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Signals' Effectiveness in an Auction Setting: the Impact of Bidders' Information on Entrepreneurial Ventures' Valuation at Acquisition

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Executive summary

This thesis analyses the effect of the number of bidders, of their information level and of signals related to the presence of VCs and to the company's human capital on the exit valuation of European and Israeli entrepreneurial ventures when the acquisition is modeled as an auction.

Entrepreneurial exits, defined as the process through which entrepreneurs leave the company they helped to create, have increasingly become a central part of the economic landscape. Indeed, entrepreneurial exits represent a unique opportunity for the overall economic development, allowing traditional companies to internalize innovation, structured equity investors to continually pursue and support new opportunities and entrepreneurs to invest their wealth and create new companies. Consistently, many scholars have decided to focus their efforts on the analysis of different exit strategies; among the others, IPOs and M&As have received particular attention, being considered the most successful exit strategies, with the latter that, ultimately, has become a predominant option both in actual markets and in literature. In particular, the main empirical evidence that has been produced analyses the signaling effect of the different characteristics of the entrepreneurial venture, like the presence of external equity investors and its human capital, on the exit valuation.

In this context, a growing strand of literature suggests to model acquisitions as auctions; however, while theoretical studies on this topic provide relevant insights about the use of auction theory to interpret acquisition dynamics, practical evidence about these results is not well developed. Therefore, this thesis aims at testing the effect of the number of bidders, of their information level and of signals related to the presence of VCs and to the company's human capital on the exit valuation of entrepreneurial ventures when the acquisition is modeled as an auction. Moreover, this thesis aims at providing evidence about these topics for private companies based in Europe and Israel, which are usually understudied, as the majority of the studies about acquisitions consider as unit of analysis public companies based in US.

In order to test the hypotheses developed for this thesis, a tailored database has been created, including both data about the company's characteristics and about its human capital. In particular, the sample considered for this dissertation is composed of 312 European and Israeli entrepreneurial ventures that have been founded between 1984 and 2013 and have performed an exit through acquisition between 2001 and 2017. Data about companies' characteristics has mainly been taken from RISIS-VICO 4.0, integrating with Zephyr and Orbis to manage missing information; on the other hand, data about the founders' previous experiences have been taken directly from their LinkedIn profiles. The sample has been used to develop a series of multivariate linear regression models (OLS), which have then been tested to assess the robustness of the results.

The findings of this thesis provide interesting insights about the importance of the number of bidders to obtain a high valuation and a renewed perspective about the effectiveness of the presence of VCs as a signal. Indeed, evidence shows that the presence of informed bidders is statistically significant and positively related to the exit valuation, while, on the other hand, when information asymmetry is higher, the presence of non-informed bidders has a negative effect on the exit valuation. Moreover, when the interaction of these variables with the presence of VCs is tested, results show that the effect of VCs is stronger when the number of non-informed bidders is larger. On the contrary, VCs seem to completely substitute the effect of informed bidders, whose effect becomes non-significantly different from 0. Aside from the research value, these results can also entail relevant implications for the selling side during acquisitions, allowing sellers to have a more complete understanding of the dynamics that concur to the price formation.

Executive summary – Italian version

Questo elaborato di ricerca ha lo scopo di analizzare come il numero di acquirenti potenziali, le informazioni in loro possesso e i segnali legati alla presenza di VC nell'assetto proprietario e alla qualità del capitale umano influenzino la valutazione di start-up europee e israeliane quando l'acquisizione viene modellata come un'asta.

Le exit, definite come il processo tramite cui gli imprenditori lasciano l'azienda che hanno aiutato a creare, sono progressivamente diventate una parte centrale del panorama economico. Di fatto, le exit rappresentano un'opportunità unica per il complessivo sviluppo economico, in quanto permettono alle aziende tradizionali di interiorizzare le innovazioni, ai fondi di investimento di alimentare un ciclo continuo di investimenti in nuove opportunità e agli imprenditori di finanziare la nascita di nuove aziende. Conseguentemente, sono stati prodotti diversi studi volti ad analizzare le possibili strategie di exit; tra le altre, IPO e M&A sono le strategie di exit che hanno ricevuto maggiori attenzioni, poiché sono considerate le più remunerative, e, in particolare, le acquisizioni stanno diventando sempre più l'opzione più considerata sia nei mercati reali che in letteratura. Principalmente, le analisi empiriche sul tema delle acquisizioni si basano sull'applicazione della teoria dei segnali alle caratteristiche delle aziende acquisite, come la presenza di investitori strutturati e il capitale umano, per determinarne l'effetto sulla valutazione ottenuta.

A questo proposito, un crescente filone di studi propone di modellare le acquisizioni come aste; tuttavia, mentre gli studi puramente teorici suggeriscono risultati interessanti derivanti da questo approccio, l'evidenza rimane limitata. Di conseguenza, questa tesi ha l'obiettivo di studiare a livello pratico come l'effetto del numero di acquirenti, del loro livello di informazione e dei segnali legati alla presenza di VC nell'assetto proprietario e alla qualità del capitale umano influenzino la valutazione di start-up europee e israeliane quando l'acquisizione viene modellata come un'asta. Inoltre, questa tesi ha l'obiettivo di fornire un'analisi empirica su aziende private con sede in Europa e Israele, in quanto la maggior parte della letteratura sulle acquisizioni considera come unità di analisi aziende quotate e localizzate in US.

Ai fini dell'analisi, è stato costruito uno specifico database contenente dati sia sulle caratteristiche delle start-up che su quelle del loro capitale umano. In particolare, il campione considerato per questa tesi è composto da 312 start-up europee e israeliane che sono state fondate tra il 1984 e il 2013 e che hanno effettuato una exit tramite acquisizione tra il 2001 e il 2017. I dati sulle caratteristiche delle start-up sono stati principalmente recuperati da RISIS-VICO 4.0 e integrati con Zephyr e Orbis in caso di informazioni mancanti; per quanto riguarda il capitale umano, invece, i dati sulle esperienze precedenti dei fondatori sono stati presi direttamente dal loro profilo LinkedIn. Il campione è quindi stato usato per costruire una serie di modelli di regressione lineare (OLS), i quali sono stati poi testati per garantire la robustezza dei risultati ottenuti.

I risultati di questo studio propongono degli spunti rilevanti sull'importanza del numero di acquirenti potenziali per ottenere una valutazione all'exit più alta e una nuova prospettiva sull'efficacia della presenza dei VC come segnale. Infatti, l'evidenza dimostra che la presenza di acquirenti bene informati è statisticamente significativa e positivamente correlata con la valutazione all'exit, mentre, d'altro canto, la presenza di acquirenti non informati sembra avere un effetto negativo. Inoltre, testando l'interazione tra il numero degli acquirenti e la presenza di VC, emerge che l'effetto della presenza di VC è più forte quando il numero di acquirenti non informati è più grande. Al contrario, i VC sembrano sostituire completamente l'effetto positivo derivante dalla presenza degli acquirenti bene informati, il quale diventa non significativamente diverso da 0. Il valore di questo elaborato di ricerca risiede non solo nell'importanza teorica dei risultati, ma anche negli spunti per la parte cedente durante le acquisizioni, fornendo ai venditori una comprensione più completa sulle dinamiche che agiscono sul prezzo e, di conseguenza, sulle leve su cui possono intervenire.

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Introduction

The aim of this thesis is to analyze the effect of the number of bidders, of their information level and of signals related to the presence of VCs and to the company's human capital on the exit valuation of European and Israeli entrepreneurial ventures when the acquisition is modeled as an auction.

In the last decades, entrepreneurial ventures have become increasingly important for the whole economic environment and, consistently, entrepreneurship literature has seen a strong development. Many of the first entrepreneurial studies have focused on the early phases of the start-ups' lifecycle, like the identification of opportunities (Ardichvili et al., 2003), the start-up phase (Korunka et al., 2003) and the financing (Choi and Shepherd, 2004), while, in more recent times, scholars have progressively analysed the exit phase (DeTienne, 2010). Indeed, the exit phase is a crucial part of the start-ups' lifecycle, which allows to have a comprehensive landscape on the overall entrepreneurial journey and to fully understand it (DeTienne, 2010). In general, the exit phase can have remarkable effect on the overall economic ecosystem in which entrepreneurial ventures are included (DeTienne, 2010), as it can allow the entrepreneurs and the other equity investors to harvest their investment (Certo et al., 2001; DeTienne, 2010), it can affect the power balances in the industry of the company (Othcere and Ip, 2006) and it can foster the whole economic development (Mason and Harrison, 2006; DeTienne, 2010).

Research about entrepreneurial exit has mainly been focused on analysing, on the one hand, the determinants of the choice of specific exit strategies and, on the other hand, which are the main factors influencing the exit valuations. For what concerns the first literature strand, scholars have first of all tried to understand what pushes entrepreneurs to prefer a specific exit path, discovering that the reward that they seek might not stop at the financial level; indeed, even though creating a great personal wealth is a major determinant of the choice of pursuing an entrepreneurial career (Bayar and Chemmanur, 2011), an emotional bond between the entrepreneur and the company is likely to emerge, which can influence the final exit choice (DeTienne et al., 2015). Another important determinant of the exit choice

came out being the specific career decisions of the entrepreneurial team, which has led to the use of human capital theory (Becker, 1964) to study the behaviour of company's human capital. Finally, the other important factor for the selection of the exit path seems to be the presence of external equity investors, like Business Angels and Venture Capitalists, who represent a crucial player for the start-ups' development, allowing young companies to overcome the initial financial gap and empowering the growth (Gompers and Lerner, 1999); in any case, the continuous existence of this type of players is sustainable only as long as they have the possibility to perform remunerative exits (DeTienne et al., 2015). For what concerns the specific exit strategies, scholars have mainly focused their analysis on the comparison between IPOs and M&As, as they are considered the most remunerative and successful types of exit (Bayar and Chemmanur, 2011). In particular, in the last period, M&As have become an increasingly important option for the exit, with the M&A market that has seen a sharp growth; on the other hand, the number of IPOs has strongly decreased (Gao et al., 2013), even if they still represent the most remunerative option (Ball et al., 2011). Consistently, scholars have increasingly focused their attention on M&As, analyzing the main determinants of the exit valuation. Specifically, given the information asymmetry that characterizes the counterparties involved in the acquisition (Wu et al., 2013), signaling theory has been widely used.

An interesting approach for the study of M&As that has emerged proposes to model acquisitions through auctions, since there are many similarities between these two types of transactions (Fisherman, 1988). Indeed, both cases are characterized by a single seller, who aims at obtaining the highest price possible, and a series of potential acquirors (i.e., the bidders), who aim at outbidding the other players while being able to pay the lowest price possible (Bulow and Klemperer, 1996). In this regard, the majority of the studies performed are based on the development of tailored mathematical models which try to predict the effect of the number of bidders (Bulow and Klemperer, 1996) and the presence of toe holders among the bidders (Singh, 1998; Bulow et al., 1999; Loyola, 2012) on the outcome of the auction and on its efficiency. On the other hand, empirical tests on what is proposed by these models and, more in general, on what traditional auction theory would predict, are somehow scarce in number. In fact, the main empirical studies provide evidence about other aspects, like the use of jump bids (Betton and Eckpo, 2000; Espen Ekbo, 2009) and the different approach

that strategic and financial acquirors might follow (Gorbenko and Malenko, 2014) due to the different interests they have.

All in all, the theoretical gap in existing literature is that, while the application of auction theory to the specific case of corporate acquisitions suggests the existence of a series of determinants of the exit price related to the resulting competition, empirical evidence about these effects is scarce. In particular, it has not been possible to retrieve any studies which directly related the number of bidders to the sale price. Therefore, a first contribution of this thesis is to test whether the overall number of bidders can actually increase the competition of the auction, and, consequently, increase the sale profits for the seller. Moreover, given the magnitude of information asymmetry in acquisitions, this thesis aims at testing whether bidders with different information levels can have a different effect on the sale price, as suggested by some theoretical studies (Dasgupta and Tsui, 2003; Povel and Singh 2006). Finally, given that signaling theory has been widely used in acquisition research (DeTienne et al., 2015), this thesis aims at testing the effect of signals related to the presence of VCs and to the company's human capital on the exit valuation when the acquisition is modeled as an auction, studying whether signals' effectiveness can depend on the number of bidders.

Considering the importance of the start-up ecosystem for the whole economic environment, the results of this thesis can be interesting not only for research reasons, but also because they can provide relevant insights to the counterparties involved in acquisitions. As a consequence, this thesis could be both a good starting point for further studies about the use of auction theory to model acquisitions and could provide interesting inputs to entrepreneurs and equity investors who aim at having a more complete understanding of the dynamics influencing the exit valuation.

Operatively, the unit of analysis of this thesis are European and Israeli entrepreneurial ventures that have been founded between 1984 and 2013 and have performed an exit through acquisition between 2001 and 2017. The data used to perform this study has been retrieved from a series of different sources. The general information about the company (e.g., legal address, industry, financials) have been retrieved from RISIS-VICO 4.0 and integrated through Zephyr and Orbis; additionally, it has been used a Google API to retrieve the geographic location of the majority of the companies in the sample. On the other hand, specific information about the careers of the founding team of the companies considered has been

retrieved from their LinkedIn profile. The overall developed sample has been used to test the hypotheses of this thesis through a series of multivariate linear regression models (OLS). The models have been built with a progressive logic, increasingly adding complexity in order to have a clearer understanding of the effect of each variable. For all models developed, the tests about the typical assumptions of OLS (i.e., absence of multicollinearity, homoskedasticity, normality of residuals) have been performed, together with a series of robustness checks on all the models that were not completely respecting all the assumptions, with the aim of providing robust and representative results.

The results of this dissertation show that, first of all, the relationship between the number of bidders and the exit valuation is rather complex. Indeed, evidence suggests that the informed bidders have a positive effect on the exit valuation, hinting that the seller should try to maximize the number of informed bidders joining the auction in order to maximize the exit valuation. On the other hand, some of the models show a significant and negative relationship between the number of non-informed bidders and the exit valuation when the information asymmetry is higher, suggesting that the seller could benefit from excluding them from the auction. Consistently, the evidence provided by this thesis does not support the solution suggested by the traditional economic theories, according to which, in an auction, the higher the number of bidders the higher the valuation. This overall setting becomes more interesting when the interaction of the number of bidders with the presence of VCs in the ownership structure of the target is tested; in fact, informed bidders seem to be substituted by the presence of VCs, as their overall effect becomes not significantly different from 0. On the other hand, the effect of VCs seems to be stronger when the number of non-informed bidders is larger, confirming once again the effectiveness of VCs as a signal in reducing the information asymmetry.

The reminder of this thesis is divided into 8 chapters. Chapter 1 presents the main literature available on the topic, starting from the general concept of exit and progressively entering in the specific studies about M&As. After showing the identified literature, Chapter 2 lists the four hypotheses developed for this dissertation, together with their theoretical background. Chapter 3 describes in detail the methodology that has been used to collect the necessary data and the respective sources; additionally, this chapter provides a detailed analysis of the main characteristics of the companies included in the sample. Chapter 4 describes

all the variables related to the companies of the sample and to their human capital that have been used in the models developed for this thesis. Chapter 5 describes the main models that have been developed for this thesis; in particular, the first part of the chapter provides descriptive statistics, while the second one contains the three basic models developed for this thesis. Chapter 6 describes the results of the robustness checks performed on the models presented in Chapter 5. Chapter 7 discusses the results of the analysis performed, together with the main theoretical background that allows to draw the conclusions presented. Finally, Chapter 8 concludes the paper by summarizing the main findings and by underlying its main limitations and potential for future developments.

1   Literature review

Being the exit one of the crucial moments of the start-up's lifecycle, many scholars have focused their efforts on this fundamental part of entrepreneurship, and this first part of this thesis is aimed at presenting the most important contributions about this topic. In order to have a complete understanding of the state of the art about exit, it is first of all important to discuss why the entrepreneurial exit is a relevant matter for the whole economic environment and to provide some of the most accepted definitions about this topic. The second step proposed in this chapter regards the specific definition of the most relevant exit strategies, together with some relevant classifications. After that, an analysis of the main determinants that lead to the selection of a specific exit strategy is going to follow. Once provided a complete perspective on the topic of exit, the last part of this chapter is going to be dedicated to M&As, which are the focus of this thesis work. In particular, first of all the main reasons that make the study of acquisitions relevant are going to be listed. Then, a review about the use of signaling theory in the M&A context is going to be provided. Finally, an overview about the use of auction theory to model acquisitions is going to be presented.

1.1   The Importance of Exit

While the first studies on entrepreneurship were mainly focused on the early steps of the entrepreneurial process, like the identification of opportunities (Ardichvili et al., 2003), the start-up phase (Korunka et al., 2003) and the financing (Choi and Shepherd, 2004), in recent times scholars have increasingly focused on the exit phase (DeTienne, 2010) and have produced a substantial amount of literature on this topic. In a certain sense, it is indeed the exit that allows to fully understand the entrepreneurial journey (DeTienne, 2010), as it can allow to distinguish between small business founders, who see the creation of a company as an alternative to a traditional income, and real entrepreneurs, who create a new venture to achieve growth and to achieve a great personal wealth (Carland et al., 1984). In fact, for real entrepreneurs, "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).

In literature, it is possible to identify at least two main reasons that make the exit an important part of the entrepreneurial process and justify the need of studying it in detail:

1. *Exit is inevitable.* Regardless of the industry, the dimension or any other aspect of the company, owners, and thus also founders, someday will decide to leave the company they have created, or will be forced to do that (Engel, 1999);
2. *The effect of the exit is not limited to the entrepreneur*, since it affects also the company itself and the whole economic environment in which it plays (DeTienne, 2010).

With regards to the second point, it is worth to enter in the details of the effects of the exit on the above-mentioned parties. The effect of the exit on the entrepreneur is quite straightforward, as it mainly concerns the loss of the ownership rights (DeTienne, 2010). From a personal wealth perspective, this is a crucial step for the entrepreneur, as, if the exit is successful, this represents the moment in which it is finally possible monetize the value of the company (Certo et al., 2001). Anyhow, this moment can also have a very strong emotional and psychological meaning for the entrepreneur (DeTienne, 2010), as the exit implies leaving the creature to which the entrepreneur has dedicated a lot of time and effort, a creature that some scholars even compare to a baby (e.g., Cardon et al., 2005).

Moving to the effects of the exit on the company, many scholars have been able to provide evidence that the succession of the founder heavily affects the future of company, even if there is no consensus on whether this effect is positive or negative (Rubenson and Gupta, 1996; Haveman and Khaire, 2004). On the positive side, the exit of the founder can allow the company to access different resources and, in particular, different sources of cash (DeTienne, 2010), empowering a renewed and increased growth (Haveman and Khaire, 2004) and the achievement of better financial performances (Virany et al., 1992). In particular, the removal of the entrepreneurial team from the executive roles of the company can be very beneficial when it is replaced by professional managers (Boeker and Wiltbank, 2005); in fact, a change in management can bring new blood to the company, reducing the conflicts and revitalizing the processes (Guest, 1962). Additionally, entrepreneurs might also lack managerial skills, as the abilities needed to establish a company and the ones needed to run it are very different (Clifford and Cavenaugh, 1985). On the other hand, the newly appointed external managers should have stronger managerial capabilities, while also being in possession of better information about the external environment (Pfeffer and Salancik,

1978). On the negative side, the change in management can also trigger the so-called "succession crisis" (Haveman and Khaire, 2004), disrupting working routines and procedures and making the employees more insecure (Haveman and Khaire, 2004). Additionally, the succession can start a viscous loop from which it can be hard to escape, as poor performances might lead to another managerial succession, which, in turn, might further worsen the performances (Grusky, 1963). The worsening of the company's performances after the founders' succession is, in a certain sense, a physiological consequence of the organizational structure of entrepreneurial firms, where decisions are usually taken in centralized way by very few individuals, among which there is the entrepreneurial team (Hofer and Charan, 1984). As a consequence, the removal of these key figures from their position is likely to negatively affect the company's processes and the confidence of the involved people (Hofer and Charan, 1984).

Moving to the environment outside the company, evidence suggests that acquisitions can significantly impact and change the industry dynamics and the power relationships, thus affecting also the competitors (Othcere and Ip, 2006). On the one hand, in case of an acquisition, the rivals of the acquired firm seem to experience a growth in the stock value after the announcement of the takeover, as well as an increased probability of being acquired in the following year (Othcere and Ip, 2006). On the other hand, IPOs seem to have a weaker effect on rivals, even though still relevant, as the IPO brings visibility to the whole industry, reducing the information asymmetry for the investors and pushing the competitors' prices up, but it also brings an even greater visibility to the IPO firms, thus changing the competitive balance in the industry in favour of this last (Akhigbe et al., 2003).

Finally, the effect of the exit does not stop at the industry level, but it can also be significant for the whole economy; it is indeed very common for entrepreneurs that have successfully exited from their business and have accumulated a considerable amount of personal wealth to reinvest this money in other entrepreneurial activities, in their community and, more in general, in philanthropic activities (DeTienne, 2010). This process of reinvesting the profits is usually defined as "entrepreneurial recycling" (Mason and Harrison, 2006), a virtuous loop that starts with the exit and ends up fostering the whole economic development.

Among the external actors that are affected by exits, external equity investors, like Business Angels (BAs), Venture Capitalists (VCs) and Private Equity funds (PEs), deserve a particular mention due to their importance for the start-up ecosystem. In fact, these investors play a significant role in fostering the growth of start-ups and in allowing them to achieve success (Nanda et al., 2017), helping them in improving in different aspects like efficiency (Croce et al., 2013) and internal organization (Hellmann and Puri, 2002). Anyhow, all these players include in their business model the explicit need to monetize their investment by exiting from the target company at some point of time, making the exit an indispensable step for the continuous creation of new funds (DeTienne, 2010).

1.1.1   Definition of Exit

Once cleared the relevance of the exit for the whole environment gravitating around the company, the aim of the following part is to provide a deeper understanding of what the exit actually is by reviewing the main definitions of this concept. Indeed, many scholars have tried to provide a definition of exit, showing different facets and peculiarities of this concept. In particular, Dawn R. DeTienne from the Colorado State University is one of the most active authors in this subject, and she has provided one of the most cited definitions of exit; according to this definition, exit is "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" (DeTienne, 2010). There are at least two aspects of this definition that make it very peculiar and that it is worth underlying:

1. The focus is on the entrepreneur, who is considered the unit of the analysis. While other studies take as a basis the firm or the whole industry (Bowman and Singh, 1993), this definition follows the principle of "understanding the designer of the firm to understand the design" (DeTienne, 2010); in fact, the different motivations (Shane et al., 2003) and goals (Sarasvathy, 2004) that push the entrepreneur to establish a new company can be a very important key for the understanding of the exit (DeTienne, 2010);

2. The companies considered for this definition are private rather than public, as in private companies the entrepreneur usually owns a higher equity stake (Wasserman,

2003), which allows him to maintain a central role and to drive decisions (DeTienne, 2010).

Similarly, many other scholars have decided to base their definition on the entrepreneur (Sarasvathy, 2003), following again the principle of understanding the designer to understand the design. In particular, it is worth mentioning the one proposed by Stam et al. (2010), which is focused on the career of the entrepreneur; in this case, the exit is defined as "the decision to quit an entrepreneurial career", assuming a more permanent connotation. A similar definition has been provided by van Praag (2003), who talks about "moving out of self-employment to (un)employment". Another interesting perspective comes from Bates (2005), who is always focused on the entrepreneur's career, but defines the exit as the result of the willingness of the entrepreneur to pursue more attractive alternatives, relating, in a sense, the concept of exit to the one of success.

As previously said, the common thread of all these definitions is the focus on the entrepreneur and, in particular, on his intentions, as they are an important determinant of the exit (DeTienne and Cardon, 2012). The approach of this thesis is very much aligned with the perspective of the entrepreneur, and it is also based on the concept of success suggested by Bates (2005); in fact, the aim of this research is to find factors that concur to the attainment of a higher exit valuation, which is usually the prominent aim of real entrepreneur when leaving the company (DeTienne, 2010).

However, in literature it is possible to find other definitions of the concept of exit based on a completely different perspective, and it is worth to give a brief overview on them in order to provide a comprehensive understanding of the overall topic, while also clarifying what is not part of the subject of this research. In particular, Decker and Mellewigt (2007) suggest that exit can also refer to the concepts of market exit and of firm exit. For what concerns the former, practitioners also refer to it as corporate restructuring or organizational exit (Wennber and DeTienne, 2014), and is about redesigning, at least partially, the organization through activities like the sale of business lines and, more in general, divestures (Bowman and Singh, 1993). On the other hand, firm exit refers to a complete closure of the firm (Decker and Mellewigt, 2007), which is considered a failure from the entrepreneur's perspective, assuming a negative connotation.

Even if many definitions of the concept of exit are available, it is also true that many scholars believe that "exits are the least understood parts of investing and entrepreneurship" (Peters, 2009). The main challenge of this subject is that, while the exit events are objective and easier to measure, the underlying exit strategies are more difficult to study, as, by definition, they evolve over time (DeTienne et al., 2015).

1.1.2   Exit through the lifecycle of the company

Before entering in the detail of the possible exit strategies, it is worth to spend a few words about the relationship between the concept of exit and the different phases of the start-up's lifecycle; in fact, the reasons that push the entrepreneurs to exit from the company and the range of viable exit routes varies a lot during the lifecycle of the company (DeTienne, 2010) and, since the exit can potentially occur at any stage, it is important to have an understanding of the of this relationship. During the lifecycle, there are two main aspects that influence the viability and the implementation of specific exit strategies. On the one hand, the company becomes increasingly mature and more attractive for the market, while, on the other hand, the equity stake hold by the founder tends to decrease over time, leaving more control rights in the hands of external equity investors (DeTienne, 2010). With regard to this, DeTienne (2010) has proposed to divide the lifecycle of a company into the five stages presented hereafter.

Conception and *Gestation*: these phases represent the beginning of the entrepreneurial journey, during which the company has not been founded yet. In fact, at this stage the entrepreneur is focused on the identification of the possible opportunities that can be exploited (Gaglio and Katz, 2001) and in understanding whether it is worth to commit resources in this new activity (Reynolds and White, 1997). The ways in which the new entrepreneur approaches entrepreneurship can be very different, ranging from a coincidental finding of an idea he was not seeking (Wong et al., 2005) to a systematic approach of search and selection of opportunities (Fiet, 2002). During these stages of the lifecycle, the concept of exit coincides with terminating the activity and abandoning the idea (DeTienne, 2010). The reasons behind the choice of stopping the entrepreneurial activity can be very different, varying from the entrepreneur's discovery of better career opportunity to the understanding that

the new idea does not make good business sense (Maertz and Champion, 2004) due to the market conditions in which it should be inserted (DeTienne, 2010).

Infancy: as the previous ones, also this stage is part of the preliminary part of the lifecycle of the start-up, but it has remarkable effects on company's future. In fact, during this phase the company has very limited resources (DeTienne, 2010) and suffers both the liability of newness (Stinchcombe, 1965) and the liability of smallness (Aldrich and Auster, 1986). As a consequence, it is very important for the founders to be fully focused on the company and on preparing the way for a successful future, as later results and exit possibilities depend on what it is done during this phase (DeTienne and Cardon, 2007). During this stage, companies can usually pursue failure and voluntary disbanding as exit routes (DeTienne, 2010). The reasons for voluntary disbanding are similar to the ones of the *Conception* and *Gestation* phases, as also during *Infancy* the entrepreneurs have still not fully committed to the new venture, but they are starting to understand all the challenges that an entrepreneurial career entails and might consider alternative opportunities as more attractive (DeTienne, 2010). Additionally, it is solely during the development of the new idea that it really becomes easier to understand its actual feasibility (DeTienne, 2010). Poor financial performances also play a role in deciding to exit from the company during this stage but, even if it can sound counterintuitive, they represent the minority of cases, as it seems that only 25% of entrepreneurs decide to exit during this phase for this reason (McGrath, 2006)

Adolescence: if the new firm survives the first stages of its lifecycle, it reaches the *Adolescence* phase, during which the primary objective of the entrepreneur is achieving growth, both in terms of resources, sales and market share (Bamford et al., 2004). Simultaneously, the company absorbs this growth by becoming more formalized and by establishing an increasingly structured organization (Lynall et al., 2003). This increased growth and organization produces the direct effect of making the company more attractive for strategic buyers, for private equity firms and for the public market (DeTienne, 2010), which increases the potential for exit. During this phase, the reasons that can lead an entrepreneur to the exit decision can be very different. First of all, the exit could take the form of forced exit, as it can happen that, during the growth of the company, the entrepreneur decides to give a portion of the equity to external investors or to other managers (Graham et al., 2002); as a consequence, the entrepreneur might increasingly lose the control of the company, and the other

shareholders might have the power to substitute him with more experienced professionals (DeTienne, 2010). Alternatively, the entrepreneur might voluntarily decide to exit form the company, and the selection of the specific exit route mainly depends on the expected economic return (DeTienne, 2010) and on the level of concern about the future of the company (Minor, 2003).

Maturity: after the growth, the company usually reaches a maturity state in which it becomes very formalized, establishing procedures and basing internal relationships on hierarchy (Lester et al., 2003). During this stage, in the majority of the cases the founding entrepreneurs have already left the company, and the ones that are still in place are likely to have founded the company to obtain a long-term family income rather than a great economic wealth. Therefore, the main exit strategies available at this stage are related to a trade sale, usually managed with the help of a business broker, or to the transfer of the company to another family member or employee (DeTienne, 2010). The reasons that might lead to this decision can mainly be identified in the willingness of the entrepreneur to harvest the investment made at the beginning or in the willingness (or the necessity) to end the entrepreneurial career due to retirement or death (DeTienne, 2010).

1.2   Description and classification of exit strategies

In general terms, entrepreneurs can choose among a wide variety of exit paths when leaving the company they have established (Wennberg et al., 2007); in fact, the needs of the counterparties involved in the transaction can be very diverse, both on the buying side (Birley and Westhead, 1993) and on the selling side (Holtz-Eakin et al., 1994; Hellmann and Puri 2002), and thus different options are needed (DeTienne et al., 2015).

In literature, the two most studied exit paths are M&As and IPOs, as they are the ones that allow to produce higher financial returns for the entrepreneur (Babich and Sobel, 2004). As a consequence, from the entrepreneur's perspective both of them are usually considered as successful options (Cumming, 2008), even though they present some peculiar differences that it is worth to underline. In fact, IPOs can be interpreted as a strategic choice to collect new resources to foster company's growth, allowing the entrepreneur to maintain his position in the company with a diluted ownership (Daily et al., 2003). On the other hand,

acquisitions are usually complete exit strategies, with the entrepreneur that, in turn, loses all his ownership rights (DeTienne and Cardon, 2012). As a consequence, it is not uncommon for an entrepreneur to prefer an IPO with respect to an acquisition, even in the case in which an acquisition can be more remunerative (Cumming, 2008), as the IPO allows him to enjoy the private benefits of being the CEO and partial owner of a listed company (Hellmann, 2006).

Another frequent exit strategy is the family succession, which involves the transfer of the ownership rights and of the operative roles to the relatives of the entrepreneur and, most likely, to his children (Bjuggren and Sund, 2005). Therefore, family succession usually does not allow the entrepreneur to harvest his investment (Bjuggren and Sund, 2005). This family relationship with the successor gives rise to the main positive side of this exit strategy, as it allows the entrepreneur to continue affecting the company even after the exit (DeTienne and Cardon, 2012). A similar case that has also attracted the scholars' attention is the one of employee buyout, defined as the purchase of a majority stake of a firm in which most of the current employees can participate (DeTienne and Cardon, 2012). In fact, also in employee buyouts the entrepreneur can have an influence on the company for a longer timeframe, as the transaction usually occurs gradually over a longer period (McCollom and Gillette 1993). Finally, in low-end markets entrepreneurs may decide to pursue an independent sale, which usually consists in contacting a market broker who is in charge of finding a counterparty to close the transaction (DeTienne and Cardon, 2012); given the way they are structured, independent sales are usually considered a simple and low risk exit strategy (DeTienne and Cardon, 2012).

