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University Prestige and Alliances at IPO: Investigating a Mediation Effect

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Abstract (English)

The affiliation with prestigious universities is one of the most effective way to certify the scientific legitimacy of startups: it allows to face problems of information asymmetry, which are relevant especially in the moment of an Initial Public Offering.

The signal provided by the academic affiliation has been investigated by conspicuous literature, but no prior research has considered the importance of the reputation of the affiliated.

We want to fill the highlighted gap. Furthermore, we have deepened the study assessing the interaction between the prestige of the affiliated university and the one of the scientists composing the company's Upper Echelons, the Venture Capitalists backing the firm and the underwriters guaranteeing the listing process. Finally, we have analyzed the mediator role that strategic alliances can play in the relation between the signal delivered by reputable academic institutions and the IPO valuation obtained by the startup.

This study has been carried out on a sample of 254 European biotechnology entrepreneurial ventures that have gone public between 1990 and 2009. The necessary data have been gathered from databases (e.g., Scopus) and then tested through multilinear regressions thanks to the software STATA.

As a matter of fact, four propositions have been confirmed, showing the positive impact of the reputation of the affiliated university on the IPO valuation. Moreover, while the certification effect of the academic institute is additive in respect to the ones of prominent Venture Capitalists and underwriters, it is redundant with the signal conveyed by the scientists of the organization.

On the other hand, the hypotheses on the mediation effect of alliances have been disproved: despite the positive impact of the tie with universities on the number of links established by the company, the results highlight a direct relationship between the prestige of the affiliated academic institution and the valuation at the listing moment. Moreover, analyzing the number of alliances, evidence of a greater statistical significance of the academic affiliation in comparison to the one of the university prestige has been found.

Abstract (Italian)

L'affiliazione ad università prestigiose è uno tra i metodi più efficaci per legittimare scientificamente una *startup*. I problemi di distribuzione asimmetrica dell'informazione sono rilevanti soprattutto durante il processo di quotazione sui mercati finanziari: l'impresa per convincere gli investitori riguardo le sue capacità può affiliarsi ad un'università prestigiosa.

Il segnale emesso dall'affiliazione accademica è stato attentamente studiato in letteratura, ma l'impatto che il prestigio di questa possa avere è stato trascurato.

Lo scopo di questa tesi è quello di estendere la ricerca ponendo l'attenzione sull'importanza del profilo dell'affiliato. E' stata inoltre valutata l'interazione tra il prestigio dell'università affiliata e quello degli scienziati nell'*Upper Echelon*, dei *Venture Capitalist* che supportano l'impresa e degli *underwriter* che hanno garantito il processo di quotazione. Per completare l'analisi è stato verificato il potenziale ruolo di mediatore svolto dalle alleanze strategiche nella relazione tra il segnale inviato dal prestigio dell'accademia e la valutazione ottenuta al momento della quotazione in Borsa.

Il campione dati è composto da 254 imprese europee che hanno svolto un'*IPO* tra il 1990 e il 2009. Le informazioni necessarie sono state raccolte da database come *Scopus* e testate attraverso regressioni multilineari mediante l'uso del software *STATA*.

I risultati ottenuti hanno confermato quattro proposizioni dimostrando l'impatto positivo del prestigio accademico sulla valutazione dell'impresa. Inoltre, mentre la certificazione data dall'università è additiva rispetto a quella emessa da prestigiosi *Venture Capitalist* e *underwriter*, essa risulta essere ridondante rispetto al

segnale fornito dagli scienziati.

Contrariamente a quanto ipotizzato, le alleanze non hanno un effetto di mediazione: nonostante l'impatto positivo dell'affiliazione accademica sul numero di cooperazioni, i risultati suggeriscono la presenza di una relazione diretta tra il prestigio dell'affiliato e la valutazione dell'impresa.

Sintesi

Espressioni quali '*imperfect information*' ed '*information asymmetry*' sono divenute parte integrante del linguaggio comune. Esse identificano transazioni contraddistinte da una distribuzione asimmetrica dell'informazione, che può causare la cessazione della trattativa comportando una perdita per gli interessati e per l'intera economia. Nel momento in cui l'incertezza caratterizzante lo scenario aumenta, le conseguenze di questa condizione hanno impatti ancor più negativi.

