and independent variables is estimated by minimizing the sum of the squares in the difference between the observed and predicted values of the dependent variable, configured as a straight line. However, upon further testing, it was decided to opt for robust variance estimators (robust standard errors), as they are in fact robust to heteroscedasticity and problems about normality of the residuals, and thus preferrable when this is present, as it happens in the models of this dissertation. This was done by using the *robust* command in Stata, which estimates the standard errors using the Huber-White "sandwich" estimators of variance. It must be noted that the regression coefficients β_1, ..., β_j with the *robust* command are exactly the same as in ordinary OLS, but with the difference that the robust standard errors take into account possible issues regarding heterogeneity and lack of normality, thus giving more accurate p-values.

Generally, linear regression models (OSL) require a series of assumptions, regarding the set of variables included in (5.1), to be respected for the model to be considered valid. More specifically, these assumptions regard multicollinearity, homoscedasticity and normality of residuals. As stated, however, it is possible to accept the validity of the models even if the last two assumptions are violated, as in this dissertation robust standard errors are employed in place of OLS. Still, for the sake of completeness, these two assumptions are hereby reported as well.

3.5.1 Multicollinearity

Multicollinearity occurs when two or more independent variables are highly correlated with one another. In the case of perfect multicollinearity, which occurs when one explanatory variable is perfectly correlated with another explanatory variable (or with a combination of two or more explanatory variables), a unique least-squares solution for the regression coefficients does not exist. Although perfect multicollinearity is rather rare, even in the case in which one independent variable is highly correlated with another independent variable (or with a combination of two or more independent variables), then the marginal contribution of that independent variable is influenced by the other independent variables. As a consequence, the estimated regression coefficients β_1, ..., β_j can be unreliable, and the tests of significance for regression coefficients can be misleading. Indeed, in the case of multicollinearity, the coefficients become very sensitive to small changes in the model and can fluctuate significantly based on the variables present in it. This happens even if the overall predictive power of the model is high, that is, the R^2 can be high and the predictions might be unaffected by multicollinearity. Still, the interpretability is heavily effected, and furthermore most of the times the model would be subject to overfitting and loss of accuracy when using datasets different from the training one. In order to identify multicollinearity, both the correlation matrix and the variance inflation factor can be employed.

The correlation matrix is a squared matrix which displays the correlation coefficients of all the possible couples of variables. Clearly, all the explanatory variables

must be present in both axes, and as a result in the diagonal of the matrix the correlation coefficients are equal to 1. Even though it is not possible to find a uniquely shared threshold to discriminate the highly correlated couples of variables from the others, a widely accepted upper limit, adopted in this dissertation as well, is 0.7. This means that all couples with correlation coefficients higher than 0.7 and lower than -0.7 are considered as highly correlated, and thus action is required to avoid multicollinearity issues. The main limit of employing the correlation matrix lies in the fact that it only allows to spot high correlation between pair of variables, failing at highlighting when an explanatory variable is a linear combination of two or more other explanatory variables.

The VIF overcomes the shortcoming of the correlation matrix, as it determines the strength of the correlation between the independent variables, computed by regressing one variable against every other variable. The formula for computing the VIF is the following:

$$VIF_i = \frac{1}{1 - R_i^2} \tag{3.3}$$

where R^2 is the coefficient of determination of a regression in which the i^{th} variable is used as dependent variable and all the other variables are used as explanatory variables (James et al., 2017). A VIF equal to 1 for the i^{th} variable indicates that there is no correlation between this independent variable and the others in the model. VIFs between 1 and 5 suggest that there is a moderate correlation, but that it is not severe enough to warrant corrective measures. VIFs greater than 5 represent critical levels of multicollinearity in which the coefficients are poorly estimated, and the p-values are questionable. Indeed, several different scholars (e.g., Sheather, 2009; Vercellis, 2009) use this value as a cutoff threshold. Other scholars are instead less conservative and set the threshold for critical multicollinearity at 10 (Kutner et al., 2004). For this dissertation it was decided to set the upper limit at 5.

3.5.2 Homoscedasticity

A second key assumption for OLS models is that of homoscedasticity, or the fact that the variance of the random error term (the "noise" or random disturbance in the relationship between the independent variables and the dependent variable) is the same across all values of the independent variables. Conversely, heteroscedasticity (the violation of homoscedasticity) occurs when the variance of the disturbance is different across the elements of the vector. In order for the estimated coefficients β_1, ..., β_j to be considered BLUE (Best Linear Unbiased Estimators), it is necessary that this assumption is respected. Violating this assumption has an impact that increases as heteroscedasticity increases. Still, in the case of this dissertation, the violation of this assumption is negligible and must be quite severe in order to present a major problem given the robust nature to heteroscedasticity of robust variance estimators. To test for homoscedasticity, both graphical and analytical tests are available. Among the former, it is possible to plot the standardized residuals against the predicted values to determine if the points are distributed fairly across all the values of the independent variables. Still, analytical tests are more reliable and thus preferrable to adopt. More specifically, amongst the most commonly used tests employed by scholars is the White test (White, 1980).

The White test is a statistical test for homoscedasticity which assumes that the variance of the error terms is constant (i.e., the null hypothesis is that of homoscedasticity). Operatively, the White Test works by regressing the squared residuals on all distinct regressors, cross-products, and squares of regressors. It might happen that the test returns a significant result even if the variances of the errors are equal, since the problem is not that of heteroscedasticity but may rather be of specification of the errors. Indeed, "the White test can be a test of heteroscedasticity or specification error or both. If no cross-product terms are introduced in the White test procedure, then this is a pure test of pure heteroscedasticity. If the cross-product is introduced in the model, then it is a test of both heteroscedasticity and specification

bias" (White, 1980). Therefore, to test for pure heteroskedasticity, it is necessary to exclude the cross products from the auxiliary regression.

3.5.3 Normality of residuals

The last assumption that needs to be checked for OLS regression models is that the residuals are normally distributed, so that their distribution has mean equal to zero and constant variance. Indeed, it might happen that the error distribution is skewed by the presence of a few large outliers: as the parameters' estimation is based on the minimization of the squared errors, a few extreme observations can exert a disproportionate influence on it. If this condition is not met, it might be problematic to determine whether the model's coefficients are significantly different from zero. In fact, the computation of the confidence intervals, as well as several significance tests for coefficients, are all based on the assumptions of normally distributed errors. Thus, a non-normal distribution of the residuals might generate confidence intervals which are either too large or too narrow. As anticipated, however, this assumption can be overlooked as normality of the error terms is not needed when applying robust estimators. Regardless, different tests, both graphical and statistical, are available for checking that this condition is respected.

One straightforward graphic method is that of using the normal probability plot or the normal quantile plot of the residuals. These graphs plot the fractiles of error distribution against the fractiles of a normal distribution having the same mean and variance. In the case in which normalcy is respected, the points should fall close to the diagonal reference line; other patterns might indicate excessive skewness (bow-shaped pattern) or excessive kurtosis (S-shaped pattern). Other graphical methods regard the use of the Kernel normality graph, the distribution of residual graph, and the box plot. Considering instead the statistical methods, both the Shapiro-Wilk test and the Jarque-Bera can be employed.

The Shapiro-Wilk test allows to verify whether a random sample comes from a normal distribution or not; this test is often used when the sample of data is small

(n<5000). Put simply, the test quantifies the similarity between the observed and normal distributions as a single number by superimposing a normal curve over the observed distribution; then, it computes which percentage W of the sample overlaps with it. If such value W, obviously ranging between 0 and 1, is too small, the test indicates that the null hypothesis (the sample is normally distributed) has to be rejected. The formula for the W value is:

$$W = \frac{\left(\sum_{i=1}^{n} a_i x_{(i)}\right)^2}{\sum_{i=1}^{n}(x_i - \bar{x})^2} \quad \text{with } (a_1, \ldots, a_n) = \frac{m^T V^{-1}}{\left(m^T V^{-1} V^{-1} m\right)^{1/2}} \tag{3.4}$$

where $x_{(i)}$ is the ith order statistics (i.e., the ith smallest value of the sample), $\bar{x}$ is the mean of the sample, $m = (m_1, \ldots, m_n)T$ is the vector of the expected values of independent and identically distributed random variables sampled from the standard normal distribution and V is the corresponding covariance matrix.

The Jarque-Bera test is instead generally used for large datasets, since other normality tests (as the Shapiro-Wilk) are not reliable when n is large. It works by matching the skewness and kurtosis of the data to check if it fits a normal distribution, which has a skew of zero (i.e., it is perfectly symmetrical around the mean) and a kurtosis of three. The test statistic JB is defined as:

$$JB = \frac{n}{6}\ \left(S^2 + \frac{(K-3)^2}{4}\right) \tag{3.5}$$

where n is the number of observations, S is the skewness and K is the kurtosis. If observations come from a normal distribution, the overall JB statistic asymptotically has a chi-squared distribution with two degrees of freedom. A sufficiently large value (JB ≥ 1) of JB will lead to reject the hypothesis that the errors are normally distributed.

3.6 Presentation of the models

The following Chapter is devoted to a throughout description of the models that were developed to test the existence of a relationship between the exit valuation (measured, as explained, with the natural logarithm of Tobin's Q) and the independent

variables presented in Chapter 3.3.3. Specifically, the models were generated with the goal of testing the hypotheses described in Chapter 2 which, for the sake of convenience, are reported hereafter:

- ***H0:*** the exit valuation is positively correlated with the number of bidders;
- ***H1:*** the exit valuation is positively correlated with the number of informed bidders;
- ***H2:*** the effect of the signal is larger if the number of non-informed bidders is larger;
- ***H3:*** the effect of the signal is smaller if the number of informed bidders is larger.

To test these hypotheses, three regression models were developed, using the sample of 1325 companies already described in Chapter 3.2. The models are hereby reported by ascending complexity. First, a model including all and only the control variables presented in Chapter 3.3.2 was run, so to have a baseline for comparison with the subsequent models. Then, the first model aimed at testing the hypotheses is rather simple, as it only includes two explanatory variables (the overall number of bidders and the dummy for the presence of VC), as well as all the control variables presented in Chapter 3.3.2. In the second model, instead, the number of bidders is replaced by the number of informed and non-informed bidders, while all the other variables included in the first model are unchanged. Lastly, the third model includes all the variables of the second model, but it also adds an interactive term between the dummy *VC_Backed* and the number of informed (*N_Informed*) and non-informed (*N_Non_Informed*) bidders.

Finally, to control for possible selection bias and the endogeneity associated to the VC-backed observations, the VC-backed targets were matched through the coarsened exact matching (CEM) algorithm (Iacus et al., 2012) with the non-VC-backed firms, controlling for a set of pre-treatment variables such as the geographical location (based in this case on the company nation), the industry of belonging (divided

into five macro-industries, as explained in Chapter 3.2) and the company age (which for VC-backed companies was computed as the age at the first round of funding).