Moving to less successful types of exit, a first and simple (DeTienne et al., 2015) option is liquidation, in which the entrepreneur decides to liquidate the assets of the company once he believes that it has served its purpose (DeTienne and Cardon, 2012). The final option for the entrepreneur to exit from a business is bankruptcy, which anyhow cannot be defined as a proper exit strategy but rather as the unsuccessful outcome of the entrepreneurial activity (Schary, 1991). In fact, bankruptcy occurs when the liquidation value of the company is lower than the sum of the company's liabilities and the creditors are not willing to accept a discount on them (Balcaen et al. 2012); as a consequence, creditors are likely to receive back

only a portion of their credits (Schary, 1991), which makes bankruptcy the most inefficient and unfavourable type of exit.

Scholars have widely studied the exit strategies just presented and have produced an abundant literature on the topic, identifying a series of factors related to the choice of a specific exit path. From the methodological standpoint, in literature it is possible to identify two main approaches used to study this subject; on the one hand, some scholars have considered a sub-sample of the exit strategies just described and have analysed them individually, while others have firstly classified the exit strategies according to some parameters and have then based the analysis on the identified groups.

Among the studies that are based on the first type of approach, a first example can be the one proposed by Cumming (2008). In his paper, the author considers IPOs, acquisitions, buybacks and write-offs as possible exit routes, underlying that the exit paths available for the companies can be both successful and unsuccessful. Similarly, also DeTienne and Cardon (2012) consider a list of possible exit strategies, which includes acquisition, IPO, family succession, employee buyout, independent sale and liquidation. Therefore, with respect to the previous case, DeTienne and Cardon (2012) consider a wider set of possible options, but still do not consider the worst possible scenario, namely bankruptcy. Finally, Balcaen et al. (2012) study the possible exits paths that ventures under distress can follow. In particular, the authors identify three main options for the exit after economic distress, which are bankruptcy, voluntary liquidation and M&A. Nevertheless, these three exit routes cannot be considered as perfect alternatives, as the bankruptcy is a path that the company is forced to follow, while the other two exit options are possibilities that the entrepreneur has after voluntarily deciding to exit.

Moving to the second type of approach, the use of classifications can be very insightful as it can allow to spot the main differences and similarities that the possible exit options present. A first example has been developed by Wennberg et al. (2010), who classify the exit strategies according to two dimensions. The first one is related to the exit route, which can either be a sale or a liquidation; as a consequence, the main difference lies in the fact that, while in the sale the company survives to the entrepreneur's exit, in the liquidation the company ceases its activities when the entrepreneur leaves it (Wennberg et al., 2010). The second dimension is instead related to the performances of the company, which can be high,

generating a gain situation, or low, generating a loss situation, where high and low are measured with respect to a reference point defined through prospect theory. Quite interestingly, there seem to be an actual correlation between these two dimensions, as apparently entrepreneurs tend to rapidly liquidate the investment in gain situations, while they tend to delay the liquidation in loss situations, probably in hope of improving the performances and, consequently, the exit valuation (Shefrin and Statman, 1985). Additionally, it seems that negative exogenous events, like the closure of a major clients, are likely to emphasize the tendency just described (Kyle et al., 2006).

By crossing the two dimensions just described, it is possible to derive four possible scenarios. *Harvest sale* occurs when the entrepreneur sells his ownership rights while the firm continues its activities; from the entrepreneur's perspective, this is the most desirable exit, as it allows to monetize the initial investment (Petty, 1997) and to achieve the objective of increasing his personal wealth (Certo et al., 2001). Anyhow, the sale of the equity of a company is not always a successful option, as it could also be considered by the entrepreneur as an alternative to bankruptcy or liquidation; in fact, if the company is facing negative profits and the entrepreneur is not able to bear with the problem and turn the situation around, he could decide to go for what the authors define a *distress sale*, "flying away" from the loss (van Witteloostuijn, 1998) before it becomes too late (Wennberg et al., 2010). On the other hand, entrepreneurs may also decide to liquidate the company; quite interestingly, this situation can also happen with profitable ventures, giving rise to a *harvest liquidation*. Even if this path can seem counterintuitive, as the sale could seem a more profitable option, in some situations this path could be the only viable alternative; in fact, it can happen that that the entrepreneur is not able to find the right buyer, or that the entrepreneur wants to rapidly change career or retire, and thus liquidation becomes attractive (Wennberg et al., 2010). Finally, if the entrepreneur decides to liquidate a company characterised by poor financial performances, this can be defined as a *distress liquidation*; this possibility is usually considered by entrepreneurs as a preferrable option with respect to bankruptcy (Thorburn, 2000), as it allows to minimize the reputational consequences that a bankruptcy creates (Pretorius and Le Roux, 2007) and to find an agreement to repay all the creditors (Thorburn, 2000). Therefore, as an overall, the classification proposed by Wennberg et al. (2010) does not directly include the option of bankruptcy, while it also limits the remunerative option to a trade sale.

		Performances	
		High	Low
Exit route	Sale	Harvest sale	Distress sale
	Liquidation	Liquidation	Distress liquidation

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

Anyhow, the most comprehensive classification that it is possible to retrieve from the literature has been designed by DeTienne et al. (2015). Given that this classification includes the greatest variety of exit options, it is worth to analyze it more in detail. In particular, DeTienne et al. (2015) propose to divide the different exit strategies into three main categories, which are:

1. Financial harvest exit strategies;
2. Stewardship exit strategies;
3. Voluntary cessation exit strategies.

Starting from the *financial harvest exit strategies*, this category includes the two most successful exit options, which are IPOs and M&As (Bayar and Chemmanur, 2011); the main common feature of these two exit paths is the possibility of creating a huge value for the entrepreneur (Cumming, 2008) through a radical change in the ownership structure of the company (Poulsen and Stegemoller, 2008). Given that, among scholars, there is a wide consensus on the belief that entrepreneurs are mainly driven by extrinsic motivations when founding a company (Campbell, 1992) and given that these motivations usually coincide with the creation of personal wealth (Kuratko et al., 1997), financial harvest exit strategies can be considered the most successful and desirable possibilities (Bayar and Chemmanur, 2011). Interestingly, it seems that the size of the funding team is likely to result in a preference for a financial harvest strategy, as there is the need of creating economic compensation for a larger number of individuals (DeTienne et al., 2015). Anyhow, it is also true that companies established by larger teams are more likely to achieve higher growth rates (Friar and Meyer, 2003), to receive funds from VCs (Beckman et al., 2007) and seem to be more innovative (Aldrich and Kim, 2007), which makes them physiologically more likely to follow a financial harvest strategy. Another important aspect is related to the founder's perceived innovativeness of the start-up, as a higher perceived innovativeness is likely to be related

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with higher risk/reward expectations (DeTienne et al., 2015). As a consequence, founders are likely to decide to invest a greater amount of resources in the venture, thus enhancing the probability of success and of pursuing a financial harvest strategy (DeTienne, 2015).

Moving to the *stewardship exit strategies*, these are defined as "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). This category includes family business succession, employee buy-out and independent sale, which are all characterized by the common feature of giving to the founders the possibility to specifically select their successors (DeTienne et al., 2015). Given the strong emotional link that is usually present between the founders and the company, the possibility of selecting a successor that is willing to continue to take care of "the baby" can strongly help in limiting the loss of socio-emotional wealth (Gómez-Mejía et al., 2007). Indeed, founders tend to pursue a stewardship strategy when the primary motivation is not the attainment of personal financial gains (Miller et al., 2012), but the wellbeing of the organization itself and of all the individuals that are part of it (Hernandez, 2012). As a consequence, the number of employees of the firms can play a great importance in the selection of the exit strategy, as founders of bigger companies should care more about what is best for the organization and should be more likely to trade off their personal financial wealth (Davis et al., 1997).

Finally, *voluntary cessation exit strategies* group together liquidation and discontinuance, which are related to the choice of disbanding the firm. These exits are the result of the fact that many entrepreneurs establish a venture to serve a temporary need, which is usually related to obtaining an interim and additional income, and, once this need is removed, the company becomes unnecessary (DeTienne et al., 2015). The main feature of these firms is that they are characterized by lower levels of innovativeness (DeTienne et al., 2015), as the entrepreneur is not likely to invest in new and risky technologies due to the limited scope of the company (Samuelsson and Davidsson, 2009).

1.3 Determinants of the exit strategy selection and of the final valuation

Once showed the possible exit paths that an entrepreneurial venture can follow, the aim of this chapter is to discuss the main factors that influence the choice of a specific exit strategy and that affect the final valuation. Anyhow, to have a full understanding of the reasons that drive the choice of a specific exit strategy, it is first of all necessary to define and understand the concept of reward from the entrepreneur's perspective. After that, given that the literature on this topic is quite broad and given that the factors that influence the choice of the exit strategy can be very diverse in nature, it has been decided to divide the chapter into three main parts: the first one focused on human capital related factors, the second one related to the presence of equity investors and the third one focused on factors that influence the specific choice of M&A or IPO.

1.3.1 The concept of reward

The necessity of understanding the concept of reward derives from the fact that there is a strong relationship between the choice a specific exit strategy and the reward that the entrepreneur is seeking. Anyhow, the concept of reward is not as simple as it would seem, as in entrepreneurship it has at least two distinct dimensions that it is worth considering. The most intuitive component is clearly related to the financial side and is represented by the economic return that the entrepreneur receives (Bayar and Chemmanur, 2011). However, it should not be forgotten that the entrepreneur needs to make a considerable investment of time, energy, efforts and resources in general to run a growing and successful company, and thus an emotional bond between the entrepreneur and the company is likely to emerge (Gao and Jain, 2012). Therefore, the entrepreneur might decide to "choose a successor from a subset of individuals who are likely to take care of their baby" (DeTienne et al., 2015), putting the financial rewards on the back burner (Hernandez, 2012). In fact, evidence suggests that, in some circumstances, entrepreneurs may decide to pursue exit strategies that would allow them to maintain a position in the decision-making structure of the company (Gómez-Mejía et al., 2007), in order to continue preserve the wellbeing of the other individuals involved in the organization (Hernandez, 2012).

Given the complexity of the concept of reward, it is interesting to understand which exit strategy can be preferred when one of the two facets just described is prevailing. In the majority of cases, the obtainment of a financial return is usually the main motivation to start a business, as entrepreneurship is usually seen as an alternative to wage labor (Campbell, 1992). Therefore, when the entrepreneur seeks for an important financial return, scholars agree that the two main options are IPOs and acquisitions (Brau et al., 2003; Bayar and Chemmanur, 2006; Bayar and Chemmanur, 2011), since they are considered to be the ones that produce higher economic returns (Cumming, 2008). In particular, on the one hand IPOs can be the most remunerative option, as there is an entire strand of literature that claims the existence of the so-called IPO premium, namely a higher valuation attained for IPOs with respect to acquisitions (Brau et al., 2003); indeed, evidence suggests that this premium actually exists (Brau et al., 2003; Poulsen and Stegemoller, 2008), and it is especially relevant for small deals (Bayar and Chemmanur, 2011). In figures, according to Koeplin et al. (2000), on average acquisitions are valued 20%-30% less then IPOs. However, it should be considered that this percentage is not consistent over time, as IPOs' valuations are, by definition, highly dependent on the market momentum (Ritter and Welch, 2002). As a consequence, entrepreneurs may decide to postpone the IPO during bearish periods to avoid being undervalued or, if the aim is to perform a rapid exit, they may prefer M&As (Lucas and McDonald, 1990).

A final remark is related to the fact that pursuing an M&A and an IPO are not mutually exclusive strategies, as it happens that entrepreneurs decide to initiate and follow both paths until the moment in which they must decide, allowing them to choose the one that yields the highest payoff (Brau et al., 2010). Scholars refer to this strategy as the dual tracking strategy, and evidence suggests that it has a positive effect on the final valuation (Brau et al., 2010). In fact, dual tracking allows to put pressure on potential acquirors, as it enables to enjoy multiple bidders coming from both M&A and IPO (Walkling and Edmister, 1985); additionally, dual tracking reduces the information asymmetry problem by sending a strong signal to the market, as an IPO requires to disclose many relevant information (Yanowitch, 2004).

On the other hand, if the emotional dimension is prevailing, entrepreneurs may consider maintaining a position in the decision-making structure more important than obtaining

a financial return (DeTienne et al., 2015). Therefore, financial harvest strategies, like acquisitions and IPOs, can become less interesting form their perspective, as they usually imply the complete loss of decision rights. On the contrary, stewardship strategies, like family succession, employee buyout and independent sale, can allow the entrepreneur to remain engaged in the company (DeTienne et al., 2015) with roles that can include the ones of advisor or of board member (Neubauer, 2003).

1.3.2   The company's human capital

Among the factors that can influence the choice of a specific exit strategy and, consequently, the exit valuation, the characteristics and peculiarities of the company's human capital have widely drawn the scholars' attention (Colombo and Grilli, 2005). The majority of the studies produced on this topic are based on the human capital theory (Becker, 1964), according to which career decisions should be interpreted through the economic logic, as individuals make choices in order to maximize their utility (Wennberg et al., 2010). In this context, this paragraph is going to present three important contributions based on the human capital theory, which, through the use of actual data, provide evidence about the effect of the human capital on exit choice. These three studies are all characterized by a common approach, in which the possible exit paths are taken as dependent variables, while the human capital characteristics are taken as independent variables.

The first study is the one of Bates (2005), who proposes a setup in which two types of exit are considered, which are successful exit and unsuccessful exit; whether the company can be considered successful or not is defined according to the opinion that the entrepreneur had of the situation at the time of the exit. From the data standpoint, the study is based on a sample of companies established between 1989 and 1992 and then closed between 1993 and 1996. The findings indicate that the quality of the human capital is very relevant for the achievement of a successful exit, as, among the others, success comes out to be related to the entrepreneur's education and to previous experience in the industry of the company. The main explanation for this phenomenon lies in the fact that good and skilled entrepreneurs are likely to have many alternatives to self-employment, which makes their self-employment opportunity cost rather high (Gimeno et al., 1997); on the contrary, bad entrepreneurs might

have almost no alternative to self-employment, so they may decide to remain in the firm they have created even if it is unsuccessful (Bates, 2005).

The second study that provides interesting insights comes from Wennberg et al. (2010) and is based on a database of 1735 Swedish ventures. As already introduced in Chapter 1.2, the main distinctive trait of this paper is that the dependent variable is defined as a classification of possible exit strategies, which are continuation, harvest sale, harvest liquidation, distress sale and distress liquidation; clearly, out of these possible exit paths, harvest liquidation is considered the most successful and remunerative for the entrepreneur. Results confirm that high quality human capital is related with the achievement of a harvest sale, as entrepreneurs with important previous working experience are more likely to follow this exit path. Additionally, it also seems that the entrepreneur's age is positive correlated with the execution of a harvest sale, probably because experience and age are somehow two related measures. However, this study also questions the specific importance of education, as the hypothesis about the positive effect of entrepreneur's education on the achievement of a harvest sale had to be rejected. A possible explanation could be that educated people sometimes become overconfident about their ability, which leads them to make mistakes and, ultimately, to fail in meeting their expectations (Clayson, 2005).

A final example is the paper proposed by DeTienne and Cardon (2012), which is based on a sample of 1334 companies from the electrical measurement instruments sector and from the surgical medical instruments sector. In this case, the dependent variable is represented by a list of exit strategies taken singularly, which are IPO, acquisition, family succession, employee buyout, independent sale and liquidation. Results indicate that the entrepreneurs' education and working experience is positively related to the achievements of IPOs and acquisitions, while it is negatively related to the choice of family succession, which is, usually, less remunerative. For what concerns the previous entrepreneurial experience, also this aspect comes out being positively related to IPOs and acquisitions, while it is negatively related to independent sale and liquidation. In this regard, this result suggests that, once entrepreneurs have gained relevant entrepreneurial experience, it becomes easier to set up a successful company. Finally, in this case the age of the entrepreneurs is positively related to liquidation and family succession, suggesting that older entrepreneurs tend not to pursue financial harvest exit strategies. Therefore, in general terms, it seems that more

educated and experienced entrepreneurs tend to pursue the most remunerative exit strategies, mainly because they set higher performance thresholds for their companies and for their career choices (Mason and Harrison, 2006).

1.3.3   The presence of external equity investors

A second group of recurring factors that affect the possibilities of success of the company is related to the presence of external equity investors in the ownership structure of the company. Given that external equity investors, sooner or later, will need to monetize their investment, they are likely to push in the direction of financial harvest exit strategies when this is possible (DeTienne et al., 2015) In general, it is possible to find three main types of external equity investors in the lifecycle of a company, which are Business Angels (BAs), Venture Capitalists (VCs) and Private Equity funds (PEs). From the perspective of this thesis, VCs are the most interesting type of equity investors, since they can play a crucial role for the growth and the success of entrepreneurial ventures, as well as in the decision of the specific exit strategy (Gompers and Lerner, 1999). The most straightforward contribution that VCs are able to bring to the company is the availability of new capital (Bertoni et al., 2011), removing the frequent constraint represented by the lack of internal finance (Carpenter and Petersen, 2002). Additionally, in literature it is possible to identify at least other three areas in which VCs provide a crucial support to start-ups, allowing them to achieve higher growth rates and, ultimately, success. These areas are innovation, strategic planning and support in the construction of a strategic network.

For what concerns the *innovation*, VCs are able to make innovation come from outside the company, as they give the possibility to appoint high quality human capital in key position by exploiting their wide network of contacts in the industry (Drover et al., 2017). Additionally, the VCs' experience, coupled with the financial support they can provide, can give a crucial contribution to foster innovation (Drover et al., 2017).

Moving to the concept of *strategic planning*, the support that VCs mainly concerns the possibility to run structured market research and competitive analysis, which, together with the VCs' experience in planning and forecasting, can allow to take better decisions based on an improved understanding of firm's internal factors and external environment

(Sarasvathy, 2001). On the other hand, small firms with insufficient capital are likely to run more basic experiments and trials, thus making the decision-making approach less robust (McGrath, 1999).

Finally, the relevance of *strategic alliances* is a topic of growing interest for scholars, as the evidence suggests that they can be an important factor in reducing the information asymmetry problem during the exit (Qi et al., 2015); in this regard, VCs, again because of their wide and established network, can allow the venture to build a portfolio of alliances (Gu and Lu, 2014; Hoehn-Weiss and Karim, 2014) which can enable the exchange of knowledge with other companies and the possibility to address the issue of limited internal expertise and skills (Gulati, 1998).

Therefore, given all the benefits that VCs can provide to start-ups described above, scholars agree that VC-backing can provide a strong certification effect (Drover et al., 2017), which is likely to result in more successful exits and higher valuations (Nahata, 2008).

One of the most interesting contributions that provides evidence about the effect of VCs on the choice of the exit strategy comes by Cumming (2008) and has been introduced in Chapter 1.2. In this study, the possible exit strategies considered are IPO, acquisition, buyback and write-off. Results suggest that, when VC's control rights are strong and, in particular, when the VC has the right to replace the founding CEO, acquisitions become significantly more likely than IPOs and write-offs (Cumming, 2008). The main reason for this result should be that, while entrepreneurs would like to enjoy the private benefits of being the CEO of public company (De Bettignies, 2008), the VC is not interested in them, preferring to pursue an acquisition which provides liquidity faster (Cumming, 2008).

Another example is the study of Bertoni and Groh (2014), who analyze the effect of the presence of cross-border VC investors on the exit strategies of a sample of 462 European start-ups; the possible exits considered here are IPO, trade sale and liquidation, together with the possibility of continuing the business. Results show that cross-border investors can enhance the number of exit alternatives, because they allow to access non-local exit options, and consequently they can make the exit easier. In particular, while in general the likelihood of a trade sale is linked to the liquidity of the local M&A market, when cross-border investors

are present this likelihood seems to become correlated also to the liquidity of the M&A market of the cross-border investor.

1.3.4   Focus on the determinants of M&A and IPO

Given that this thesis is focused on exits performed through acquisition, the following chapter is going to be dedicated to the factors that influence the specific choice of M&A and IPO. In fact, these exit strategies can be considered the two most direct alternatives, as they can both be very lucrative for the seller and, in particular, for the entrepreneur (Bayar and Chemmanur, 2011). In this regard, many scholars have developed studies considering just M&A and IPO as possible exit paths, and the aim of this chapter is to present an overview on the main determinants that influence this choice.

Brau et al. (2003) have proposed a very complete review of the topic, which is going to be used as the basis of this chapter. In particular, they have divided the determinants of the choice between M&A and IPO into four different families, which are: industry-related factors, market timing factors, deal-specific factors and demand for funds factors.

Starting from the *industry-related factors*, one of the most important determinants is the industry concentration; the authors hint that a high level of concentration is likely to make the IPO more interesting, because if the concentration is high the further potential for consolidation is lower, while also problems with antitrust authorities may occur (Brau et al., 2003). However, under these conditions, M&As can still represent the best option for small firms, as being acquired by an incumbent can improve the probability of survival (Sharma and Kesner, 1996). Additionally, Brau et al. (2003) noted that there are some industries in which companies show a preference for M&As, while others in which companies seem to prefer IPOs. Therefore, it seems that a link between the industry and selected exit strategy exists, even though this link can change over time. For example, at the time of the analysis, high-tech firms were preferably choosing IPOs, due to the high valuations that then resulted in the so-called "dot-com bubble" (Maksimovic and Pichler 2001), while the firms in the financial services industry were preferably choosing M&As, due to the deregulation that was being pursued in their market which, at the time, was also very fragmented (Berger et al., 1999). Another important factor is the capital structure of the target, which is usually similar

among companies in the same industry, as the leverage is usually considered by investors as a proxy of the risk of a company (Pagano et al. 1998). Therefore, investors might not want to bear the risk of holding stocks of companies coming from highly levered industries, which in turn would risk being severely underpriced in IPOs and thus would prefer M&As (Brau et al. 2003).

Second, *market-timing factors* refer to existence of hot issue periods in the IPO market, which have been documented by many scholars (Loughran et al., 1994; Pagano et al., 1998). In hot issue periods the information asymmetry tends to be lower, so investors feel confident also when paying high prices, while in the other periods underpricing is likely to be stronger. In this regard, evidence suggests that IPOs and M&As tend to occur in negatively correlated clusters (Mitchell and Mulherin, 1996), so companies will tend to choose IPOs in hot issue periods, while they will prefer M&As in the other periods.

Moving to the *deal-specific factors*, first of all the authors suggest that the size of the firm is very relevant; in fact, IPOs are characterized by high fixed costs (Pagano and Roell, 1998), so small firms, like start-ups in the early phases of their lifecycle, are likely not to find them profitable and to prefer M&As. Additionally, also the ownership after the deal can be a matter of concern, as the entrepreneurs might want to retain some ownership rights even after the exit. Among the two, IPOs are for sure the most gradual way of reorganizing the ownership structure, allowing the entrepreneur to maintain an ownership position in the company for longer (Bebchuk and Zingales, 1999). Nevertheless, also in acquisitions it is possible, to a certain extent, to tailor the contract to the specific needs of the selling side, making this issue manageable also in this second exit path (Brau et al., 2003).

Finally, the last group of factors is the one of *funding demand factors*. Even if it is hard to study these factors, since it is difficult to track the actual reasons behind the exit decision, the authors believe that the access to capital markets can be a preferrable way to find new sources of financing (Brau et al., 2003), as this is usually one of the main reasons that push companies to go public (Lowry and Schwert, 2000).

1.4 The growing importance of M&As

After describing the main exit paths that a company can follow, together with the main determinants that lead to the selection of a specific route, the aim of this paragraph is to present how and why M&As are becoming increasingly important for the economy and, as a consequence, why the work of this thesis is relevant.

In general terms, there are many factors that can make acquisitions a big business opportunity, like the presence of synergies, economies of scale and the possibility of resource transfer and diversification. In particular, acquisitions can become extremely beneficial when the acquiror is an incumbent and the target is a young and innovative company (Henkel et al., 2015), as having the support of established players is likely to be crucial for the survival of young companies (Signori and Vismara, 2018). On the contrary, if a small company decides to pursue an IPO, then it would need to defend itself alone from competition, which can be extremely though for newcomers (Bayar and Chemmanur, 2011). In particular, the need of incumbents' support becomes even more crucial in sectors strongly based on R&D, like the high-tech one, as important investments are required in order to remain competitive (Lehmann et al., 2012). On the other hand, from the acquiror perspective, acquisitions can be a very good opportunity to innovate and grow more effectively by gathering external resources (Puranam and Srikanth, 2007).

Looking at the world of VCs, also VC-backed companies are becoming more and more likely to be acquired than to undergo an IPO (Gao et al., 2013), mainly due to its growing complexity and time needed (Rose and Solomon, 2016), even though the highest profits for the VCs are still made through IPOs (Ball et al., 2011). To put this decline of IPOs in numbers, in the US in the period from 1980 to 2000 an average of 310 companies per year went public, while in the period from 2001 to 2012 this number decreased to 99 per year (Gao et al., 2013). On the other hand, M&As trend has been following the opposite direction, confirming once again that the frequencies of these two exit strategies is negatively correlated (Mitchell and Mulherin, 1996). The sharp increase in M&A activity can be clearly seen in figure 1, where the yearly number of M&As worldwide during the last 35 years has been plotted.
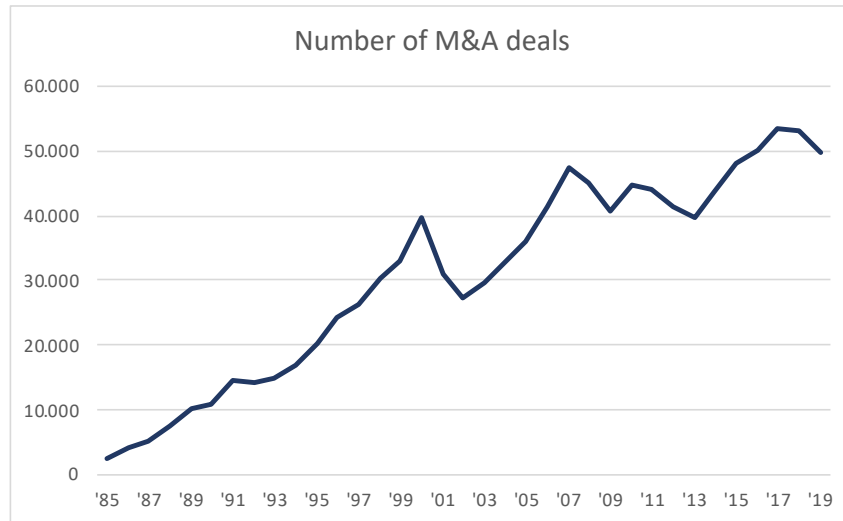
Figure 1: Number of M&A deals worldwide 1985 - 2019 (Statista, 2020)

Consistently, also the number of studies on M&As has followed the same sharp growth. In particular, there are two strands of literature that are very interesting for the work of this thesis: the first one is related to the use of signaling theory in M&As, while the second one is related to the use of auction theory to model acquisitions. The following chapters aim at providing a brief overview of the most relevant studies and contributions in these two areas.

1.5   Signalling theory in M&As

The underlying concept for the use of signaling theory in the M&A market is that, similarly to the IPO market, transactions are characterized by a high degree of information asymmetry between buyers and sellers (Akerlof, 1970), which makes it difficult from the acquiror's perspective to distinguish between good and bad companies (Keasey and McGuinness, 2008). The main issue raising by the inability to fully take apart good companies from bad companies is that buyers discount this information asymmetry in the offer price, reducing the return for the seller (Reuer et al., 2012). As a consequence, the seller has an incentive in sending signals and revealing information about its quality (Keasey and McGuinness, 2008), but it also faces a credibility problem in doing that, making the acquisition process rather inefficient (Ravenscraft and Scherer, 1987).

These inefficiencies become even more significant when the targets are young and small companies, like start-ups, as their valuations is usually mainly based on intangible assets, which are, by definition, harder to evaluate. Therefore, for start-ups in particular signals can strongly ease the due diligence process and, as a consequence, allow to obtain higher valuations (Wu et al., 2013).

In order to study the acquisition dynamics, a few scholars have tried to understand if some families of signals typical of IPOs, for which literature is more advanced, can be significant also for the M&A process. In fact, there are some peculiar differences between M&As and IPOs that do not allow to directly conclude that the same signal is valid in both situations. In particular, there are at least three main sources of differences to be considered, which are summarized hereafter.

1. While in IPOs the counterparty is represented the market, in acquisitions there is usually a single acquiror, which makes its characteristics way more important for a successful closure of the deal. In fact, acquirors can be very diverse among each other and they are likely to respond in different ways to the same signal (Reuer et al., 2012); for example, acquirors established in a different country or in a different industry from the one of the target are likely to suffer more of information asymmetry, and thus they should be more responsive to signals and obtain higher benefits from them (Reuer et al., 2012). Therefore, the effect of the signal should not be studied per se, but together with its contingent effect on the acquiror;

2. In acquisitions, an important determinant of the final valuation are the expectations about the potential synergies that may arise between target and acquiror (Leung and Kwok, 2018), as the success of an acquisition strongly depends on the strategic fit of the two companies (Bauer and Matzler, 2013);

3. The choice of the payment method is more complicated for acquisitions, as different alternatives are possible; in particular the most common ones are cash, acquiror's shares or a mix of the two. The selection of a specific payment method can become a strategic decision for the acquiror, as, for example, paying in cash could entail the impossibility to pursue other investments in the future for liquidity reasons (Gorbenko and Malenko, 2018). On the other hand, it should be considered that also

targets may have preferences between the options listed before (Gorbenko and Malenko, 2018), adding further complexity to the settlement of the deal.

Therefore, when trying to understand the takeover dynamics, the acquirors characteristics and behavior become very relevant. In this regard, some scholars have studied how the approach and the performances of the acquiror evolve when pursuing serial acquisitions. Quite interestingly, it seems that pursuing serial acquisitions has a real effect on acquirors' results, even though there is no consensus on whether this effect is positive or negative. On the one hand, the perspective proposed by Aktas et al. (2011) suggests that CEOs learn from signals that they receive, becoming better in capturing them and, as a consequence, in bidding over time; in support of this statement, it should also be considered that acquiror tend to pursue similar deals over time (Amburgey and Miner, 1992). On the other hand, others believe that CEOs may suffer of overconfidence and of managerial hubris, which can give rise to declining performances over time (Billett and Quian, 2008; Ismail, 2008). In this regard, Aktas et al. (2011) noted that acquirors tend to increase their bidding aggressiveness after receiving positive market reactions about their previous acquisitions. Nevertheless, also the hypothesis that returns can diminish because of an increased competition in the market (Espen Eckbo, 2009) finds support in data, thus linking the worsening of the performances not only to the acquirors behavior, but also to external factors.

Even though the aforementioned differences between M&As and IPOs make these two exit paths quite diverse, there are many signals that are similarly effective in both these exit options (Wu et al., 2013). In order to study the most relevant and meaningful signals that are used in acquisitions, Wu et al. (2013) suggest dividing them with respect to the two main phases of the acquisition process in which they can be used, which are the target selection and the valuation.