I suddetti problemi interessano tutte le transazioni economiche delle imprese. Le organizzazioni necessitano di risorse per sviluppare i propri progetti ed una delle modalità per ottenerle consiste nell'intraprendere un'Offerta Pubblica Iniziale (OPI). I fondi richiesti durante tale operazione non sono facilmente ottenibili, essendo gli investitori reticenti ad investire in un business caratterizzato da carenza di dati pubblici, che ne comporta una difficoltà nel valutarne l'effettiva convenienza. Inoltre, nel momento in cui l'impresa è di recente formazione, a causa dell'assenza di dati storici, i problemi delineati sono ancor più rilevanti.

Sulla base del momento di originazione Stiglitz (2000) ha individuato due tipologie di asimmetria informativa: selezione avversa e azzardo morale.

La selezione avversa si manifesta prima dell'inizio della transazione ed è dunque definita *ex-ante information asymmetry*. Akerlof (1970), attraverso l'esempio del mercato di macchine usate, ne identifica l'origine nella incapacità da parte del cliente di giudicare la qualità dell'oggetto in questione a causa del set limitato di dati a sua disposizione. Questa situazione comporta la mancata realizzazione della trattativa

e forza i venditori di prodotti contraddistinti da una qualità elevata ad uscire dal mercato.

L'azzardo morale si verifica invece al termine della transazione ed è per questo comunemente conosciuto come *ex-post information asymmetry*. Quest'ultimo scaturisce dall'impossibilità di controllare tutte le azioni della controparte, la quale può dunque massimizzare la propria funzione di utilità.

Nonostante le peculiarità che contraddistinguono i problemi di distribuzione asimmetrica dell'informazione, entrambe comportano un fallimento di mercato e generano inefficienze nell'economia, in quanto precludono il conseguimento di una soluzione Pareto ottimale.

Considerando lo scopo di questo elaborato (i.e., l'analisi dell'impatto della reputazione dell'università affiliata sulla valutazione ottenuta al momento della quotazione dell'impresa in Borsa e la verifica di un eventuale ruolo di mediatore assunto dalle alleanze strategiche in tale relazione) ed avendo esposto la natura dei suddetti problemi, è possibile affermare la limitata attinenza dell'azzardo morale, in quanto esso si manifesta a seguito dell'OPI. La tematica della selezione avversa viene invece presa in considerazione e viene proposta un'analisi approfondita delle conseguenze e delle eventuali soluzioni individuate in letteratura.

Metodi efficaci attraverso i quali l'impresa può diminuire la magnitudine del problema delineato sono stati studiati dalla teoria dei segnali. I segnali sono azioni osservabili finalizzate alla trasmissione di informazioni riguardanti la qualità di un determinato oggetto, non altrimenti valutabile (Spence, 1973).

La teoria dei segnali è stata ampiamente sviluppata ed applicata a svariati contesti. I primi studi, condotti da Spence (1973, 2002), trattano del mercato del lavoro e propongono l'implementazione di sistemi di segnali in grado di limitare le

asimmetrie informative. Nel caso specifico, coloro che intendono essere assunti da un datore di lavoro possono segnalare a questi le proprie qualità, fornendo dettagli sulla propria formazione, consentendo una riduzione dell'incertezza della transazione ed un aumento delle probabilità di essere il candidato prescelto.

In generale, i segnali, per essere considerati tali, devono possedere alcune caratteristiche fondamentali. Devono innanzitutto essere osservabili per essere riconosciuti dal ricevente e devono trasmettere un contenuto informativo rivelando caratteristiche difficilmente verificabili da parte dello *stakeholder*. In secondo luogo, essi devono avere un costo, che risulti inversamente relazionato alla qualità del *signaler*.

Inoltre, affinché il segnale sia valido questo deve portare ad un *separating equilibrium*: a seguito dell'emissione del segnale, il mittente deve poter identificare la qualità dell'oggetto della transazione distinguendolo dagli altri presenti sul mercato. Bergh et al. (2014) hanno definito le caratteristiche essenziali affinché questo tipo di equilibrio avvenga: il contesto deve essere caratterizzato da asimmetrie informative, il segnale deve avere un costo negativamente relazionato alle capacità da certificare, una condizione Pareto ottimale deve essere raggiunta e il contenuto segnaletico deve essere successivamente confermato dalla qualità effettiva dell'oggetto in questione.