3.6.1 Model 0: control variables

Before running the models aimed at testing the above-mentioned hypotheses, a model, comprised only of the control variables and meant as a baseline for results' comparison, was run. Consequently, the model is the following:

$$\begin{aligned} Tobin'sQ_i = {} & \beta_0 + \beta_1 Geo\_UK_i + \beta_2 Geo\_Germany_i + \beta_3 Geo\_France_i \\ & + \beta_4 Geo\_NorthernEurope_i + \beta_5 Geo\_SouthernEurope_i \\ & + \beta_6 Benelux_i + \beta_7 Ind\_HighKnowledgeIntServices_i \\ & + \beta_8 Ind\_HighTechManufacturing_i \\ & + \beta_9 Ind\_LifescienceBiotech_i + \beta_{10} Ind\_Software_i \\ & + \beta_{11} Company\_age_i + \beta_{12} TotalAssets_i \\ & + \beta_{13} AcqMarketSentiment_i + \beta_{14} ProbAcquisition_i \\ & + \beta_{15} MediaCoverage_i + \beta_{16} MediaCoverageSq_i \\ & + \beta_{17} Debt\_Accounting_i + \beta_{18} Payment\_Deferred_i \\ & + \beta_{19} Payment\_Earnout_i + \beta_{20} Payment\_Liabilities_i \\ & + \beta_{21} Payment\_Other_i + \beta_{22} Cash\&Equivalent_i \\ & + \beta_{23} Domestic_i + \beta_{24} Toehold_i + \varepsilon_1 \end{aligned} \tag{3.6}$$

The results of the regression are summarized in Table 6. The R^2 for the model is 0.4126, meaning that control variables alone explain 41.26% of the variation of the natural logarithm of Tobin's Q, which is a satisfactory result. Moreover, the F-test is equal to 0 with four decimal places, proving that the overall model is statistically significant. Additionally, the VIF shows that there are no problems of multicollinearity.

Moving to the results of the regression, considering the variables for the geographic location, both *Geo_ France* and *Geo_ NorthernEurope* are negatively (-0.533 and -0.466 respectively) and significantly (p-values of 0.026 and 0.054 respectively) correlated with the exit value. On the other hand, the dummy *Ind_ LifescienceBiotech* is positively correlated (0.257) to *Ln_ TobinQ*, and statistically significant. Moreover, the model shows that *Company_ Age* has a negative (-0.152) and significant (p-value

equal to 0.022) impact on the exit valuation, shedding some light over the conflicting and mixed results reported by scholars (e.g., Nelson, 2003; Boeker and Wiltbank, 2005; Wennberg et al., 2010; Balcaen et al., 2011; DeTienne and Cardon, 2012; Anderson et al., 2017). Similarly, the total assets are negatively correlated to the exit valuation, and statistically significant (p-value of 0,000), backing the hypothesis that smaller companies are able to obtain higher valuations due to stronger growth opportunities (Meoli et al., 2013). In addition, the dummy *Domestic*, controlling for domestic versus cross-border acquisitions, also has the same negative effect and statistical significance, as expected. *MediaCoverage* is proved to have a quadratic significant relationship with the exit value, with a concave-downward profile. Last, out of all the dummies controlling for the payment method, the only significant one is *Payment_Earn-out*, with a p-value of 0.043 and a positive (0.311) effect on the acquisition valuation. Last, the constant term is also found do be statistically significant.

Variable	***Coefficient β***	***Robust Std. Err.***	***P-Value***
Geo_UK	*-0.230024*	*0.229919*	*0.317*
Geo_France	*-0.533335*	*0.238828*	*0.026***
Geo_Germany	*-0.248165*	*0.246239*	*0.314*
Geo_NorthernEurope	*-0.466900*	*0.242070*	*0.054**
Geo_SouthernEurope	*-0.391428*	*0.273554*	*0.153*
Geo_Benelux	*-0.096278*	*0.252911*	*0.704*
Ind_HighKnowledgeIntServices	*0.090854*	*0.102551*	*0.376*
Ind_HighTechManufacturing	*0.031943*	*0.169062*	*0.850*
Ind_LifescienceBiotech	*0.257715*	*0.118455*	*0.030***
Ind_Software	*0.089352*	*0.110828*	*0.420*
Company_Age[1]	*-0.152610*	*0.066579*	*0.022***
TotalAssets[1]	*-0.337012*	*0.030141*	*0.000***
AcqMarketSentiment	*0.000362*	*0.000319*	*0.256*
ProbAcquisition	*-0.062796*	*0.086649*	*0.469*
MediaCoverage	*0.000478*	*0.000106*	*0.000***

MediaCoverageSq	*0.000000*	*0.000000*	*0.001***
DebtAccounting[1]	*0.005074*	*0.021054*	*0.810*
Payment_ Deferred	*-0.311576*	*0.206440*	*0.131*
Payment_ Earn-out	*0.311424*	*0.153979*	*0.043***
Payment_ Liabilities	*0.090831*	*0.136013*	*0.504*
Payment_ Other	*-0.101938*	*0.090737*	*0.261*
Cash&Equivalent[1]	*-0.002414*	*0.007214*	*0.738*
Domestic	*-0.476126*	*0.078832*	*0.000***
Toehold	*0.058402*	*0.129764*	*0.653*
Constant	*4.980126*	*0.444600*	*0.000***
R-Squared	*0.4126*	**F-Test**	*15.12*
Mean VIF	*2.12*	**P-Value**	*0.0000*

1. Ln

* p-value < 10%
** p-value < 5%

Table 6: Regression results of model 0

3.6.2 Model 1: the effect of the number of bidders

The first model aims at testing the hypothesis that the overall number of bidders has a positive effect on the exit valuation (H0). Therefore, the main explanatory variable used is *N_ Bidders*, which regards the overall number of bidders -winsorized at 5% level- for each target company; still, another explanatory variable, the dummy *VC_ Backed*, was included. Clearly, all the control variables described in Chapter 3.3.2 were added to the regression model, which is reported hereafter:

$$
\begin{aligned}
Tobin'sQ_i = \; & \beta_0 + \beta_1 N\_Bidders_i + \beta_2 VC\_Backed_i + \beta_3 Geo\_UK_i \\
& + \beta_4 Geo\_Germany_i + \beta_5 Geo\_France_i \\
& + \beta_6 Geo\_NorthernEurope_i + \beta_7 Geo\_SouthernEurope_i \\
& + \beta_8 Benelux_i + \beta_9 Ind\_HighKnowledgeIntServices_i \\
& + \beta_{10} Ind\_HighTechManufacturing_i \\
& + \beta_{11} Ind\_LifescienceBiotech_i + \beta_{12} Ind\_Software_i \\
& + \beta_{13} Company\_age_i + \beta_{14} TotalAssets_i \\
& + \beta_{15} AcqMarketSentiment_i + \beta_{16} ProbAcquisition_i \\
& + \beta_{17} MediaCoverage_i + \beta_{18} MediaCoverageSq_i
\end{aligned}
\tag{3.7}
$$

$$+ \beta_{19} Debt\_Accounting_i + \beta_{20} Payment\_Deferred_i$$
$$+ \beta_{21} Payment\_Earnout_i + \beta_{22} Payment\_Liabilities_i$$
$$+ \beta_{23} Payment\_Other_i + \beta_{24} Cash\&Equivalent_i$$
$$+ \beta_{25} Domestic_i + \beta_{26} Toehold_i + \varepsilon_1$$

The results of the regression are summarized in Table 7. The R^2 for the model is 0.4210, a 0.86% improvement with respect to Model 0, meaning that the independent variables included in the model contribute to better explain the variation in a company's valuation at exit. Moreover, the F-test is equal to 0 with four decimal places, proving that the overall model is statistically significant. Additionally, the model does not suffer from multicollinearity, as shown by the VIF.

Moving to the results of the regression, it can be noticed that the explanatory variable *N_ Bidders* lacks statistical significance (p-value equal to 0.929, far above the 0.1 threshold commonly set for significance). For that reason, it is not possible to neither accept nor reject H0, seemingly contrasting with traditional economic theories (Vickrey, 1961). However, in the development of the second and third models, it appears that the effects of informed and non-informed bidders is diametrically opposed, leading to believe that grouping them together may not be precise. Regardless, the second explanatory variable (the dummy *VC_ Backed*) has a positive (0.258) and highly statistically significant (p-value 0,001) effect on the exit valuation, as posited by the literature. As for the previous model, both *Geo_ France* and *Geo_ NorthernEurope* are negatively (-0.576 and -0.475 respectively) and significantly (p-values of 0.015 and 0.051 respectively) correlated with the exit value, while the dummy *Ind_ LifescienceBiotech* has the opposite and significant effect. Additionally, the model also validates the negative and significant impact of the company's age and total assets on the exit valuation, as well as the fact that a domestic acquisition is correlated to a lower-value exit deal. *MediaCoverage* is confirmed to have an inversed u-shape relationship with the exit value, while the only payment method displaying statistical significance is the earn-out one, with a positive (0.440) effect on the acquisition valuation. Last, the constant term is also found do be statistically significant.

Variable	*Coefficient β*	*Robust Std. Err.*	*P-Value*
N_Bidders[1]	*-0.000105*	*0.001176*	*0.929*
VC_Backed	*0.258121*	*0.075248*	*0.001***
Geo_UK	*-0.243341*	*0.233018*	*0.297*
Geo_France	*-0.576809*	*0.237920*	*0.015***
Geo_Germany	*-0.285791*	*0.249167*	*0.252*
Geo_NorthernEurope	*-0.475789*	*0.244034*	*0.051**
Geo_SouthernEurope	*-0.403515*	*0.274646*	*0.142*
Geo_Benelux	*-0.125875*	*0.258213*	*0.626*
Ind_HighKnowledgeIntServices	*0.087494*	*0.109628*	*0.425*
Ind_HighTechManufacturing	*0.053256*	*0.168147*	*0.752*
Ind_LifescienceBiotech	*0.235176*	*0.121619*	*0.053**
Ind_Software	*0.078790*	*0.143113*	*0.582*
Company_Age[2]	*-0.208976*	*0.066284*	*0.002***
TotalAssets[2]	*-0.327858*	*0.031639*	*0.000***
AcqMarketSentiment	*0.000460*	*0.000340*	*0.176*
ProbAcquisition	*-0.082580*	*0.088162*	*0.349*
MediaCoverage	*0.000411*	*0.000104*	*0.000***
MediaCoverageSq	*0.000000*	*0.000000*	*0.004***
DebtAccounting[2]	*0.001108*	*0.021622*	*0.959*
Payment_Deferred	*-0.273931*	*0.201616*	*0.174*
Payment_Earn-out	*0.332090*	*0.155319*	*0.033***
Payment_Liabilities	*0.095840*	*0.135635*	*0.480*
Payment_Other	*-0.100010*	*0.091002*	*0.272*
Cash&Equivalent[2]	*-0.004990*	*0.007091*	*0.482*
Domestic	*-0.463798*	*0.079118*	*0.000***
Toehold	*0.046927*	*0.128267*	*0.715*
Constant	*4.940488*	*0.448820*	*0.000***
R-Squared	*0.4210*	**F-Test**	*15.62*
Mean VIF	*2.17*	**P-Value**	*0.0000*

1. Winsorized at 5% level
2. Ln

* p-value < 10%
** p-value < 5%

Table 7: Regression results of model 1

3.6.3 Model 2: separation of informed and non-informed bidders

The second model aims at testing the hypothesis that the number of informed bidders positively effects the exit valuation (H1). Consequently, all variables employed in Model 1 have been included in Model 2 as well, with the difference of adding *N_Informed* and *N_Non_Informed* in the place of *N_Bidders*. Therefore, the regression model, whose results are summarized in Table 8, is the following:

$$
\begin{aligned}
Tobin'sQ_i = {} & \beta_0 + \beta_1 N\_Informed_i + \beta_2 N\_Non\_Informed_i + \beta_3 VC\_backed_i \\
& + \beta_4 Geo\_UK_i + \beta_5 Geo\_Germany_i + \beta_6 Geo\_France_i \\
& + \beta_7 Geo\_NorthernEurope_i + \beta_8 Geo\_SouthernEurope_i \\
& + \beta_9 Benelux_i + \beta_{10} Ind\_HighKnowledgeIntServices_i \\
& + \beta_{11} Ind\_HighTechManufacturing_i \\
& + \beta_{12} Ind\_LifescienceBiotech_i + \beta_{13} Ind\_Software_i \\
& + \beta_{14} Company\_age_i + \beta_{15} TotalAssets_i \\
& + \beta_{16} AcqMarketSentiment_i + \beta_{17} ProbAcquisition_i \\
& + \beta_{18} MediaCoverage_i + \beta_{19} MediaCoverageSq_i \\
& + \beta_{20} Debt\_Accounting_i \\
& + \beta_{21} Payment\_Deferred_i + \beta_{22} Payment\_Earnout_i \\
& + \beta_{23} Payment\_Liabilities_i + \beta_{24} Payment\_Other_i \\
& + \beta_{25} Cash\&Equivalent_i + \beta_{26} Domestic_i + \beta_{27} Toehold_i + \varepsilon_1
\end{aligned}
\tag{3.8}
$$

The R^2 for the model is 0.4244, a small (0.34% of additional variation explained) improvement with respect to Model 1; additionally, the result of the F-test, which is equal to 0 with four decimal places, proves that the overall model is statistically significant. Albeit small, the improvement with respect to the previous model signals that separating bidders into informed and non-informed is indeed right. As for the previous model, there are no problems of multicollinearity.