The *target selection* is a crucial step for the development of a successful takeover, as the selection of the wrong target can lead to integration difficulties and, ultimately, to the failure of the acquisition (Wu et al., 2013). Therefore, signals can help to solve this inefficiency and reduce the risk of adverse selection, having a positive effect on the target's probability of being acquired (Ragozzino and Reuer, 2007). During this phase, also in M&As, it seems that being backed by prominent VCs and being part of prominent alliances can

increase the probability of being chosen as a target (Reuer et al., 2012). Anyhow, a relevant limitation of the main studies performed on this topic (Ragozzino and Reuer, 2007; Reuer et al., 2012) is that the sample of targets of the acquisition considered is made of publicly listed companies, for which the information asymmetry problem is lower. During the target selection, one of the main factors that influence the choice of a specific target is the geographical distance between acquiror and target, which is inversely proportional to the probability of being selected (Grote and Umber, 2006). This consideration is going to have great importance for the construction of the models proposed in this thesis, as the geographical distance is going as a factor to distinguish between informed and non-informed bidders.

Once the right target has been identified, the *valuation* phase follows. During this phase, the central concept for the use of signaling theory is the one of acquisition premium, which is the difference between the market value of the target and the price paid (Wu et al., 2013). Given that, at this stage, information asymmetries still persist, the signals described before, namely the presence of prominent VCs and strategic partners, can still play an important role, even though it is different. In fact, while before the effect of these signals was easing target selection, during this stage signals would allow to reduce the discount that buyers tend to apply to their offer price as a result of information asymmetry, thus allowing to receive higher acquisition premiums (Reuer et al., 2012).

1.6   Modelling acquisitions: the use of auction theory

A growing number of scholars have proposed to model acquisitions as auctions. In fact, there are many similarities between acquisitions and auctions (Fisherman, 1988), and the main ones are listed hereafter.

1. The sale of a company is an event that occurs only once or, at most, a couple of times during its lifecycle and, in the same way, also many items typical of auctions, like artworks or wine, are auctioned just very few times (Ashenfelter, 2018). As a consequence, in both cases the seller can be considered like a monopolist (Bulow and Klemperer, 1996);

2. During the sale of a company, it is very likely to have more potential acquirors showing interest for taking over it and, in order to finalize the acquisition, they should

propose better conditions to the seller. In the same way, in auctions usually many bidders are present and, in order to win, they must outbid the others;

3. From the seller's perspective, in many countries the Board has the "fiduciary obligation to accept the highest offer" (Espen Eckbo, 2009) and, in the same way, auctioneers accept the highest bid.

Inside the growing number of studies that use auction theory as a basis to model acquisitions, it is possible to distinguish two main strands of literature, which differ for the approach used. In the first one, which is also the most numerous in terms of papers available, the studies approach the problem in a purely mathematical way, namely through the development of a tailored theoretical model of the auction and without recurring to any empirical evidence; from the perspective of this thesis, these studies are of great importance, as they can provide a structured theoretical background for the development of the hypotheses and for the analysis. On the other hand, other scholars have developed papers based on statistical studies that analyze samples of real data; these studies, which are fewer in number, are important for this thesis as they are based on the same approach used here, providing important information on the state of the art on this topic.

Before entering in the details of the models, it is worth to clarify two alternative hypotheses about the bidders' valuation of the target that are recurrent among auction studies. In fact, scholars usually make a distinction between common value and private value auctions. In common value auctions, the value of the sale item is the same for every bidder (i.e., common), but they have a different level of information about it (Athey and Segal, 2013) as a result of the noisy signals that they receive (Espen Eckbo, 2009), making the valuation of each bidder different. On the other hand, in private value auctions each bidder perfectly knows his true valuation of the sale item, as it is a result of his personal evaluation skills, and thus he does not suffer of the winner's course (Espen Eckbo, 2009). Given that in private value auctions valuations are based on individuals' capabilities, each valuation is independent from the ones of the other bidders (Athey and Segal, 2013).

Clearly, actual settings are usually in between these two hypotheses, as on the one hand bidders suffer of the information asymmetry and are likely to update their valuation when additional information are provided but, on the other hand, each bidder has individual abilities in evaluating the target and might benefit of specific post-acquisition synergies, and

thus he is going to have his own valuation. To make these considerations more practical with an example, trade buyers might be interested in a target due to the specific synergies that could arise, making the value private; on the other hand, all the bidders could be able to exploit the same benefits from the acquisition (e.g., cost-cutting, the possibility to enter in a new market), so some components of the valuation should be common (Espen Eckbo, 2009).

1.6.1   Mathematical models

As previously said, this category represents the most numerous one in terms of contributions and, consequently, it provides more variegated results. The study proposed by Bulow and Klemperer (1996) can be a good starting point for the analysis of this series of papers, as it allows to clarify how these studies are generally structured and to introduce one of the pivotal points of this thesis, namely the relevance of the number of bidders for the exit valuation. In particular, Bulow and Klemperer (1996) developed a mathematical model of an auction, in which the expected revenue for the seller is a function of the value of the company's assets and of the signals that the bidders receive, with the aim of understanding whether it is more profitable to pursue an auction with no reservation price or an optimally structured negotiation characterized by one bidder less. The optimally structured negotiation is defined as an auction between the N bidders followed by a final "take it or leave it" offer to the only remaining bidders. Bulow and Klemperer (1996) have been able to demonstrate that it is always more profitable for the seller to pursue an auction with $N+1$ bidders, putting a cap on the relevance of the seller's bargaining power. In fact, findings suggest that having additional bidders has a strong positive effect on price, so sellers should focus their efforts on this aspect. In this regard, sellers should not be willing to accept any type of lock-up agreement that one of the buyers might propose, as it would limit the possibility to have other bidders (Bulow and Klemperer, 1996). In the same way, also the idea that having a lower number of bidders can have a positive effect on the valuation as it allows to maintain control on the negotiation (e.g., Choper et al., 1989) seems not to be backed by these results. Finally, it is worth underlying that these findings have been tested under both the hypotheses of private value and common value auctions and thus they can be considered quite robust.

Anyhow, one of the main limitations of the contribution proposed by Bulow and Klemperer (1996) is that the presence of different levels of information among the bidders

has been included as one of the factors affecting the final valuation, but no considerations about how to influence bidders with signals and about how to leverage on this asymmetry between bidders have been made; in any case, some of the successive studies address this limitation. For the sake of simplicity these studies can be divided into three main sub-categories, based on the different perspective that they take on the topic. In particular, in the following part a first study which enters in the detail of the differences among heterogeneous bidders is going to be presented; then, three studies that consider the case in which some of the bidders already hold a toehold in the target are going to be discussed; finally three further studies that evaluate the sale from the perspective of the incumbents are going to be described.

The first contribution is the one of Povel and Singh (2006), who propose an auction setting in which there are only two bidders, of which one is better informed than the other. The main problem related to this setting is that the less informed bidder is likely to fear the winner's course, namely, to have an over optimistic valuation of the target that leads to over-paying it by beating a better-informed bidder, and thus he is likely to discount this factor in the offer price. Therefore, given that the lower offer of the less informed bidder has a negative effect on the overall sale price, Povel and Singh (2006) propose to use a two-stages selling procedure, which discriminates against the better-informed bidder in order to re-balance the situation. In particular, according to the authors, in the first stage the target should enter in negotiations with the better-informed bidder, asking him to make an offer; if the offered price is sufficiently high, the target should accept it and terminate the process without involving the less-informed bidder, otherwise the target should ask both the better-informed and the less-informed bidder to join a modified first price auction. The auction is defined as "modified" because the bids of the better-informed bidder are discounted by a certain factor, so that, even if his bid is the highest, he may still not win the auction. If the better-informed bidder decides not to join the auction, then the target is proposed at a lower price to the less-informed bidder. In this way, the chances of winning are reduced for the better-informed bidder, and this should push him to bid more aggressively, enhancing the target's revenue. To a certain extent, this approach could be considered similar to setting a reservation price, but it is actually more efficient than that, as the reservation price does not push the better-informed bidder to bid more while it increases the risk that the target is not sold. Additionally, the authors also argue that this sale technique complies with the Delaware Law, as if

both the Board and the Shareholders decide to commit to this selling model before the sale due to the higher expected revenues, then this approach would not encounter legal limitations.

Moving to the second group of papers, having an initial toehold in the target is one of the most studied sources of asymmetry and, to a certain extent, it is also one of the easiest to determine. Therefore, many scholars have paired the concept of heterogeneity to the specific situation in which some of the bidders hold an initial toehold in the target. Given the relevance of toeholds in the entrepreneurial literature, it is first of all necessary to understand why they push toe holders to have a more aggressive behavior during the auction (Singh, 1998; Bulow et al., 1999). There are two main reasons for this behavior:

1. Having a toehold means being both a buyer and a seller in an auction context, so a toe holder gets a payoff even in case of losing the auction (Loyola, 2012);
2. The risk and the cost of overbidding is lower for a toe holder, as the number of shares to be bought is smaller (Loyola, 2012).

In this direction, the first contribution presented here is the one of Loyola (2012), who has developed a model, under the assumption of independent private values, in which two asymmetric bidders are interested in fully acquiring a target in which they both hold a toehold. In particular, the asymmetry arises from the fact that one of the two bidders, defined as aggressive bidders, has a bigger toehold than the other. According to the mathematical model, if it is not possible to set a reservation price, then a two stages negotiation is the option that allows to extract the highest value from the sale; during the negotiation, the target should firstly make a take-it-or-leave-it offer to the aggressive bidder at a high price and, if refused, should make another take-it-or-leave-it offer to the other bidder. In general terms, this is consistent with what found by Povel and Singh (2006), as also in this case discriminating against the stronger bidder leads to higher revenues. However, the superiority of the negotiation with respect to an auction does not hold anymore when there is the possibility to set a reservation price.

A similar perspective has also been considered by Ettinger (2009), who analyses a setting characterized again by the presence of two bidders, but of which only one holds a toehold in the target. The acquisition is modeled as an ascending auction with independent

private values. Anyhow, the main difference with the previous model is that Ettinger (2009) introduces the concept of participation cost, which makes the model way more realistic. In fact, in real settings, acquirors need to perform a series of due diligence activities before deciding to get involved in the acquisition of a target, and the costs related to these activities occur before the auction. In particular, performing an acquisition requires a strong involvement of the top management, which entails a matter of opportunity costs, and the involvement of pools of consulting firms, bankers and lawyers, whose services are expensive (Ettinger, 2009). Again, through the development of a tailored mathematical model, the main finding of this study is that the stronger bidder always deters the other one from participating to the auction. In fact, the toe holder, being both a buyer and a seller, can have a relevant payoff even if the price is high, having an incentive to push the price upward. As a consequence, the decision of participating to the auction would be characterized by a negative expected value for the other bidder, deterring him from making an offer to acquire the target. This last consideration has relevant implications for the target, as the lower competition has a negative effect on the sale price (Vickrey, 1961). Therefore, the target should concentrate on making the participation costs as low as possible, so that it is possible to attract other bidders. In practical cases, the reduction of the participation costs is likely to happen, as it is in the best interests of the selling shareholders.

Finally, Dasgupta and Tsui (2003) study a setting in which there are always two heterogenous bidders, but in which there are two different sources of heterogeneity, which are the difference in initial toeholds and the asymmetric effects of the signals on the bidders' valuation; this second factor is very important in order to make the mathematical model more realistic, as bidders are usually characterized by different competences and abilities in evaluating the target, making the contingent effect of the signals different. The setting proposed in this study is based on a matching auction, which is a particular type of auction in which one of the bidders just needs to match the bid of the other bidder in order to win. In this setting, a matching auction is useful because it allows to discriminate against the stronger bidder, and this is achieved by imposing an order of moves in which the stronger bidder has to bid first and can bid only once, while the second one just has to decide whether to match the offer of the stronger bidder and win or to refuse to participate. According to the model, if the effects of the signals on the two bidders are symmetric and the toeholds that they hold are asymmetric or if the toeholds are symmetric and the two value functions are asymmetric

(i.e., there is a relevant level of asymmetry among the bidders), then the matching auction described before is better than all the other types of auctions, allowing to achieve a higher sale price.

The last group of studies analyses this setting in the specific case in which incumbents are involved in the acquisition. Becker et al. (2016) approach the problem by starting from the consideration that, in recent acquisitions like the one of Instagram ($1 billion) or the one of Tumblr ($1,1 billion), the price paid for the two companies was enormous with respect to their low revenues and the high level of uncertainty on future performances. As a consequence, the authors believe that there are some ventures that seems to be "born to be sold" (Beckers et al., 2016), as they are able to attract the interest of the incumbents even though they are characterized by negative profits. In fact, these start-ups usually enter a market dominated by incumbents and, thanks to a superior value proposition, are able to rapidly increase their market share at the expense of the other players, which react by acquiring them. It is interesting to note that these start-ups usually have very limited resources, thus making the support of the incumbents necessary in order to survive; therefore, if all the incumbents decide to ignore these start-ups, these are likely to unsuccessfully terminate their business due to the low level of profitability. However, if at least one of the incumbents shows interest in acquiring the start-up, also the others might become interested in buying it, as they fear the negative externalities that could emerge. As a consequence, this type of start-ups has an incentive to generate noisy signals about the interest of one or more competitors to push all the other to react, so that they can influence the M&A process in their favour (Kesner et al., 1994). In this direction, findings suggest that the bidding behaviour of the incumbents is mainly influenced by the uncertainty about other bidders' behaviour and, only to a lower extent, by the perceived threat of the start-up activities with respect to their core business (Becker et al., 2016).

A similar setting has been proposed by Ding et al. (2013), who underline that, when talking about horizontal mergers, the fact that bidders are competitors generates further complexities in the auction dynamics. In fact, non-winning bidders are subject to positive externalities when the synergies between the winning bidder and the target are low, while they are subject to negative externalities when these synergies are high. Under these circumstances, if the acquisition is modelled like a Cournot oligopoly, it comes out that profit-share

auctions are expected to provide higher revenues for the seller. Profit-share auctions are a particular type of auction in which the winning bidder awards the target's shareholders with a stake of the merged company, which will allow them to receive a portion of future profits (Ding et al., 2013). In this regard, Ding et al. (2013) have also been able to collect evidence about the increasing use of profit-share auctions in real settings.

Finally, Pagnozzi and Rosato (2016) propose a different perspective on the topic, starting from the consideration that usually companies, when entering a new market, decide to acquire one of the current players. According to the authors, there are three main factors the new entrant considers when selecting the target, which are:

1. The *takeover mechanism*, which in this model is defined exogenously and can be either an auction or bilateral negotiations;
2. The *market share* of the target;
3. The *expected synergies* that should arise from the acquisition.

In this setting, the bidders are modelled as asymmetric and compete in a Cournot oligopoly. In such situation, Pagnozzi and Rosato (2016) suggest that, if synergies are high, the acquisition generates a negative effect on the incumbents, which, in turn, might be willing to offer more than the true value of the target in order to preserve their business. As a consequence, if the takeover mechanism is an auction, the external acquiror is likely to choose a target that generates lower synergies in order to be able to pay it a fair price, as the acquisition would not generate negative externalities for the incumbents. On the other hand, in case of private negotiation, the incumbents are not able to participate in the acquisition and thus the final price is lower, generating lower profits for the target. Anyhow, while different takeover mechanisms can create both advantages and disadvantages for the counter-parties involved, Pagnozzi and Rosato (2016) argue that the final losers of this situation are the customers, as the acquisition often results inefficient.

1.6.2   Statistical studies

As stated in the introduction of this chapter, the studies that analyse a sample of real data to draw conclusions are lower in number. In particular, one of the most complete

contributions is the one of Espen Eckbo (2009), who has provided a complete analysis of the most important statistical findings on this topic.

One of the main aspects that scholars have studied through actual data is related to the concept of jump-bidding, namely making bids with a substantial premium on the pre-auction price in order to signal to the other potential bidders a high private value and deter them from the competition (Fishman, 1988; Dodonova and Khoroshilov, 2014). Evidence suggests that jump bids are widely used, as Betton and Eckpo (2000) have been able to demonstrate on a sample of 454 acquisitions that the average jump between the first and the second bid is 10%, the double of the average jump among all the bids, which is 5%. Jump bids can be very effective, but there are two main factors that could limit their effect (Espen Eckbo, 2009). In fact, if the investigation costs are low, other bidders might still decide to participate, as the probability of obtaining a positive payoff is higher. Similarly, if the analysis and evaluation of the target has been performed before the auction, at the time of the auction the cost related to the evaluation can be considered sunk and thus no more relevant for the calculation of the payoff (Espen Eckbo, 2009).

Finally, the paper proposed by Gorbenko and Malenko (2014) analyses the acquisition valuation with respect to the type of acquiror, distinguishing between strategic and financial bidders. The main difference between the two types of acquirors is that, while strategic bidders are usually competitors or part of the target's supply chain that aim at achieving synergies, financial bidders are mainly represented by private equity firms, who generally look for undervalued targets. The study is based on a sample of 349 takeover auctions occurred between 2000 and 2008. The analysis shows that, in general, strategic bidders value the targets more, as they consider the possible arising synergies in the offer price; however, companies characterized by bad performances are usually valued more by financial bidders, as they are more experienced in turning around companies under pressure and they can ensure cheaper access to financing. It is also interesting to note that financial bidders' expenditures seem to be correlated with macroeconomics indicators. Therefore, it is possible to conclude that the heterogeneity of targets and bidders is a relevant topic, as different targets usually attract different bidders.

2 Theoretical background and hypotheses development

After providing an overview of the main literature available on the topics of auction theory and signaling theory in corporate acquisitions, the aim of this chapter is to define in the detail the research objectives of this thesis. In particular, this thesis lays on two theoretical building blocks and, consistently, this chapter is divided into two main parts. The first part of this chapter is focused on the theoretical background on auction theory that allows to hypothesize a positive effect of the number of bidders on the auction price and, in particular, that this effect should be driven by the presence of informed bidders among them.

On the contrary, the second part of this chapter aims at backing the use of signals in corporate takeovers. In particular, this thesis aims at evaluating the effect of signals related to the human capital of the company and to the presence of VCs when the acquisition is modeled as an auction.

2.1 Auction theory

In general, auctions represent a prominent element of the economic environment, as a series of economic transactions are performed through auctions, ranging from simple online auctions, like the ones on eBay, to Government contracts (Klemperer, 1999). Therefore, also scholars have widely studied this topic and have produced an abundant literature on auction theory, analysing many different auctions settings and modelling a great variety of possible situations. In fact, one of the main factors influencing the outcome of the auction is the auction procedure, as the winning bidder and the price paid can differ a lot in different settings (Vickrey, 1961). Even though the range of possible auctions procedures is very broad, there are at least three recurring aspects that, in any setting, need to be defined and that allow to categorize the studies available in literature. First of all, auctions can be open or closed; while in the former the bidders can submit multiple bids with the only condition of being higher than the current highest bid, in the latter all the bidders can submit just one

bid, all at the same time, without knowing the bids of the other bidders (Vickrey, 1961). Then, auctions can be either ascending or descending; in the case of ascending auctions, the price starts low and grows until there are bidders willing to offer more, while, in descending auctions, the price starts high and decreases until one of the bidders is willing to buy (Chen et al, 2011). Finally, auctions can either be first-price or second-price; the difference is that, in the first type, the price paid is equal to the highest bid, while, in the second type, the price paid is equal to the second highest bid (Chen et al, 2011). Upon these three dimensions, auctioneers can then decide to include additional complexities that allow to better fit the auction procedure to the specific situation (Vickrey, 1961).

By combining the three aforementioned dimensions, it is possible to define the following four types of auctions, which are considered by scholars the most common and classical ones and that, consequently, are the basis of the vast majority of the studies (Krishna, 2010; Chen et al., 2011).

The first type of auction is the *open ascending auction*, also known as English auction, which is considered to be the simplest procedure (Vickrey, 1961). In this setting, the bidders can make an unlimited number of ascending bids, until the moment in which none of them is willing to continue raising (Costa Filho et al., 2016); therefore, if the bidders are rational, the sale price will be equal to the second highest valuation that bidders give to the selling object, as when the price reaches this level only one bidder should be willing to continue the auction, thus winning (Vickrey, 1961).

The second classic type of auction is the *open descending auction*, also known as Dutch auction, as it became famous in the context of the sale of tulips in Dutch markets. In this setting, the auctioneer starts from a high price and announces the prices in a descending way, until one bidder decides to make his bid and wins the auction. The main problem that each bidder faces when deciding to make a bid is that, if the price paid is higher than the bidder's valuation of the object, the purchase is not going to be profitable, while, if the bidder decides to wait too long in order to pay a lower price and make a higher profit, there is the risk of being outbid by other bidders. Therefore, at the equilibrium, each bidder should bid when the price reaches his personal valuation of the object (Vickrey, 1961).

The third type of setting is the *first-price sealed-bid auction*, in which all the bidders bid only once, simultaneously, and the highest bid defines who the winner is. With respect to the price paid, this auction setting is usually considered similar to the Dutch auction, as in both cases bidding more than the true value of the objects leads to a condition that is not profitable, while bidding less entails the risk of being outbid by other bidders (Costa Filho et al., 2016). As a consequence, at the equilibrium, also in this case each bidder's bid should be equal to his personal valuation.

Finally, the fourth type is *second price sealed-bid auction*, also known as Vickrey auction, in which all the bidders submit their bid only once and simultaneously; the bidder with the highest offer is the one who wins the auction, but the price paid is equal to the second highest bid. For what concerns the equilibrium price, this case is usually analysed together with the English auction, as also here the price paid at the equilibrium should be equal to the second highest bid (Vickrey, 1961).

Among these auction settings, the most used one for modelling M&As is the traditional English auction for the three main reasons listed hereafter (Fishman, 1988; Ravid and Spiegel, 1999). Consequently, also in this thesis work the sale is going to be through an English auction.

1. It is the simples and most straightforward model, with an equilibrium that can be easily identified and studied (Vickrey, 1961);
2. Existing laws do not impose a specific bidding order, and allow bidders to revise their bids (Ravid and Spiegel, 1999);
3. In many markets, like in the US with the Delaware Law, the Board of Directors or the special committee that has been organized to manage the sale have the legal obligation to extract the highest possible price from the sale (Loyola, 2012); therefore, even if particular auction settings could theoretically generate higher profits for the seller, the seller should always be in the position of accepting higher offers, and the traditional English auction ensures that this rule is respected (Loyola, 2012).

From the perspective of auction models, the sale of an entrepreneurial venture can be considered as the simplest case possible, as the sale of a company corresponds to the sale of single and unique object, for which it is easier to identify equilibriums (Vickrey, 1961); on

the contrary, when auctions involve commodities or, in general, objects in large quantities, the chances of having an optimal allocation of resources are considerably reduced (Vickrey, 1961).

2.1.1   Auction price determinants

By analyzing the literature on auction settings, it is possible to identify the main factors that influence the sale price. Among these factors, two of them are at the basis of the hypothesis development and are going to be discussed in detail in the dedicated Chapters 2.2 and 2.3. These factors are:

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

Additionally, there are at least three additional major factors that influence the final valuation that are out of the scope of this thesis work. Anyhow, it is worth to briefly summarize them here in order, on the one hand, to provide a more complete perspective on the topic and, on the other hand, to better clarify which factors are not going to be considered in this thesis.

The first one, as introduced in the first part of Chapter 2.1, is related to the *specific auction mechanism* selected to perform the sale (Vickrey, 1961). Even though some mechanisms might be able to theoretically extract higher profits from the auction, the sale of a company is usually modelled with an English auction, for the reasons discussed in Chapter 2.1.

Secondly, the power balances in auctions settings can be completely changed when one or some of the bidders *hold a toehold in the target* (Ettinger, 2009; Loyola, 2012). The main effect of toeholds is that toe holders tend to bid in a more aggressive way, as during the auction they are both sellers and buyers, while they also have better information on the target than the other bidders. Therefore, literature has focused on proposing a solution to this problem based on the implementation of asymmetric auction settings aimed at discriminating against toe holders to re-balance the situation.

Finally, the *presence of competitor companies* among the bidders can further increase the competition, as competitors might fear the negative externalities coming from the acquisition of the target by another company (Ding et al., 2013; Pagnozzi and Rosato, 2016). As a consequence, being their payoff negative in case they lose the auction, competitors might be pushed to raise their bid up to a level that is not economically beneficial.

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

The effect of the number of bidders on the seller's revenue has been considered by many scholars in studies about auctions, as the importance of this aspect is common to all the auction settings and it seems to have a relevant effect on the sale price. The intuition behind the importance of the number of bidders on the sale price is that, if a greater number of bidders decides to join an auction, the competition increases, pushing each bidder to offer more (Holt, 1979). In fact, under the assumption of being rationale, each bidder would try to maximize his personal payoff, which is the difference between his true valuation of the auctioned item and the price paid. Therefore, if there are few bidders, or, in the limit case, even just one, this one would not have an incentive to offer more than the minimum, and all the profits would be made by the buyer (McAffee and McMillan, 1987); on the contrary, when the number of bidders is approaching infinite, the sale price would tend to the highest possible valuation, with all the profits that would be made by the seller (Holt, 1979).

The fact that competition pushes bidders to bid more aggressively and, consequently, enhances the seller's revenue can be found in a series of mathematical representations of auctions (Holt, 1979). A simple but complete example is be the one of the *homogeneous rectangular case*, a mathematical model in which the individual values (v_i) for all the N bidders are drawn from the same rectangular distribution (Vickrey, 1961); for the sake of simplicity, the limits of the rectangular distribution are usually 0 and 1. Under the assumption that bidders' choices are represented and driven by a linear utility function, there is a unique equilibrium for all the bidders, which is to bid $\frac{N-1}{N} \times v_i$ (Vickrey, 1961). As a consequence, the expected sale price p should be

$$p = \frac{N - 1}{N + 1} \quad\quad\quad (2.1)$$

and it is valid both for first price and second price auctions (Vickrey, 1961). Therefore, given that the first derivative of the sale price with respect to N is positive for any value of N, it can be concluded that this mathematical model hints that the competition pushes bidders to bid more and, as consequence, pushes the sale price up.

Given that auctions are widely used in the economic environment, ranging from online auctions to the ones managed by the government (Roth and Ockenfels, 2002), it is possible to find some evidence about the importance of the number of bidders in different sectors. Starting from a simple and everyday setting, Bapna et al. (2008) have studied the dynamics of price formation in a sample of 1009 eBay auctions. Coherently with what stated above, results suggest that the arrival of additional bidders has a positive effect on the price growth, even though this effect seems to be reduced towards the end of the auction.

On the other hand, it is worth mentioning that a minority of scholars has put a cap on the importance of competition for the specific case of common value auctions (Gilley and Karels, 1981). In fact, even though these studies recognize that the existence of a competitive effect that pushes the price up, they also suggest that more competition makes the winner's course problem more severe, as there might be more informed bidders to outbid, consequently pushing all the bids down (Hong and Shum, 2002); therefore, according to these scholars, the two effects could offset each other (Pinkse and Tan, 2005) and, given that this balance could result to be negative for the seller, the focus should not be just on increasing the number of bidders (Menicucci, 2009). Among the others, Hong and Shun (2002) have provided evidence about the occurrence of this phenomenon in auctions for construction contracts, while Sendak (1991) has found similar results in timber auctions.

Moving to studies focused on the use of auctions in corporate acquisitions, an initial hint about the relevance of the number of bidders for the final valuation has been provided by Bulow and Klemperer (1996). This study has already been presented in Chapter 1.6.1, and its main finding is that, from the price standpoint, for the seller it is always better to have an additional bidder than to develop an optimally structured negotiation procedure.

Therefore, according to these findings, there is a cap on the importance of the seller's bargaining power, who should consequently focus on maximizing the number of bidders.

On the other hand, the problem of the number of bidders can also be analyzed from an opposite perspective, as having a low number of bidders can result in leaving the ones with a higher valuation out of the auction, which is the point raised by Hounwanou (2018). One necessary pre-condition for this result is the presence of entry costs, as they generate a negative payoff for the bidders if the acquisition is not finalized. In fact, given that these costs have to be faced before the auction, they can trigger potential inefficiencies. In actual settings, these costs are mainly related to the due diligence activities, which have to be carried out before deciding to make an offer. Entering in the details of the model, in the proposed setting bidders are modelled as risk neutral and have the possibility to hold a toehold in the target prior to the auction. The interesting finding is that, given that bidders have different private valuations, the probability that the bidder with the highest valuation decides not to take part in the auction is not zero, and it is directly proportional to the size of the toehold in possession of the other bidders. As a consequence, this situation can generate a clear inefficiency and have a negative effect for the seller on the price paid. Therefore, given that there is the possibility that bidders with a high valuation decide not to take part in an auction, having a higher number of bidders can limit and partially address this problem.

Moving to the side of practical evidence about the importance of the number of bidders for the valuation in acquisition, it is first of all worth mentioning that the literature on this topic is rather scarce. One of the main studies has been provided Bradley et al. (1988), who have analyzed the effect of the number of bidders on a sample of 236 acquisitions occurred between 1963 and 1984. The authors consider just two possibilities for the number of bidders, which are single-bidder and multi-bidder auctions. The results of the analysis show that targets in multi-bidder scenarios are able to obtain higher gains, and that the price paid in these situations by the acquirors can also reach levels that make the takeover unprofitable for the buyer. Additionally, Bradley et al. (1988) also underline that the companies that are able to attract more bidders seem to be the best ones for the buyers, as they are the ones that are able to generate the highest level of synergies after the acquisition.

Summarizing, it is possible to say that the positive effect of the number of bidders on the final valuation is a topic that seems to be strongly backed by theoretical results, but that

still misses a complete practical evidence. In fact, the study of Bradley et al. (1988) only shows that having multiple bidders is better than having just one, while, on the other hand, the mathematical models mentioned above predict that, more generally, the valuation should grow together with the number of bidders. Therefore, the first hypothesis of this thesis is going to be related to understanding whether this tendency is backed by actual results or not. As a consequence, the following hypothesis can be advanced:

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

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

In general, corporate acquisitions are characterized by strong levels of information asymmetries among the counterparties involved (Ragozzino and Reuer, 2011), which often lead to an inefficient outcome (Akerlof, 1970). In fact, in order to properly evaluate the target, potential acquiror should be informed about the target's technology, growth prospects, human capital, brand and key customers and partners, but these information are not evenly distributed among buyers and sellers (Ragozzino and Reuer, 2011). The direct consequence is that buyers are likely to face the problem of adverse selection, consequently discounting the information asymmetry in the offer price and lowering the profits for the seller (Wu et al., 2014). Therefore, to better understand the auction dynamics and to better determine which are the factors that influence the sale price the most, it is necessary to deep dive into the characteristics of the different players that take part into an auction, in order to have an understanding of the information they hold.

The most straightforward distinction is clearly the one between buyers and sellers, as, in the auction, they have opposite roles and objectives. Given their different positions in the auction, there can be a strong information asymmetry among them, as sellers usually hold better information about the current state of the business, as well as on future growth potentials (Povel and Singh, 2006). As a consequence, even though this information asymmetry is, at least partially, physiological, bidders tend to discount this factor in the offer price, thus reducing the profit for the seller to reduce the risk of overpaying the target (Povel and Singh, 2006).

Anyhow, for what concerns the development of *Hypothesis 1*, the most interesting and important information asymmetries are the ones among bidders themselves, which are the result of their distance, in broad terms, from the target. Indeed, the concept of distance between target and bidders in this thesis has three main dimensions:

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

In general, the role of the acquiror can be played by a wide variety of players, both coming from the same industry of the target as well as from other industries. Therefore, a primary source of asymmetry is the distance between the target and the potential acquirors in terms of industry (Povel and Singh, 2006). Starting from the closest players, bidders can potentially even be internal to the company; this is usually the case of managements bids, in which the managers, or a sub-group of the top managements, decide to declare interest in acquiring the company (Povel and Singh, 2006). Given that the managers work for the company, the information they hold about the quality of the company and about its growth potential should be better than the ones of the other potential acquirors, allowing a more precise valuation of the target.