Infine, è di fondamentale importanza specificare la natura del cosiddetto *signaler*. Infatti, il segnale può essere emesso direttamente dall'interessato, come nell'esempio dell'educazione del candidato, oppure può essere inviato da una terza parte, come un *Venture Capitalist* supportante una giovane impresa. Si possono dunque riscontrare casi di segnali multipli quando svariati segnali vengono trasmessi contemporaneamente (come quelli emessi simultaneamente da *Venture Capitalist* ed *underwriter*). Nel momento in cui ciascun segnale certifica una particolare caratteristica dell'impresa si parla di segnali additivi, in caso contrario essi risultano ridondanti, avendo un analogo contenuto informativo.

Inoltre, in alcune circostanze è l'entità che testimonia la qualità dell'impresa a

sostenere la maggior parte del costo connesso al segnale. È questo il caso di aziende imprenditoriali affiliate a terze parti prestigiose, quali *Venture Capitalist* ed *underwriter*. Queste figure, infatti, affiliandosi ad organizzazioni giovani e rischiose mettono a repentaglio la propria reputazione e il proprio capitale, certificando efficacemente la qualità del business supportato.

La presente composizione tratta di teorie dei segnali applicate al contesto delle OPI al fine di ridurre i problemi derivanti dalla distribuzione asimmetrica dell'informazione.

La decisione di considerare l'Offerta Pubblica Iniziale tra le molteplici tipologie di aumento del capitale deriva dalle sue caratteristiche intrinseche. Infatti, differenti transazioni sono soggette a diversi gradi di asimmetria informativa. La quotazione in Borsa rappresenta la più complessa e costosa di queste ed è inoltre caratterizzata da un'elevata incertezza sull'effettivo valore delle azioni, che risultano quindi difficilmente valutabili dall'investitore. A causa dei fattori delineati la teoria dei segnali ricopre un ruolo di fondamentale importanza in questo contesto.

Inoltre, l'attenzione del presente elaborato è posta sulle *startup* biotecnologiche. Le industrie *knowledge-intensive* sperimentano problemi legati allo scambio di informazioni e di conoscenze tacite, difficilmente quantificabili in termini monetari da parte dell'investitore esterno. Di conseguenza, l'impresa deve trovare dei mezzi per testimoniare e spiegare le sue qualità agli *stakeholder* evitando al tempo stesso fenomeni di *spillover*. Tale necessità è acuita dal contesto considerato.

Come testimoniato dalla letteratura, l'azienda imprenditoriale può emettere svariati segnali per certificare la propria qualità: divulgare dati sulla composizione e sulle caratteristiche del Consiglio di Amministrazione (Certo, Daily, Covin and Dalton, 2001), sul background e sulla reputazione del *Top Management Team* (Kilduff, Angelmar and Mehra, 2000), sull'affiliazione accademica (Bonardo et al., 2011), sul

supporto fornito da *Venture Capitalist* (Davilaa, Fostera and Gupta, 2002) ed *underwriter* (Carter, Dark and Singh, 1998) e sulla formazione di alleanze con organizzazioni lungo la catena del valore (Stuart, Hoang and Hybels, 1999).

I segnali elencati certificano caratteristiche peculiari della stessa impresa, dunque possono essere implementati contemporaneamente al fine di ridurre i problemi di incertezza e di distribuzione asimmetrica dei dati.

Altri problemi riguardanti le *startup* sono legati ai cosiddetti '*knowledge gap*' e '*funding gap*': esse devono reperire risorse per accrescere le proprie dimensione e sviluppare il proprio business e creare relazioni di cooperazione con imprese operanti in altre fasi di sviluppo del prodotto è uno tra i metodo più efficaci per il conseguimento di tali obiettivi.

Le alleanze strategiche sono definite come collaborazioni volontarie tra compagnie indipendenti, volte allo sviluppo e alla commercializzazione di prodotti, tecnologie e servizi innovativi (Gulati, 1998).

Il settore *biotech* prevede processi di sviluppo prodotti composti da diverse fasi di elaborazione e richiedenti lunghi lassi temporali, in media tra i dieci e quindici anni. Inoltre, come sottolineato precedentemente, esso fonda il proprio vantaggio competitivo sulle conoscenze tacite accumulate nel corso degli anni, favorendo dunque la formazione di alleanze.