Focusing on the results of the model, all the control variables that resulted statistically significant in Model 1 are still significant (namely: *Geo_France*,

Geo_NorthernEurope, *Ind_LifescienceBiotech*, *Company_Age*, *TotalAssets*, *MediaCoverage*, *Payment_Earn-out* and *Domestic*) and with unchanged effect (the signs of the coefficients are still the same) on the exit valuation, albeit with slightly different absolute effects and significance. Moving to the explanatory variables, the dummy *VC_Backed* is confirmed to have has a positive (0.255) and significant (p-value of 0.001) effect on the exit value. Focusing instead on the variables accounting for the number of informed and non-informed bidders, it is interesting to notice that while their effect is diametrically opposed, only non-informed bidders are statistically significant (p-value of 0.058) and negatively (-0.008) correlated to the exit valuation. Therefore, the p-value (0.265) for *N_Informed* does not allow us to confirm nor reject H1. A more in-depth discussion of this result is postponed to Chapter 4.

Variable	***Coefficient β***	***Robust Std. Err.***	***P-Value***
N_Informed[1]	*0.001841*	*0.001652*	*0.265*
N_Non_Informed[1]	*-0.008434*	*0.004446*	*0.058**
VC_Backed	*0.255246*	*0.074990*	*0.001***
Geo_UK	*-0.270045*	*0.232400*	*0.245*
Geo_France	*-0.581005*	*0.234100*	*0.013***
Geo_Germany	*-0.321033*	*0.248277*	*0.196*
Geo_NorthernEurope	*-0.447347*	*0.237307*	*0.060**
Geo_SouthernEurope	*-0.407273*	*0.270315*	*0.132*
Geo_Benelux	*-0.112645*	*0.251941*	*0.655*
Ind_HighKnowledgeIntServices	*0.108235*	*0.109480*	*0.323*
Ind_HighTechManufacturing	*0.076490*	*0.168624*	*0.650*
Ind_LifescienceBiotech	*0.294339*	*0.128240*	*0.022***
Ind_Software	*0.105039*	*0.146595*	*0.474*
Company_Age[2]	*-0.198859*	*0.065688*	*0.003***
TotalAssets[2]	*-0.327954*	*0.031419*	*0.000***
AcqMarketSentiment	*0.000461*	*0.000339*	*0.175*
ProbAcquisition	*-0.094820*	*0.087242*	*0.277*

MediaCoverage	*0.000401*	*0.000104*	*0.000***
MediaCoverageSq	*0.000000*	*0.000000*	*0.006***
DebtAccounting²	*0.002703*	*0.021699*	*0.901*
Payment_ Deferred	*-0.258470*	*0.205337*	*0.208*
Payment_ Earn-out	*0.327397*	*0.153285*	*0.033***
Payment_ Liabilities	*0.111096*	*0.136664*	*0.416*
Payment_ Other	*-0.102938*	*0.090843*	*0.257*
Cash&Equivalent²	*-0.004877*	*0.007138*	*0.495*
Domestic	*-0.454279*	*0.077964*	*0.000***
Toehold	*0.045948*	*0.134189*	*0.732*
Constant	*4.934583*	*0.441429*	*0.000***
R-Squared	*0.4244*	**F-Test**	*15.32*
Mean VIF	*2.17*	**P-Value**	*0.0000*

1. Winsorized at 5% level
2. Ln

* p-value < 10%
** p-value < 5%

Table 8: Regression results of model 2

3.6.4 Model 3: interactive effects of signals

The last model grows in complexity compared to Model 2, as it tests the effect of the presence of VCs contingent to the number of informed bidders (H3) and non-informed bidders (H2). Consequently, all the variables already included in Model 2 are still employed, to which the interactive terms between the dummy *VC_ backed* and *N_ Informed* (*VC_ backed#N_ Informed*) and *VC_ backed* and *N_ Non_ Informed* (*VC_ backed#N_ Non_ Informed*) are added. Therefore, the regression model, whose results are reported in Table 9, is the following:

$$
\begin{aligned}
Tobin'sQ_i = \; & \beta_i + \beta_1 N\_Informed_i + \beta_2 N\_Non\_Informed_i + \beta_3 VC\_backed_i \\
& + \beta_4 VC\_backed\#N\_Informed_i \\
& + \beta_5 VC\_backed\#N\_Non\_Informed_i + \beta_6 Geo\_UK_i \\
& + \beta_7 Geo\_Germany_i + \beta_8 Geo\_France_i \\
& + \beta_9 Geo\_NorthernEurope_i + \beta_{10} Geo\_SouthernEurope_i \\
& + \beta_{11} Benelux_i + \beta_{12} Ind\_HighKnowledgeIntServices_i
\end{aligned} \tag{3.9}
$$

$$+ \beta_{13} Ind\_HighTechManufacturing_i$$
$$+ \beta_{14} Ind\_LifescienceBiotech_i + \beta_{15} Ind\_Software_i$$
$$+ \beta_{16} Company\_age_i + \beta_{17} TotalAssets_i$$
$$+ \beta_{18} AcqMarketSentiment_i + \beta_{19} ProbAcquisition_i$$
$$+ \beta_{20} MediaCoverage_i + \beta_{21} MediaCoverageSq_i$$
$$+ \beta_{22} Debt\_Accounting_i$$
$$+ \beta_{23} Payment\_Deferred_i + \beta_{24} Payment\_Earnout_i$$
$$+ \beta_{25} Payment\_Liabilities_i + \beta_{26} Payment\_Other_i$$
$$+ \beta_{27} Cash\&Equivalent_i + \beta_{28} Domestic_i + \beta_{29} Toehold_i + \varepsilon_1$$

Even in this case, the model is statistically significant, as the F-test is equal to 0 with four decimal places. The R^2 is 0.4275, a small improvement with respect to the previous models (0.65% and 0.31% of additional variation explained compared to Model 1 and 2 respectively). The VIF shows that there are no problems of multicollinearity.

Focusing on the results, all the control variables that resulted statistically significant in the previous models (namely: *Geo_France*, *Geo_NorthernEurope*, *Ind_LifescienceBiotech*, *Company_Age*, *TotalAssets*, *MediaCoverage*, *Payment_Earn-out* and *Domestic*) are still significant and with unchanged effect (the signs are still the same). Clearly, there are negligible changes in both the absolute effects (coefficient β) and significance (p-value). Moving to the explanatory variables, the dummy *VC_Backed* still has a positive (0.179) and significant (p-value of 0.094) effect on the exit valuation, which is however lower when compared to the second model. As for Model 2, even in this case the relationship between the number of informed and non-informed bidders is diametrically opposed. Again, only non-informed bidders have a significant and negative effect on the exit valuation. This confirms previous results and conclusions on H1. Last, of the two interactive variables, only the one regarding the non-informed bidders is statistically significant (p-value=0.049), and positively (0.015) correlated to the exit valuation.

Additionally, the F-test on:

$$VC\_Backed\#N\_Informed + N\_Informed = 0 \quad (3.10)$$

was run, resulting in a p-value of 0.880. Clearly, this result does not allow to reject the null hypothesis and indicates that there is no evidence to state that, when VCs are present, the coefficient of informed bidders is different from 0. This suggests that VCs might have a substitutive effect on the number of informed bidders.

Variable	***Coefficient β***	***Robust Std. Err.***	***P-Value***
N_Informed[1]	*0.003530*	*0.002404*	*0.142*
N_Non_Informed[1]	*-0.015921*	*0.006342*	*0.012***
VC_Backed	*0.179087*	*0.106843*	*0.094**
VC_Backed#N_Informed	*-0.003244*	*0.002836*	*0.253*
VC_Backed#N_Non_Informed	*0.015310*	*0.007775*	*0.049***
Geo_UK	*-0.289770*	*0.233493*	*0.215*
Geo_France	*-0.602958*	*0.234984*	*0.010***
Geo_Germany	*-0.337707*	*0.246967*	*0.172*
Geo_NorthernEurope	*-0.462024*	*0.238158*	*0.053**
Geo_SouthernEurope	*-0.421266*	*0.269536*	*0.118*
Geo_Benelux	*-0.133561*	*0.252745*	*0.597*
Ind_HighKnowledgeIntServices	*0.105662*	*0.109317*	*0.334*
Ind_HighTechManufacturing	*0.079896*	*0.168130*	*0.635*
Ind_LifescienceBiotech	*0.301779*	*0.128539*	*0.019***
Ind_Software	*0.106302*	*0.145763*	*0.466*
Company_Age[2]	*-0.194035*	*0.065369*	*0.003***
TotalAssets[2]	*-0.327981*	*0.031205*	*0.000***
AcqMarketSentiment	*0.000393*	*0.000340*	*0.248*
ProbAcquisition	*-0.099899*	*0.085685*	*0.244*
MediaCoverage	*0.000411*	*0.000103*	*0.000***
MediaCoverageSq	*0.000000*	*0.000000*	*0.005***
DebtAccounting[2]	*0.003015*	*0.021534*	*0.889*

Payment_ Deferred	*-0.251338*	*0.210174*	*0.232*
Payment_ Earn-out	*0.347212*	*0.152763*	*0.023***
Payment_ Liabilities	*0.130630*	*0.138796*	*0.347*
Payment_ Other	*-0.099610*	*0.090364*	*0.271*
Cash&Equivalent²	*-0.005128*	*0.007156*	*0.474*
Domestic	*-0.449334*	*0.077775*	*0.000***
Toehold	*0.063340*	*0.140505*	*0.652*
Constant	*4.999589*	*0.446293*	*0.000***
R-Squared	*0.4275*	**F-Test**	*15.08*
Mean VIF	*2.47*	**P-Value**	*0.0000*

1. Winsorized at 5% level
2. Ln

* p-value < 10%
** p-value < 5%

Table 9: Regression results of model 3

To better understand the results of the model and be able to accept or reject H2 and H3, an analysis on the average marginal effects of the explanatory variables is needed. As reported in Table 10, the marginal effects of both *N_Non_Informed* and *VC_Backed* are statistically significant. Moreover, the negative marginal effect of the non-informed bidders is confirmed, as well as the positive marginal effect related the presence of a VC as a shareholder at acquisition.