Moving to the external bidders, these can first of all be competitors of the target company (Povel and Singh, 2006), which are usually particularly interested in the potential synergies that could arise from the acquisition (Gorbenko and Malenko, 2014). In this case, given that the business of the bidders is the same as the one of the target, it is still possible to state that bidders should hold high quality information about the target, being in a good position to understand its real economic valuation (Wu et al., 2014). Similarly, also suppliers, customers and, in general, other players of the target's supply chain can have the abilities and the information to make a proper valuation of the target, for the same reasons expressed for competitors (Gorbenko and Malenko, 2014). Moving further from the target, all the remaining bidders belong to a different industry from the one of the target and therefore should have more difficulties in estimating the proper valuation. Anyhow, this last group also include equity investors, like VCs and PEs, which are very different from all the other bidders in terms of business model, but which play a crucial role in the growth and in the development of start-ups. In fact, these investors are likely to have less experience in specific

industries than current players, but they have more knowledge about how to evaluate the target and how to manage it; additionally, their network usually allows them to obtain more favourable conditions for financing (Gorbenko and Malenko, 2014). Anyway, it is interesting to note that usually "financial bidders" and "strategic bidders", which is the group under which all the other bidders described above can fit, usually target different companies and are rarely in direct competition (Gorbenko and Malenko, 2014). In fact, financial bidders seem to prefer "targets that perform poorly and have few investment opportunities" (Gorbenko and Malenko, 2014), so that they can buy them at a discounted price and exploit their ability in turning around poorly managed businesses. For this thesis work, only companies that had made an acquisition in the same industry as the one of the target have been considered as potential bidders; therefore the concept of industry distance is considered, but it is not used as a proxy of information asymmetry as all the bidders should be quite close to the company. Nevertheless, a more detailed description about how bidders have been identified will be provided in Chapter 3.

In order to differentiate between informed and non-informed acquirors, many scholars have proposed to use the geographical distance between the target and the acquiror as a proxy of information asymmetry (Coval and Moskowitz, 2001; Portes et al., 2001; Ivkovic and Weisbenner 2005; Ragozzino, 2009; Ragozzino and Reuer, 2011; Chakrabarti and Mitchell, 2013; Bick et al., 2017). In fact, in order to conclude a successful acquisition, acquirors need to have a huge amount of information about the target, and the geographical distance can play a crucial role in its collection (Ragozzino, 2009). Additionally, this need for information, which is present in any type of transaction, becomes even more significant in the case of start-ups, because their valuation is more complicated as it is strongly based on intangible assets, whose value is, by definition, harder to be defined (Grote and Umber, 2006; Wu et al., 2014).

Entering more in detail in the dynamics that make the information asymmetry arise from the geographical distance, the root cause is mainly that local acquirors are more familiar with current market conditions and social dynamics (Ragozzino, 2009). Therefore, local acquirors can leverage on their network to engage managers, suppliers and customers in order to obtain better information about the target (Coval and Moskowitz, 1999); additionally, they can more generally collect information from other personal contacts in the industry and from

other sources, like the media (Coval and Moskowitz, 1999). As a consequence, farther acquirors are likely to experience adverse selection and, fearing the winner's course, are likely to discount the information asymmetry in the offer price (Ragozzino and Reuer, 2011). On the other hand, local acquirors should be in the right position to spot and estimate the real value of the target and to use the information they hold to outbid less informed bidders while still being profitable (Chakrabarti and Mitchell, 2013).

Moreover, geographical distance can also make some additional costs arise, further lowering the maximum offer price of non-local bidders. First of all, the research of information itself is a costly process, as it usually entails the need of involving external advisors (Chakrabarti and Mitchell, 2013). Additionally, acquisitions can generate litigations (Chakrabarti and Mitchell, 2013), and local bidders are likely to have a better knowledge of local regulations and should be more capable of managing the deriving complexity (Ragozzino, 2009). The matter of increased costs does not end when the acquisition is over, as geographical proximity also allows to ease the monitoring and management of the acquired company (Grote and Umber, 2006). The concept of costs is also strictly related to the one of time, as if the settlement of the acquisition deal requires more time, the related costs are likely to be higher (Bick et al., 2017). Additionally, complex deals require the involvement of the top management for longer and increase the uncertainty surrounding the deal, creating costs both for the target and for the acquiror (Bick et al., 2017).

Lastly, also the cultural fit between targets and bidders can be a relevant factor influencing the acquisition settlement and success (Datta and Puia, 1995; Li et al., 2014). In literature, national culture is defined as "the collective programming of the mind distinguishing the members of one group or category of people from others" (Hofstede, 1980). National cultures are relevant because they strongly influence the characteristics of organizational cultures (Schenider and Meyer; 1991; Terprsta and David, 1991), making it possible to assume that stronger cultural differences between countries are likely to result in stronger differences between respective companies (Kogut and Singh, 1988; Datta and Puia, 1995). Including considerations about the cultural fit between targets and bidders is very important for the development of precise models, as the use of the sole geographical distance might not fully capture the liability of foreignness, namely the "the additional costs that multinational enterprises have to face relative to their indigenous competitors when operating in

foreign markets" (Denk et al., 2012); in fact, there might be historical frictions among close countries that might generate cultural problems (Buchner et al., 2018). The main reason for which cultural distance between targets and bidders generates information asymmetry (Reddy and Fabian, 2020) is related to the fact that cultural differences can make it hard for the investor to fully understand a business, its characteristics and its practices (Beugelsdijk and Frijns, 2010). Indeed, cultural distance can create a barrier for information sharing and can lower the level of trust among the counterparties involved, increasing the transaction costs (Li et al., 2014). Additionally, cultural differences can also affect the overall success of the acquisition, which is highly dependent on the post-acquisition coordination among the counterparties involved (Ahern et al., 2015). In fact, cultural distance can make the integration of the targets and of its employees more difficult and more costly, limiting the arising of synergies (Boateng et al., 2019), and increasing the agency costs (Buchner et al., 2018). Therefore, acquirors are likely to discount the asymmetries arising from the cultural distance in their offer price (Boateng et al., 2019), lowering the targets' profits.

Nevertheless, it worth mentioning that cross-border acquisitions can also be very beneficial for the acquirors that are able to overcome the barriers that different cultures create (Rottig et al., 2013), having a "double-edged sword effect" on the acquirors' performances (Reus and Lamont, 2009). Indeed, Reus and Lamont (2009) suggest that the integration of an acquired target is a complicated process, and cultural differences can have an "impeding effect" and generate unsuccessful outcomes; however, in the long run, the companies that hold the necessary integration capabilities can learn from the opportunity of being exposed to a different culture (Morosini, 1998), as diversity creates the potential for learning (Ghoshal, 1987). In any case, the literature presented in this paragraph suggests that cultural differences can negatively affect the quality and quantity of information that acquirors hold and, consequently, in this thesis it is going to be used as a proxy of information asymmetry.

Summarizing these considerations, local and culturally close acquirors should be more informed than the other acquirors, and this should allow them to better evaluate the real quality of the target and to make an offer in line with its true value. Additionally, the settlement of local deals should be less complex, bearing lower costs and needing less time for the completion, further increasing the potential profit for local acquirors. For all these reasons, acquirors should prefer to acquire targets that are geographically and culturally

close to them; accordingly, evidence supports this statement, giving rise to the so-called "home bias" (Grote and Umber, 2006).

Given that close acquirors should be more informed with respect to the others, they should not fear the winner's course as much as the other potential acquirors and thus they should be confident in outbidding them (Povel and Singh, 2006). Therefore, informed acquirors and, as a consequence, close acquirors, should be willing reach higher levels of bids with respect to other bidders, thus having a higher probability of winning the auction and improving the profits for the seller (Wu et al., 2014).

Evidence about the importance of being acquired by informed acquirors can be found in the work of Cheng et al. (2008), who have studied this phenomenon in a sample of 1612 publicly listed targets who have faced an acquisition between 1985 and 2006. Consistently with what stated before, one of the main findings is that, when the proxies they have selected to measure information asymmetry signal a high level of information asymmetry, the bid premium on the stock price that acquirors are willing to pay is lower. It is worth underlying that this effect is already present in a sample of publicly listed targets, for which the information asymmetry problem is considered to be less relevant due to the great amount of information that have to be published; therefore, it can be expected that this effect becomes even stronger in case of private companies. In this regard, different studies show that private companies usually face a discount of around 15%-30% on the sale price with respect to comparable public targets (Koeplin et al., 2000; Officer, 2007).

On the other hand, another interesting perspective has been provided by Dionne et al. (2015), who study the effect of information asymmetry in acquisitions on a sample of 1026 US companies acquired between 1990 and 2007. As in other studies and in this thesis work, the acquisition is modeled as an English auction. The variable that they use as a proxy of information asymmetry is a dummy that measures whether a bidder is a "block-holder", namely a toe holder that holds at least 5% of the target before the acquisition, or not (Dionne et al., 2015). In contrast to the concept presented before, according to which the presence of informed bidders should raise the sale price, this study suggests that block-holders can end up paying a significant lower premium with respect to less informed bidders, due to the fact that the bidders that do not hold private information decide not to join the auction or decide to withdraw at the very beginning due to the winner's course. Anyhow it is worth underlying

that considering as informed bidders only the ones that hold a 5% stake of the company is a very strong assumption, which makes it very difficult for an acquiror to be considered as informed.

Therefore, it seems that there is theoretical background about the effect of the presence of informed bidders on the auction price, while practical evidence is limited and, to a certain extent, also contrasting. Therefore, providing new evidence about this topic would be a relevant contribution.

Consistently, the following hypothesis can be advanced:

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

2.4   Signalling theory: definition and applications

Signalling theory has been widely used to describe the behaviour of the different parties involved in certain transaction when they have access to different information (Connelly et al., 2011). In general, information could be divided into public and private; while the formers are available for all the parties involved, the latter make the information asymmetry problems emerge, as they are available only to a minority of players, allowing them to take better decisions than the others (Stiglitz, 2002). According to Stiglitz (2000), the concept of information asymmetry can be related to two main aspects. On the one hand, it can refer to the concept of quality, and emerges when there is some uncertainty about the quality of one of the counterparties involved; on the other hand, it can also refer to a certain level of ambiguity about the intentions and behaviour of the counterparties involved, which gives rise to the moral hazard problem (Elizur and Gavious, 2003). For the purpose of this thesis, the theory of information asymmetry has been used to study the uncertainty of the target during acquisitions from the perspective of the bidders, while the part related to moral hazard has not been considered.

To introduce more in detail the concept of signalling theory as a solution to the problem of information asymmetry, the starting point has to be the paper proposed by Spence (1973), who presented this theory to study the behaviour of people in the labour market, in which the employers have a lack of information about the quality of potential employees.

Under these conditions, education can be a crucial element to distinguish between good and bad employees, as low-quality candidates would not be able to achieve high academic results, and, as a consequence, education can be considered a signal of quality. Similarly, Kirmani and Rao (2000) apply the same concept of signals to firms, suggesting that signals can allow to distinguish between high-quality and low-quality companies. In fact, considering that if high-quality firms are able to signal their true quality, they will obtain a higher payoff, while if low-quality firms signal their true quality, they will obtain a lower payoff, only high-quality firms have an incentive to send signals to outsiders.

In general terms, it is possible to say that, when using this theory, three key elements need to be identified. The first one, as previously said, is the signal itself, while the other two are the signaller and the receiver, which are the two actors involved in the transaction (Connelly et al., 2011). These three elements are presented more in detail below.

Broadly speaking, the role of the *Signaller* could be covered by either a person, a product or a company (Connelly et al., 2011), and much depends on the considered strand of literature. In particular, the organizational behaviour and human resource management studies focus on individuals, whether they are managers (Ramaswami et al., 2010) or employees (Hochwater et al., 2007). On the other hand, strategy studies consider both people and, in particular, managers (Garanova et al., 2007), firms (Zhang and Wiesema, 2009) and products (Lampel and Shamisie, 2000). However, the most interesting strand of literature for this thesis work is the one about entrepreneurial studies, which consider as signallers start-ups and IPO firms and their key personnel (Bruton et al., 2009); in particular, the majority of the studies have focused on the key managers of the company (Zimmerman, 2008), while others have also considered entrepreneurs (Elitzur and Gavious, 2003) and franchisors (Michael, 2009). In any case, signallers are usually in competition with other signallers, as they all have an incentive to send signals in order to be selected by the receiver, so a portion of them is likely to try to produce false signals. As a consequence, the potential presence of false signallers gives rise to a credibility problem for all the signallers involved (Johnstone and Grafen, 1993). The main solution that scholars have found to this problem is that a signal, in order to be credible, has to be costly (Connelly et al., 2011); in fact, if a signal is costly to be produced, low-quality firms are less likely to find profitable to use it and therefore only high-quality firms should be able to credibly show their true quality (Ndofor and

Levitas, 2004). Anyhow, signals are used to show hidden qualities and potential positive aspects, therefore their effectiveness strongly depends on the "signal fit" (Connelly et al., 2011) with the receiver. In fact, if the signal sends information about a quality that is not relevant for the receiver, its effectiveness is likely to be rather low (Connelly et al., 2011).

Moving to some deeper considerations about *Signals*, in literature it is possible to find a great variety of them, and the ones that are related to this thesis have already been presented in the literature review and will be further analysed in course of the chapter. Therefore, the focus of this part is more on analysing which are the characteristics of a good signal rather than of listing signals that have already been addressed by other scholars. Many of the studies agree that, in order to be effective, one of the most important characteristics of the signal is its visibility, namely "the extent to which outsiders are able to notice the signal" (Connelly et al., 2011); in literature, it is possible to find various names for this concept, like "signal clarity" (Warner et al., 2006) or "signal intensity" (Gao et al., 2008). Clearly, signallers should aim at the maximum level of possible visibility in order to properly convey their hidden quality. However, in order to enhance the effectiveness of the signal, signallers can also decide to work on its frequency (Janney and Folta, 2003), as signals are like snapshots of the signaller's quality in a fixed moment of time, and only their perpetuation allows to maintain the differentiation advantage (Davila et al., 2003). In particular, a higher level of signals frequency can be more effective if the signals sent are different among each other, as they allow to reinforce the good impression on receivers (Connelly et al., 2011). On the other hand, it is also very important to ensure consistency among the different signals, in order not to create confusion for the receivers (Fischer and Reuber, 2007).

Finally, also the role of *Receiver* can be played by a wide variety of actors, depending on the specific context. In particular, it is interesting to pinpoint that, while strategy researchers have considered both potential investors, shareholders and other stakeholders like the customers as receivers (Kang, 2008), entrepreneurial studies, which are again the ones related to this thesis work, have concentrated more on existing and potential investors (Busenitz et al., 2005). The importance of studying also the receivers is mainly given by the fact that, as previously said, there is a matter of fit between the signal and the receiver, and thus its effectiveness of the signal strongly depends on the characteristics of the receiver (Connelly et al., 2011). In particular, one of the first aspects that it is necessary to consider refers

to the receivers' attention, as if receivers are not continuously monitoring the environment the signals cannot be received and thus, by definition, cannot be effective (Gulati and Higgins, 2003). Once the signal is received, the second important aspect is related to interpretation, as receivers might give different importance and weight to the same signal (Perkins and Hendry, 2005). To summarize these considerations, a signal in order to be effective needs to be:

1. Costly, as only good signallers are likely to be able to absorb the cost related to a costly signal (Bird and Smith, 2005);
2. Visible, as the receivers need to be able to actually receive it (Connelly et al., 2011);
3. Consistent, on the one hand with the qualities of the signallers and, on the other hand, in line with what the receiver is looking for (Connelly et al., 2011).

Since the target companies usually suffer of the information asymmetry problem, it is their interest to signal to potential acquirers their quality, as this would allow to reduce the offer price discount (Wu et al. 2014) and overcome the adverse selection problem (Ragozzino and Reuer, 2011); therefore, signaling theory (Spence, 1973) has been extensively used to study acquisitions. In this thesis, the signals considered are related to two main domains. On the one hand, the first one is related to the presence of external equity investors in the ownership structure of the company and, in particular, to the presence of VCs. On the other hand, the second group is related to signals about the quality of the founding team of the entrepreneurial venture.

2.5   The presence of external equity investors

In general terms, the access to different sources of financing is clearly crucial for the development and growth of entrepreneurial ventures (Colombo and Grilli, 2006); nevertheless, obtaining a sufficient access to capital is one of the toughest challenges that entrepreneurs need to face when establishing and running a company (Kerr and Nanda, 2009).

The main reason behind the finance gap that entrepreneurial ventures face is the presence of frictions in credit markets, which do not allow good entrepreneurs to access the capital needed to implement their ideas (Beck et al., 2000; Carpenter and Petersen, 2002; Guiso et al., 2004). In fact, due to the small size of new-born firms and their relatively high

probability of failure, imperfections related to information asymmetry and agency costs arise, leading to credit rationing (Stiglitz and Weiss, 1981; Berger and Udell, 1998). Evidence about the existence of a finance gap for entrepreneurial ventures can be found in the correlation between the entrepreneur's personal wealth and the success rate of the founded company. In fact, high net worth individuals seem to be more prone to become successful entrepreneurs (Lindh and Ohlsson, 1996), since they can use their wealth to absorb the uncertainty that an entrepreneurial career entails, as well as a collateral for borrowings (Evans and Jovanovic, 1989). Under these conditions, a key role for the new companies' development is played by the local VC (Guiso et al., 2004) and banking system (Sorenson and Stuart, 2001), as they can leverage on the geographical proximity to reduce the screening and monitoring costs, narrowing the information asymmetry problem (Kerr and Nanda, 2009).

Due to the complexities and imperfections that characterize the credit market, the sources of financing that companies use throughout their lifecycle can be very different. In general, it seems that entrepreneurs tend to mainly rely on internal sources of financing for the very first period of the life of the entrepreneurial venture, using their own founds or the ones of close friends and family members (Fluck et al., 1998). Nevertheless, this use of insider finance soon reaches a peak, between two and nine years from the foundation of the company, after which the company starts to rely more on external sources of financing (Flick et al., 1998). These external sources can both be related to equity, where Business Angels (BAs) and VCs represent the most common counterparties, and to debt, which entails the involvement of banks (Fluck, 2000).

In particular, these sources of financing assume different levels of importance during the phases of the lifecycle of because the needs of a company in terms of capital dramatically evolve during its growth. According to Invest Europe, the main phases and needs of the financing process of a company are the following ones:

1. *Seed*: funding provided and used to do research and complete the product definition and design. These funds are not meant to support mass production;
2. *Start*-up: funding provided when the design of the product is complete in order to start mass production and to cover marketing costs;
3. *Later Stage*: funding provided to a fully operative and established company;
4. *Growth*: funding provided to expand the business, both vertically and horizontally;

5. *Rescue*: funding provided to save a business under pressure and to turn it around;

6. *Replacement Capital*: funding provided by new shareholders, entering the ownership structure with a minority stake.

These different stages, together with their specific need for capital, have been linked to the most relevant sources of financing by Cumming and Johan (2014) in the graph provided hereafter.
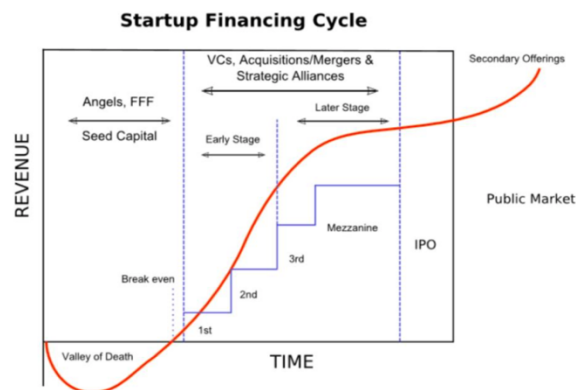
Figure 2: Start-up financing cycle (Cumming and Johan, 2014)

As it is possible to notice from the graph, during the first phases of its lifecycle an entrepreneurial venture mainly survives and operates thanks to the funds provided by the founder and by the so-called "FFF", family, friends and fools (Cumming and Johan, 2014). The availability of this option for financing is crucial for the survival of the company, as during its early life information asymmetries are more relevant, preventing external and structured investors from investing into the company, and the company is still not profitable and thus it is not able to financially sustain its activities itself (Berger and Udell 1998). Indeed, young companies tend to recur to bootstrapping at the beginning of their lifecycle, defined as tendency of entrepreneurial ventures to meet their financial requirements without recurring to the involvement of external new debt and equity holders (Winborg and Landstrom, 2001). When the company becomes more structured and the information asymmetry decreases, the relative importance of the external financers starts to increase. Debt represents an important form of external financing and, even though it can be hard for entrepreneurial ventures to access to loans due to the information asymmetry and the limited level of collateralizable assets available, it can still represent a viable option (Colombo and Grilli, 2006),

especially in areas, like the European one, in which the young companies' equity market is quite recent. Nevertheless, the main form of external financing accessed by start-ups is related to equity financing (Drover et al., 2017). Starting from the first stages of the start-up's lifecycle, the first type of expert investor that a start-up can encounter is likely to be a Business Angel (BA). BAs are usually professionals or former entrepreneurs that decide to invest their own capital into new business ideas (Drover et al., 2017), both singularly and, in recent times, in investor groups (Kerr et al., 2014). BAs are usually characterized by a strong experience in the specific industry and technology of the funded start-up, as well as by a relevant managerial and entrepreneurial experience, allowing them to foster the company's development (Shane, 2008) and to provide an important certification effect for future investors (Drover et al., 2017). Anyhow, the most relevant investors for this thesis work are VCs, as these players can dramatically affect the growth and the success of a start-up and, consequently, the exit performances.

2.5.1   Venture Capital affiliation

Venture capital is usually defined as "a professionally managed pool of capital that is invested in equity-linked securities of private ventures at various stages in their development" (Sahlman, 1990). According to Invest Europe, VCs can actively finance the company both is *Seed*, *Start-up* and *Later Stage* phases. The literature on the effect of VCs on the performances of entrepreneurial ventures is quite broad, and the reasons that make VCs a crucial partner for the start-ups' development can be very diverse. In general terms, evidence suggests that VC-backed firms are way more likely to survive and pursue a successful growth than the non-VC-backed ones (Puri and Zarutskie, 2012). These results are primarily due to increased productivity that the start-up is able to achieve after the VC intervention (Chemmanur et al. 2011; Croce et al. 2013); one of the main reasons for the improvement in performances is the possibility of appointing reputable professionals in key roles of the start-up, which is a direct consequence of the wide network that the VC is able to access and open for the funded company (Hellmann and Puri, 2002). For all these reasons, the exit valuation for VC-backed firms is usually higher than the one of non-VC-backed similar companies (Ivanov and Xie, 2010). Therefore, from the perspective of a newly established

entrepreneurial venture, being backed by a prominent VC can be a very visible and important signal of quality (Drover et al., 2017).

In general, VCs can be very different among each other and can have diametrically different objectives, but it is possible to distinguish and classify them according to their structure. The most common type of VC is called Independent VC (IVC) (Sahlman, 1990), in which typically a limited liability company, the general partners, raises money from limited partners, which can both be institutional investors or high net worth individuals, and invests this money into selected targets (Luukkonen et al., 2013). IVC funds are characterized by a limited lifespan, which is usually around 10 years, at the end of which they need to monetize their investments (Luukkonen et al., 2013). Another important type of VC is the Corporate VC (CVC), which can be defined as "equity investments made by non-financial corporations in young, early-stage companies, not made solely for financial gain." (Chesbrough and Tucci, 2002). Indeed, the main characteristic of CVC is that the objective of the investment is not purely financial, but it is rather strategic, as the investor, for example, primarily aims at being exposed to new technologies and innovation rather than at obtaining a big financial gain; this concept can also be taken to its extreme, as sometimes the strategic objective can even fully offset the financial one (Chesbrough and Tucci, 2002). The third important type of VC is represented by Governmental VC (GVC), which are VCs established and funded by governments to fill the funding gap present in some areas or in specific markets (Luukkonen et al., 2013). Therefore, GVCs may have different objectives, but all linked to foster specific industries' development and to the overall job creation (Leleux and Surlemont, 2003).

Even though VCs can be very different in nature and, consequently, can have diametrically different objectives, the positive effect of their investment in entrepreneurial ventures is common to all these different form (Drover et al., 2017). Therefore, this thesis work is going to limit the analysis to the effect of VCs in general on entrepreneurial ventures.

2.6   Human capital related signals

Founders of start-ups are usually considered very talented and creative individuals, as they are the ones that transform a simple idea into a business. In fact, founders are usually

able to spot unmatched needs in the market and lead their team to the creation of a product or service characterized by a superior value proposition. The importance of the founders for the new venture is huge, as they are the originators of the peculiar characteristics of the company, like the company's culture and the business strategy (Robbins, 2000). From the financial standpoint, the founders are the ones that, on the one hand, bear the risk related to the venture and, on the other hand, the ones that enjoy the upsides of the business (Dobrev and Barnett, 2005). During the creation of a new venture, founder can also decide to involve a number of co-founders, other individuals that, just like the founders, can play a crucial role for the creation of a successful future for the company (Hannan and Freeman, 1989). In fact, given the role of co-founders, the early moment in which they join the start-up and their strict connection with the founders, their importance in defining all the aspects of the organization can be considered as comparable to the one of the founders.

Together with the founders, the company typically includes additional professional as employees, who also play an essential role in transforming the founders' idea in a real business opportunity (Hannan and Freeman, 1989); however, this group of people is not included in the analysis of this thesis work, as employees usually join the company in later moments and just with specific tasks, so their role and their impact on the characteristics of the start-up is likely to be smaller than the one of founders and co-founders.

Given the overall importance of the founders and the strong links that exist between them and the start-up, many scholars consider important to study and analyze their characteristics and their experiences. In general terms, it seems that founders and co-founders are people that value autonomy very much and that, consequently, aim at having and keeping control on the whole organization (McClelland, 1961); in fact, they are likely to be responsible for many different tasks and areas of a company, ranging from the simple recruitment of employees to the formulation of the company's strategy (Lazear, 2005). This autonomy usually entails a higher tolerance for risk (Hall and Woodward, 2010), as founders can enjoy all the upsides related to the positive performances of the company, but they are also responsible for negative results; indeed, by choosing an entrepreneurial career they show a preference for variable returns with respect to securing a fix wage that derives from working as an employee. During the early phases of the start-up's lifecycle, founders are responsible for all the main activities necessary for the creation of a successful future; in fact, they are

responsible for the definition of the scope and the scale of the company, for the whole financing process, which includes finding the right investors and close beneficial deals with them, and for the development of a growth strategy (Nelson, 2003). Due to their reference role, it is very important for them to be experienced and skilled in the management of the newly established company (Stinchcombe, 1965), as they have to show and transmit confidence to all the other team members.

In order to have a deeper understanding of the importance of the human capital for the success of entrepreneurial ventures and to generate evidence on this topic, a series of studies based on the human capital theory (Becker, 1964) have been produced. The human capital theory proposes to interpret the career choices of individuals, both in terms of education (university choice, education) and working experience (pursue specific careers, change job), as driven by an economic logic (Wennberg et al., 2010) and thus aimed at maximizing the individual's utility (Becker, 1964). In particular, given the aforementioned importance of the founders for newborn organizations, human capital theory has mainly been applied to this group of people (Wennberg et al., 2010).

Before entering in the detail of the studies on the human capital of entrepreneurial ventures, it is worth presenting a few human capital definitions that are going to be useful in the continuation of the analysis. First of all, Becker (1964) distinguishes between general human capital and specific human capital. General human capital is related to abilities and knowledge that can be applied and used in a variety of settings and situations with similar effectiveness. This category usually includes education and previous working experience. On the other hand, specific human capital refers to skills that are tailored for a specific are or for the single organization. In general, specific human capital can be more impactful and can bring more value to a specific organization, but, at the same time, it is likely to lack transferability, making it sensibly less valuable in different settings (Sturman et al., 2008). A similar classification proposes a distinction between industry specific and firm specific human capital (Mayer et al., 2012). In particular, the former allows to have a better knowledge and understanding of the industry and of the surrounding economic environment, thus enhancing the probability of success of strategic projects. On the other hand, firm specific human capital allows to have a better knowledge on how to move and approach the different tasks inside the company.

2.6.1 Founders' education and working experience

As previously explained, founders usually come up with innovative ideas that lead to the creation of a new venture. Therefore, one of the main aspects that has been addressed in literature is about which are the past experiences and events that are more likely to trigger this creative entrepreneurial process. Indeed, the rationale behind this method is that previous experiences are likely to shape the entrepreneurs' abilities and approach, preparing them for all the challenges that establishing and managing a company entail (Eldrich and Yang, 2013). In particular, there are two main aspects of the previous experience that are relevant for the entrepreneurial career, which are the education and the working experience accumulated by the entrepreneur both before and during the lifecycle of the new venture (Howard and Tiantian, 2013). Clearly, the knowledge acquired can be very diverse, including both declarative knowledge, namely knowledge about facts, or "know-what", and procedural knowledge, which is knowledge about procedures, or "know-how" (Argote and Miron-Spektor, 2011). The importance of experience is driven by the fact that, usually, people make mistakes in order to learn, as there is the need of trying different potential alternatives to find the right solution; therefore, having a high level of experience should imply a lower propensity to make mistakes and, consequently, an eased and smoother path to success (Argote and Miron-Spektor, 2011). Additionally, experience can help in building higher levels of confidence for entrepreneurs, which can then be extended to the whole working team (Howard and Tiantian, 2013). Lastly, having a considerable amount of experience can also help in creating wide and diverse networks of contacts, as entrepreneurs, during their careers, are usually able to get in touch with many different professionals, who can be very helpful during the new venture's development (Audretsch et al. 2011).

On the practical evidence side, data confirm that, usually, entrepreneurs decide to establish a new venture after spending at least a few years in accumulating experience, both through studies and working (Sørensen and Fassiotto, 2011); indeed, this experience seems to have a positive effect on company's performances (Goslin and Barge, 1986; Sørensen and Fassiotto, 2011). Nevertheless, it is worth mentioning that some scholars also suggest that the relationship between founders' experience and new venture's performances strongly depends on the specific experience acquired (Sandberg and Hofer, 1987), finding a weaker

effect when the previous experience has been acquired in areas and sectors that are very different from the one of the start-up (Deakins and Freel, 1998).

As stated in the introduction of this chapter, it is possible to divide the experience acquired by founders into three main categories, according to the different type of knowledge acquired and to the different moment in life in which this happens. These categories are:

1. Studies and academic experience;
2. Working experience accumulated before funding the start-up;
3. Knowledge acquired during the start-up's lifecycle.

Nevertheless, the scope of this thesis is going to be limited to the first two categories. Therefore, even though scholars have performed some studies about the importance for entrepreneurs to never stop their learning process, as the external environment is continually changing and new innovations are always arising (Howard and Tiantian, 2013), these are not going to be considered.