Tre sono gli attori principali dell'industria con cui la *startup* può cooperare: università e centri di ricerca, compagnie biotecnologiche ed imprese farmaceutiche.

Le università e i centri di ricerca sono poste a monte della catena del valore e hanno l'obiettivo di garantire il perseguimento di una ricerca continua e proattiva. Le scoperte di tali istituzioni sono solitamente commercializzate da *startup* operanti nello stesso settore.

In seconda istanza, si identificano altre compagnie biotecnologiche, le quali

relazionandosi orizzontalmente raggiungono economie di scala.

Infine, per facilitare la commercializzazione dei prodotti realizzati, l'impresa può rivolgersi ad attori dell'industria farmaceutica, in quanto questi ultimi possiedono competenze commerciali, di marketing e distribuzione. Essendo la *startup* priva di tali connotati questo tipo di collaborazione è la più frequente nel mercato.

Molteplici studi (DeCarolis e Deeds, 1999; Stuart et al., 1999) hanno investigato la relazione che intercorre tra il numero di alleanze strategiche che contraddistinguono una compagnia e il suo valore di mercato al momento della quotazione in Borsa, ma nessuna ricerca ha analizzato il possibile ruolo di mediatore che tali collaborazioni possono ricoprire.

Nel contesto delineato, il segnale studiato è dato dall'affiliazione dell'impresa con un'università prestigiosa.

Innanzitutto, si suppone l'esistenza di una relazione positiva tra il prestigio dell'accademia affiliata e la valutazione ottenuta al momento della quotazione dell'impresa sui mercati finanziari.

In secondo luogo è stato indagato l'impatto di interazioni tra la principale variabile indipendente e altri segnali di prestigio. Si argomenta, dunque, che il segnale di reputazione accademica sia più efficace nel caso in cui le più alte linee gerarchiche dell'organizzazione siano contraddistinte da un basso prestigio scientifico e che la certificazione emessa dalla rilevanza dell'affiliato sai additiva rispetto a quelle fornite da *Venture Capitalist* e *underwriter* .

Infine, si propone una ipotesi circa il potenziale ruolo di mediatore assunto dalle alleanze strategiche nella relazione tra prestigio universitario e valore delle azioni. È necessario dunque valutare l'impatto diretto che la reputazione accademica ha sul valore dell'impresa e analizzare in seguito il legame tra prestigio dell'università e la formazione di cooperazioni e l'impatto che queste ultime hanno direttamente sul

valore all'OPI.

Il campione di riferimento utilizzato per i test empirici è composto da 254 imprese europee biotecnologiche, che hanno esordito in Borsa tra il 1990 e il 2009. Per costruire tale database un'estesa raccolta dati è stata necessaria: informazioni riguardanti le caratteristiche della compagnia, il numero di alleanze che quest'ultima ha sviluppato, l'eventuale affiliazione accademica, la composizione del Consiglio di Amministrazione e i necessari dati finanziari sono stati estrapolati dal prospetto informativo dell'organizzazione, precedentemente raccolto dalla banca dati *EURIPO*.
Per quanto concerne le informazioni riguardanti il prestigio dell'università e degli scienziati - numero di pubblicazioni e di citazioni nei venti anni precedenti l'Offerta Pubblica Iniziale - il database *Scopus* è stato utilizzato. È importante sottolineare che la ricerca è stata ristretta a determinate aree di studio: *Diagnostics, Genetics, Immunology, Instruments, Investigation of new drugs* e *Protein Engineering and Services*.
Infine, le collaborazioni instaurate dall'impresa hanno richiesto un'analisi approfondita del prospetto al fine di definirne la tipologia (*upstream, downstream, horizontal*) e il momento in cui esse sono state formate.

I risultati confermano in parte le ipotesi proposte. La prima iterazione del modello dimostra che la certificazione data dall'affiliazione con un'università prestigiosa ha un effetto positivo e statisticamente significativo sul valore delle azioni all'esordio della *startup* in Borsa.
Le successive variazioni del modello testimoniano che i segnali dati dalla reputazione accademica e dal prestigio scientifico dell'organizzazione certificano competenze affini, e sono additivi rispetto alla certificazione fornita dai *Venture Capitalist* e *underwriter*.
Infine, il modello di mediazione consente di comprendere come l'effetto segnaletico del prestigio dell'università sul valore delle quote di mercato sia diretto, quindi non

mediato dal numero di alleanze che la compagnia è stata in grado di formare. Il coefficiente che definisce questa relazione, infatti, rimane positivo e statisticamente significativo anche nel momento in cui viene valutato l'effetto delle collaborazioni sulla *Tobin's Q*.