Variable	***dy/dx***	***Std. Err***	***P-Value***
N_Informed¹	*0.002216*	*0.001726*	*0.199*
N_Non_Informed¹	*-0.009718*	*0.004596*	*0.035***
VC_Backed	*0.251748*	*0.075078*	*0.001***

1. Winsorized at 5% level

* p-value < 10%
** p-value < 5%

Table 10: Marginal effects of the independent variables

Still, to draw the right conclusions on H2 and H3, it is necessary to compute the marginal effect of the dummy *VC_Backed* at the quartiles of the explanatory variables *N_Informed* and *N_Non_Informed*. As reported in Table 11, when the number of informed bidders increases, the marginal effect of being backed by a venture capitalist decreases (as predicted by H3) until it reaches a point (for the 0-percentile quartile) in

which such effect is not statistically significant anymore. Thus, these results confirm H3. One the other hand, the marginal effect of being backed by a venture capitalist for the non-informed bidders increases as their number increases, and such effect becomes significant as well. For that reason, it is possible to confirm H2.

	N_Informed			***N_Non_Informed***		
VC_backed	***dy/dx***	***Std. Err.***	***p-value***	***dy/dx***	***Std. Err.***	***p-value***
0. VC_backed	***(base outcome)***			***(base outcome)***		
1. VC_backed						
1	*0.330249*	*0.093826*	*0.000***	*0.118230*	*0.112325*	*0.293*
2	*0.304297*	*0.081942*	*0.000***	*0.194779*	*0.086547*	*0.025***
3	*0.210223*	*0.088147*	*0.017***	*0.332567*	*0.076677*	*0.000***
4	*-0.003876*	*0.246142*	*0.987*	*0.715312*	*0.229757*	*0.002***

N_Informed: 1. at=4; 2 at=12; 3 at=41; 4 at=107
N_Non_Informed: 1. at=2; 2 at=7; 3 at=16; 4 at=41

* p-value $< 10\%$
** p-value $< 5\%$

Table 11: Marginal effect of dummy VC_Backed at different values of the number of bidders

Last, an analysis of the marginal effect of the number of both informed and non-informed bidders allows us to get additional interesting insights. Indeed, the marginal effect of informed bidders, regardless of whether the target is VC-backed or not, has no significant effect. Additionally, the difference between the two cases is not statistically significant (p-value equal to 0.253), as expected: as bidders are already informed, the presence of another signal is not important. Conversely, the difference between the marginal contribution of non-informed bidders in the case in which the target is backed by a VC against the case in which no VC is present as a stakeholder is statistically significant (p-value equal to 0.049) and with a positive (.015) effect. This is expected, as the signal "transforms" a non-informed bidder into an informed bidder, which does not discount the information asymmetry anymore. Indeed, the marginal effect of the number of non-informed bidders is negative (-0.016) and significant (0.012) when no VC backs the target.

Variable	*N_Informed*			*N_Non_Informed*		
VC_Backed	***dy/dx***	***Std.Err.***	***P-Value***	***dy/dx***	***Std.Err.***	***P-Value***
0	*0.003530*	*0.002404*	*0.142*	*-0.015921*	*0.006342*	*0.012***
1	*0.000286*	*0.001909*	*0.881*	*-0.000611*	*0.005390*	*0.910*
1 vs 0	*-0.003244*	*0.002836*	*0.253*	*0.015309*	*0.007775*	*0.049***

0: VC not present
1: VC present

* p-value $< 10\%$
** p-value $< 5\%$

Table 12: Marginal effect of the number of bidders at different values of dummy VC_Backed

Variable	*(a)*	*(b)*	*(c)*	*(d)*	*(e)*	*(f)*	*(g)*	*(h)*	*(i)*	*(j)*	*(k)*	*(l)*	*(m)*	*(n)*	*(o)*	*(p)*	*(q)*	*(r)*	*(s)*	*(t)*	*(u)*	*(v)*	*(w)*	*(y)*
N_Bidders	1.00																							
N_Informed	0.96	1.00																						
N_Non_Informed	0.74	0.53	1.00																					
VC_Backed	0.09	0.10	0.04	1.00																				
Geo_UK	-0.08	-0.04	-0.16	-0.09	1.00																			
Geo_France	0.09	0.08	0.09	0.14	-0.33	1.00																		
Geo_Germany	0.03	0.04	-0.02	0.05	-0.32	-0.13	1.00																	
Geo_NorthenEurope	0.05	0.02	0.13	-0.02	-0.31	-0.13	-0.13	1.00																
Geo_SouthernEurope	-0.02	-0.03	0.02	0.02	-0.24	-0.10	-0.10	-0.09	1.00															
Geo_Benelux	-0.04	-0.04	-0.02	0.00	-0.25	-0.10	-0.10	-0.10	-0.08	1.00														
Ind_HighKnowledgeIntServices	0.00	-0.01	-0.02	-0.04	0.06	-0.02	-0.03	-0.05	-0.03	-0.01	1.00													
Ind_HighTechManufacturing	-0.17	-0.17	-0.12	-0.09	-0.01	-0.03	0.04	0.03	0.02	0.00	-0.16	1.00												

Ind_LifescienceBiotech	-0.14	-0.17	0.01	0.10	-0.11	0.00	0.09	-0.01	0.04	0.01	-0.33	-0.12	1.00										
Ind_Software	0.60	0.61	0.41	0.05	-0.01	0.06	-0.02	0.06	-0.03	0.00	-0.36	-0.14	-0.27	1.00									
Company_Age	0.10	0.08	0.13	0.12	-0.21	0.06	0.09	0.07	0.04	0.04	-0.05	-0.06	0.06	0.03	1.00								
TotalAssets	-0.17	-0.17	-0.10	-0.03	-0.16	0.02	0.08	-0.02	0.11	0.13	-0.01	0.04	0.03	-0.16	0.23	1.00							
AcqMarketSentiment	0.27	0.23	0.25	0.03	-0.15	-0.04	0.09	0.06	0.05	-0.03	-0.01	0.03	0.07	-0.06	0.32	0.03	1.00						
ProbAcquisition	-0.01	0.01	-0.03	0.04	-0.04	0.04	-0.04	0.03	0.01	0.02	-0.01	-0.01	-0.02	0.07	0.13	-0.12	-0.20	1.00					
MediaCoverage	-0.01	-0.01	0.00	0.11	0.01	0.02	0.00	-0.02	-0.04	0.03	0.02	-0.04	0.05	-0.03	0.13	0.24	0.07	-0.03	1.00				
DebtAccounting	-0.13	-0.13	-0.08	0.02	-0.14	0.04	0.09	-0.07	0.10	0.13	0.00	0.03	0.03	-0.12	0.17	0.76	-0.03	-0.07	0.18	1.00			
PaymentMethod	-0.05	-0.05	-0.02	-0.04	-0.09	-0.03	0.00	0.05	0.07	0.01	0.00	0.04	-0.03	-0.06	-0.05	-0.07	0.05	-0.01	-0.05	-0.03	1.00		
Cash&Equivalents	0.15	0.12	0.16	0.05	-0.21	0.05	0.11	0.02	0.04	0.04	0.00	-0.02	0.09	-0.05	0.32	0.21	0.56	-0.18	0.07	0.20	0.07	1.00	
Domestic	-0.07	-0.07	-0.06	-0.10	0.21	-0.02	-0.12	-0.13	0.05	-0.09	0.15	-0.08	-0.16	-0.02	-0.07	-0.12	-0.11	0.03	0.00	-0.06	-0.01	-0.11	1.00
Toehold	0.05	0.06	0.01	-0.01	0.09	-0.07	-0.03	0.00	-0.02	-0.02	0.07	-0.03	-0.04	0.03	0.00	-0.02	0.02	0.00	-0.02	0.00	-0.02	-0.01	0.03	1.00

Table 13: Correlation Matrix

3.7 Robustness checks

The aim of this Chapter is that of providing a set of robustness checks for the models described in Chapter 3.6. Robustness checks are a fundamental step of the development of linear regression models, since they allow to understand whether the relationships which have been found are truly representative, or if they are instead simply the result of spurious regression or related to the peculiar way in which the variables were defined. Commonly, robustness checks are performed by changing some variables or their functional form in the models, with the goal of assessing the effect of such transformation. If the results do not change after changing the way some variables are expressed, then the consistency of the model can be confirmed.

First, all the models were run again by using different levels of winsorization for the variables *Ln_TobinQ*, *N_Bidders*, *N_Informed* and *N_Non_Informed*. In particular, it was decided to winsorize the explained variable at the 0.5% level (instead of 1%), and then run the models with three different levels (1%, 2% and 5%) of winsorization for the other three explanatory variables. The result of the tests showed that the variables that were statistically significant in the models described in Chapter 3.6 maintained their significance, with negligible changes in the values of the coefficients and p-values.

Second, given the importance of the dummy *VC_Backed* in the models' results, it was decided to assess whether, and how much, the reputation of VCs impacts the exit valuation. Moreover, to better investigate H1, an additional second model was tested, using the ratio of informed bidders over the total number of bidders as an explanatory variable. As for the models in Chapter 3.6, robust standard errors (using the *robust* command in Stata) were employed. For the sake of convenience, only these second set of robustness checks will be reported hereafter.

3.7.1 Model 2A: the effect of reputable VCs

As anticipated, the first robustness check was run on Model 2. More specifically, it was decided to assess the effects of separating VCs into highly and lowly reputable,

according to the definition given in Chapter 3.3.3.2. Indeed, the explanatory variable *VC_ Backed* was common to all the models developed in Chapter 3.6 and proved to have a positive and significant relationship with the exit valuation. Therefore, the dummy *VC_ Backed* was split into *VC_ High* and *VC_ Low*, the former assuming value 1 if the target is backed by at least one reputable VC, while the latter assuming value 1 if the company is backed by a VC that cannot be considered as reputable, and 0 otherwise. All the other variables added to Model 2 are included in this model as well, with the difference of removing *VC_ Backed* in place of *VC_ High* and *VC_ Low*. The results of the model, reported hereafter, are summarized in Table 14:

$$
\begin{aligned}
Tobin'sQ_i = {} & \beta_0 + \beta_1 N\_Informed_i + \beta_2 N\_Non\_Informed_i + \beta_3 VC\_High_i \\
& + \beta_4 VC\_Low_i + \beta_5 Geo\_UK_i + \beta_6 Geo\_Germany_i \\
& + \beta_7 Geo\_France_i + \beta_8 Geo\_NorthernEurope_i \\
& + \beta_9 Geo\_SouthernEurope_i + \beta_{10} Benelux_i \\
& + \beta_{11} Ind\_HighKnowledgeIntServices_i \\
& + \beta_{12} Ind\_HighTechManufacturing_i \\
& + \beta_{13} Ind\_LifescienceBiotech_i + \beta_{14} Ind\_Software_i \\
& + \beta_{15} Company\_age_i + \beta_{16} TotalAssets_i \\
& + \beta_{17} AcqMarketSentiment_i + \beta_{18} ProbAcquisition_i \\
& + \beta_{19} MediaCoverage_i + \beta_{20} MediaCoverageSq_i \\
& + \beta_{21} Debt\_Accounting_i \\
& + \beta_{22} Payment\_Deferred_i + \beta_{23} Payment\_Earnout_i \\
& + \beta_{24} Payment\_Liabilities_i + \beta_{25} Payment\_Other_i \\
& + \beta_{26} Cash\&Equivalent_i + \beta_{27} Domestic_i + \beta_{28} Toehold_i + \varepsilon_1
\end{aligned}
\tag{3.11}
$$

The R^2 for the model is 0.4252, a small (0.08% of additional variation explained) improvement with respect to Model 2; additionally, the overall model is statistically significant, as the result of the F-test is equal to 0 with four decimal places. Albeit small, the improvement with respect to Model 2 signals that separating highly and lowly reputable VCs can better explain the variation in the exit valuation. Similarly to Model 2, there are no problems of multicollinearity.