It is also interesting to note that signals related to experience can be related to different information domains, and that the effect of multiple signals from the same domain is somehow limited, as the degree of uncertainty that the entrepreneurs can reduce is finite (Pollock and Rindova, 2003). Therefore, from the perspective of the entrepreneurs, it is important to deliver signals that can prove their quality in different areas (Pollock and Rindova, 2003). Consistently, in this thesis a distinction between families of signals is going to be proposed in the following, because replicative signals and signals that certify qualities in different domains should not be considered in the same way. The basis for the division in domains of the experience-related signals is the study of Colombo et al. (2019), who analyze the information asymmetry problem in the case of IPO of biotech firms in Europe. In fact, IPOs for biotech firms represent a setting on which the information asymmetry problem is very relevant, as the uncertainty on the firm's quality is on two different dimensions: on the one hand, investors have to understand the market potential of the products offered by the company, while, on the other hand, they also have to consider the scientific quality of the firm, which is key to create innovative solutions (Colombo et al., 2019). In particular, in their paper the authors evaluate the effect of affiliation with prestigious universities, underwriters and venture capitalists on the exit valuation. These signals can be categorized into

two different domains, namely the science domain for the affiliation with prestigious universities and the business and finance domain for the presence of prestigious VCs and underwriters. In their study, evidence suggests that these signals are additive and that they both provide different and important information.

Therefore, it is possible to tailor the division of the signals proposed by Colombo et al. (2019) to the specific case of founders' experience. In particular, in this thesis a distinction is going to be made between (1) business and managerial experience and (2) technical experience of the founder.

Starting from the education, evidence suggests that educated individuals are more likely to start a new venture (Robinson and Sexton, 1994; Kim et al., 2006) and that, more importantly, the level of education seems to be positively correlated with the performances of the founded company. In fact, different scholars (e.g., Robinson and Sexton, 1994; Fairlie and Robb, 2007) have analyzed the effect of education on a series of proxies of company's performances, finding robust positive results; in particular, education seems to have a strong influence on company's growth (Cooper et al., 1994). One of the main reasons behind these results is likely to be that education seems to be a major determinant of the ability of raising new capital (Bates, 1990), which is fundamental to guarantee the start-up's survival and growth. More in detail, evidence also suggests that education can have a very relevant effect in sectors characterized by higher levels of complexity and innovation, like, for example, the ones related to technology, in which having a specific technical knowledge can allow to create more innovative results (Lee and Zhang, 2010); consistently, this education seems to be even more effective when combined with working experience in the same sector as the one of the newly founded venture (Jo and Lee, 1996). According to Colombo and Grilli (2005), studies in economic and managerial areas are related to a higher growth rates with respect to technical studies, which anyway also show a positive relationship with growth (Almus and Nerlinger, 1999).

From the entrepreneur's perspective, the higher level of growth and success achieved by educated founders is mainly related to the fact that entrepreneurs with higher levels of education are more likely to set higher performance and return thresholds. In fact, educated entrepreneurs are likely to have access to a broad number of career paths and opportunities, as well as are likely to have a more complete knowledge on the possible exit paths that can

be pursued (Arenius and DeClerq, 2005). As a consequence, the opportunity costs of educated entrepreneurs when deciding to establish a new venture can be considered as rather high and, to make it worth, the performances of the venture need to be consistently competitive. It is also interesting to note that educated entrepreneurs are likely to have a wider network of contacts, which can be built during the periods of study (Arenius and DeClerq, 2005), that can allow them to identify new career opportunities and ease the decision of leaving the firm (Diochon et al., 2008). Indeed, Ratzinger et al. (2018) have provided evidence that entrepreneurs with high-level education are more likely to secure equity investments, removing the financial constraints of the initial phases of the company's lifecycle and, consequently, unleashing its potential. In particular, this effect seems to be stronger when the education reaches the doctoral level. Therefore, in this thesis the PhD is going to be used as proxy of high-level technical education, while, similarly, an MBA is going to be used as a proxy of high-level business education.

Moving to the working experience, a series of studies provide evidence about its relevance for the development of a successful entrepreneurial venture, especially when there is a link between the experience and the founded company (Jo and Lee, 1996; Davidsson et al., 2001). The main reason behind the positive effect of working experience on the company's success is that entrepreneurs, during their previous experiences, have the chance to learn practices and processes that are usually successful and, when founding a new venture, they have the chance to replicate and adapt these best practices (Freeman, 1986). Similarly to what happens with education, also the working experience allows to build a strong network (Hellmann and Puri, 2002), which again can allow to achieve higher rates of growth and enhance the probabilities of a successful exit. Nevertheless, different career paths are likely to train and develop very diverse skills and capabilities, making it interesting to deep dive into these differences. In particular, previous experience can be divided into employee experience, managerial experience (as compared to scientific experience) and entrepreneurial experience.

The employee experience represents, in general, the most basic type of experience possible and it is likely to be the starting point of many entrepreneurs' careers. The skills acquired with employee jobs are usually task specific, making their relevance for the entrepreneurial career high only if the entrepreneur needs to perform some of the same activities

he was doing as an employee before in the venture he founds (Gathmann and Schoenberg, 2007). Even though the employee experience is usually very specific, employees can still decide to pursue an entrepreneurial career, usually creating a company in the same sector as the one of their former employers, giving rise to the phenomenon of the "employee entrepreneurship" (Franco, 2005). It is interesting to note that, even though employee entrepreneurship is not the most common type of entrepreneurship, companies founded by employees in the same sector as the one of their former employers seem to be highly successful (Franco, 2005). Additionally, some scholars have hint that the most successful employee entrepreneurs are the ones that have experienced working in small companies, as these jobs are likely to entail a wider variety of tasks to be performed and more horizontal responsibilities (Sorensen, 2007; Elfenbein et al., 2010). Given the specificity of simple employee experience, it is not going to be considered as a signal in this thesis.

In a similar way to employee experience and, in a certain sense, also to a bigger extent, also previous managerial experiences can impact the success rate of the start-up and give a boost to the entrepreneurial process. In fact, managerial activities usually include organizational tasks and business practices, which can be very effective when transferred to the new venture (Stewart et al., 1998). Anyhow, there is mixed evidence also about the importance of managerial experience on the survival rate and on the performances of a company, as creating a business and managing it require different skills and capabilities. In fact, many of the managerial activities in established companies are usually based on pre-determined and well-defined roles and on strict procedures to be followed (Yang and Aldrich, 2017), while start-ups are usually characterized by more flexible roles and by a horizontal organization. Therefore, the positive effect of managerial experiences seems to be limited to certain conditions. In any case, experienced top managers are characterized by high opportunity costs when creating a new venture, while they also bear the risk of damaging their long-term reputation, so it is their very best interest to remain only if it is worth (Cohen and Dean, 2005). Additionally, experienced managers usually have the possibility to financially support the new venture, mitigating the financial constraints of the company and signaling their commitment to external investors (Cohen and Dean, 2005). Therefore, as an overall, having managerial experience can be a powerful signal of quality for the entrepreneur.

On the other hand, technical working experience refers to skills and abilities of the founders in specific areas like R&D, process design and engineering (Colombo and Grilli, 2005). Given that the technical working experience is characterized by a lower level of transferability than the managerial working experience, the technical working experience should be acquired in the same sector as the one of the new venture to be effective (Gabrielsson and Politis, 2012).

Lastly, previous entrepreneurial experience seems to provide the most helpful skills when starting a new venture, as it implies having faced in the past challenges that are similar to the ones of the new business (DeTienne and Cardon, 2012). First of all, evidence suggests that experienced entrepreneurs are likely to start a business in order to increase their personal wealth (Westhead et al., 2003), which makes them more likely to set higher performance objectives (DeTienne and Cardon, 2012). Moreover, experienced entrepreneurs are likely to have large amounts of personal financing, which can be reinvested in the new venture; in fact, in many cases entrepreneurs, after cashing out from their previous business, tend to reinvest in new ventures (Stam et al., 2008), giving rise to the so called "entrepreneurial recycling" process (Mason and Harrison, 2006). This, together with the easiness to access also external sources of financing due to a more developed network (Westhead et al., 2003), is likely to result in a higher growth rate for the start-up (Colombo and Grilli, 2005).

As an overall, for signals related to working experience, the sum of the years of work in managerial and technical roles of the founder is going to be considered, together with whether the founder is a serial entrepreneur or not.

2.6.2   The importance of diversity

The concept of diversity, which refers to the inclusion of people with different cultures and backgrounds, is becoming more and more important in business sectors. Indeed, companies are increasingly concerned about including different people with different backgrounds in their organizations and, consequently, the diversity of people occupying important positions in the company is increasing. For the purpose of this thesis, diversity is important, as the presence of these groups in key positions in the start-up is expected to produce better performance results (Carter et al., 2010).

The importance of diversity derives from the fact that, by putting together different people with variegated backgrounds, it is possible to obtain higher levels of information and creativity (Carter et al., 2010), resulting from the different experiences, networks and cultural approaches that people have (Carter et al., 2010). Additionally, the presence of diverse people favors the creation of an organizational culture based on fairness and equality (Carter et al., 2010), in which people feel freer to exchange perspectives and idea, positively affecting group dynamics as a whole. The direct effect of the team diversity is an improved decision-making process, as the people of the team are likely to propose more creative alternatives (Hambrick et al., 1996) and consider more disruptive possibilities (Cox and Blake, 1991). Therefore, diversity is likely to allow to take better decisions, having a positive effect on the performances of the company.

Different scholars have found evidence about this last argument. One of the most relevant studies has been proposed by Carter et al. (2010), who have found evidence that the number of women and of ethnic minorities on the company's ROA is positive and significant. Similarly, Campbell and Minguez-Vera (2008) found that gender diversity in the board of companies has a positive relation with the company's valuation.

Nevertheless, few studies suggest that, in some cases, diversity can also make tensions arise, having a negative effect on the company's success (Smith et al, 2006; Adams and Ferreira, 2009). Indeed, while it seems clear that diversity allows to achieve "process gains" (Stahl et al., 2010) related to an increased creativity, it can also produce "process losses" (Stahl et al., 2010), increasing conflicts and lowering the team integration. Therefore, it is crucially important to manage diversity in the right way, easing the integration and allowing a fruitful communication (Maznevski, 1994), in order to achieve positive results.

Entering more in detail in the notion of diversity, it is interesting to note that scholars have considered different dimensions of this concept. The first and most common one is related to gender diversity, and its importance is strongly recognized by policy makers; in fact, policymakers are increasingly putting gender equality at the center of their agenda. In particular, considering the case of Europe, Norway, from 2008, requires companies to have 40% of female directors, France, from 2016, requires public companies to have at least 40% of female members of the Board and other countries, like Germany and UK, have asked companies to define and set voluntary gender quotas and to disclose information about this

topic (Adams et al., 2011). In literature, it is possible to find different reasons that support gender equality in high level positions. First of all, as previously said, diversity in general improves creativity, and gender diversity is no exception to that (Nemeth, 1986; Watson et al., 1993). Secondly, the appointment of women in key positions can be used to signal strategy change and to improve company's image (Adams et al., 2011). In particular, it seems that women are more committed to following stakeholders-oriented strategies than men (Adams et al., 2011), which can reduce frictions with the external environment and enhance the long-term value. Internally, the presence of women can improve the groups dynamics, as usually they are characterized by a more sensible nature and a stronger interest in finding the best possible alternative for the collective good (Huse and Nielsen, 2010). Additionally, when working in team they are usually more inclined to ask questions (Huse and Nielsen, 2010), which enhances the possibilities of discovering problems and finding solutions. For all these reasons, gender diverse companies are likely to have better performances and, as a consequence, higher (Farrell and Hersch, 2005).

Another dimension of diversity that is receiving increasing consideration is related to race and ethnical diversity. In fact, people with different backgrounds are likely to be able to propose different perspectives and solutions for problems, thus allowing to take better decision and, similarly to the previous case, enhance the company's performances (Hillman et al., 2002). Therefore, first of all racial diversity allows to take better decisions in new situations and in situations characterized by a higher degree of uncertainty, as the different background that diverse people have can lead to a deeper knowledge of the environment and of the different markets (Amason, 1996) and, consequently, to have a deeper understanding of customers' needs. Moreover, ethnical diversity can have a clear positive effect on the reputation of the company, as it shows the company's interest for a wider range of stakeholders and for the establishment of an ethical environment (Albinger and Freeman, 2000).

In this thesis work, the number of members of the funding team is going to be used as a proxy of diversity in general terms. The rationale of this decision is that the collected data do not have a sufficient granularity in terms of founders' personal information to allow a more precise analysis, which should be based on the different dimensions of diversity, of which the two presented before represent just the most common ones. Indeed, even if

information about the sex and on the nationality of the founders are usually missing, it is clear that, if a founding team is larger, it is also going to be more diverse.

2.7   The contingent effect of signals

Since the target companies usually suffer of the information asymmetry problem, it is their interest to signal to potential acquirers their quality, as this would allow to reduce the offer price discount and obtain a higher valuation (Wu et al. 2014). In fact, as previously presented, the use of signaling theory to study acquisitions is abundant.

An interesting insight on possible advances on the study of these signals comes from the study of Wu et al. (2014), which suggest that the contingent effect of signals is an under-studied topic; in fact, the paper hints that it is reasonable to believe that the same signal would have a larger effect when the firm is less established, as the information asymmetry problem is bigger, and thus the discount on the final valuation is bigger; however, no practical evidence is available about this statement. Similarly, when the value of an entrepreneurial venture is clearer for the bidders, the effect of a signal should be weaker and the discount on the price due to information asymmetry should be smaller. A specific example of the contingent importance of the signal has been provided by Colombo et al. (2019), who have found that, in the specific case of IPOs of biotech firms, the effect of the affiliation with a prestigious university, which is a signal of scientific quality, is stronger when the scientific reputation of the professionals working for the target is weaker.

Therefore, by generalizing this idea on a series of different signals, it is possible to advance 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   Data sources

After presenting the hypotheses that this thesis aims at testing, the goal of this chapter is to provide a complete understanding of the data that have been used for the models. In particular, this chapter has been divided into two main parts; in the first one, the process of data collection has been described in detail, while, in the second one, the final sample's characteristics have been presented and analyzed.

3.1   Data gathering methodology

The companies analysed in this thesis are European and Israeli entrepreneurial ventures that have been founded between 1984 and 2013 and have performed an exit through acquisition between 2001 and 2017. As showed in Chapter 2, the aim of this thesis is two-fold; on the one hand, the first two hypotheses are related to understanding the impact of the number of bidders and of their information level on the final price, while on the other hand, the other two hypotheses aim at grasping the effect of signals in this auction setting. Therefore, the data needed for this analysis belong to two main areas:

1. General information about the company (e.g., country, industry, founding year, financials);
2. Specific information about the founding team of the company.

The final sample is composed of 312 entrepreneurial ventures for which it has been possible to retrieve complete information about these two domains.

3.1.1   Entrepreneurial ventures' information

In general, the data about the general characteristics of the entrepreneurial ventures have been taken from three main databases, which are RISIS-VICO 4.0, Zephyr and Orbis. Additionally, it has been used a Google API to retrieve the coordinates of the geographic

location of the companies considered when the information was not available in the databases mentioned above.

RISIS-VICO 4.0 is database whose development has been funded by the European Commission as part of the RISIS project. It includes European and Israeli companies that have been founded after 1988 and that have received at least one round of VC within 10 years from the official date of foundation. Together with RISIS-VICO 4.0, a control sample of non-VC-backed firms developed by PoliMi has been provided to begin the analysis. Additionally, a database of 9490 exit deals performed by the companies included either in RISIS-VICO 4.0 or in the control sample and, therefore, including both VC-backed and non-VC-backed companies has been taken as a starting point for this thesis. In particular, the list of deals included 1220 IPOs, which have been excluded from this thesis work due to the M&A focus, and 8270 M&As. Anyhow, for 205 of these M&A deals it was not possible to retrieve the NACE code of the target, which is necessary for the following steps, so they were excluded narrowing the list of deals to 8065. Additionally, for 764 of these companies it has not been possible to retrieve complete information on the geographic location, reducing the total number of deals considered to 7301. As an overall, the data available are related to basic information about the target (company name, company NACE code, company founding year), main financials (total assets, revenues), information about the deal (valuation, date) and about the acquiror (acquiror name, country of origin, NACE code).

From the list of deals just mentioned, an initial sample of around 1000 entrepreneurial ventures acquisitions has been randomly selected. Anyhow, many of these companies had to be excluded from the sample as, during the data gathering, it was not possible to retrieve complete information about them; therefore, the final sample is composed of 312 entrepreneurial ventures.

Starting from the initial sample of around 1000 entrepreneurial ventures, first of all in some cases the data about the value of the total assets of the company or about the deal value were missing; therefore, it has been necessary to research this information into the other two databases mentioned at the beginning of the chapter, namely Orbis and Zephyr. Orbis is a database developed by Bureau van Dijk which, as of 2020, contains data about 375 million of companies from all over the world; among these data, accounting figures are included and, consequently, it allows to retrieve the value of the total assets. Anyhow, for

37 of the companies of the final sample the value of the total assets for the year of the deal was not available, so it has been decided to take the most recent one among the values of total assets of the previous 2 years; in particular, for 29 companies it has been taken the value of the total assets of the year before the deal and for 8 companies it has been taken the value of two years before the deal. If the value of the total assets was not available in the 2 years before the acquisition deal, the company was excluded from the sample. Moving to Zephyr, also this database has been developed by Bureau van Dijk, and, as of 2020, it includes data about 1,8 million of deals, both actual and rumoured. In particular, for the scope of this thesis, Zephyr provides the information on the monetary value of the deal and on the percentage of the equity of the target acquired, which allow to compute the total valuation of the company. Again, if it was not possible to retrieve the valuation of the company in the acquisition, the company was excluded from the sample. Therefore, for all the 312 entrepreneurial ventures included in the final sample it has been possible to retrieve complete information about the company, its financials and the acquisition valuation.

The following step has then been focused on determining the number of bidders for each target company. The complete list of potential acquirors has been defined by including all the acquirors involved in at least one of the 7301 acquisition deals mentioned before. Therefore, the resulting number of potential acquirors is 6054. Then, these acquirors have been paired to the 312 targets of the sample, considering an acquiror as a potential bidder for the targets of the sample only if the two conditions listed hereafter were simultaneously true. Therefore, from the list of 6054 potential acquirors, only 2952 have been considered as potential bidders, as the others were not respecting at least one of the two following conditions.

1. The acquiror needed to have made an acquisition in the same year as the one in which the target of the sample was acquired;
2. The acquiror needed to have made an acquisition of a company belonging to the same industry as the one of the target of the sample.

The first condition is quite straightforward, as it captures whether a certain acquiror is active in the M&A activity in a certain period of time. In particular, if an acquiror has made an acquisition in the same exact year as the one in which the target of the sample has been acquired, then it can be considered as active.

Moving to the second condition, the industry considerations have been performed on the basis of the NACE code. NACE, which stands for "Statistical Classification of Economic Activities in the European Community", is the standard industry classification system used in the countries of the European Union. Its most updated version for the time being is the *Revision 2*, which is the one adopted for this thesis. According to this classification, each industry is represented by a four-digit code, where the first digit refers the macro industry, while the following ones progressively add levels of detail. For the scope of this thesis, it has been decided to consider just the first two digits of the NACE code in order to define industries, as done in a series of previous studies (e.g., Puziak, 2017; De Lange and Merlevede, 2020; Ferris et al., 2021). The only exception to this division has been done for the codes 72.1 and 72.2, which correspond to "Research and experimental development on natural sciences and engineering" and "Research and experimental development on social sciences and humanities" respectively. In fact, given the important differences that exists between industry 72.1, which includes, for example, biotech start-ups, and industry 72.2 from the perspective of young businesses and given the high number of targets coming from industry 72.1 in the complete list of deals (450 deals in industry 72.1 out of 7301 deals in total), it has been decided to consider them separately. Therefore, a potential acquiror is considered as a bidder for a target of the sample if it has made an acquisition of a company which has the first two digits of the NACE code equal to the ones of the target of the sample; as said before, this acquisition has to be performed in the same year in which the target of the sample has been acquired.

After defining the number of the bidders for each target of the sample, the following step has been to divide them, on the basis of their level of information, into two different group, namely informed and non-informed. As explained in Chapter 2.3, the parameters that have been as a proxy of information asymmetry are the (1) geographical distance and the (2) cultural distance between target and bidders.

The research of the geographic coordinates of both companies has been performed following two main steps:

1. *Research of the company's coordinates in the Orbis database.* In around half of the cases, Orbis directly provides the geographic coordinates of the company researched, so, when available, this information has been taken from there. In the other cases,

Orbis almost always provides the address of the company; therefore, if the address was available it was used in the next step, otherwise the company was removed from the sample;

2. *Translation of the address into the coordinates*. This step has been performed through the development of a simple tailored Python programme which, using a Google API[1], takes as an input the full address of the company and provides as output an Excel file with its corresponding geographic coordinate. The complete code has been included in the Appendix.

After that, it has been computed the geographical distance in kilometres between each target of the sample and all its potential bidders. As expected, all the acquirors located in continents different from Europe, like the ones in US, resulted to be very far from the target and thus they would have all been classified as non-informed. Given that considering all the acquirors coming from outside Europe as non-informed is far from reality, it has been implemented an additional feature, aimed at grasping the fact that same of these acquirors might already be active in Europe or, more in general, in areas geographically closer to the targets of the sample. In particular, the rational of this adjustment is that, if an acquiror has made in the past an acquisition of a company based in an area that is close to one of the targets of the sample, then the network and the contacts of the acquiror should expand until that area. The distance calculated with this additional feature is going to be named adjusted distance. Operatively, the data for the implementation of this adjustment has been obtained through the following steps:

1. For all the bidders of the targets of the sample defined before, the list of all the acquisitions performed in the five years before the year in which the target of the sample had been acquired has been downloaded. These data have again been taken from Zephyr;

2. For all the acquisitions downloaded in step 1, the geographic coordinates of all the targets involved in these deals have been downloaded. The methodology used to download the geographic coordinates data is the one explained before, namely

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[1] https://maps.googleapis.com/maps/api/geocode/json

searching for all the targets in Orbis and, when the data were not available, complete them through the Google API.

After obtaining the necessary data, the adjusted distance between the target of the sample and each of its bidders has been computed as the minimum between the following values:

1. Distance between the target of the sample and the bidder's headquarter;
2. Distance between the target of the sample and each of the companies acquired by the bidder during the five years before the acquisition of the target of the sample.

Parallelly, the coordinates collected have also been used to calculate the distance between each target and its actual acquiror for each of the 7301 acquisitions taken as a starting point, with the aim to define a threshold for the distance. The threshold is necessary to distinguish between the bidders that can be considered as geographically close to the target and, on the contrary, the ones that are far from the target. In particular, it has been decided to take the median of all these distances as the threshold, which came out being 341 kilometres. Consistently, bidders that had an adjusted distance from the target smaller than the threshold have been defined as geographically close, while the others have been defined as far from the target.

For what concerns the cultural distance, it has been measured through the Kogut and Singh Index, also known as KSI (Kogut and Singh, 1988), as this approach is the most widely used in previous studies. Operatively, the Kogut and Singh Index is calculated as the arithmetic average of the variance-corrected squared differences along the different dimensions of cultural distance (Kogut and Singh, 1988). The formula used in this thesis is proposed hereafter.

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

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

were the four dimensions of cultural distance proposed by Hofstede (1980), namely (1) power distance, (2) individualism versus collectivism, (3) masculinity versus femininity and (4) uncertainty avoidance. However, recent studies (e.g., Čuhlová, 2016) also include the two dimensions added later by Hostede (2015), which are (5) long-term orientation vs. short-term orientation and (6) indulgence vs. restraint. Consistently, in this thesis all the six dimensions have been used.

Operatively, as a first step the list of all the countries of origin of targets and bidders involved in the list of 7301 acquisitions has been defined, which came out being 70. However, for 11 of these countries (i.e., Bahamas, Bermuda, British Virgin Islands, Cayman Islands, Curacao, Cyprus, Gibraltar, Liechtenstein, Mauritius, Monaco and Oman) Hofstede does not provide the values for the cultural dimensions, so all the deals involving acquirors or targets with a country of origin part of the list just presented have been excluded from the analysis (32 deals out of 7301). Then, for all the remaining 59 countries, the values of the six dimensions of cultural distance have been directly downloaded from Hofstede's website[2], therefore the values considered are the most updated ones as of the January 2021. It could be argued that it would be more precise to take the values of Hofstede's dimensions at the time of the deal, rather than the most updated ones; nevertheless, evidence suggests that the values of these dimensions are quite stable over time and, in particular, the cultural distances among countries tend to be constant over time (Beugelsdijk et al., 2015), so, consistently with other previous studies (e.g., Čuhlová, 2016) it has been decided to consider just the most updated values. These values have been used to compute the Kogut and Singh Index between each of the 59 countries considered and, similarly to what has been done for the geographical distance, it has been decided to consider the median of the distances among the 59 countries as the threshold to divide between culturally close and culturally far acquirors. In particular, the resulting median is 1,8 which is, as an example to put this number in a perspective, the distance between Italy and Romania, or the distance between Austria and Finland.

Having defined geographically close bidders and culturally close bidders, a bidder has been defined as informed if:

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[2] https://www.hofstede-insights.com/

1. It was geographically close to the target (i.e., closer than the median of the geographical distances) **<u>AND</u>**
2. It was culturally close to the target (i.e., closer than the median of the cultural distances).

The rational of using these two dimensions together is that a bidder, in order to be exposed to relevant and detailed information about the target, needs to be spatially close to it. However, this is not enough for the acquiror to be informed, as it also needs to be culturally close to the target in order to understand properly the information that it is receiving. The theoretical reasons backing this last statement have been described in Chapter 2.3

3.1.2 Human capital database

Given that in this thesis considers the models are largely based on variables related to the human capital of the company, the collection of information about the founding team has been a very important step; in fact, in order to perform a valid analysis, there is the need of having precise and specific data. Therefore, the research of information has followed a precise series of steps, developed and perfected throughout the whole data collection, in order to try to maximize the amount and the quality of data collected. Data about the founders have been searched for all the targets for which it was possible to retrieve complete information about financials, industry and geographic location.
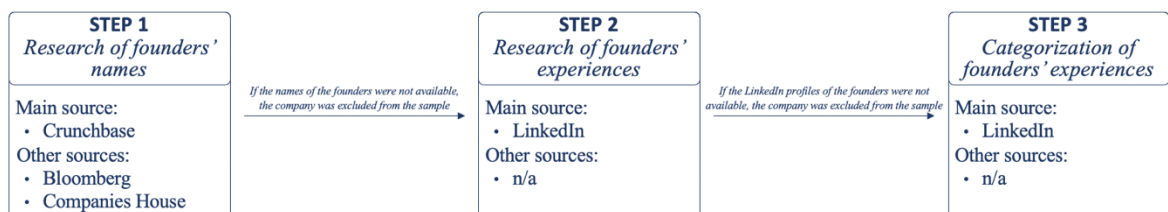
Figure 3: Description of the data collection process

In order to start the process, it is first of all necessary to find the founders' name. The first attempt has always been trying to find the company on Crunchbase, a very famous database that collects information about public and private companies from all over the world;

in fact, this website came out being the most complete one in terms of founders' data. Additionally, sometimes Crunchbase provides the official website of the company, which can be a relevant source when case names are nor directly available on Crunchbase. If information on Crunchbase were not available, the next option was to search on Bloomberg, as also this website is quite complete in terms of founding team information. If even the research on Bloomberg was not effective, the next step was to use the Google exact match function, which allows to search for an exact combination of words; in particular, the words searched were "Company Name" AND "Founder", as this allowed to find all and only the websites and articles containing these exact words, while excluding the related content not useful for this data collection. Among the results of the research, only the websites included in the first two Google pages were considered. In particular, all the single websites were opened and analysed in order to find the names of the founders and to understand whether the website was reliable or not. Anyhow, even if the website was not part of the list of the most famous and established ones, the names were still kept in order to make a second check on LinkedIn. Additionally, just for the companies established in United Kingdom, it was possible to use the Companies House[3] website, a website directly managed by the UK government which collects official documents about all the UK companies. Among these documents, a specific file, called "Incorporation", contains the names of the founders. If all these possibilities were not successful, the last attempt was related to directly searching for the company on LinkedIn, as sometimes the founders were listed as former employees. If even this last research was not successful, the company was removed from the sample; On the other hand, if names were retrieved successfully, it was possible to move to the following step.

Then, all then names found in the first step were searched in LinkedIn. If the founders did not have a LinkedIn profile or there was not absolute certainty about whether the LinkedIn profile was the right one or not, they were excluded by the sample, together with the company. If the LinkedIn profile was available, then the data were divided into two main groups, namely, the one related to education and the one related to working experience. The former contained all the degrees that a founder has (Bachelor, Master, PhD, MBA and Other Masters), and, for each of them, the years of beginning and end, the specialization and the university. On the other hand, the latter contained all the jobs that a founder had performed,

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[3] https://find-and-update.company-information.service.gov.uk/

together with the years of beginning and end, the role (classified into five categories, which are: (1) managerial (2) technical (3) commercial (4) financial (5) other), the sector, and three dummies related to whether he was a founder, a CEO or part of the C-level of the company considered. Once all the available information was recorded, the process was considered to be over.

3.2   Database description

The result of the process described in the previous chapter is a final database of 312 targets and, for each of them, at least one bidder, including the real acquiror of the target, has been identified. Therefore, the aim of this chapter is to provide a complete description of the characteristics of the sample.

From the geographic standpoint, the targets of the sample are located in 17 different countries. Among these countries, Israel, which accounts for 5 targets of the sample, is the only non-European country. In particular, the complete list of countries of origin of the targets of the sample can be found in Table 2, in which the countries have been divided into three main macro areas. The most important country in terms of number of targets is United Kingdom with 137, followed by France (54) and Germany (35). A detailed breakdown of the number of targets per country is provided in Table 5.

The division in macro areas is aimed at categorizing the countries on the basis of how good they are in terms of economic environment for the development of start-ups. The basis of this classification is the ranking proposed by NinbleFins (2020), which is aimed at understanding which are the best countries for start-ups in Europe. The ranking is based on a composite score calculated as the weighted average of four parameters, which are *Economic Health*, *Cost of Doing Business*, *Business Climate* and *Labour Force Quality*. This ranking includes only the top 12 European countries according to these parameters, hence Israel and some of the countries of origin of the target of the sample were not present. For the division in macro areas, it has been decided to put the top three countries of the NinbleFins (2020) ranking in the *Advanced* category, all the ones present in the ranking outside the top three positions (i.e., from fourth to twelfth) in the *Runner-ups* category and the ones not present in the ranking in the *Others* category. For what concerns Israel, since it was not included in

the NinbleFins (2020) ranking, it has been decided to consider other rankings with a global scope. In particular, the main ranking considered is the one proposed by StartupBlink (2020), where Israel obtains a top score for the quality of the new businesses born there, only behind UK and US. For this reason, it has been decided to classify Israel as *Advanced*. Additionally, these other classifications have been useful to test whether the division performed for this thesis and the relative ranks of the countries are consistent among different classifications, which is actually the case.