In conclusione, presentiamo la struttura generale della composizione. Agli occhi del lettore questa tesi si articola in sette capitoli, seguiti da un'appendice, nella quale sono riportati i risultati dei modelli realizzati.

Il primo capitolo introduce la problematica in questione, sottolineandone le premesse teoriche necessarie per uno studio approfondito. Le tematiche affrontate spaziano dalla definizione delle asimmetrie informative, allo sviluppo della teoria dei segnali, studiata a fondo nel contesto di aziende imprenditoriali in procinto di essere quotate in Borsa.

Il secondo capitolo analizza le modalità segnaletiche che un'organizzazione in fase di quotazione può implementare al fine di aumentare la qualità informativa degli investitori e, di conseguenza, accrescere la performance della transazione.
Nella stessa sezione, una revisione della letteratura sulle proprietà segnaletiche dell'affiliazione accademica e delle alleanze viene sviluppata per mostrare i risultati di studi pregressi sulle principali tematiche dell'elaborato.

Il terzo capitolo descrive il processo logico che ha portato alla definizione delle proposizioni sviluppate ed investigate. Questo si articola in sottosezioni, ciascuna delle quali propone la deduzione di una determinata proposizione.

Il quarto capitolo presenta la modalità con cui la ricerca dei dati è stata svolta e definisce le variabili utilizzate nei modelli elaborati. Inoltre, le analisi quantitative che consentono di cogliere le distribuzioni delle variabili del campione di riferimento sono state riportate.

La quinta sezione introduce brevemente la teoria sottostante ai modelli formulati e successivamente la contestualizza al fine di fissarne i concetti fondamentali.

Il sesto capitolo mostra i risultati emersi dai modelli sviluppati.

Il settimo capitolo, infine, sottolinea il contributo apportato dalla nostra ricerca alla letteratura imprenditoriale e ne evidenziando eventuali concordanze e discrepanze. Per completare l'analisi critica dello studio condotto le eventuali mancanze e prospettive di ricerca futura vengono coscientemente definite.

Chapter 1

Introduction

Information is a valuable resource and comes directly from data. Data are related to entities and transactions involving two or more primary actors. It is of great importance to get the correct data since, from data processing, it is possible to extract information, essential to take coherent and valuable decisions.

Given the obstacles in getting the needed information at the right moment, expressions like '*imperfect information*' and '*information asymmetry*' have become a part of the daily speech. While the former issue arises in the moment in which there is a certain difficulty in obtaining a complete set of information, the latter problem is related to scenarios in which one actor has more information than another one leading to an asymmetric distribution of data.

When one side of the market is in advantage in respect to the other one, even if there is mutual interest in realizing the transaction, no deal will take place due to uncertainty. That is why, in order to avoid market failures, the company has the need to address such problems.

The main method used to limit the impacts of information asymmetry is the implementation of signals. A signal is an observable action aimed at conveying specific data about something which cannot be well assessed by outsiders (Spence, 1973). If this action is correctly implemented, it decreases the information gap.

Signalling theory has been extensively developed through time and subsequently applied to several contexts. However, this composition focuses the attention on a very specific arena, that is the realm of entrepreneurial ventures willing to go public.

An entrepreneurial venture is a young and small company that misses track records and reliable information about the quality of its managers, business practices and products or services. Therefore, due to its intrinsic characteristics, it is affected by uncertainty and information asymmetry, which discourage investors to provide resources to the firm. This condition is even accentuated in the moment in which the venture is going to be listed on an Official Stock Exchange.

To evaluate the quality of the IPO stock, the buyer needs sensitive information, which, as it has been mentioned, is difficult to get. Lacking the necessary terms of the valuation equation (data on the entrepreneurial venture), the investor will likely decide not to take part to the deal. In this case the company will not get the required funding and the potential shareholder will probably have missed a fruitful opportunity. To avoid the consequent market failure[1] entrepreneurs must provide some signals.