Focusing on the results of the model, all the control variables that resulted

statistically significant in the models of Chapter 3.6 are still significant (namely: *Geo_France*, *Geo_NorthernEurope*, *Ind_LifescienceBiotech*, *Company_Age*, *TotalAssets*, *MediaCoverage*, *Payment_Earn-out* and *Domestic*) and with unchanged effect (the signs are still the same) on the exit valuation, albeit with negligible changes in the values of the coefficients and p-values. The explanatory variables *N_Informed* and *N_Non_Informed* exhibit a behavior equal to the one in Model 2, but again with negligible differences in the overall effect. Considering the other pair of explanatory variables, the results show that both *VC_High* and *VC_Low* are statistically significant. However, *VC_High* has a higher effect (the coefficient is 0.364, compared to 0.225 for *VC_Low),* as well as more statistical significance (the p-value is 0.001, compared to 0.005 for *VC_Low).* Consequently, it is possible to confirm what posited by the literature: receiving venture capital prior to acquisition has a positive effect on the exit valuation, which is more accentuated if one of the VCs affiliated with the target is considered highly reputable.

Variable	***Coefficient β***	***Robust Std. Err.***	***P-Value***
N_Informed	*0.001919*	*0.001658*	*0.247*
N_Non_Informed	*-0.008398*	*0.004472*	*0.061**
VC_High	*0.364628*	*0.108781*	*0.001***
VC_Low	*0.225503*	*0.080207*	*0.005***
Geo_UK	*-0.276946*	*0.232667*	*0.234*
Geo_France	*-0.593577*	*0.234605*	*0.012***
Geo_Germany	*-0.332103*	*0.248163*	*0.181*
Geo_NorthernEurope	*-0.448328*	*0.237648*	*0.059***
Geo_SouthernEurope	*-0.417868*	*0.270380*	*0.122*
Geo_Benelux	*-0.133072*	*0.252658*	*0.598*
Ind_HighKnowledgeIntServices	*0.107998*	*0.109510*	*0.324*
Ind_HighTechManufacturing	*0.080779*	*0.168631*	*0.632*
Ind_LifescienceBiotech	*0.288225*	*0.128607*	*0.025***
Ind_Software	*0.103108*	*0.146910*	*0.483*

Company_ Age	*-0.195734*	*0.065562*	*0.003***
TotalAssets	*-0.327557*	*0.031487*	*0.000***
AcqMarketSentiment	*0.000429*	*0.000340*	*0.208*
ProbAcquisition	*-0.090665*	*0.087511*	*0.300*
MediaCoverage	*0.000384*	*0.000105*	*0.000***
MediaCoverageSq	*0.000000*	*0.000000*	*0.010***
DebtAccounting	*0.001938*	*0.021811*	*0.929*
Payment_ Deferred	*-0.265382*	*0.206239*	*0.198*
Payment_ Earn-out	*0.334980*	*0.153163*	*0.029***
Payment_ Liabilities	*0.118296*	*0.136133*	*0.385*
Payment_ Other	*-0.100339*	*0.090946*	*0.270*
Cash&Equivalent	*-0.004874*	*0.007116*	*0.493*
Domestic	*-0.453351*	*0.077999*	*0.000***
Toehold	*0.038815*	*0.134644*	*0.773*
Constant	*4.950727*	*0.441955*	*0.000***
R-Squared	*0.4252*	**F-Test**	*15.01*
Mean VIF	*2.15*	**P-Value**	*0.0000*

1. Winsorized at 5% level
2. Ln

* p-value < 10%
** p-value < 5%

Table 14: Regression results of model 2A for robustness check

3.7.2 Model 3A: the effect of reputable VCs and interactive effects

The second robustness check was carried out for Model 3, which studies the effect of the presence of VCs contingent to the number of informed bidders (H3) and non-informed bidders (H2). Similarly to Model 2A for the robustness check of Model 2, it was decided to assess the effects of separating VCs into highly and lowly reputable. The other variables included in Model 3 are included in this model as well, with the above mentioned the difference of removing *VC_Backed* in place of *VC_High* and *VC_Low*. Additionally, the interactive variables also took into account the separation of VCs into the two categories. Therefore, four new interactive variables (namely *VC_High#N_Informed*, *VC_Low#N_Informed*, *VC_High#N_Non_Informed*,

VC_Low#N_Non_Informed) were included in the model, while the interactive variables *VC_Backed#N_Informed* and *VC_Backed#N_Non_Informed* were removed. Consequently, the model, whose results are summarized in Table 15, is the following:

$$
\begin{aligned}
Tobin'sQ_i = {} & \beta_i + \beta_1 N\_Informed_i + \beta_2 N\_Non\_Informed_i + \beta_3 VC\_High_i \\
& + \beta_4 VC\_Low_i + \beta_5 VC\_High\#N\_Informed_i \\
& + \beta_6 VC\_Low\#N\_Informed_i + \beta_7 VC\_High\#N\_Non\_Informed_i \\
& + \beta_8 VC\_Low\#N\_Non\_Informed_i + \beta_9 Geo\_UK_i \\
& + \beta_{10} Geo\_Germany_i + \beta_{11} Geo\_France_i \\
& + \beta_{12} Geo\_NorthernEurope_i + \beta_{13} Geo\_SouthernEurope_i \\
& + \beta_{14} Benelux_i + \beta_{15} Ind\_HighKnowledgeIntServices_i \\
& + \beta_{16} Ind\_HighTechManufacturing_i \\
& + \beta_{17} Ind\_LifescienceBiotech_i + \beta_{18} Ind\_Software_i \\
& + \beta_{19} Company\_age_i + \beta_{20} TotalAssets_i \\
& + \beta_{21} AcqMarketSentiment_i + \beta_{22} ProbAcquisition_i \\
& + \beta_{23} MediaCoverage_i + \beta_{24} MediaCoverageSq_i \\
& + \beta_{25} Debt\_Accounting_i \\
& + \beta_{26} Payment\_Deferred_i + \beta_{27} Payment\_Earnout_i \\
& + \beta_{28} Payment\_Liabilities_i + \beta_{29} Payment\_Other_i \\
& + \beta_{30} Cash\&Equivalent_i + \beta_{31} Domestic_i + \beta_{32} Toehold_i + \varepsilon_1
\end{aligned}
\tag{3.12}
$$

The R^2 for the model is 0.4312, the highest amongst all the tested models, and able to explain and additional 0.44% of variation when compared to Model 3. Moreover, the overall model is statistically significant, as the result of the F-test is equal to 0 with four decimal places. Comparably to the other models, there are no problems of multicollinearity.

Focusing on the results of the model, all the control variables that resulted statistically significant in Model 3 of Chapter 3.6.4 are still statistically significant (namely: *Geo_France*, *Geo_NorthernEurope*, *Ind_LifescienceBiotech*, *Company_Age*, *TotalAssets*, *MediaCoverage*, *Payment_Earn-out* and *Domestic*), with similar effects and comparable significance. The explanatory variables *N_Informed* and

N_Non_Informed exhibit a behavior comparable to that of Model 3. Considering the other pair of explanatory variables, the results show that only *VC_High* is statistically significant (p-value=0.0899) and positively (0.258) correlated to the exit valuation. Indeed, the p-value (0.173) for the dummy *VC_Low* is too high to deem it statistically significant. Focusing on the interactive terms, it is possible to notice that, whereas the ones related to the interaction with *VC_High* are not statistically significant, those with *VC_Low* are: indeed, the interaction has a negative effect with informed bidders and positive effects with non-informed ones.

Variable	***Coefficient β***	***Robust Std. Err.***	***P-Value***
N_Informed	*0.003738*	*0.002403*	*0.120*
N_Non_Informed	*-0.015824*	*0.006341*	*0.013***
VC_High	*0.258868*	*0.151908*	*0.089**
VC_Low	*0.156050*	*0.114410*	*0.173*
VC_High#N_Informed	*0.002909*	*0.003725*	*0.435*
VC_High#N_Non_Informed	*0.001955*	*0.011075*	*0.860*
VC_Low#N_Informed	*-0.005113*	*0.002987*	*0.087**
VC_Low#N_Non_Informed	*0.020116*	*0.008174*	*0.014***
Geo_UK	*-0.298137*	*0.234841*	*0.204*
Geo_France	*-0.612219*	*0.236502*	*0.010***
Geo_Germany	*-0.349247*	*0.247884*	*0.159*
Geo_NorthernEurope	*-0.474305*	*0.239511*	*0.048***
Geo_SouthernEurope	*-0.436584*	*0.270974*	*0.107*
Geo_Benelux	*-0.143202*	*0.250658*	*0.568*
Ind_HighKnowledgeIntServices	*0.097142*	*0.109345*	*0.374*
Ind_HighTechManufacturing	*0.083240*	*0.168098*	*0.621*
Ind_LifescienceBiotech	*0.301185*	*0.128909*	*0.020***
Ind_Software	*0.087138*	*0.145912*	*0.550*
Company_Age	*-0.192094*	*0.065206*	*0.003***
TotalAssets	*-0.326272*	*0.031201*	*0.000***

AcqMarketSentiment	*0.000330*	*0.000342*	*0.335*
ProbAcquisition	*-0.095720*	*0.086055*	*0.266*
MediaCoverage	*0.000381*	*0.000104*	*0.000***
MediaCoverageSq	*0.000000*	*0.000000*	*0.010***
DebtAccounting	*0.001372*	*0.021621*	*0.949*
Payment_ Deferred	*-0.246834*	*0.211299*	*0.243*
Payment_ Earn-out	*0.359015*	*0.152751*	*0.019***
Payment_ Liabilities	*0.136758*	*0.137807*	*0.321*
Payment_ Other	*-0.104870*	*0.090210*	*0.245*
Cash&Equivalent	*-0.004919*	*0.007113*	*0.489*
Domestic	*-0.451692*	*0.078031*	*0.000***
Toehold	*0.029911*	*0.141785*	*0.833*
Constant	*5.038254*	*0.447507*	*0.000***
R-Squared	*0.3714*	**F-Test**	*13.46*
Mean VIF	*4.64*	**P-Value**	*0.0000*

1. Winsorized at 1% level
2. Ln

* p-value < 10%
** p-value < 5%

Table 15: Regression results of model 3A for robustness check

As for Model 3, the marginal effect of the explanatory variables, reported in Table 16, were studied.

Variable	***dy/dx***	***Std. Err.***	***P-Value***
N_ Informed[1]	*0.002425*	*0.001719*	*0.159*
N_ Non_ Informed[1]	*-0.009391*	*0.004558*	*0.040***
VC_ High	*0.361866*	*0.106863*	*0.001***
VC_ Low	*0.227546*	*0.079925*	*0.004***

1. Winsorized at 5% level

* p-value < 10%
** p-value < 5%

Table 16: Marginal effects of the independent variables for Model 3A

Similarly to Model 3, all independent variables, except from *N_ Informed*, are statistically significant. Specifically, non-informed bidders have a negative marginal effect, while both highly and lowly reputable VCs have a significant and positive marginal effect on the exit valuation, with the formed having a bigger impact.

Likewise, the marginal effect of the dummies *VC_High* and *VC_Low*, at the quartiles of the explanatory variables *N_Informed* and *N_Non_Informed*, were compute and are reported in Table 17. Considering the marginal effect of *VC_High*, it is noticeable that the result obtained for *N_Informed* are contrasting with what is expected. Indeed, the marginal effect should decrease as the number of informed bidder increases, as it correctly happens for *VC_Low*, whereas in this case the marginal effect increases and it is statistically significant. This results provide mixed evidence for H3. On the other hand, the results obtained for the marginal effects of both *VC_High* and *VC_Low* with *N_Non_Informed* are in line with what is expected, and find further proof for H2. Indeed, the result prove that the marginal effect of a signal becomes stronger as the number of non-informed bidder becomes larger, as expected.