Advanced	Runner-ups	Others
Germany	Austria	Belgium
Ireland	Denmark	Bulgaria
Israel	Finland	France
United Kingdom	Netherlands	Italy
	Norway	Poland
	Sweden	Portugal
		Spain

Table 2: Division of targets' countries in macro areas

From the perspective of the industry, the sample considered is quite variegated. In terms of number of observations, the most important industries are IT, financial services, manufacturing and scientific research. The following graph shows the distribution of the targets of the sample and of the bidders considered with respect to the first digit of the NACE code.
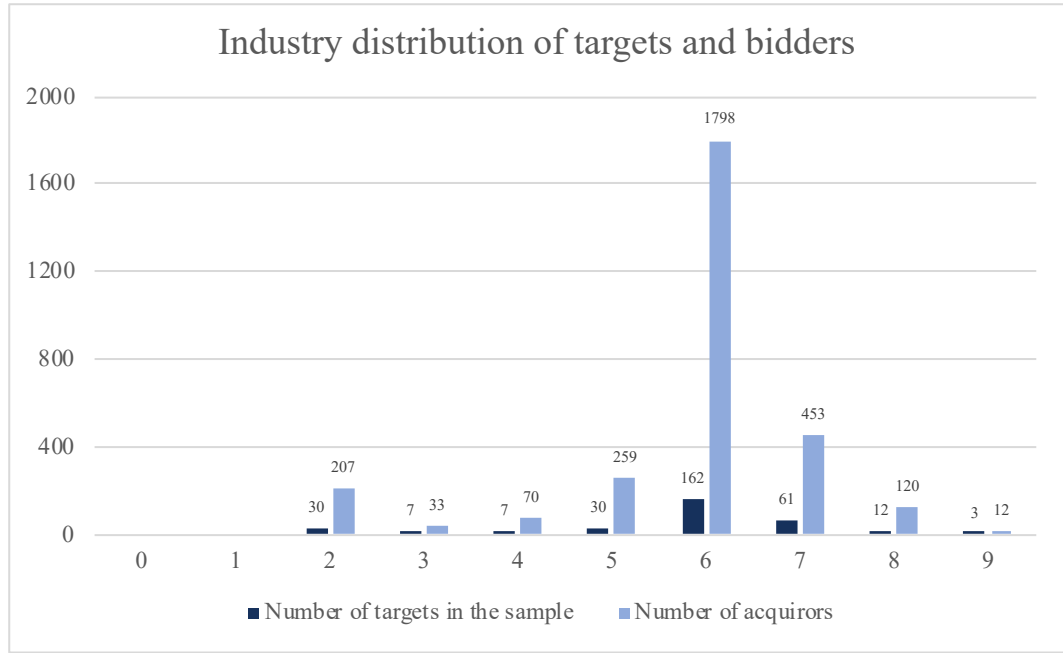
Figure 4: Number of targets and bidders for each first digit of the NACE code

Moreover, the targets of the sample have been classified in five macro-industries in order to control for the industry effect in the models. The five macro-industries identified are *LifeScience Biotech*, *High Knowledge Intensive Services*, *High Tech Manufacturing*, *Software* and *Other*. This classification has been proposed by Colombo and Montanaro (2020), based, in turn, on the Eurostat indicators on High-tech industry and Knowledge – intensive services[4]. The class *LifeScience Biotech* includes all the targets of the sample with any of the following numbers as first digits of the NACE code: 21, 26, 72 75, 86 or 87. *High Knowledge Intensive Services* includes all the targets that, according to the Eurostat indicators on High-tech industry and Knowledge – intensive services[3], belong to high-tech or knowledge intensive industries, excluding the ones from LifeScience and Biotech industries, already part of the previous category. Similarly, *High Tech Manufacturing* includes all the targets of the sample belonging to high-tech or medium high-tech manufacturing industries, excluding the ones part of LifeScience and Biotech industries. *Software* includes all the targets that belong to the software industry, which correspond to the following 4-digit NACE codes: 5820, 5821, 5829, 6200, 6201, 6202, 6203, 6209. Finally, *Other* includes all the targets of the sample not belonging to any of the other classes named before.

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

Macro-industry	Number of targets	Percentage of targets
LifeScience Biotech	72	23%
High Knowledge Intensive Services	46	15%
High Tech Manufacturing	9	3%
Software	169	54%
Other	16	5%
Total	**312**	**100%**

Table 3: Number of targets of the sample for the five macro-industries defined

Besides, by analyzing the characteristics of the targets of the sample at the time of the acquisitions, it is possible to derive some interesting insights. In particular, the average valuation of the target of the sample at the acquisition is € 120,9M, while the book value of the assets is, always on average, € 48,4M. The average age of the targets of the sample when they were acquired is 10 years; this number is consistent with worldwide data about start-ups acquisitions, as the 37% of the start-ups acquired is between 5 and 10 years old when acquired, while the 28% is between 10 and 15 years old (Statista, 2018). Finally, out of 312 targets, 209 (67%) were VC-backed at the time of the acquisition. Table 4 includes additional information about the companies' characteristics just described, providing a breakdown per year of acquisition. As it is possible to note, the number of deals is well distributed over the years, with 2014 and 2015 being the years with the highest number of occurrences. Additionally, by looking at the trends, it is possible to note that deal value tends to increase over the years, and, in a similar way, also the total assets do, even though at a slower pace.

Acquisition year	Number of targets	Percentage	Average deal value (€k)	Average total assets (€k)
2001	1	0,3%	2.338	695
2002	3	1,0%	25.938	16.608
2003	3	1,0%	29.141	35.946
2004	12	3,8%	89.424	22.050
2005	18	5,8%	46.155	20.395
2006	15	4,8%	40.311	11.841
2007	21	6,7%	59.730	18.899
2008	28	9,0%	57.129	19.203
2009	29	9,3%	62.484	28.009
2010	13	4,2%	54.743	35.444
2011	20	6,4%	72.226	39.716
2012	13	4,2%	53.004	33.991
2013	23	7,4%	65.648	21.671
2014	35	11,2%	161.405	60.261
2015	31	9,9%	144.375	50.757
2016	25	8,0%	475.958	230.295
2017	22	7,1%	182.273	33.896
Total	**312**	**100%**	**120.937**	**48.378**

Table 4: Breakdown of targets' figures per year

Moving to the number of bidders identified for the targets of the sample, they are, on average 66, of which 14 have been considered as informed. By looking at the different countries, the overall number of bidders seems to be quite similar among the areas, while the number of informed bidders presents the biggest variations. In fact, *Advanced* countries have triple the number of informed bidders of *Runner-ups*, and double the number of informed bidders of *Others*, hinting that the market there should be more active and, consequently, it

should be easier and more profitable to sell a company. In particular, United Kingdom, with 20, is the country with the highest number of informed bidders.

Country	Number of targets in the sample	Average number of bidders	o/w informed bidders
Germany	35	73	12
Ireland	9	60	7
Israel	5	53	3
United Kingdom	137	67	20
Subtotal Advanced	186	68	18
Austria	2	60	5
Denmark	8	98	5
Finland	11	104	10
Netherlands	8	36	7
Norway	3	70	2
Sweden	9	56	3
Subtotal Runner-ups	41	74	6
Belgium	11	49	12
Bulgaria	2	160	2
France	54	52	11
Italy	6	84	8
Poland	3	69	3
Portugal	2	15	-
Spain	7	88	2
Subtotal Other	85	59	9
Total	**312**	**66**	**14**

Table 5: Breakdown of the number of bidders for each country and macro-area

For what concerns to the targets' human capital characteristics, the average number of founders for each company of the sample is 1,5 (474 founders in total for 312 companies). Indeed, 196 of the targets of the sample (63%) have been founded by just one founder, while the remaining 116 companies have been founded by a number of founders included between 2 and 6. Having a look at the education of the founders, 260 out of the 474 founders identified (55%) declare to hold a Bachelor degree, while 137 declare to hold at least one Master degree (29%). Considering higher levels of education, 103 out of the 474 founders (22%) hold a PhD, while 54 hold an MBA (12%). Moving to the working experience prior to the start-up's foundations, in this thesis it has been decided to consider just the relevant ones, namely the ones that the founder is willing to report on the LinkedIn profile. Therefore, these numbers are likely to be a lower bound of the actual figures. In particular, in the sample considered founders have, on average, 7 years of working relevant working experience before founding the start-up. Of these 7 years, on average 2,5 years have been spent in managerial roles, while 1,9 in technical roles. Moreover, 58 of the founders (12%) had a previous experience as CEOs of a company, while 72 (15%) had already founded a company. From an industry standpoint, the majority of the founders (278, equivalent to 59%) had at least one of the previous experiences in the same macro-industry as the one of the start-up. Table 6 summarizes the figures about previous education and working experience.

Experience	Frequency of observations	Percentage
Education		
No degree declared	73	15%
Bachelor of Science	260	55%
Master of Science	137	29%
PhD	103	22%
MBA	54	11%
Working experience		
Number of years	7	n.a.
Number of years in managerial positions	2,5	n.a.
Number of years in technical positions	1,9	n.a.
Previous experience as CEO	58	12%
Previous experience as founder	72	15%
Previous experience in the same industry	278	59%

Table 6: Summary of founders' experiences before the start-up's foundation

4 Definition of the variables

After presenting the hypotheses that this thesis aims at analyzing and describing the data that have been collected for this purpose, the aim of this chapter is to present the variables that have been chosen in order to make this study. The variables considered for this thesis belong to four main groups, which are: dependent variables, control variables, independent variables and instrumental variables.

4.1   Dependent Variable

As presented in the literature review, a great number of scholars have used a discrete variable as the dependent variable of their model, where each value represented a different possible exit path (Bates, 2002; Wennberg et al., 2010; DeTienne and Cardon, 2012). However, given that this thesis is focused on M&As as the only possible exit strategy, this approach cannot be pursued. Another approach, primary chosen by scholars who aim at evaluating the performances of the start-up in general terms, consists in using measurements like the total factor productivity (Colombo and Murtinu 2016; Bhawe et al. 2017)

Anyhow, there is a third strand of literature that better fits the needs of this thesis, which considers as the dependent variable the exit valuation. In particular, some scholars suggest using the valuation in absolute terms, while others prefer to use it in relative terms. Starting from the former, the majority of the authors have considered the total valuation at the exit (Bayar and Chemmanur, 2011; Nadeau, 2011), while others have considered the valuation premium (Brau et al. 2010) or the pre-money valuation (Gompers and Lerner, 2000). On the contrary, other scholars have preferred to use a relative measure and, in particular, the Tobin's Q (Adams and Ferreira, 2009; Bebchuck et al., 2009; Sheikh, 2018), calculated as the division between the exit valuation and the total value of the assets. The Tobin's Q has the main advantage of being a relative measure, thus easing the comparison between firms which differ in dimension, and therefore it has been chosen as the dependent variable for this thesis. In particular, after carefully analysing the distribution of the data, it has been decided to consider the logarithm of the Tobin's Q (*log_TobinQ*).

In order to calculate the Tobin's Q, it has first of all been necessary to compute the exit valuation and retrieve the total value of the assets for all the 312 start-ups of the sample. For what concerns the exit valuation, when the acquisition was just referring to a portion of the equity, the partial valuation has been scaled to the whole company by dividing the economic value by the percentage acquired; instead, when the valuation was already referring to the whole company, it has been taken like that. Moving to the total assets, as explained in Chapter 3.1.1, it has been decided to take this value in the year of the exit and, in for the 37 companies in which it was not available, it has been decided to take the value up to two years before.

4.2   Control Variables

Given that some variables that are out of the scope of this thesis are clearly related to the firm's valuation, they have been included in the model as control variables, in order to avoid the achievement of misleading results. The selected control variables are listed hereafter.

Company_age: this variable aims at representing the age of the company at the moment of the acquisition and has been calculated as the log of the difference between the year in which the acquisition has occurred and the year in which the company has been founded. The aim of this variable is to represent the maturity of the company at the time of the acquisition, which can be very important when considering how it approaches innovation (Acemoglu and Cao, 2015). Many scholars have decided to use the age of the company as a control variable, however there is mixed evidence about his effect; in fact, while some studies suggest that maturity can have a positive effect when facing the market and can signal more complete products and technologies, others believe that a higher age can result in lower innovation capabilities (Boeker and Wiltbank, 2005; Wennberg et al., 2010; DeTienne and Cardon, 2012; Anderson et al., 2017).

Geographical area – 2 dummies: as explained during the presentation of the database, the countries of origin of the companies have been divided into three macro-areas, which are Advanced, Runner-ups and Others. Therefore, it has been decided to create two dummy variables, the first one (*area_advanced*) that assumes value 1 if the company comes

from a country belonging to the Advanced category, 0 otherwise and the other one (*area_runnerups*) that work in the same way for the Runner-ups category. If both these variables assume simultaneously value 0, then the company belongs to the Others category; indeed, it has been decided not to include the third dummy about the Others area to avoid multicollinearity problems. The necessity of these control variables originates from the fact that there is a series of studies that show that the geographic area can have an effect on the final valuation due to the different conditions of local markets and economic environments (Gupta and Sapienza, 1992; Soreson and Stuart, 2001).

Industry classification – 4 dummies: as explained during the presentation of the database, the companies of the sample have been divided into five macro industries according to their classification through the NACE code, which are HighKnowledgeInt_Services, HighTech_Manufacturing, LifeScience_Biotech, Software and Other. Therefore, four dummies have been created (*ind_highknowledgeintservices*, *ind_hightechmanufacturing*, *ind_lifesciencebiotech* and *ind_other*) all assuming value 1 if the company was part of the industry specified in the name of the variable, 0 otherwise. As said for the geographical dummies, it has been decided not to create a dummy for the industry "Software" to avoid multicollinearity problems. These dummy variables allow to take into account and measure industry specific factors that should have an effect on the exit valuation (Ragozzino and Reuer, 2007).

total_assets: this variable has been introduced to measure the targets' dimension, and it is calculated as the log of the company's Total Assets at the year of the acquisition; a detailed explanation about the value of Total Assets selected has been provided in Chapter 3.1.1. It has been decided to use the log of the Total Assets to control for the firm size as this measure is widely accepted and it is the most used one in entrepreneurial studies (Dang et al., 2018).

4.3   Independent Variables

The independent variables used in this thesis belong to three main domains, which are variables related to the number of bidders, variables related to the target's human capital and variables related to the presence of external equity investors.

4.3.1 Number of bidders

n_bidders: represents the total number of bidders identified for a certain target of the sample through the methodology described in Chapter 3.1.1. The variable has been winsorized at 1% level in order to reduce the effect of outliers. As explained in Chapter 2.2, the number of bidders should have a positive effect on the exit valuation (Vickrey, 1961).

n_informed: represents the total number of informed bidders for a certain target of the sample. As defined in Chapter 3.1.1, a bidder has been considered informed if it was simultaneously geographically close to the target and culturally close to the target. As explained in Chapter 2.2, the informed bidders should be the ones driving the valuation, as they do not discount the information asymmetry in the offer price (Wu et al., 2014). Consistently with what done for *n_bidders*, also this variable has been winsorized at 1% level in order to reduce the effect of outliers.

n_non_informed: represents the total number of non-informed bidders for a certain target of the sample or, in the same way, the difference the total number of bidders and number of informed bidders for a certain target of the sample. Indeed, non-informed bidders are bidders that do not respect at least one of the two conditions of closeness to the target (i.e., geographically close and culturally close). For the obtainment of a higher valuation, the effect of non-informed bidders should be minor, as they discount the information asymmetry in the offer price (Wu et al., 2014). Consistently with what done for *n_bidders*, also this variable has been winsorized at 1% level in order to reduce the effect of outliers.

4.3.2 Target's human capital

As explained in Chapter 3.1.2, the focus of this thesis is on the founding team of the entrepreneurial ventures considered and, in particular, on the founding CEO. Therefore, apart from the number of team members, all the variables related to the human capital developed for this thesis refer just to the founding CEO.

n_team_members: represents the number of people belonging to the founding team when the start-up was established. The positive effect of the number of team members on the company's success and on the exit valuation should be at least twofold; indeed,

companies with a higher number of founders should be less financially constrained (Berger and Udell 1998) and should set higher performance thresholds for themselves (DeTienne, 2010). Additionally, bigger teams should have higher levels of diversity, improving their decision-making process and their decisions (Carter et al., 2010).

dummy MBA: this dummy variable represents whether the founder CEO has obtained an MBA degree before founding the new venture, assuming value 1 if the founder holds an MBA, 0 otherwise. Indeed, high levels of entrepreneur's education should positively contribute to the start-up's success (Ratzinger et al., 2018), and an MBA is a perfect example of high-level business education.

dummy PhD: this dummy variable represents whether the founder CEO has obtained an PhD degree before founding the new venture, assuming value 1 if the founder holds an PhD, 0 otherwise. Just as it is for *dummy MBA*, high levels of entrepreneur's education should positively contribute to the start-up's success (Ratzinger et al., 2018), and a PhD is a perfect example of high-level technical education.

exp_managerial: represents the log of the sum of the years spent in relevant managerial roles by the founder CEO of the targets of the sample before founding the target considered. The experience is defined as "relevant" because it includes just the experiences that the entrepreneur is willing to report in the LinkedIn profile. Managerial experience should have a positive effect on the target's success and valuation, as it can allow to transfer effective organizational and business practices to the new venture (Stewart et al., 1998).

exp_technical: represents the log of the sum of the years spent in relevant technical roles by the founder CEO of the targets of the sample before founding the target considered. The experience is defined as "relevant" because it includes just the experiences that the entrepreneur is willing to report in the LinkedIn profile. Technical experience should have a positive effect on the target's success and valuation when it is strictly related to the new business (Gabrielsson and Politis, 2012), as it should allow the founder to acquire specific skills and abilities in areas like R&D, process design and engineering (Colombo and Grilli, 2005).

dummy serial_entrepreneur: this dummy variable represents whether the founder CEO has founded other companies before founding the target of the sample, assuming value 1 if this happened, 0 otherwise. Experienced entrepreneurs should be experienced in facing the challenges that establishing a new business entail, while they should also be able to access additional sources of financing resulting from their eventual previous successes (DeTienne and Cardon, 2012).

4.3.3   External equity investors

dummy VC_backed: this variable is a dummy that aims at measuring whether a company is VC-backed or not, assuming value 1 if the company is VC-backed, 0 otherwise. The necessity of this variable is given by the fact that there are many studies that have analysed the treatment effect of being backed by VCs among different exit paths, and they agree that being backed by a VC has a positive effect. In fact, VCs helps the start-up to improve its efficiency (Croce et al., 2013), internal organization (Hellmann and Puri, 2002) and growth rate (Nanda et al., 2017), while also allowing to create a strong network (Tykvova, 2018) and, ultimately, favouring a higher valuation.

dummy VC_high: this variable is a dummy that aims at measuring whether a company is backed by a prominent VC or not, assuming value 1 if the company is backed by at least one prominent VC, 0 otherwise. A VC is defined as prominent if it has performed at least 3 successful exits (i.e., M&A or IPO) during the 5 years before the acquisition of the target of the sample. The threshold of 3 successful exits represents the median number of successful exits performed by the VCs of the considered sample. The presence of prominent VCs should have a strong certification effect for the target, as prominent financial players highly value their reputation and, consequently, are expected to consider only the deals which are likely to have a positive effect on their reputation (Carter et al., 1998; Colombo et al., 2019).

dummy VC_low: this variable is a dummy that aims at measuring if a company is backed by VC that cannot be defined as prominent, as it has not performed at least 3 successful exits (i.e., M&A or IPO) during the 5 years before the acquisition of the target of the sample; consistently, the variable assumes value 1 if the company is backed by a non-

prominent VC, 0 otherwise. Non-prominent financial players should have a weaker certification effect for the targets of the sample.

4.4   Instrumental variable

Given that a series of studies suggest the existence of an endogeneity problem with VC financing (Kortum and Lerner, 2000; Colombo and Montanaro, 2020), it has been decided to introduce an instrumental variable to study this phenomenon. Therefore, the instrumental variable *dist_closest_VC_hub* has been added, which is calculated as minimum distance of the targets of the sample from the closest VC Hub. The VC Hubs considered for this analysis are Inner London, Île de France, Oberbayern, Stockholm, Helsinki-Uusimaa, Hovedstaden, Noord-Holland, Darmstadt, Rhône-Alpes and Köln, which represent the first ten European VC Hubs according to the work of Colombo et al. (2019).

5 Methodology

5.1 Descriptive statistics

Table 7 summarizes the descriptive statistics for the independent variable, control variables and dependent variables used in the models developed for this thesis work. In particular, for each variable mean, median, standard deviation, first and third quartiles, kurtosis and skewness are reported, with the aim of providing a complete understanding of the distribution of data.

Starting from the Tobin's Q, which has been taken in the log form, it is possible to notice that the mean (0,51) is very close to the median (0,48), which, together with the low level of skewness (0,33), suggests that the distribution is rather symmetric. Additionally, it is possible to notice that the standard deviation of this variable is quite high (0,56), signaling a great data variability and spread, as the values of the log of the Tobin's Q range from -1,42 to 2,55. Indeed, the distribution of this variable is characterized by a relevant level of Kurtosis (4,40), indicating the presence of bigger tails.

For what concerns the Company age, again considered in its log form, mean (0,94) and median (0,95) are aligned, suggesting a quite symmetrical distribution of observations, characterized by a slight left skewness (-0,48). Indeed, all the observations apart one are in the range of mean +/- 3 standard deviations.

Moving to the dummies controlling for the area, these variables clearly show that the majority of the start-ups of the sample belong to the *Advanced* area (186 out of 312), which can be seen both from the mean (0,60) and from the median (1). On the contrary, *Runner-ups* is the category with the lowest number of targets (41 out of 312), which can be seen from the mean (0,13) and from the 1st, 2nd and 3rd quartile equal to 0. The category *Other* is slightly bigger Runner-ups (mean of 0,27) but still not as big as *Advanced*.

Similarly, the dummies controlling for the industry of the start-up show that the industry distribution is not homogeneous. Indeed, the majority of the companies belong to the *Software* industry (54%), so the other four dummies listed in the table all have 1st, 2nd or 3rd quartile equal to 0, with *Life-Science Biotech* being the biggest among the three (mean of 0,23).

For what concerns the variable controlling for the company's dimension, namely, the company's Total Assets in log form, it is possible to notice that mean (3,89) and median (3,93) are very close, with a level of skewness equal to -0,002, signaling that the observations are distributed symmetrically. Moreover, the variable is characterized by a rather low standard deviation (0,89).

Moving to the independent variables, the overall number of bidders presents a relevant standard deviation (57,17), as the values range from 3 to 182, and present a slight right skewness. Indeed, the overall number of bidders presents a value of Kurtosis smaller than 3 (2,19). Similar considerations can be made for the number of informed and non-informed bidders, with the only difference that the informed ones present a higher level of Kurtosis (3,90) and Skewness (1,37).

The number of team members has a mean value of 1,52 and presents a relevant right skewness. In fact, in the majority of cases the founder has founded the company alone (196 out of 312), resulting in both the minimum and the median equal to 1, while the maximum is equal to 6.

For what concerns the dummies related to the founding CEOs' previous experience, namely MBA, PhD and serial entrepreneur, they all present 1st, 2nd and 3rd quartile equal to 0. In fact, only 10% of the founding CEOs hold an MBA, 23% hold a PhD and 20% have founded other companies before founding the target of the sample. On the other hand, the variables measuring the actual number of years of previous working experience (i.e., managerial and technical), taken in their log form, are characterized by relevant levels of standard deviation (0,43 and 0,37, respectively) and by a right skewness (0,85 and 1,47, respectively).

Lastly, for what concerns the VC_backed dummy, it is possible to notice that the mean is rather high (0,67) and the median is equal to 1, showing that the majority of the companies of the sample are VC-backed (209 out of 312). Among the VC-backed ones, almost half of them are backed by a prominent VCs, as the mean of VC_high is 0,30.

Variable name	Mean	Std. Dev.	1st Quartile	Median	3rd Quartile	Kurtosis	Skewness
Dependent variable							
TobinQ (log)	0,51	0,56	0,16	0,48	0,82	4,40	0,33
Control variables							
company_age (log)	0,94	0,25	0,78	0,95	1,13	2,87	-0,48
area_advanced	0,60	0,49	0	1	1	1,15	-0,39
area_runnerups	0,13	0,33	0	0	0	5,76	2,18
area_other	0,27	0,45	0	0	1	2,05	1,02
ind_highknowledgeintservices	0,15	0,36	0	0	0	4,96	1,99
ind_hightechmanufacturing	0,03	0,17	0	0	0	32,69	5,63
ind_lifesciencebiotech	0,23	0,42	0	0	0	2,63	1,27
ind_other	0,05	0, 22	0	0	0	17,55	4,07
ind_software	0,54	0,50	0	1	1	1,03	-0,17
total_assets (log)	3,89	0,80	3,34	3,93	4,36	3,34	0,00
Independent variables							
n_bidders	66,25	57,17	20	40	108	2,19	0,76
n_informed	13,79	15,01	3	8	21	3,90	1,37
n_non_informed	52,39	47,39	14,5	32	77	2,81	0,96
n_team_members	1,52	0,82	1	1	2	9,07	2,10
dummy MBA	0,10	0,30	0	0	0	7,86	2,62
dummy PhD	0,23	0,42	0	0	0	2,69	1,30
exp_managerial (log)	0,32	0,43	0	0	0,70	2,11	0,87
exp_technical (log)	0,21	0,37	0	0	0,30	3,53	1,45
dummy serialentrepreneur	0,20	0,40	0	0	0	3,37	1,53
dummy VC_backed	0,67	0,47	0	1	1	1,52	-0,72
dummy VC_high	0,30	0,46	0	0	1	1,78	0,88
dummy VC_low	0,37	0,48	0	0	1	1,28	0,53

Table 7: Descriptive statistics

5.2   OLS regression and tests

Entering in the operative details of this thesis, a multiple linear regression model has been used to analyze the relationship between the selected dependent variable, namely the entrepreneurial venture's Tobin's Q, and the set of explanatory variables presented in Chapter 4. In particular, the ordinary least squares (OLS) method has been used, which consists in minimizing the sum of the squares of the differences between the dependent variable observed and the ones predicted by the linear function of the independent variables. In general, linear regression can be represented through the following formula

$$y_i = \beta_0 + \beta_1 \cdot x_{1i} + \beta_2 \cdot x_{2i} + \dots + \beta_k \cdot x_{ki} + \varepsilon_i \qquad (5.1)$$

where y is the dependent variable or, in the same way, the explained variable, β_0 is the constant term (the intercept), $\beta_1 \dots \beta_k$ are the coefficients of the independent variables, $x_1 \dots x_k$ are the independent variables, or explanatory variables, and ε is the disturbance. The disturbance accounts for the variation in the dependent variable that the selected independent variables do not explain; indeed, it is usually not possible to include every influence on the explained variable, even when the model is very complete.

Linear regression models are characterized by a series of assumptions about the terms involved in (5.1) and about their relations, which have to be checked in order to obtain unbiased and stable results. In particular, the assumptions checked for the models proposed in this thesis are related to multicollinearity, homoskedasticity and normality of residuals.

5.2.1   Multicollinearity

Perfect multicollinearity is present in a model when two or more independent variables have an exact linear relationship; the direct consequence is that the OLS method is not able to estimate the coefficients of the explanatory variables. Even though it is not frequent to find perfect multicollinearity, it is still possible to find variables that are highly correlated. As a consequence, small changes in data or in the variables set are likely to produce relevant effects on the estimated coefficients $\beta_1 \dots \beta_k$, even though the overall predictive power of the model might still be high. In other words, when some of the independent variables are

correlated, the R^2 of the model can still be high and the predictions made by the model can be unaffected by multicollinearity, but the signs and the magnitudes of the coefficients $\beta_1 \ldots \beta_k$ can result improbable and unexpected. Therefore, a high degree of multicollinearity can limit the interpretability of the model and it can result in none of the variables having a sufficiently low p-value. In order to detect and test for multicollinearity, there are two main instruments, which are the correlation matrix and the variance inflation factor (VIF).

The correlation matrix shows the correlation coefficients between couples of variables. Therefore, it takes the form of a square matrix, where the variables are present on both the vertical and horizontal axes and all the values on the main diagonal are equal to 1. In *Stata*, the statistical software used for this research, it is possible to obtain the correlation matrix through the *correlate* command. Correlation matrixes are an important tool before the actual construction of the model, as they allow to understand whether some of the variables have to be split in different models or not. In literature, it is not possible to find a uniquely accepted threshold of correlation coefficient above which the variables can be considered as correlated, but a commonly used limit value is 0,7. Therefore, also in this thesis 0,7 has been set as threshold (i.e., variables are considered correlated for values of the correlation coefficients smaller than -0,7 or higher than +0,7). Nevertheless, it is worth mentioning that the correlation matrix measures just the correlation among pairs of variables, not allowing to spot when a variable is a linear combination of two or more other variables.

The shortcoming of the correlation matrix just presented can be overcome through the use of the variance inflation factor (VIF), as it allows to analyze the correlation between one independent variable and a combination of others. Indeed, VIF measures how much the variance of a coefficient is increased because of collinearity. VIF is calculated with the following formula

$$VIF_i = \frac{1}{1 - R_i^2} \qquad (5.2)$$

where R_i^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). It is possible to set some thresholds for VIF, above which multicollinearity can be considered as high. In particular, a series of studies propose a threshold of 10 (Kutner et

al., 2004), while others, being more conservative, propose 5 as a cutoff value (Sheater, 2009; Vercellis, 2009). For the purpose of this thesis, the threshold has been set to 5.

5.2.2   Homoskedasticity

A problem with linear regression is the potential occurrence of heteroskedasticity, which is present when the variance of the disturbance is different across the elements of the vector. Indeed, one of the assumptions of linear regression models is related to the presence of homoskedasticity (i.e., the absence of heteroskedasticity), namely that residuals should have constant variance. When this condition is verified, the OLS provides the best linear unbiased estimator ("BLUE") and results are efficient (Hachen and Shively, 1995). To test for the presence of heteroskedasticity it is possible to use both graphical methods, which consist in trying to visually spot patterns in the residuals when plotted against the fitted values, and analytical methods. Given that these last should be more precise, as heteroskedasticity can take many different forms, in this thesis it has been decided to use analytical methods.

In particular, the White test (White, 1980) is a statistical test that proposes as null hypothesis that the variance of the errors in a regression model is constant (i.e., homoskedasticity is present). On the other hand, the alternative hypothesis is that the null hypothesis is rejected, which makes this test a non-constructive test. Operatively, the White test works by creating an auxiliary regression where the dependent variable is represented by the square of the residuals, while the independent variables are the original regressors, together with their squares and cross-products. Nevertheless, there can be cases in which the White test is statistically significant, but heteroskedasticity might not necessarily be the cause, as there could be specification error. Therefore, to test for pure heteroskedasticity, it is necessary to exclude the cross products from the auxiliary regression proposed by the White test.

5.2.3   Normality of residuals

The last assumption is related to the normal distribution of residuals, characterized by mean equal to 0 and constant variance. Analytically, it is possible to use two main tests

to understand whether the residuals are normally distributed, which are the Shapiro Wilk test (Shapiro and Wilk, 1965) and the Jarque-Bera test (Bera and Jarque 1981).

The Shapiro-Wilk test is a powerful instrument to test for the normality of a sample of data, especially when the sample is small, which is the case of this thesis. In particular, this method aims at testing the null hypothesis of normality of the sample by comparing two different estimators of the variance through the following test statistics W:

$$W = \frac{\left(\sum_{i=1}^{n} a_i x_{(i)}\right)^2}{\sum_{i=1}^{n}(x_i - \bar{x})^2} \qquad \text{with} \qquad (a_1, \dots, a_n) = \frac{m^T V^{-1}}{(m^T V^{-1} V^{-1} m)^{1/2}} \qquad (5.3)$$

where $x_{(i)}$ is the i-th order statistics (i.e., the i-th smallest value of the sample), $\bar{x}$ is the mean of the sample, $(m_1, \dots, m_n)^T$ 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 values of the W statistics range from 0 to 1, and when the value is too low the null hypothesis of the normal distribution of the sample has to be rejected.

Moving to the Jarque-Bera test, this test aims at testing the normality of a sample by setting the null hypothesis that both skewness and kurtosis coefficients are 0. The test statistics JB is computed as

$$JB = \frac{n}{6}\left(S^2 + \frac{(k-3)^2}{4}\right) \qquad (5.4)$$

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.

For the purpose of this thesis, normality of residuals has been checked both analytically, using the two methods just described, and graphically, using the following instruments: Kernel normality graph, Distribution of residual graph, QQ-Plot and Box Plot.

5.3   Models' presentation

The aim of this chapter is to present the models that have been developed for this thesis work in order to finding a relationship between the exit performance (i.e., the Tobin's Q) and the dependent variables presented in Chapter 4. In particular, the goal of the models presented in this chapter is to test the hypotheses presented in Chapter 2, which, for the sake of simplicity, 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.

As introduced in Chapter 5.2, to test these hypotheses a series of multiple regression models (OLS) have been developed. All these models are based on the same sample of 312 European and Israeli entrepreneurial venture that have performed an exit through acquisition between 2001 and 2007, and whose characteristics have been described in Chapter 3. In particular, the models developed present a growing complexity; indeed, the first one is the simplest one and includes the overall number of bidders, all the control variables presented in Chapter 4.2 and the independent variables related to the company's human capital and to the presence of VC. On the other hand, the second one divides the overall number of bidders into informed and non-informed, while keeping all the other variables included in the first model unchanged. Finally, the third model includes all the variables of the second model, while adding the interaction between the most relevant signal (i.e., dummy *VC_backed*) and the number of informed and non-informed bidders.

5.3.1   Model 1: the effect of the overall 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), and, consequently, the first variable included is the overall number of bidders (winsorized at 1% level). Then, all the control variables presented in Chapter 4.2 are included, namely four for the industry classification, two for the geographical area, the company size and the company age. Finally, the independent variables, both related to the presence of VCs and to the company's human capital (i.e., number

of members of the founding team, 2 dummies that account for the CEO's high-level educa-
tion, 2 variables that summarize the CEO's relevant previous working experience and one
dummy for CEO's previous entrepreneurial experience). The overall regression is reported
hereafter:

$$Tobin's\ Q_i = \beta_0 + \beta_1 ind\_highknowledgeintservices_i \quad\quad (5.5)$$
$$+ \beta_2 ind\_hightechmanufacturing_i + \beta_3 ind\_lifesciencebiotech_i$$
$$+ \beta_4 ind\_other_i + \beta_5 area\_advanced_i + \beta_6 area\_runnerups_i$$
$$+ \beta_7 total\_assets_i + \beta_8 company\_age_i + \beta_9 n\_bidders_i$$
$$+ \beta_{10} VC\_backed_i + \beta_{11} n\_team\_members_i + \beta_{12} MBA_i + \beta_{13} PhD_i$$
$$+ \beta_{14} serial\_entrepreneur_i + \beta_{15} exp\_managerial_i$$
$$+ \beta_{16} exp\_technical_i + \varepsilon_i$$

Table 7 summarizes the results of the regression. The first thing that can be noticed
is that the p-value of the F-test is equal to 0 with four decimal places, signaling that the
overall model is statistically significant. The value of the R^2 is 0,2565, which means that the
26% of the variation of the Tobin's Q is explained by the explanatory variables included in
the model. Similarly, the adjusted R^2, which is a modified version of the R^2 that considers
both the number of regressors and the number of observations in the sample, comes out being
0,2162, showing that 22% of the variation of the Tobin's Q is explained by the selected
regressors. Even though, generally speaking, 0,2162 is not high as a value for the adjusted
R^2, it has to be considered that the exit valuation is very complex topic, which, usually,
cannot be fully explained with a single model.

For what concerns multicollinearity, this model does not present any problem, as the
result of the VIF test is 1,44, far below the conservative threshold of 5. On the other hand,
the hypotheses of homoskedasticity and of normality of residuals have to be rejected, as the
tests described in Chapter 5.2 do not overcome the threshold of 0,05. In any case, further
considerations on the robustness of these results are postponed to Chapter 6.

Moving to the results of the regression, it is first of all possible to note that, among
the dummies controlling for the industry, only *ind_lifesciencebiotech* comes out being sig-
nificant, with a p-value of 0,002. For what concerns the dummies controlling for the geo-
graphic location of the target, it is possible to note that both of them are positively correlated

with the *Tobin's Q* and strongly significant. Additionally, also the value of the total assets has a very high significance (p-value of 0,000) and is negatively related to the *Tobin's Q*, confirming that smaller companies receive higher valuations due to the stronger growth opportunities (Meoli et al., 2013).

Variable	β	p-value
ind_highknowledgeintservices	0,2273	0,121
ind_hightechmanufacturing	0,2108	0,318
ind_lifesciencebiotech	0,4517	0,002**
ind_other	-0,2234	0,138
area_advanced	0,2165	0,001**
area_runnerups	0,2037	0,035**
total_assets[1]	- 0,2517	0,000**
company_age[1]	- 0,1048	0,415
n_bidders[2]	0,0006	0,384
VC_backed	0,1908	0,007**
n_team_members	0,0392	0,292
MBA	0,2836	0,003**
PhD	0,0599	0,439
serial_entrepreneur	-0,0099	0,903
exp_managerial[1]	-0,0257	0,715
exp_technical[1]	0,0396	0,621
Constant	0,8987	0,000**

R-squared	0,2565	F-test	6,36
Adjusted R-squared	0,2162	p-value	0,000

1. Variable used in its log form   * p-value < 10%
2. Variable winsorized at 1% level   ** p-value < 5%

Table 7: Model 1 - the effect of the overall number of bidders

Moving to the independent variables, the first thing that pops out is that the overall number of bidders is not statistically significant (p-value of 0,384); therefore, given that the p-value is too high, it is not possible to neither accept nor reject H0. This result, which seems, at a first glance, in contrast with traditional economic theories (Vicrey, 1961), will be clarified with the development of the other models, as the effects of informed and non-informed bidders comes out being diametrically opposed and putting them all together may not be precise. Among the other variables, dummy *VC_backed* has statistically significant (p-value of 0,007) positive coefficient (0,1908), which is consistent with previous literature and which confirms that the presence VCs has a positive effect on the exit valuation. Similarly, also the dummy *MBA* is strongly significant and positively related to the exit valuation. Finally, it is also worth mentioning that the *Constant* is statistically significant (p-value of 0,000).

5.3.2 Model 2: separating informed and non-informed bidders

The second model aims at testing whether the number of informed bidders has a positive effect on the exit valuation (H1). Therefore, Model 2 includes all the variables that are part of Model 1, apart from the overall number of bidders, which has been divided into informed and non-informed bidders. The regression used in Model 2 is reported hereafter, while Table 8 summarizes the results.

$$
\begin{aligned}
Tobin's\ Q_i = \beta_0 &+ \beta_1 ind\_highknowledgeintservices_i \qquad\qquad (5.6)\\
&+ \beta_2 ind\_hightechmanufacturing_i + \beta_3 ind\_lifesciencebiotech_i\\
&+ \beta_4 ind\_other_i + \beta_5 area\_advanced_i + \beta_6 area\_runnerups_i\\
&+ \beta_7 total\_assets_i + \beta_8 company\_age_i + \beta_9 n\_informed\_bidders_i\\
&+ \beta_{10} n\_non\_informed\_bidders_i + \beta_{11} VC\_backed_i\\
&+ \beta_{12} n\_team\_members_i + \beta_{13} MBA_i + \beta_{14} PhD_i\\
&+ \beta_{15} serial\_entrepreneur_i + \beta_{16} exp\_managerial_i\\
&+ \beta_{17} exp\_technical_i + \varepsilon_i
\end{aligned}
$$

Again, the first thing that can be noticed is that the p-value of the F-test is equal to 0 with four decimal places, signaling that the overall model is statistically significant. The R^2 and adjusted R^2 come out being 0,2634 and 0,2208, respectively; given that both values improved by roughly 1% with respect to Model 1, it is possible to say that, by separating the

informed bidders from the non-informed ones, the variations of the dependent variable can be better explained.

For what concerns multicollinearity, also in this case the result of the VIF test (1,48) is far below the conservative threshold of 5. On the other hand, the null hypotheses of homoskedasticity and of normality of residuals should be rejected, with further considerations about the robustness of these results to be postponed to Chapter 6. In any case, given that Model 2 is more complete than Model 1, while Model 3 includes interactive variables which may affect the overall interpretability of the results, it is worth analyzing now the graphs about the normality of residuals to have a more complete understanding of the situation. Starting from the Kernel density graph, it is possible to notice that residuals roughly follow a normal distribution, but the mean and the values around it presents a density that is too high. Indeed, the same can be noticed from the histogram that plots the distributions of residuals, with a high bar in the middle.
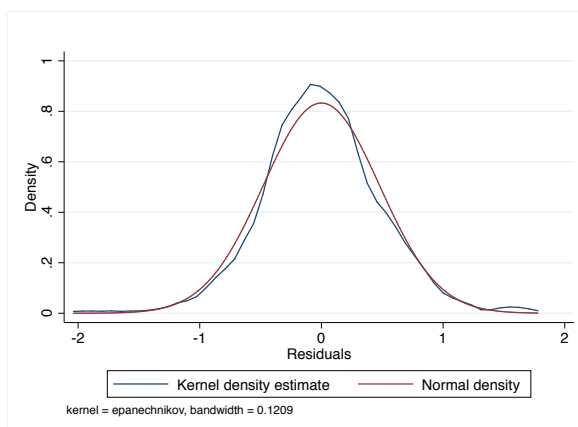
Figure 6: Kernel density estimate
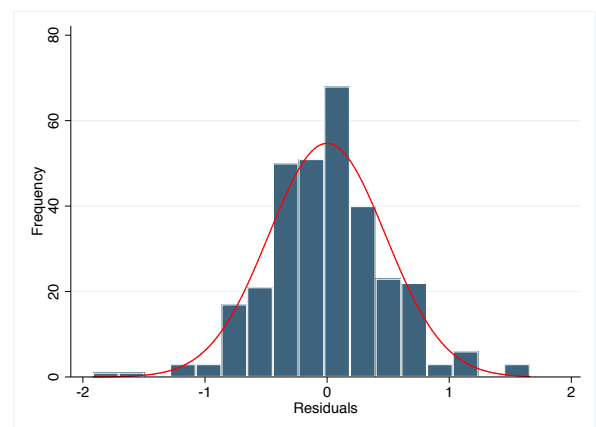
Figure 5: Distribution of residuals

By looking at the boxplot, it is possible to exclude skewness for the distribution of residuals, as the distance between each quartile and the median seems constant. However, the boxplot underlines the presence of outliers both above and below the graph, which can also be noticed from the QQ-plot. In any case, no reasons have been detected that would allow to exclude these observations from the sample.

Summarizing these considerations, it is possible to say that the models developed in this thesis do not present any multicollinearity problems, as it can be seen from the values

of the VIF test and from the overall correlation matrix presented in Table 10. Indeed, the only variables that come out being correlated from the matrix are the number of bidders and the number of informed and non-informed bidders, which have never been used in model together. All the other correlation coefficients are largely below the threshold of 0,7. On the other hand, hypotheses about homoscedasticity and normality of residuals have to be rejected, with further considerations about the robustness of the results that are postponed to Chapter 6.
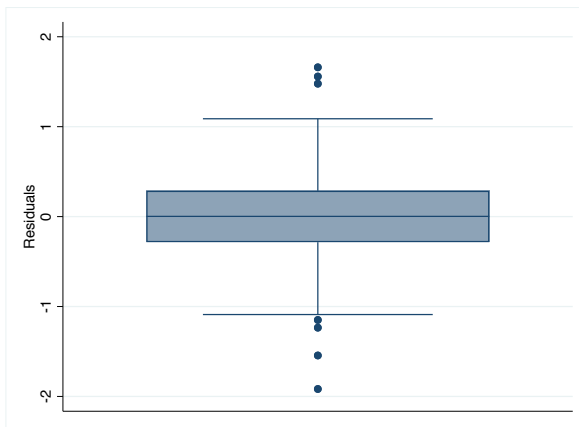
Figure 8: Box plot
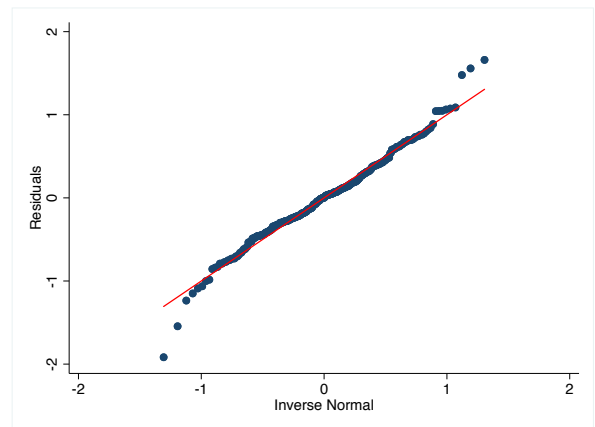
Figure 7: QQ plot

Moving to the results of the regression, all the control variables that resulted statistically significant in Model 1 are still significant (i.e., *ind_lifesciencebiotech*, *area_advanced*, *area_runnerups*, *total_assets*), and the signs of the coefficients remain unchanged, while there have been minor changes in the magnitude of the coefficients and in the respective p-values. Similar considerations can be made for the dummy *VC_backed* and for the dummy *MBA*, which have again a positive effect on the exit valuation and are statistically significant. The most relevant change with respect to Model 1 is that, by separating informed bidders by non-informed ones, the number of informed bidders comes out being statistically significant, with a p-value of 0,068, and positively related with the exit valuation, with a coefficient of 0,005. On the other hand, the number of non-informed bidders is not statistically significant, with a p-value of 0,858. As a consequence, these results allow to confirm H1.

Variable	β	p-value
ind_highknowledgeintservices	0,2192	0,134
ind_hightechmanufacturing	0,2272	0,281
ind_lifesciencebiotech	0,4549	0,002**
ind_other	-0,2009	0,182
area_advanced	0,1787	0,012**
area_runnerups	0,2293	0,019**
total_assets[1]	-0,2461	0,000**
company_age[1]	-0,1245	0,334
n_informed_bidders[2]	0,0050	0,068*
n_non_informed_bidders[2]	-0,0002	0,858
VC_backed	0,1947	0,006**
n_team_members	0,0443	0,235
MBA	0,2691	0,005**
PhD	0,0609	0,430
serial_entrepreneur	-0,0147	0,856
exp_managerial[1]	-0,0460	0,520
exp_technical[1]	0,0456	0,568
Constant	0,9037	0,000**

R-squared	0,2634	F-test	6,18
Adjusted R-squared	0,2208	p-value	0,000

1. Variable used in its log form   * p-value < 10%
2. Variable winsorized at 1% level   ** p-value < 5%

Table 8: Model 2 - division between informed and non-informed bidders

5.3.3   Model 3: the contingent effect of VCs

Model 3 aims at testing the effect of the presence of VCs on the exit valuation contingent to the number of informed (H3) and non-informed bidders (H2) in the auction setting. Therefore, Model 3 includes all the variables of Model 2, to which the interaction of the dummy *VC_backed* with the number of informed bidders and with the number of non-informed bidders has been added. The overall regression performed is reported hereafter, while the results are reported in Table 9. For the sake of simplicity, the interactive variables are reported in capital letters.

$$
\begin{aligned}
Tobin's\ Q_i = \beta_0 \ + \ & \beta_1 ind\_highknowledgeintservices_i \quad\quad\quad\quad (5.7)\\
+ \ & \beta_2 ind\_hightechmanufacturing_i + \beta_3 ind\_lifesciencebiotech_i\\
+ \ & \beta_4 ind\_other_i + \beta_5 area\_advanced_i + \beta_6 area\_runnerups_i\\
+ \ & \beta_7 total\_assets_i + \beta_8 company\_age_i + \beta_9 n\_informed\_bidders_i\\
+ \ & \beta_{10} n\_non\_informed\_bidders_i + \beta_{11} VC\_backed_i\\
+ \ & \beta_{12} n\_team\_members_i + \beta_{13} MBA_i + \beta_{14} PhD_i\\
+ \ & \beta_{15} serial\_entrepreneur_i + \beta_{16} exp\_managerial_i\\
+ \ & \beta_{17} exp\_technical_i + \beta_{18} N\_INFORMED\_VC\_BACKED_i\\
+ \ & \beta_{19} N\_NON\_INFORMED\_VC\_BACKED_i + \varepsilon_i
\end{aligned}
$$

Also in this case, the p-value of the F-test is equal to 0 with four decimal places, which makes also this model statistically significant. For what concerns the R^2, it is possible to see that the value has raised to 0,2715, while the adjusted R^2 has raised to 0,2241, showing further improvements from the previous models.

As an overall, it is possible to notice from Table 9 that, with the introduction of the interactive variables, some of the coefficients and of the p-values have changes from the previous models. The control variables that were significant in the previous models (i.e., *ind_lifesciencebiotech*, *area_advanced*, *area_runnerups*, *total_assets*) are still significant and the sign of the coefficients results unchanged. For what concerns the independent variables, the dummy *VC_backed* does not come out being significant anymore (p-value of 0,395) due to the fact that it is included in the interaction. On the other hand, the dummy *MBA* remains significant, with values of the coefficient (0,2664) and p-value (0,006), comparable to the ones of the previous models. The number of informed bidders has a higher

coefficient (0,008) and a lower p-value (0,036). For what concerns the number of non-informed bidders, the coefficient remains almost unchanged with respect to Model 2 (-0,0017), while the p-value decreases from 0,858 to 0,167. Considering the interactive variables, *N_NON_INFORMED_VC_BACKED* (i.e., the interaction between number of non-informed bidders and dummy *VC_backed*), comes out being statistically significant (p-value of 0,075) and positively related to the *Tobin's Q*, with a coefficient of 0,0027. As a consequence, these results suggest that a relationship between the number of non-informed bidders and the presence of VCs exists, and that the effect of the presence of VCs is stronger when the number of non-informed bidders is larger. On the other hand, the interactive variable *N_INFORMED_VC_BACKED* comes out not being statistically significant. In any case, the F-test on

$$N\_INFORMED\_VC\_BACKED \; + \; n\_informed\_bidders \; = 0 \qquad (5.8)$$

has been run, and the resulting p-value (0,4268) does not allow to reject the null hypothesis of the test, suggesting that the there is no evidence to say that, when VCs are present, the coefficient of the number of informed bidders is different from 0. As a consequence, this would hint that VCs might have a substitutive effect on the number of informed bidders. In any case, in order to have a complete understanding of the results coming from the interaction included in this regression and to draw the proper conclusions about H2 and H3, it would be necessary to analyze the marginal effects. However, given that the models presented in this chapter violate some of the OLS assumptions, the analysis of marginal effects is postponed to Chapter 6.1.3, where the robust regression of Model 3 is proposed.

Variable	β	p-value
ind_highknowledgeintservices	0,0459	0,678
ind_hightechmanufacturing	0,0364	0,844
ind_lifesciencebiotech	0,2525	0,011**
ind_other	-0,1654	0,283
area_advanced	0,1750	0,014**
area_runnerups	0,2191	0,025**
total_assets[1]	-0,2475	0,000**
company_age[1]	-0,1228	0,339
n_informed_bidders[2]	0,0080	0,036**
n_non_informed_bidders[2]	-0,0017	0,167
VC_backed	0,0992	0,395
n_team_members	0,0389	0,298
MBA	0,2664	0,006**
PhD	0,0630	0,413
serial_entrepreneur	-0,0197	0,809
exp_managerial[1]	-0,0503	0,482
exp_technical[1]	0,0442	0,580
N_INFORMED_VC_BACKED	-0,0048	0,300
N_NON_INFORMED_VC_BACKED	0,0027	0,075*
Constant	1,1840	0,000**

R-squared	0,2715	F-test	5,73
Adjusted R-squared	0,2241	p-value	0,000

1. Variable used in its log form   * p-value < 10%
2. Variable winsorized at 1% level   ** p-value < 5%

Table 9: Model 3 - the interactive effect of VCs

Variable	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
(a) ind_highknowledgeintservices	1,0000																	
(b) ind_hightechmanufacturing	-0,0717	1,0000																
(c) ind_lifesciencebiotech	-0,2278	-0,0944	1,0000															
(d) ind_other	-0,0967	-0,0401	-0,1273	1,0000														
(e) area_advanced	-0,0262	0,0638	0,0012	0,0433	1,0000													
(f) area_runnerups	-0,0012	-0,067	0,0346	-0,0474	-0,4726	1,0000												
(g) total_assets	0,0274	0,1269	0,023	-0,0131	-0,1137	0,0709	1,0000											
(h) company_age	-0,0847	0,0814	-0,0603	-0,0308	-0,2256	0,1438	0,2521	1,0000										
(i) n_bidders	-0,3325	-0,1111	-0,4158	-0,2179	0,0293	0,0561	-0,0872	0,1591	1,0000									
(j) n_informed_bidders	-0,2402	-0,1151	-0,3567	-0,1383	0,3012	-0,1989	-0,1541	0,0643	0,7227	1,0000								
(k) n_non_informed_bidders	-0,3248	-0,0973	-0,388	-0,219	-0,0607	0,1309	-0,0557	0,1709	0,9753	0,5526	1,0000							
(l) VC_backed	0,2919	0,121	0,0124	0,1632	-0,05	0,0108	0,1383	0,107	-0,2766	-0,2339	-0,2601	1,0000						
(m) n_team_members	-0,0098	-0,0391	-0,0963	-0,0232	-0,0046	0,1008	0,2208	-0,0028	0,1353	0,014	0,1592	0,1536	1,0000					
(n) MBA	0,0382	-0,0583	-0,0096	0,1609	-0,0017	-0,069	0,0193	-0,0491	-0,0494	0,0211	-0,0658	0,125	0,0565	1,0000				
(o) PhD	0,0762	-0,0022	0,3741	-0,0222	0,0572	0,0378	-0,0871	-0,163	-0,2657	-0,2259	-0,2483	0,186	-0,0174	-0,0071	1,0000			
(p) serial_entrepreneur	0,0851	-0,0762	-0,1393	-0,0635	-0,0601	-0,018	0,0385	-0,0969	0,0955	0,0561	0,0975	-0,003	0,164	0,0505	-0,1159	1,0000		
(q) exp_managerial	-0,0246	-0,043	0,0415	0,0402	0,0484	-0,0819	0,0124	-0,1902	0,0672	0,1568	0,0312	0,0699	-0,009	0,0494	-0,0488	0,2421	1,0000	
(r) exp_technical	-0,0795	-0,0251	0,0955	-0,0216	0,0449	-0,0436	-0,0977	-0,1629	-0,0313	-0,0512	-0,0208	-0,1575	0,0213	0,0317	0,1766	-0,0262	-0,1261	1,0000

Table 10: Correlation matrix

6   Robustness

After presenting the models developed for this thesis work, the aim of this chapter is to describe a series of robustness checks that have been performed on Models 1, 2 and 3 in order to assess the soundness of the results obtained. Indeed, performing changes on the models is a necessary step, as, in absence of further analysis, results might also be the due to the way in which the variables have been defined. Furtherly, performing additional tests is necessary in order to overcome the problems of heteroskedasticity and of normality of residuals that the models presented in Chapter 5 highlighted. In particular, the changes performed belongs to three main domains; first of all, the three models presented in Chapter 5 have been run again using the *robust* command in *Stata*. Secondly, being the dummy *VC_backed* a crucial variable for the models, it has been decided to introduce considerations about the reputation of VCs in order to assess the impact of this change on the results. Lastly, a test to study the endogeneity of the presence of VCs has been performed.

6.1   Robust regression

Given that, as explained in Chapter 5.3, the models developed for this thesis (i.e., Models 1, 2 and 3) present problems of heteroskedasticity and of normality of residuals, in this chapter these models are going to be studied once again using the robust regression (*robust* command in *Stata*). Indeed, robust regression can be the proper solution when some of the OLS assumptions are violated, as this does not overly affect its results; additionally, robust regression works better than OLS when outliers are present and there are no reasons to exclude them, which is the case of this thesis, as it allows to give to outliers a different weight.

6.1.1   Model 1A: robust regression of Model 1

The robust regression of Model 1 has been performed using the exact same variables used for Model 1 and presented in Chapter 5.3.1. The results of the robust regression are reported in Table 11.

Variable	β	p-value
ind_highknowledgeintservices	0,0039	0,973
ind_hightechmanufacturing	-0,0126	0,888
ind_lifesciencebiotech	0,2283	0,030**
ind_other	-0,2234	0,135
area_advanced	0,2165	0,002**
area_runnerups	0,2037	0,019**
total_assets[1]	- 0,2517	0,000**
company_age[1]	- 0,1049	0,446
n_bidders[2]	0,0006	0,373
VC_backed	0,1908	0,005**
n_team_members	0,0392	0,342
MBA	0,2836	0,002**
PhD	0,0599	0,477
serial_entrepreneur	-0,0204	0,800
exp_managerial[1]	-0,0257	0,684
exp_technical[1]	0,0396	0,641
Constant	1,1221	0,000**

R-squared	0,2565	F-test	7,21
Adjusted R-squared	-	p-value	0,000

1. Variable used in its log form   * p-value < 10%
2. Variable winsorized at 1% level   ** p-value < 5%

Table 11: Model 1A - robust regression of Model 1

As it is possible to notice, the R^2 of the regression is 0,2565. In general, it is possible to say that the variables that were statistically significant in Model 1 remain statistically significant also with this change, with values of the coefficients that are almost unchanged. Consistently, it is worth to underline that overall number of bidders is not significant also in this case, confirming that no conclusions can be made on H0.

6.1.2 Model 2A: robust regression of Model 2

The robust regression of Model 2 has been performed using the exact same variables used for Model 2 and presented in Chapter 5.3.2. The results of the robust regression are reported in Table 12.

First of all, it can be noticed that the R^2 of the model is 0,2634, higher than the one of Model 1. In general terms, the variables that were statistically significant in the simple version of Model 2 come out being significant also with the robust regression, with comparable p-values and coefficients. The only exception to this last statement is the number of informed bidders, whose coefficient has remained unchanged (0,005), but whose p-value as decreased from 0,068 in the simple version of Model 2 to 0,038 in Model 2A. Therefore, this result furtherly suggests to confirms H1.

Variable	β	p-value
ind_highknowledgeintservices	0,0183	0,876
ind_hightechmanufacturing	0,0263	0,775
ind_lifesciencebiotech	0,2540	0,017**
ind_other	-0,2009	0,182
area_advanced	0,1787	0,014**
area_runnerups	0,2293	0,010**
total_assets[1]	-0,2461	0,000**
company_age[1]	-0,1245	0,363
n_informed_bidders[2]	0,0050	0,038**
n_non_informed_bidders[2]	-0,0002	0,844
VC_backed	0,1947	0,004**
n_team_members	0,0443	0,286
MBA	0,2691	0,003**
PhD	0,0609	0,471
serial_entrepreneur	-0,0147	0,856
exp_managerial[1]	-0,0460	0,469
exp_technical[1]	0,0456	0,593
Constant	1,1046	0,000**

R-squared	0,2634	F-test	6,94
Adjusted R-squared	-	p-value	0,000

1. Variable used in its log form   * p-value < 10%
2. Variable winsorized at 1% level   ** p-value < 5%

Table 12: Model 2A - robust regression of Model 2

6.1.3 Model 3A: robust regression of Model 3

Also in this case, the robust regression of Model 3 has been performed using the exact same variables included in the simple version of Model 3 and presented in Chapter 5.3.3. The results of the regression are presented in Table 13.

First of all, it can be noticed that the R^2 of the model is 0,2715, higher than the one of Model 1 and 2. In general terms, once again the variables that were statistically significant in the simple version of Model 3 come out being significant also in Model 3A, with comparable p-values and coefficients; therefore, the results found with the simple version of Model 3 can be considered as robust. There are anyway few changes that it is worth underlying, as they are related to the variables on the number of bidders and to the interactive variables. In particular, in this case the number of informed bidders is characterized by a lower p-value, as it decreases from 0,036 in the simple version of Model 3 to 0,020 in Model 3A. Similarly, also the interactive variable between the number of non-informed bidders and the dummy *VC_backed* (*N_NON_INFORMED_VC_BACKED*) is characterized by a lower p-value in the current version of the model, as it decreases from 0,075 in Model 3 to 0,037 in Model 3A. Similarly, the interactive variable *N_ INFORMED_VC_BACKED* is still not statistically significant, and the p-value of the F-test on

$$\text{N\_INFORMED\_VC\_BACKED} + n\_informed\_bidders = 0 \qquad (6.1)$$

is too high (0,3254) to allow to reject the null hypothesis of the test. Therefore, this would suggest that the presence of VCs has a substitutive effect on the number of informed bidders. In any case, the most interesting outcome of Model 3A is that the number of non-informed bidders becomes statistically significant, with a p-value of 0,087 and, quite interestingly, a negative coefficient (-0,0017). These results are going to be discussed in detail in Chapter 7.

Variable	β	p-value
ind_highknowledgeintservices	0,0459	0,714
ind_hightechmanufacturing	0,0364	0,702
ind_lifesciencebiotech	0,2525	0,018**
ind_other	-0,1654	0,295
area_advanced	0,1750	0,016**
area_runnerups	0,2191	0,013**
total_assets[1]	-0,2475	0,000**
company_age[1]	-0,1228	0,368
n_informed_bidders[2]	0,0076	0,020**
n_non_informed_bidders[2]	-0,0017	0,087*
VC_backed	0,0992	0,430
n_team_members	0,0389	0,358
MBA	0,2664	0,004**
PhD	0,0630	0,455
serial_entrepreneur	-0,0197	0,814
exp_managerial[1]	-0,0503	0,428
exp_technical[1]	0,0442	0,601
N_INFORMED_VC_BACKED	-0,0048	0,222
N_NON_INFORMED_VC_BACKED	0,0027	0,037**
Constant	1,1840	0,000**

R-squared	0,2715	F-test	7,08
Adjusted R-squared	-	p-value	0,000

1. Variable used in its log form   * p-value < 10%
2. Variable winsorized at 1% level   ** p-value < 5%

Table 13: Model 3A - robust regression of Model 3

Anyway, as introduced in Chapter 5.3.3, it is necessary to analyze the average marginal effects of the independent variables included in this model in order to have a deeper understanding of the results of this regression. Average marginal effects have been computed and are reported in Table 14. As it is possible to notice, the dummy *VC_backed* has an overall significant positive marginal effect, and the same can be stated for the number of informed bidders, while the number of non-informed bidders has a non-significant overall marginal effect.