	N_Informed			***N_Non_Informed***		
VC_High	***dy/dx***	***Std. Err.***	***p-value***	***dy/dx***	***Std. Err.***	***p-value***
0. VC_High	***(base outcome)***			***(base outcome)***		
1. VC_High						
1	*0.291466*	*0.138151*	*0.035***	*0.344814*	*0.148961*	*0.021***
2	*0.314739*	*0.121463*	*0.010***	*0.354590*	*0.117187*	*0.003***
3	*0.399105*	*0.118053*	*0.001***	*0.372187*	*0.118174*	*0.002***
4	*0.591110*	*0.314768*	*0.061**	*0.421066*	*0.344768*	*0.222*
VC_Low	***dy/dx***	***Std. Err.***	***p-value***	***dy/dx***	***Std. Err.***	***p-value***
0. VC_Low	***(base outcome)***			***(base outcome)***		
1. VC_Low						
1	*0.351265*	*0.099952*	*0.000***	*0.052113*	*0.119402*	*0.663*
2	*0.310365*	*0.087428*	*0.000***	*0.152693*	*0.092208*	*0.098**
3	*0.162103*	*0.093310*	*0.083**	*0.333737*	*0.081012*	*0.000***
4	*-0.175321*	*0.258938*	*0.498*	*0.836636*	*0.240766*	*0.001***

N_Informed: 1. at=4; 2 at=12; 3 at=41; 4 at=107
N_Non_Informed: 1. at=2; 2 at=7; 3 at=16; 4 at=41

* p-value $< 10\%$
** p-value $< 5\%$

Table 17: Marginal effect of dummies VC_High and VC_Low at different values of the number of bidders

Last, an analysis of the marginal effect of the number of both informed and non-informed bidders allows us to get additional interesting insights. The marginal effect of informed bidders, regardless of whether the target is VC-backed or not by a highly reputable VC, has no significant effect. Additionally, the difference between the two cases is not statistically significant (p-value equal to 0.435), as expected: as bidders are already informed, the presence of another signal is not important. Oddly enough, this difference becomes statistically significant and with a negative effect when the target is backed by a lowly reputable VC, contrasting with what is expected. Conversely, the difference between the marginal contribution of non-informed bidders in the case in which the target is backed by a lowly reputable VC against the case in which no VC is present as a stakeholder is statistically significant (p-value equal to 0.014) and with a positive (0.020) effect. This is expected, as the signal "transforms" a non-informed bidder into an informed bidder, which does not discount the information asymmetry anymore. Indeed, the marginal effect of the number of non-informed bidders is negative (-0.016) and significant (0.012) when no VC backs the target. Strangely, such effect does not exist in the case in which the target is backed by a prominent VC.

Variable	***N_Informed***			***N_Non_Informed***		
VC_High	***dy/dx***	***Std.Err.***	***P-Value***	***dy/dx***	***Std.Err.***	***P-Value***
0	*0.002150*	*0.001859*	*0.248*	*-0.009576*	*0.004945*	*0.053**
1	*0.005060*	*0.003276*	*0.123*	*-0.007621*	*0.009828*	*0.438*
1 vs 0	*0.002909*	*0.003725*	*0.435*	*0.001955*	*0.011075*	*0.860*
VC_Low	***dy/dx***	***Std.Err.***	***P-Value***	***dy/dx***	***Std.Err.***	***P-Value***
0	*0.004013*	*0.002229*	*0.072**	*-0.015921*	*0.005878*	*0.012***
1	*-0.001099*	*0.002153*	*0.610*	*-0.000611*	*0.006020*	*0.910*
1 vs 0	*-0.005112*	*0.002987*	*0.087**	*0.015309*	*0.008174*	*0.049***

0: VC not present
1: VC present

* p-value $< 10\%$
** p-value $< 5\%$

Table 18: Marginal effect of the number of bidders at different values of dummies VC_High and VC_Low

3.7.3 Model 2B: the effect of the proportion of informed bidders

As anticipated, a third model was developed in order to assess the effect of informed bidders on the acquisition value. For this scope, both *N_ Informed* and *N_ Non_ Informed* were removed in place of *Ratio_ Informed*, which is computed as the ratio of informed bidders over the total number bidders; all the other variables are instead kept the same as Model 2. The rationale is that, while the number of informed bidders per might have no significant effect on the exit valuation, the proportion of informed bidders participating in the tender might be more relevant. Therefore, the model is the following:

$$
\begin{aligned}
Tobin'sQ_i = \; & \beta_0 + \beta_1 Ratio\_Informed_i + \beta_2 VC\_backed_i + \beta_3 Geo\_UK_i \\
& + \beta_4 Geo\_Germany_i + \beta_5 Geo\_France_i \\
& + \beta_6 Geo\_NorthernEurope_i + \beta_7 Geo\_SouthernEurope_i \\
& + \beta_8 Benelux_i + \beta_9 Ind\_HighKnowledgeIntServices_i \\
& + \beta_{10} Ind\_HighTechManufacturing_{\ i} \\
& + \beta_{11} Ind\_LifescienceBiotech_i + \beta_{12} Ind\_Software_i \\
& + \beta_{13} Company\_age_i + \beta_{14} TotalAssets_i \\
& + \beta_{15} AcqMarketSentiment_i + \beta_{16} ProbAcquisition_i \\
& + \beta_{17} MediaCoverage_i + \beta_{18} MediaCoverageSq_i \\
& + \beta_{19} Debt\_Accounting_i \\
& + \beta_{20} Payment\_Deferred_i + \beta_{21} Payment\_Earnout_i \\
& + \beta_{22} Payment\_Liabilities_i + \beta_{23} Payment\_Other_i \\
& + \beta_{24} Cash\&Equivalent_i + \beta_{25} Domestic_i + \beta_{26} Toehold_i + \varepsilon_1
\end{aligned}
\tag{3.13}
$$

As the results reported in Table 19 show, the model is significant (F-test = 0.0000) and explains 42.54% of the variation of *Ln_ TobinQ*. The results of the VIF indicate no multicollinearity issues.

As in the previous case, all control variables which resulted significant are still significant (albeit with slightly different p-values), with negligible variation in their effect (β). The new explantory variable *Ratio_ Informed* has a positive (0.453) and significant (p-value=0.028) effect on the acquisition value, supporting the idea that the

proportion of informed bidders competing for an acquisition, and not just their overall number, is important and impacts the exit valuation. As for the previous models, the explanatory variable *VC_Backed* is still positively (0.248) correlated to the exit valuation and highly statistically significant. An additional test, however not reported, was carried out by splitting the variable *VC_Backed* into *VC_High* and *VC_Low*, as for the previous model. The results, both regarding the β coefficients and p-values, are comparable as far as the control variables and the explanatory variable *Ratio_Informed* are concerned. Additionally, both *VC_High* and *VC_Low* were found to have a positive and significant effect on the exit valuation, the former having a bigger impact (0.362 versus 0.217), confirming once again that the prominence of a VC is a strong signal of quality of a startup and positively influences the exit valuation.

Variable	***Coefficient β***	***Robust Std. Err.***	***P-Value***
Ratio_Informed	*0.453038*	*0.206261*	*0.028***
VC_Backed	*0.248588*	*0.075494*	*0.001***
Geo_UK	*-0.290407*	*0.231734*	*0.210*
Geo_France	*-0.590152*	*0.232724*	*0.011***
Geo_Germany	*-0.342814*	*0.248327*	*0.168*
Geo_NorthernEurope	*-0.467576*	*0.235159*	*0.047***
Geo_SouthernEurope	*-0.406352*	*0.266793*	*0.128*
Geo_Benelux	*-0.124891*	*0.247295*	*0.614*
Ind_HighKnowledgeIntServices	*0.060702*	*0.102129*	*0.552*
Ind_HighTechManufacturing	*0.107607*	*0.169568*	*0.526*
Ind_LifescienceBiotech	*0.242417*	*0.118513*	*0.041***
Ind_Software	*0.017509*	*0.112691*	*0.877*
Company_Age[1]	*-0.201273*	*0.065746*	*0.002***
TotalAssets[1]	*-0.327439*	*0.031350*	*0.000***
AcqMarketSentiment	*0.000392*	*0.000321*	*0.223*
ProbAcquisition	*-0.090338*	*0.087314*	*0.301*
MediaCoverage	*0.000411*	*0.000104*	*0.000***

MediaCoverageSq	*0.000000*	*0.000000*	*0.004***
***DebtAccounting*[1]**	*0.003707*	*0.021960*	*0.866*
Payment_ Deferred	*-0.246429*	*0.203578*	*0.226*
Payment_ Earn-out	*0.332360*	*0.153782*	*0.031***
Payment_ Liabilities	*0.108606*	*0.134652*	*0.420*
Payment_ Other	*-0.100327*	*0.090605*	*0.268*
***Cash&Equivalent*[1]**	*-0.005431*	*0.007062*	*0.442*
Domestic	*-0.459144*	*0.078153*	*0.000***
Toehold	*0.066397*	*0.137274*	*0.629*
Constant	*4.681444*	*0.429994*	*0.000***
R-Squared	*0.4254*	**F-Test**	*15.75*
Mean VIF	*2.08*	**P-Value**	*0.0000*

1. Ln

* p-value < 10%
** p-value < 5%

Table 19: Regression results of model 2B for robustness check

3.7.4 Model 2C: endogeneity of the presence of VCs

One last robustness check was run on Model 2, with the goal of testing whether the variable *VC_ Backed* is endogenous or not, as different papers suggest that venture capital financing suffers from an endogeneity problem (Kortum and Lerner, 2000; Colombo and Montanaro, 2020). To run the test, the instrumental variable *Dist_ Closest_ VC_ hub*, described in Chapter 3.3.4, was introduced. Clearly, all the other variables employed in Model 2 were used in this model as well.

The regression, whose results are summarized in Table 20, was run with the *ivreg* command in Stata, which instruments the variable *VC_ Backed* with the variable *Dist_ Closest_ VC_ hub*. As it is possible to notice, the variable *VC_ Backed*, as well as other control variables (namely: *Geo_ France*, *Geo_ NorthernEurope*, *Ind_ LifescienceBiotech*, *Company_ Age and MediaCoverage*), are not statistically significant anymore. On the other hand, the independent variable *N_ Non_ Informed* still maintains its significant and negative effect on the exit valuation.

Regardless, the correlation between *VC_ backed* and *Dist_ Closest_ VC_ hub* is

very low (-0.0857), suggesting that the instrumental variable should be substituted with a more fitting one. Indeed, by running two tests of endogeneity (Durbin and Wu-Hausman), both p-values resulted higher than the 0.05 threshold (being equal to 0.9877 and 0.9878 respectively), meaning that it is not possible to reject the null hypothesis that the dummy *VC_Backed* is exogenous and should therefore be treated as such. For these reasons, no conclusions can be drawn about the endogeneity of the presence of VCs.