Variable	dy/dx	p-value
n_informed_bidders[2]	0,0044	0,064*
n_non_informed_bidders[2]	0,0001	0,909
VC_backed	0,1768	0,017**
n_team_members	0,0389	0,358
MBA	0,2664	0,004**
PhD	0,0630	0,455
serial_entrepreneur	-0,0197	0,814
exp_managerial[1]	-0,0503	0,428
exp_technical[1]	0,0442	0,601

1. Variable used in its log form	* p-value < 10%
2. Variable winsorized at 1% level	** p-value < 5%

Table 14: Marginal effects of the independent variables

In any case, in order to properly understand whether H2 and H3 should be confirmed or rejected, it is necessary to compute the marginal effect of the dummy VC_backed at the quartiles of the variables *n_informed* and *n_non_informed*, and the results of this calculation are reported in Table 15. As it is possible to notice, for what concerns the number of non-informed bidders (H2), when the number of non-informed bidders increases, the marginal effect increases and becomes more statistically significant. Therefore, this result allows to confirm H2. On the other hand, H3 cannot be confirmed; indeed, as the number of informed bidders increases, the marginal effect decreases, which is what is predicted by H3, but also its significance decreases, up to the point in which it becomes non-significant.

	n_informed		n_non_informed	
VC_backed	dy/dx	p-value	dy/dx	p-value
0. VC_backed	(base outcome)		(base outcome)	
1. VC_backed				
1	0,2284	0,011**	0,0729	0,481
2	0,2044	0,011**	0,1209	0,168
3	0,1423	0,061*	0,2443	0,000**
4	-0,0396	0,828	0,5074	0,001**

n_informed: 1._at=3; 2._at=8; 3._at=21; 4._at=59   * p-value < 10%
n_non_informed: 1._at=14.5; 2._at=32; 3._at=77; 4._at=173   ** p-value < 5%

Table 15: Marginal effect of dummy VC_backed at different values of the number of bidders

Finally, by calculating the marginal effects of the number of bidders (both informed and non-informed) at different values of dummy *VC_backed*, it is possible to derive interesting insights. Indeed, as reported in Table 16, it can be noted that, when VCs are not present, the number of informed bidders has a significant positive effect (0,0076) on the exit valuation, while the number of non-informed bidders has a significant negative effect (-0,0017) on the exit valuation. Taken together, these results might explain why the relationship predicted by H0 is not backed by the results of Model 1. On the other hand, when VCs are present, marginal effects show that both the coefficients of informed and non-informed bidders become non-statistically significant, suggesting that, when they are present, it becomes no more important to have many informed bidders for the purpose of the valuation.

	n_informed		n_non_informed	
VC_backed	dy/dx	p-value	dy/dx	p-value
0	0,0076	0,020**	-0,0017	0,087*
1	0,0028	0,325	0,0010	0,322

0: VC not present   * p-value < 10%
1: VC present   ** p-value < 5%

Table 16: Marginal effect of the number of bidders at different values of dummy VC_backed

6.2 Model 2B: the effect of reputable VCs

The second robustness check has been performed just on Model 2, as it includes the division between informed and non-informed bidders while not assessing the interactive effect with the dummy *VC_backed*, which would add further complexity to the model and which would produce results that are more difficult to interpret. In particular, being the dummy *VC_backed* a crucial variable for the models presented in Chapter 5, as it comes out being statistically significant, positively related to the exit value and effective when used for the interaction with the number of bidders, it has been decided to try to modify it. Therefore, dummy *VC_backed* has been split into *VC_high* and *VC_low*, where the former assumes value 1 if the company is backed by at least one prominent VC according to the definition given in Chapter 4.3.3, while the latter assumes value 1 if the company is backed by a VC that cannot be considered as reputable, 0 otherwise. Therefore, this model includes all the variables that are part of Model 2, apart from dummy *VC_backed* that has been split into *VC_high* and *VC_low*. The overall regression is reported hereafter, while the results are reported in Table 17.

$$
\begin{aligned}
Tobin's\ Q_i = \beta_0\ & +\ \beta_1 ind\_highknowledgeintservices_i \hspace{2cm} (6.2)\\
& +\ \beta_2 ind\_hightechmanufacturing_i\ +\ \beta_3 ind\_lifesciencebiotech_i\\
& +\ \beta_4 ind\_other_i\ +\ \beta_5 area\_advanced_i\ +\ \beta_6 area\_runnerups_i\\
& +\ \beta_7 total\_assets_i\ +\ \beta_8 company\_age_i\ +\ \beta_9 n\_informed\_bidders_i\\
& +\ \beta_{10} n\_non\_informed\_bidders_i\ +\ \beta_{11} VC\_high_i\ +\ \beta_{12} VC\_low_i\\
& +\ \beta_{13} n\_team\_members_i\ +\ \beta_{14} MBA_i\ +\ \beta_{15} PhD_i\\
& +\ \beta_{16} serial\_entrepreneur_i\ +\ \beta_{17} exp\_managerial_i\\
& +\ \beta_{18} exp\_technical_i\ +\ \varepsilon_i
\end{aligned}
$$

For what concerns the output of the regression, it can be noticed that, also in this case, the p-value of the F-test is 0 with four decimal places, signaling that the model is statistically significant. The R^2 is 0,2720, while the adjusted R^2 is 0,2273, slightly higher than the respective values obtained for Model 2. Also in this model, no problems of multicollinearity have emerged, as the VIF test provides a value of 1,52. On the other hand, the null hypotheses of homoskedasticity and of normality of residuals have to be rejected.

Variable	β	p-value
ind_highknowledgeintservices	0,0265	0,803
ind_hightechmanufacturing	0,0428	0,816
ind_lifesciencebiotech	0,2429	0,014**
ind_other	-0,1959	0,192
area_advanced	0,1936	0,007**
area_runnerups	0,2526	0,010**
total_assets[1]	-0,2476	0,000**
company_age[1]	-0,1502	0,245
n_informed_bidders[2]	0,005	0,089*
n_non_informed_bidders[2]	-0,0001	0,891
VC_high	0,2659	0,001**
VC_low	0,1344	0,082*
n_team_members	0,0468	0,208
MBA	0,2752	0,004**
PhD	0,0481	0,533
serial_entrepreneur	-0,0185	0,819
exp_managerial[1]	-0,0466	0,512
exp_technical[1]	0,0388	0,626
Constant	1,1282	0,000**

R-squared	0,2720	F-test	6,08
Adjusted R-squared	0,2273	p-value	0,000

1. Variable used in its log form   * p-value < 10%
2. Variable winsorized at 1% level   ** p-value < 5%

Table 17: Model 2B - the reputation of VCs

Looking at numbers, it is possible to notice that, also in this case, the control variables that came out being statistically significant in all the models of Chapter 5 have maintained their significance, with negligible changes in the values of the coefficients. The number of informed bidders is statistically significant also in this case, with a slightly increased p-value (0,089) and with the value of the coefficient that has remained exactly equal to the one of Model 2 (0,005); therefore, this outcome provides further support to what predicted by H1. Similarly, also the dummy *MBA* remains statistically significant in this model. For what concerns the two variables introduced about VCs, both *VC_high* and *VC_low* are statistically significant, with *VC_high* that has the lowest p-value (0,001) and a coefficient that is roughly twice the one of *VC_low* (0,2659 vs 0,1344). As a consequence, these results seem to confirm to a larger extent the positive effect of the presence of VCs on the acquisition valuation, clarifying that reputable VCs that should have a stronger effect.

6.3   Model 2C: endogeneity of the presence of VCs

The last robustness check aims at testing the potential endogeneity of the variable dummy *VC_backed*, as a series of studies suggest the existence of an endogeneity problem with VC financing (Kortum and Lerner, 2000; Colombo and Montanaro, 2020); the check has been performed by introducing the instrumental variable *dist_closest_VC_hub*. Also in this case, Model 2 has been taken as the basis for the construction of this model, thus maintaining here all the variables included in Model 2.

Table 18 summarizes the results of the regression performed with the *Stata* command *ivreg* on Model 2, in which the variable dummy *VC_backed* has been instrumented with *dist_closest_VC_hub*. As it is possible to notice, the independent variables that were statistically significant in Model 2 are not significant anymore. The main reason for this result is likely to be the very low correlation between dummy *VC_backed* and *dist_closest_VC_hub* (correlation factor of -0,0162), which can be defined as a bizarre and unexpected results and which suggests that *dist_closest_VC_hub* should be substituted with a more fitting variable. Therefore, no conclusions can be made about the endogeneity of the presence of VCs, and finding a good instrumental variable can be a good starting point for future developments.

Variable	β	p-value
ind_highknowledgeintservices	0,3490	0,445
ind_hightechmanufacturing	0,3471	0,492
ind_lifesciencebiotech	0,2520	0,056*
ind_other	-0,5490	0,231
area_advanced	0,2044	0,041**
area_runnerups	0,2747	0,052*
total_assets[1]	-0,2562	0,000**
company_age[1]	-0,4725	0,289
n_informed_bidders[2]	0,0076	0,112
n_non_informed_bidders[2]	0,0009	0,615
VC_backed	1,2658	0,319
n_team_members	0,0703	0,319
MBA	0,1202	0,580
PhD	0,1691	0,561
serial_entrepreneur	0,0163	0,887
exp_managerial[1]	-0,1819	0,331
exp_technical[1]	0,2268	0,343
Constant	0,9683	0,002**

R-squared	-	F-test		3,25
Adjusted R-squared	-	p-value		0,000

1. Variable used in its log form   * p-value < 10%
2. Variable winsorized at 1% level   ** p-value < 5%

Table 18: Model 2C - endogeneity of the presence of VCs

6.4   Overall results

After performing the robustness tests on the different models developed for this thesis, it is possible to briefly summarize the outcome of the analysis. H0 cannot be neither confirmed nor rejected, as the p-value of the variable about the number of bidders is higher than 0,370 in both versions of the model. H1 is confirmed by the evidence coming both from the basic version of Model 2, from its robust regression (Model 2A) and from the model with the distinction of VCs on the basis of their reputation (Model 2B). For what concerns H2, results show that a relationship between the effect of the presence of VCs and the number of non-informed bidders exists and, in particular, that the positive effect of the presence of VCs on the Tobin's Q is larger when the number of non-informed bidders is larger; as a consequence, H2 is confirmed. On the other hand, H3 cannot be confirmed, as, when the number of informed bidders increases, the marginal effect of the presence of VCs actually decreases, but it also becomes non-significative. In any case, by analyzing Model 3 and Model 3A, it is possible to derive some additional insights. Indeed, results suggest that, first of all, when VCs are not present non-informed bidders have a significative negative effect on the exit valuation. On the other hand, when VCs are present, the effect of both informed and non-informed bidders becomes non-significantly different from 0, suggesting that VCs have a substitutive effect on the number of bidders. Finally, no conclusions can be made about the endogeneity of the presence of VCs in the ownership structure of the start-ups of the sample (Model 3C), as the selected instrumental variable is not fitting the needs of the analysis.

7 Discussion

The aim of this chapter is to discuss and analyze how the number of bidders and signals related to the company's human capital and to the presence of VCs affects the exit valuation of the European and Israeli start-ups that compose the sample developed for this thesis when the acquisition is modeled as an auction.

In literature, a series of studies, both about auctions in general and, more specifically, about acquisitions modeled as auctions, suggest that an increased competition (i.e., a larger number of bidders) should have a positive effect on the sale price (Holt, 1979; McAffee and McMillan, 1987; Bradley et al., 1988; Bulow and Klemperer, 1996), which is predicted by H0. Nevertheless, this thesis does not provide evidence about this phenomenon, as the variable related to the overall number of bidders never comes out being statistically significant. This result might be related to the still conflicting evidence about the effect of the presence of a large number of bidders on the sale price in an auction setting, as scholars have not reached a unique consensus. In general, all the authors recognize the existence of a *competitive effect* in auction settings, which should push each bidder to bid more aggressively when competition increases in order to maintain the chances of winning (Hong and Shum, 2002). Moreover, a higher number of bidders should allow to have a more dynamic setting, characterized by faster bids and a faster flow of questions, furtherly pushing the price up (Bulow and Klemperer, 2002). Parallelly, a series of scholars suggest that, if the auctions are modeled as common value, when the number of bidders increases, the winner's course problem becomes more severe, giving rise to the *winner's course effect* (Bulow and Klemperer, 2002; Hong and Shum, 2002). Indeed, when many bidders are present, each of them might worry more that "if the price is fair, why hasn't someone else bought it?" (Bulow and Klemperer, 2002). Similarly, Pinkse and Tan (2005) argue the existence of the so-called *affiliation effect*, which can occur both in private value auctions and common value auctions and which, to a certain extent, is similar to the *winner's course effect*. More in detail, the *affiliation effect* suggests to the winning bidder that the competition is not as strong as it seemed before the auction (Pinkse and Tan, 2005). In any case, these arguments support the existence of both positive (i.e., *competitive effect*) and negative (i.e., *winner's course effect*) forces acting on

the sale price that are a direct consequence of the number of bidders, with the overall effect that could either be positive or negative (Gilley and Karels, 1981; Bulow and Klemperer, 2002). In support of the existence of the *winner's course effect*, Bulow and Klemperer (2002) argue that, in many settings, auctioneers try to increase the supply or to set prices that lead to rationing in order to create more winners, as this should allow to reduce the "bad news" coming from winning the auction and increase the sale price. In this regard, the underpricing phenomenon of IPOs can be read as an attempt of the seller to create excess demand, as this allows to eliminate the *winner's course* of being buyer only when few optimistic investors are making offers (Bulow and Klemperer, 2002). Additionally, few studies claim that maintaining a lower number of bidders in the auction can allow the seller to better control the overall selling process, which can lead to more remunerative outcomes (Choper et al., 1989). Therefore, it would be beneficial to better study the functional form of the relationship between the number of bidders and the sale price, which could be characterized by marginal decreasing returns (Vickrey, 1961), up to the point in which it becomes non-monotonic (Pinkse and Tan, 2005). Indeed, as an overall, the fact that H0 can neither be confirmed or rejected might be a result of the fact that the relationship between the number of bidders and the sale price is more complex than what traditional economic theories would suggest.

On the other hand, the positive effect of the presence of informed bidders on the exit valuation, which is predicted by H1, is confirmed by the results of all the models in which this variable is included. Indeed, according to many scholars, corporate acquisitions are an example of economic transactions strongly characterized by information asymmetries (Ragozzino and Reuer, 2011; Wu et al., 2014). Therefore, potential acquirors are likely to face the problem of adverse selection, discounting the information asymmetry in the offer price and reducing the profits for the seller (Wu et al., 2014). In this regard, informed bidders should be willing to offer higher prices and drive the overall valuation (Wu et al., 2014). In any case, while the theoretical background seems to be well developed and established, practical evidence about the effect of informed bidders on the sale price in corporate acquisitions is somehow scarce. In fact, the main study that has been retrieved is the one of Cheng et al. (2008), who have analyzed the effect of information asymmetry in a sample of 1612 publicly listed targets who have faced an acquisition between 1985 and 2006; results suggest that, when the proxies of information asymmetry signal a low level of information asymmetry, the bid premium on the stock price that acquirors are willing to pay is higher. Starting from

this background, the advances proposed by this thesis work are related both to the method used for modeling the auction and its information asymmetry and to the results of the models. For what concerns the method, in the work of Cheng et al. (2008) the proxies of information asymmetry selected are (1) financial analysts' coverage, (2) analyst forecast error, (3) forecasted dispersion and (4) bid-ask spread; therefore, all these measures are related to the company itself and to its coverage by analysts, and not to the relationship between the target and the specific bidder. On the other hand, many scholars have suggested that the geographical distance (Coval and Moskowitz, 2001; Portes et al., 2001; Ivkovic and Weisbenner 2005; Ragozzino, 2009; Ragozzino and Reuer, 2011; Chakrabarti and Mitchell, 2013; Bick et al., 2017) and the cultural distance (Datta and Puia, 1995; Li et al., 2014) between target and bidders represent sources of information asymmetry during acquisitions. Indeed, geographical distance can strongly influence the acquirors' ability to collect information about the target, as local bidders should have more developed local network (Ragozzino, 2009); additionally, farther acquirors are likely to face more costly acquisition processes, as the presence of external advisors might be necessary for longer (Chakrabarti and Mitchell, 2013). Similarly, cultural differences between target and bidders can make it hard for an acquiror to fully understand a foreign business (Beugelsdijk and Frijns, 2010; Reddy and Fabian, 2020), creating barriers for information sharing and lowering the overall level of trust among the counterparties involved (Li et al., 2014). In any case, the practical usage of these sources of information asymmetry to distinguish between informed and non-informed bidders in acquisitions is limited. Therefore, the combination of these two measures to define informed bidders used in this thesis brings added value to research, as it allows to put together different aspects that concur to contrasting the information flow between the counterparties involved. In any case, it would be beneficial to try to use these measures to develop a continuous variable of information asymmetry, in order to have a deeper understanding of its effect on the sale price. Indeed, in this thesis, as explained in Chapter 3.1.1, thresholds for geographic and cultural distances have been calculated, and bidders have been defined as either close or far from the target.

As far as the results for H1 are concerned, this research provides new and practical evidence about the importance, from the seller standpoint, of being acquired by informed bidders in order to obtain a higher valuation. Additionally, the confirmation of H1 provides important information on the specific relationship between the number of informed bidders

and the exit valuation, as results suggests that the higher the number of informed bidders, the higher the company's Tobin's Q. Following the line of argument that both *competitive effects* and *winner's course effects* influence the behavior of bidders during the auction and their bids (Bulow and Klemperer, 2002; Hong and Shum, 2002), the overall positive effect of the number of informed bidders on the valuation can be the result of the predominance of the *competitive effects*. Finally, this thesis has the advantage of providing evidence about this topic for European and Israeli private companies, while the majority of the previous studies refer to the US market and consider mainly public targets.

Moving to the signals having an effect on the auction setting, it is first of all worth to provide an overview about which signals came out being statistically significant and which did not. The dummy *VC_backed* is strongly statistically significant in all the models and positively related to the exit valuation, confirming what previous literature suggests (Chemmanur et al. 2011; Puri and Zarutskie, 2012; Croce et al. 2013; Drover et al., 2017). The number of team members (*n_team_members*) never came out being statistically significant, while in some previous studies it was (Carter et al., 2010); one reason could be related to the fact that the relationship between the number of team members and the company's performances should have a U-shape, with the optimal in correspondence of 3 members (Tamvada and Shrivastava, 2011). The dummy *MBA* is statistically significant and strongly related to the company's Tobin's Q; this result provides further evidence on the importance for the entrepreneur to obtain an MBA degree, as previous literature suggests that it can have a positive effect on firm's performances (Monastyrenko, 2014) and on Tobin's Q (Bhagat et al., 2010; Rakhmayil and Yuce, 2013). On the other hand, dummy *PhD* never comes out being statistically significant; this result is quite peculiar, as some of the previous studies found a positive relation between signals of high-level education of the company's human capital and the company's performances (Almus and Nerlinger, 1999; Colombo and Grilli, 2005). Moving to the founders' working experience, the dummy *serial_entrepreneur* never comes out being statistically significant. Anyway, experienced entrepreneurs should have already faced many of the challenges that an entrepreneurial career entails, would set higher performance objectives (Westhead et al., 2003; DeTienne and Cardon, 2012) and should have more founds to be invested into the company coming from previous successful exits (Stam et al., 2008). Similarly, previous managerial and technical working experiences of the founder never came out being statistically significant, while previous studies suggest that

they should have a positive relationship with the exit valuation (Freeman, 1986). The lack of statistical significance that all the variables related to previous working experience present might be due to the fact that working experience becomes really effective when it is related to the business of the new venture (Sandberg and Hofer, 1987; Jo and Lee, 1996; Davidsson et al., 2001), which is something that is not considered in this thesis.

Moving to H2, which predicts that the effect of the signal, namely, the presence of a VCs in the ownership structure of the company, is stronger when the number of non-informed bidders is larger, all the models suggest confirming it. In fact, the interactive variable between the number of non-informed bidders and the dummy *VC_backed* is statistically significant and positively related to the Tobin's Q in all the models in which it is included, and the analysis of the marginal effects confirms this result. Indeed, being backed by a VC is a very strong signal of quality, as VCs are very selective when they make investments (Megginson and Weiss, 1991), develop long relationships with the invested company, run multiple rounds of due diligence (Carter and Manaster, 1990), are characterized by a strong industry expertise and should have many investment alternatives (Jain and Kini, 1995); for all these reasons, VC should be able to strongly reduce the information asymmetry and, consequently, when there are more non-informed bidders the effect of VCs on the valuation should be stronger. Consistently, Reuer et al. (2012) hypothesize that affiliations with prominent VCs are particularly beneficial in cross-industry and cross-country acquisitions, when the level of information asymmetry is higher; nevertheless, their study did not find any statistical significance to confirm this hypothesis. Therefore, the confirmation of H2 provides important advances on this topic, as it allows to show that strong signals, like being backed by a VC, are very effective also in auction settings and have a bigger effect when the information asymmetry is higher, improving the competition and, ultimately, the seller's gains.

Moreover, a very interesting and, to a certain extent, unexpected finding is that, in Model 3A, the number of non-informed bidders is statistically significant and negatively related to the Tobin's Q when information asymmetry is high, that is when no strong signals, like the presence of VCs, are in place. This result can furtherly back the idea that the effect of the overall number of bidders on exit performances is not straightforward and can assume a non-monotonic shape (Pinkse and Tan, 2005). Indeed, the negative sign of the coefficient of the number of non-informed bidders could be explained by looking at the two main forces

that affect the bidding behavior explained before, namely the *competitive effect* and the *winner's course effect* (Hong and Shum, 2002). In particular, non-informed bidders should have a weak effect on the overall competition of the auction, as they should discount the information asymmetry in the offer price and be willing to place lower bids (Wu et al., 2014); on the other hand, their effect on the winner's course perceived by the other bidders might still be relevant, as informed bidders would have to outbid a higher number of bidders. In other words, while the *winner's course effect* should depend only on the overall number of bidders, the *competitive effect* should mainly be driven by informed bidders. Therefore, it can make sense that additional non-informed bidders, when effective signals are not in place, might have a negative effect on the sale price and, consequently, it would be beneficial for future research to analyze this effect in detail. In any case, when VCs are present, the overall effect of the number of non-informed bidders on the exit valuation becomes non significantly different from 0.

On the other hand, H3, which predicts that the effect of a signal and, in particular of the presence of VCs, should be weaker when the number of informed bidders is larger, cannot be accepted, as the effect actually gradually decreases, but it also becomes non-significative; in any case, it is very interesting that, when VCs are present, there is no evidence to state that the overall coefficient of the number of informed bidders is different from 0, suggesting that the relationship is rather substitutive. Therefore, it seems that VCs make the presence of a high number of informed bidders not necessary in order to obtain a high exit valuation. One of the main reasons for this result might be due to the fact that VCs usually have wide and developed networks (Hellmann and Puri, 2002) and a relevant knowledge of the specific sector in which the entrepreneurial venture plays (Jain and Kini, 1995; Hochberg et al., 2015), together with a great experience in exits coming from the fact that VCs usually undergo continuous cycles of investments and exits (Sahlman, 1990). Therefore, VCs should have the ability to contact and attract the right buyers for the target in which they have invested and should have a high bargaining power when organizing the transaction. Additionally, attracting the right bidders for the target would allow the VCs to limit the number of bidders and maintain more control on the overall selling process (Choper et al., 1989).

On a side note, it is also worth reporting that the results of Model 2B, which divides the prominent VCs from the others, shows that both prominent and non-prominent VCs are

statistically significant and positively correlated with the Tobin's Q, with the effect of prominent VCs that seems to be twice the ones of non-prominent VCs. The stronger effect of prominent VCs confirms the outcome of previous studies, which suggest that prominent VCs should have a stronger reputation and a stronger certification effect (Carter et al., 1998; Colombo et al., 2019). On the other hand, no results can be drawn about the endogenous nature of the dummy *VC_Backed* (Model 3C), as the chosen instrumental variable came out not being correlated with the dummy *VC_Backed*. This last result is quite bizarre, as other previous studies provided evidence about the endogeneity of the presence of VCs (Kortum and Lerner, 2000; Colombo and Montanaro, 2020).

Finally, for what concerns the control variables included in the model, the value of the total assets of the company, which is a proxy of the firm's size, is always statistically significant and negatively related to the Tobin's Q, confirming that smaller companies receive higher valuations due to the stronger growth opportunities (Meoli et al., 2013). Similarly, the two dummies controlling for the geographical origin of the company are always statistically significant and positively related to the exit valuation, confirming that geographical area can influence the final valuation due to the different conditions of local markets and economic environments (Gupta and Sapienza, 1992; Soreson and Stuart, 2001). For what concerns the company's age, the related variable never came out being statistically significant, which might reflect the fact that some of the previous studies suggest a positive effect of the age on the exit (Boeker and Wiltbank, 2005), while others have found a negative relation (Nelson, 2003). Lastly, out of the four dummies controlling for the industry of the target, only Life Science – Biotech is statistically significant and positively related to the exit valuation, while the other three are never significant.

8 Conclusions, limitations and future development

This thesis analyses the effect of the number of bidders (both aggregate and divided into informed and non-informed bidders) and of signals related to the presence of VCs and to the company's human capital on the exit valuation of European and Israeli entrepreneurial ventures when the acquisition is modeled as an auction.

In particular, the results of the models developed for this thesis provide new support to the use of auction theory to model acquisitions, showing that it is important to consider bidders and their information level; moreover, this research provides further insights about the importance of the presence of VCs as signal during acquisitions, analyzing its effect with respect to the number of bidders.

A first important contribution of this thesis is related to the relevance of the number of informed bidders for the exit valuation. Indeed, a flourishing literature exists about the necessity of lowering the overall information asymmetry in order to settle an efficient transaction and to increase the exit valuation; however, no studies have been retrieved directly relating the number of informed bidders to the exit valuation in corporate acquisitions. In particular, this thesis provides evidence about the direct relationship between the number of informed bidders and the exit valuation, showing that the higher the number of informed bidders, the higher the valuation. On the contrary, this thesis provides also evidence about the fact that, when information asymmetry is higher due to the absence of strong signals, non-informed bidders can have a negative effect on the exit valuation. Taken together, these results hint that the relationship between the overall number of bidders and the exit valuation is rather complicated, in line with the strand of literature that claims that the presence of additional bidders in the auction can trigger different mechanisms, which may also have a negative effect on the sale price.

Secondly, the other important contribution is about the relationship between signals and the number of informed and non-informed bidders; in particular, the signal that has been tested in interaction with the number of bidders is the presence of VCs in the ownership structure of the company, as, in literature, VCs are considered a strong and effective signal. More in detail, the effect of the presence of VCs comes out being stronger when the number of non-informed bidders is larger, positively affecting the valuation. On the other hand, the positive effect of the number of informed bidders seems to be completely substituted by the presence of VCs, as the coefficient of the number of informed bidders becomes non-significantly different from 0 when VCs are part of the ownership structure of the company.

Even though this thesis has been able to confirm two of the starting hypotheses (H1 and H2) and has found interesting insights for the other two (H0 and H3), there are obviously some limitations that it is now worth to underline. In particular, the limitations mainly refer to the sample, the modeling of the auction and the number of signals used for the interaction.

Starting from the sample, the overall number of companies considered is 312, which is quite in line with some of the previous studies, but it could be enlarged in order to reach the magnitude of more complete research. Indeed, even though it has been tried to build a sample that is as representative as possible of the actual market by putting no limits on the exit valuation, a series of companies had to be excluded due to insufficient availability and granularity of data. In any case, this outcome is somehow a physiological consequence of the data needed for this research, as the information about the human capital have to be very precise and complete in order to allow a proper analysis, and not much can be done about that. In any case, it would be beneficial to enlarge the sample, by working on the temporal and geographical dimensions. In fact, the start-ups included in the sample have performed and exit through acquisition between 2001 and 2017, while more recent years have been excluded; therefore, given the high rate of development of the M&A market, a potential progress would be to include also more recent transactions in the analysis. For what concerns the geographical dimension, this thesis includes companies that are based in 17 countries (16 European and Israel). Therefore, even though the European scope can be a considered a positive aspect of this research, including companies from the other European countries would be more representative of the real market; additionally, in order to obtain more robust results, also companies from other important markets, like the US one, should be included.

For what concerns the human capital related variables, the fact that all the information derive from the founders' LinkedIn profile can be a source of inaccuracy. In fact, founders might, on the one hand, try to over declare their career achievements and, on the other hand, decide not to include and update all the information about their experience. Therefore, a possible improvement would be to try to double check the reliability of the information found, with the inclusion of some considerations about the reputation of previous studying and working experiences. Finally, it would be beneficial to assess whether results change when the signals related to human capital are based on the overall funding team, as in this thesis just the founding CEO is considered.

Moving to the way in which the auction has been modeled, bidders have been defined as all the companies that have performed an acquisition of company in the same industry and in the same year as the one in which the target of the sample has been acquired, as explained in Chapter 3.1.1. Therefore, it would be interesting to explore alternative methods to define the overall number of bidders. For what concerns the modeling of the information asymmetry among target and bidders, as explained in Chapter 3.1.1, the geographical and cultural distance between all the targets of the sample and each bidder has been computed, defining informed only the bidders that had a geographical distance from the target smaller than a certain threshold and a cultural distance from the target smaller than a certain threshold. Even though the use of thresholds and, in particular, the use of the median of a certain distribution, is widely used to distinguish between groups, this approach can also become simplistic. Therefore, in order to reach more robust and precise conclusions, it would be appropriate to develop a continuous measure of information asymmetry based on the parameters used in this thesis, as this could also allow to have a deeper understanding of the specific role of cultural and geographical distance in triggering information asymmetry.

Finally, when testing the interaction between signals and informed (H3) and non-informed (H2) bidders, this thesis only analyses the presence of VCs as interactive variable. Therefore, it would be beneficial to analyze the effect of different signals on the bidders, as the results coming from H2 and H3 provide very interesting insights. In particular, Reuer et al. (2012), when trying to understand the effect of VCs to reduce information asymmetry, suggests that also prominent investment banks and prominent alliance partners could have similar effects; in any case, as explained in Chapter 7, Reuer et al. (2012) were not able to

find support for any of the hypotheses just listed. Additionally, there might be other signals related to human capital that, by themselves or in combination with each other, might have similar effects to the presence of VCs.

As a conclusive remark, the research value of this thesis does not stop to the results obtained, as it can trigger interesting implications on a series of topic. Indeed, entrepreneurial exit is a crucial component of the economic environment, so having a deeper understanding of its main determinants can result in more efficient and effective sale processes and, ultimately, in higher gains for the sellers. In particular, this thesis provides interesting insights about which bidders should be targeted to join the auction. In fact, geographically and culturally close bidders should, in general, be preferred by the seller, as evidence suggests that they have a positive effect on the valuation; on the other hand, non-informed bidders (i.e., bidders geographically and/or culturally far from the target) can have a negative effect on the sale price, and thus they should not be included in the sale process when strong signals are not in place (this thesis has tested the presence of VCs in the ownership structure of the company). As a consequence, these results suggests that sellers should not always try to invite to the auction as many bidders as possible, as suggested by traditional economic theories, but rather be focused in inviting the "right" bidders (i.e., the ones that can have a real positive effect on competition). Moreover, given the additional evidence about the strength of the presence of VCs as a signal to reduce the information asymmetry and to make the overall acquisition process more efficient, policy makers should furtherly try to push for the development of this type of financial players. Indeed, the contribution of VCs to the overall economic development is very important, as they can support promising start-ups during their development and growth and, in particular, they can play a crucial role for signaling and certifying their quality at the time of exit, creating economic remuneration for them, for the seller and, more in general, wealth for the overall economic environment.

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Appendix

The Python code reported hereafter has been used to extract the geographic coordinates of the companies considered from the Google API: https://maps.googleapis.com/maps/api/geocode/json.

```python
import requests
import pandas as pd

GOOGLE_API_KEY = ''


def extract_lat_long_via_address(address_or_zipcode):
    lat, lng = None, None
    api_key = GOOGLE_API_KEY
    base_url = "https://maps.googleapis.com/maps/api/geocode/json"
    endpoint = f"{base_url}?address={address_or_zipcode}&key={api_key}"
    r = requests.get(endpoint)
    if r.status_code not in range(200, 299):
        return None, None
    try:
        results = r.json()['results'][0]
        lat = results['geometry']['location']['lat']
        lng = results['geometry']['location']['lng']
    except:
        pass
    return lat, lng


address = pd.read_excel('/Users/TB/Desktop/ricerca_coord.xlsx')
lat_res = []
lon_res = []
for add in address['Address']:
    lat, lon = extract_lat_long_via_address(add)
    lat_res.append(lat)
    lon_res.append(lon)
address['Latitude'] = lat_res
address['Longitude'] = lon_res
address.to_excel('/Users/TB/Desktop/ricerca_coord.xlsx')
```