Variable	***Coefficient β***	***Robust Std. Err.***	***P-Value***
N_Informed[1]	*0.001645*	*1.214843*	*0.473*
N_Non_Informed[1]	*-0.008149*	*0.002292*	*0.024**
VC_Backed	*0.260370*	*0.003619*	*0.830*
Geo_UK	*0.108628*	*0.135055*	*0.421*
Geo_France	*-0.187573*	*0.296282*	*0.527*
Geo_Germany	*0.009919*	*0.210402*	*0.962*
Geo_NorthernEurope	*-0.020144*	*0.159462*	*0.899*
Geo_SouthernEurope	*0.006746*	*0.237468*	*0.977*
Geo_Benelux	*0.210133*	*0.177655*	*0.237*
Ind_HighKnowledgeIntServices	*0.066740*	*0.079799*	*0.403*
Ind_HighTechManufacturing	*0.100064*	*0.187390*	*0.593*
Ind_LifescienceBiotech	*0.211540*	*0.164708*	*0.199*
Ind_Software	*0.051048*	*0.109060*	*0.640*
Company_Age[2]	*-0.124072*	*0.099565*	*0.213*
TotalAssets[2]	*-0.297744*	*0.054186*	*0.000**
AcqMarketSentiment	*0.000602*	*0.000293*	*0.040**
ProbAcquisition	*-0.077239*	*0.064541*	*0.231*
MediaCoverage	*0.000421*	*0.000375*	*0.262*
MediaCoverageSq	*0.000000*	*0.000000*	*0.428*
DebtAccounting[2]	*-0.003878*	*0.027165*	*0.886*
Payment_Deferred	*-0.057298*	*0.185916*	*0.758*

Payment_ Earn-out	*0.227283*	*0.119507*	*0.057***
Payment_ Liabilities	*0.090479*	*0.117764*	*0.442*
Payment_ Other	*-0.070039*	*0.065141*	*0.282*
Cash&Equivalent²	*-0.007154*	*0.005686*	*0.208*
Domestic	*-0.466439*	*0.109598*	*0.000**
Toehold	*0.071729*	*0.152309*	*0.638*
Constant	*4.160323*	*0.527511*	*0.000**
R-Squared	*0.3910*	**P-Value**	*0.0000*

1. Winsorized at 5% level
2. Ln

* p-value < 10%
** p-value < 5%

Table 20: Regression results of model 2C for endogeneity of VCs

3.8 Overall results

Having conclude the robustness check for the models, it is possible to draw some conclusions on the analyses. First of all, H0 can be neither confirmed nor rejected, as the p-value of the variable controlling for the number of bidders (*N_ Bidders*) is higher than the 0.1 threshold in Model 1 and its equivalent with different levels of winsorization, as explain in Chapter 3.7. Similarly, no statistically significant results are obtained for the effect of the number of informed bidders both for Model 2 and its robustness check, in which VCs are distinguished on the basis of their reputation. Therefore, it is not possible to confirm nor reject H1. However, upon further inspection, it was found that, whereas the absolute number of informed bidders is not significantly correlated to the exit valuation, its proportion with respect to the total number of bidders is, and it has a positive effect. Moving to H2, the results confirm the existence of a positive and significant interactive effect between the signal (being VC-backed) and the number of non-informed bidders. Specifically, the exit valuation in higher when the number of non-informed bidders is higher and the target is backed by a VC. Moreover, a further analysis shows that there is a significant and positive difference in the marginal effects of the number of non-informed bidder in the case in which a VC is present against the case in which it is not. Considering H3, in Model 3 the results are in line with what is expected: the marginal effect of a signal is lower as the number

of informed bidder is higher. In the results of the robust regression (Model 3A), in which VCs are split between highly and lowly reputable, the results remain valid for *VC_Low*. Finally, it is not possible to conclude that venture capital financing (i.e., the presence of VCs as shareholders in a startup) is endogenous, given the results obtained in Model 2C.

4. Discussion

This objective of this Chapter is to discuss and analyze the results from the models of Chapters 3.6 and 3.7, specifically addressing how the number of bidders and their level of information, as well as the signals related to the presence and reputation of VCs, affects the exit valuation of private European, British and Israeli start-ups that make up the sample developed for this dissertation, when the exit occurs through an acquisition that is modeled as an auction.

First, amongst the control variables included in the models, the one regarding the total assets (acting as a proxy for the firm's size) was always statistically significant and negatively correlated to the exit valuation. This confirms the idea that smaller companies are able to receive higher valuations due to their stronger growth opportunities (Meoli et al., 2013). Age also came out to be negatively and significantly correlated with *Ln_ TobinQ*, shedding light on the debate on whether it has a positive (e.g., Boeker and Wiltbank, 2005) or negative (e.g., Nelson, 2003) effect on the exit valuation. Considering instead the variables accounting for the industry, only *Ind_ LifescienceBiotech* resulted significant, with a positive effect on the exit value. Regarding the variables controlling for the geographical origin of the venture, both *Geo_ France* (accounting for France) and *Geo_ NorthernEurope* (accounting for Denmark, Sweden, Finland, and Norway) came out to be significantly and negatively correlated to the firm's valuation at exit. This confirms the idea that the area in which a company is founded and developed effects the exit value, as different countries have different economic environments and also offer different degrees of support for the development of start-ups (Gupta and Sapienza, 1992; Soreson and Stuart, 2001). Amongst the variable controlling for the method of payment, only *Payment_ Earn-out* was found to be significantly correlated to the exit value, producing a positive effect.

Media coverage was found to have a significant inverse u-shape relationship with the exit valuation. Finally, as expected, the dummy controlling for domestic acquisition resulted negatively and significantly correlated with the exit value, signaling that domestic acquisitions tend to be smaller than cross border ones.

Moving instead to the first hypothesis (H0), intuitively one can expect that more bidders competing for an auctioned item drive the price of the object up. Indeed, an increase in competition is expected to push a more aggressive bidding behavior to favor the chances of winning (Hong and Shum, 2002), moving the price of an item towards efficiency price (Amaral et al., 2012), as predicted by H0. In fact, when the number of competing bidders approaches infinite, the winning bid would allow the seller to make all the profits, thus maximizing his payoff (Holt, 1979). Moreover, when several bidders are involved in tender contests, the auction becomes more dynamic as it is characterized by faster bidding, which in turn drives the price up (Bulow and Klemperer, 2002). Still, whereas different theoretical studies support such argument (Vickrey, 1961; McAfee and McMillan, 1987; Bulow and Klemperer, 1996), too little empirical evidence specifically focused on the M&A context (Walkling and Edmister, 1985; Bradley et al., 1988) can be found. On the other hand, several empirical papers outside the boundaries of M&A find a positive relationship between the number of bidders and the seller's payoff in an auction (e.g., Bapna et al., 2007; Hungria-Gunnelin, 2013). However, this dissertation does not provide evidence of this phenomenon, since the variable related to the overall number of bidders (*N_Bidders*) is never statistically significant. This should not come as a surprise, since a consensus of the effect of the number of bidders of the final auctioned price has not yet been reached amongst scholars. Clearly, the winner's curse effect is more severe when the competition is high: in order to win, a bidder must outbid every other interested buyer, suffering a higher risk of overpaying (Milgrom, 1989). This is particularly true in the case of common value auctions, in which it is necessary for the winner to be "more optimistic" on the value of the auctioned object than all the other bidders (Haile et al., 2003). Such risk pushes bidders (especially those with less information) to underprice the target as a protection

mechanism in a way that the effects of competition and winner's curse offset each other (Pinkse and Tan, 2005). Indeed, the bidders might ask themselves "If the price is fair, why hasn't someone else bought it?" (Bulow and Klemperer, 2002). Moreover, some studies also support the idea that, to increase the seller's payoff, lower number of bidders are better, as it is easier for the seller to control the overall sale process and maximize the sales price (Choper et al., 1989). Given the above, the number of bidders competing in an auction can have both a positive (competitive) and a negative (winner's curse) overall effect (Gilley and Karels, 1981; Bulow and Klemperer, 2002). Consequently, a better analysis on the relationship between the number of bidders and the sale price is needed. Indeed, the fact that H0 can neither be confirmed nor rejected hints at the fact that the relationship between the number of bidders and the sale price of an auctioned item (in this case, a company) might be more complex than what is suggested by traditional economic theories.

Moving to the hypothesis H1, which predicts that the exit valuation is positively correlated with the number of informed bidders, the results show that it is not possible to confirm nor reject it. It is commonly agreed between theorists studying asset pricing that information asymmetries reduce asset prices (e.g., Easley and O'Hara, 2004) since prospect buyers minimize the risk of overpaying by underbidding, and therefore reduce the profit for the seller (Povel and Singh, 2006). M&As are usually characterized by high information asymmetries (Ragozzino and Reuer, 2011), since a bidder might not be able to retrieve the necessary information on the target (i.e., technology, growth prospects, human capital, brand and key customers and partners) to correctly evaluate it. In this case, bidders are confronted with the potential issue of the winner's curse as they face adverse selection, being unable to distinguish "lemons from peaches" (Akerlof, 1970). To account for that, bidders discount their offers and reduce the target's profits (Wu et al., 2014). On the other hand, if bidders were informed, then they should be willing to offer higher prices, hence driving the overall valuation up (Wu et al., 2014). However, whereas theoretical studies seem to predict a positive effect of the level on information on the exit valuation, practical evidence is limited and contrasting. Cheng

et al. (2008) employ a sample of 1,612 public companies acquired between 1986 and 2006 and find that their proxies of information asymmetry as perceived by market investors (namely financial analysts' coverage, analyst forecast error, forecasted dispersion and bid-ask spread) are positively and significantly associated to the bid premium paid. The authors explain the result by stating that an opaque target (a target with high information asymmetry) is discounted by the market, so an informed bidder that understands the true value of the target offers a price premium higher than other non-informed bidders (in order to win the takeover), and is still profitable. In that sense, then, a more informed bidder will increase the valuation of a target, even though the final price would still be below its true value. Zhu and Jog (2009) use a sample of 2,029 domestic and 1,127 cross-border deals for publicly listed target firms in emerging countries occurred between 1990 and 2007 and show that the information asymmetry (measured as idiosyncratic risk) has a significant and positive relationship with the premium paid. Still, the measures of asymmetries employed in the two above-mentioned papers only regard the target company in relationship to the market and are not referred specifically to the target-bidder relationship. Indeed, scholars have suggested other measures of information asymmetry, namely: geographical distance (Coval and Moskowitz, 2001; Kang, 2008; Ragozzino, 2009; Ragozzino and Reuer, 2011; Chakrabarti and Mitchell, 2013; Crook et al., 2017), cultural distance (Datta and Puia, 1995; Li et al., 2014; Lim et al., 2016) and industry distance (Ravenscraft and Scherer, 1987; Gorbenko and Malenko, 2014). Indeed, geographical closeness is preferred by acquirors, as they can collect information more easily thanks to their local network (Ragozzino, 2009), and thus they can better evaluate the target (Grote and Umber, 2006). Moreover, the overall data collection and due diligence process is cheaper, so close acquirors can outbid competitors while still being profitable (Chakrabarti and Mitchell, 2013). Similarly, cultural differences reduce the quantity, quality and credibility of the information available (Dastidar and Zaheer, 2010), while also making it difficult for a prospect acquirer to understand the operations and business of the target (Beugelsdijk and Frijns, 2010). This diminishes the trust between the two

counterparties (Li et al., 2014), and raises agency (Buchner et al., 2018) and transaction (Li et al., 2014) costs. Moreover, industry affinity also plays a role, as having knowledge of the industry in which the target operates allows an acquiror to correctly evaluate the target's resources, suppliers, buyers and management competences (Montgomery and Hariharan, 1991). Additionally, previous M&A experience can also be beneficial for a prospect bidder, as experienced buyers are better equipped to acquire and assess information on the target (Heil and Robertson, 1991; Bingham et al., 2007). Anyhow, there is a gap in the literature (and specifically, in empirical studies) on the use of these proxies of information asymmetry, so employing them adds value to research.

All in all, the result of this dissertation provide new and practical evidence on the effect of informed bidders on the exit valuation. Specifically, it is not possible to confirm nor reject H1. Despite finding no evidence on the positive effect of positive bidders on the exit value, interestingly enough, the results in Models 2 and 3 (with their respective robustness checks) show that non-informed bidders are statistically significant and negatively correlated to the exit value. These results can be explained by considering the two main forces that affect the bidding behavior as previously mentioned, namely the competitive effect and the winner's curse effect (Hong and Shum, 2002). The results provide additional evidence supporting the idea that the effect of the overall number of bidders on the exit valuation can be more complex than a simple linear relationship. Specifically, non-informed bidders' competitive effect should be rather weak, as by fearing the winner's curse, they discount information asymmetry in the offer price, placing lower bids (Wu et al., 2014). However, the winner's curse effect becomes more severe as the overall number of bidders grows (Milgrom, 1989), since the more the bidders, the worst the "news" for the winner, given that to win he must have been more over-optimistic that all of the competition. This means that, whereas the winner's curse is driven by the overall number of bidders, the competitive effect is probably driven only by informed ones. Therefore, an increase in non-informed bidders has negative effects on the valuation, as each bidder preemptively

reduces the maximum price he is willing to pay so minimize the winner's curse. Regardless, despite not finding evidence for H1, another interesting result was obtained. Indeed, upon further investigation on the role of informed bidders, it was found that their ratio over the total number of bidders involved in an auction is positively and statistically correlated with the exit value.

Considering instead H2, interesting conclusions can be drawn. In fact, the hypothesis predicts that the effect of a signal (specifically, the presence of a venture capitalist as equity investor in the target) is stronger when the number of non-informed bidders is larger, and finds support in the results of the models. First, the interactive variable *VC_Backed#N_Non_Informed* is statistically significant and positively correlated to the exit valuation. Most importantly, the analysis of the marginal effects show that, as the number of non-informed bidders increase, the marginal effect of the presence of a VC increases positively and significantly. Indeed, venture capitalists are highly selective in their investments (Megginson and Weiss, 1991), frequently rely on their network to scout new ventures and undergo several rounds of due diligence with the startups the want to commit their money in (Carter and Manaster, 1990). Moreover, given their industry expertise, they screen out ventures that are speculative or lack attractive future financial prospects (Gulati and Higgins, 2003) in order to protect their reputational capital. For these reasons, VCs have a strong certification effect and, as a consequence, their effect on reducing information asymmetries is stronger when more non-informed bidders take part in the auction. For example, despite not finding statistical significance on his claim, Reuer et al. (2012) suggest that the affiliation with a venture capitalist is particularly beneficial in cross-industry and cross-country acquisitions, in which information asymmetries are even higher than domestic counterparts. Regardless, given the results obtained, this dissertation importantly contributes to the literature, as it provides empirical evidence on the fact that signals (i.e. being backed by a VC) are beneficial to reduce information asymmetries and have stronger effects when the competition is higher, as measured by an increase in the number of non-informed bidders.

Similarly, evidence is also found to support H3, which predicts that the effect of a signal (specifically, the presence of a VCs as a shareholder in the target) should be weaker when the number of informed bidders is larger. Indeed, the results of Model 3 show that when the number of informed bidders increases, the marginal effect of being backed by a venture capitalist decreases (as predicted by H3) until it reaches a point (for the 0-percentile quartile) in which such effect is not statistically significant anymore. Indeed, many informed bidders are competing the signal has less "value", as it does not affect the dynamics of the auction since bidders are already well informed (the asymmetry is already low), and the main force at play is that of the competitive effect. A similar result is obtain for the robustness check of Model 3, specifically when considering the effect of lowly reputable VCs. Quite surprisingly, instead, in this last model the marginal effect of highly reputable VCs is found to increase as the number of informed bidders increase. An additional test suggested that the presence of a VCs as a shareholder might have a substitutive effect on the number of informed bidders.

To conclude, considering the effect of signals on the exit valuation, the results prove that the presence of venture capitalists as equity investors at the moment of exit favors higher valuations, confirming the results already reported in the literature (e.g., Puri and Zarutskie, 2012; Croce et al. 2013; Drover et al., 2017). Indeed, the models show that the dummy *VC_Backed* is strongly significant and positively correlated to the exit value in all the models tested. Moreover, even when distinguishing between highly and lowly reputable VCs (as in the robustness checks of Model 2 and 3), both resulted statistically significant and positively correlated with the Tobin's Q. However, as expected, highly reputable venture capitalist have a stronger certification effect and thus can better signal the quality of a venture (Carter et al., 1998; Colombo et al., 2019): indeed, their effect comes out to be around 1.5 times that of less prominent VCs. Still, no conclusions on the endogeneity of the variable *VC_Backed* can be drawn. In fact, despite previous scholars providing proof on the endogeneity of the presence of VCs (Kortum and Lerner, 2000; Colombo and Montanaro, 2020), the instrumental variable adopted in Model 2C did not yield the expected results in the endogeneity

tests and, furthermore, it resulted uncorrelated with the dummy *VC_Backed*.

5. Conclusions, limitations and future developments

The goal of this dissertation is that of examining if, and how, the number of bidders, taken both as an aggregate and divided between informed and non-informed, as well as the signals related to the presence and relevance of venture capitalists as shareholders in the company, affects the exit valuation at acquisition of a sample of private European, British and Israeli startups, using auction theory as a framework for the analysis.

This dissertation provides a relevant contribution to the extant literature on M&As, and in particular regarding both auction and signaling theory, by filling important gaps in both. At the same time, this work integrates the two theories, which have been usually adopted separately by scholars. Thus, this dissertation lays the foundation for further studies to be developed on the topic. Indeed, the results indicate that acquisitions are rather complex, and cannot be explained by traditional economic theories. Furthermore, they provide evidence on the importance, as valuable signals, of the presence of VCs as shareholders in the target, and offer interesting insights on their effect contingent to the characteristics (i.e., number and level of information) of the bidders.

Even though no evidence was found regarding the first two hypotheses, the results are still a valuable contribution to the literature, which is almost non-existent on the topic. Indeed, while several theoretical papers have been published regarding the importance of lowering information asymmetries to maximize the exit valuation, no empirical studies were found on the matter. The results of the models show that acquisitions appear to be rather complex, and that the relationship between the

number of bidders and the exit valuation is likely different than linear, contrasting with what posited by traditional economic theories. In fact, competitive effects may be partially offset by the winner's curse effect, which might become more severe with an increase in the number of bidders. Moreover, the results show that bidders with low information asymmetry do not positively and significantly contribute to raising the final sale price, whereas non-informed bidders have a negative impact on the exit valuation.

Two important additional contributions regard the findings on the contingent effect of signals. Indeed, no empirical studies are available on the topic, so this dissertation alleviates some of the gaps in the literature. The contingent effect studied in this dissertation regards the interaction between the presence of VCs and the number of informed and non-informed bidders. Specifically, the results show that the signal is stronger when the number of non-informed bidders is larger (positively affecting the valuation with increasing marginal effects), while it is weaker when the number of informed bidders is larger (positively affecting the valuation with decreasing marginal effects). This is expected, as signals play a relevant role in alleviating information asymmetries. Additionally, a signal such as the presence of VCs as shareholders has even more relevance when deals regard private companies (as in the case of our sample), as information asymmetries are very high, since private firms do not have to disclose the same amount of information to the market as public ones.

Obviously, despite the results obtained through the models and the sample employed, this work clearly has limitations which could be better implemented, particularly regarding the sample, the way in which a bidder is defined and the number of signals used for the interaction.

First, despite the sample consisting of 1325 observations and thus being rather large and in line with previous studies, it could be extended in order to provide more accurate results. As explained, many companies had to be excluded during the sample development process due to insufficient availability of data. This problem could be solved by widening both the temporal and geographical dimensions. Indeed, the sample

comprises of acquisitions occurred between 1997 and 2017, thus excluding the last four years, which however experienced a notable growth in M&As. Therefore, a potential improvement would be that of also including the transactions occurred in the past four years to the unit of analysis, to obtain even more robust results. Still, it also needs to be kept in mind that the sample covers a large time window, during which the economic environment (and consequently the M&A activity) changed a lot. For instance, the sample covers both the dot-com bubble (2000-2002) and the 2007-2008 financial crisis, in which potential acquirers clearly revised their M&A intentions, and during which targets (specifically belonging to certain industries) were most likely discounted by the market and prospect buyers. Thus, it could be interesting to also investigate the effects of such crises on M&A activity and targets' exit valuation, and compare them to expansionary, more flourishing periods.

Considering instead the second dimension which could be leveraged on to increase the observations in the sample, this dissertation deliberately focuses of companies based only in Europe, the U.K. and Israel, as these countries are usually overlooked by academics, who typically devote their attention to ventures headquartered in the U.S.A. While this deliberate effort might be considered as a positive contribution to the literature, enlarging the geographical scope to include ventures from other countries, and the U.S.A. specifically, would allow to obtain more robust and consistent results, and support to draw conclusions on a broader geographical basis.

Moving instead to the definition of a potential acquirer, the proxy employed to consider a company as such was that of checking whether it performed an acquisition of a venture in the same industry of the target and in the same year in which the target being evaluated was bought, as explained in Chapter 3.1. As such, other alternative definitions could be explored. Additionally, when discriminating between informed and non-informed bidders, different measures were employed, considering the cultural and geographical distance as well as the industry relatedness and prior acquisition experience. In all cases, thresholds were employed (specifically, the median value): while

widely adopted as an approach, this might result over-simplistic. Consequently, a continuous measure of information asymmetry, based on the same proxies employed in this dissertation, could be developed, so to obtain more robust, precise and understandable results.

Moreover, despite the fact that this dissertation is a first contribution to the study of the contingent effect of signals, its focus is limited only to the presence (and reputation) of venture capitalists as equity investors in the target company. Therefore, given the interesting results obtained for both H2 and H3, the effect of different signals could be also explored, for example considering different equity investors (e.g., business angels), alliance partners, or prominent investment banks who issued debt to the startup. Additionally, given the results obtained in Model 2C regarding the endogeneity of the dummy *VC_Backed*, an alternative instrumental variable in place of *Dist_Closest_VC_hub* should be adopted.

To conclude, the results of this dissertation do not stop at mere research value, but rather generate relevant implications for a variety of actors. First, given the importance of exit for the economy as a whole, a better understanding of the factors contributing to sale price formation can result in more efficient and effective sales processes, which ultimately increase the gains for the sellers. In that regard, this dissertation provides useful insights to entrepreneurs on which bidders to involve when selling their venture. Indeed, the results show that informed bidders (bidders who are culturally and geographically close, or industry related or with prior acquisition experience in the same industry) at worst have no effect on the exit value. On the other hand, though, non-informed bidders will decrease the entrepreneur's payoff, as results show that they are negatively correlated to the sale price: for this reason, they should be excluded from the auction. This means that, opposite to what traditional economic theories suggest, the entrepreneur is better off selecting the "right bidders", rather than focusing on involving the highest possible number. Moreover, this dissertation also provides evidence on the importance of venture capitalists as signals of the quality of a venture, their role in alleviating information asymmetries and their

positive impact on the exit value. Thus, this work shows that founders, despite diluting their ownership, would benefit from raising venture capital, and should devote their efforts towards this type of financing, given the financial (e.g., "smart capital", higher exit value) as well as strategic (e.g.., strategic support, badge of quality, etc.) advantages related to VC-affiliation, as VCs provide not just money, but also support, during the development and growth of startups. Moreover, such contribution, as well as their certification effect, allow to generate better returns for them (and consequently their limited partners), the founders and, more generally, the entire economic environment. For these reasons, policy makers should focus their efforts on fostering the development of this type of financial player.

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