1.1 Information Asymmetry

Information is a fundamental resource needed in every business transactions. An imperfectly informed market is one where information is hard to get. A specific case in which there is imperfect information is represented by information asymmetry, that arises in the moment in which one side is better informed than the other one. Information asymmetries lead to adverse selection and moral hazard (Stiglitz, 2000). They are distinguished for their own features, the moment in which they appear and the possible solutions to overcome them. They are inefficient conditions in the market, as transactions will not happen properly without complete sets of information.

Adverse selection, also known as ex-ante information asymmetry, arises before

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1 *We define a market failure as a condition in which the allocation of goods and services is not optimal.*

a transaction when one counterparty has more information than the other one. Akerlof (1970) explains this concept leveraging on the example of the market of used cars. He says that the population of sellers of used cars is divided into two main groups, the sellers of good quality cars (so called '*plums*') and the ones that trade bad quality vehicles (i.e., '*lemons*'). The author assumes that '*the demand for used automobiles depends more strongly upon two parameters: the price and the average quality*'. Just the owners of the vehicle are able to evaluate its quality level, while the buyers only know the probability to get a '*plum*' or a '*lemon*'. This is because they are not able to verify the characteristics of the object of the transaction. Thus, the potential purchasers attribute a value equal to the weighted average of the prices attached to the specific type of car, where the weights are the probabilities to get a '*plum*' or to get a '*lemon*'. This action will lead to a pooling equilibrium in which the two kinds of sellers are treated in the same way due to the inability of the clients to tell a good quality car from a low quality one. The described scenario will drive out of the market the salespersons of '*plums*' reducing the size of the market as well as the quality of the available products. Furthermore, as soon as the customers understand that only '*lemons*' are offered, the value of the cars will be decreased to the maximum price they are available to pay for a low-quality vehicle.

This situation is inefficient for both sides of the market: on one hand the sellers of good cars will refuse all deals even if the demand is still high and, on the other hand, the buyers interested in '*plums*' will not be satisfied. This brings to a market failure. In order to overcome it, it is necessary to share additional information that allows the purchasers to confer the right value to the specific product.

The cost of dishonesty is another fundamental concept included in the aforementioned paper. This consists in people offering low quality automobiles, trying to misrepresent their products to get higher valuations. Akerlof believes that this expense '*lies not only in the amount by which the purchaser is cheated; the cost must also include the loss incurred from driving legitimate business out of existence*'. This issue is

related to opportunistic behavior on one side and, on the other side, to the inability of getting the valuable information required.

Adverse selection can be solved by highlighting the quality of the object of the transaction, distinguishing it from the mass, through the implementation of signals[2].

Moral hazard emerges in the moment in which the actions of a person are not verifiable by another one, when he wants to pursue his own objectives even if they are in contrast with the goals of the counterparty. Therefore, it is related to opportunistic behaviors, conflicts of interests and limited observability of the operations undertaken by the other entity (Hölmstrom, 1979). In such scenario, a Pareto optimal solution enabling to share the risk related to transactions is usually precluded, as the proper incentives to implement the right actions are not in place. Hence, just suboptimal results can be reached.

This is also called ex-post imperfect information problem, as it appears after having signed an agreement and it regards the following actions of the counterparty. It is even known as incentive problem, since there is the necessity to properly design incentives to overcome the displayed issue.

The concept of ex-post information asymmetry has been deeply studied in the principal-agent theory (Ross, 1973), which revolves around the delegation of power and the separation between who runs the business (i.e., managers) and who puts money inside the firm (i.e., shareholders). In the displayed situation shareholders do not have the possibility of observing and controlling managers behaviors, resulting in them acting opportunistically[3].

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2 *As we will see later, in the Signalling Theory Section, the described scenario is not defined as a pooling equilibrium, but it starts to be a separating equilibrium.*

3 *For example, undertaking less risky projects in order to be sure to reach the defined goals, even if other riskier and more complex ideas are more useful for the business itself and, as a consequence, for the owners of the enterprise.*

The solutions to avoid this inefficient scenario involve the implementation of controlling systems and data sharing platforms, as well as the design of contracts that discourage the implementation of opportunistic actions.

Being moral hazard an ex-post issue, it arises after the IPO moment, hence it is out of the scope of this thesis. We will concentrate on adverse selection happening exactly in the moment of going public. This is due to the fact that the focus of this composition is represented by the years before the listing date and the IPO moment. This entails a concentration on the adverse selection surrounding investors during the purchase of newly issued shares in an Initial Public Offering. This context is characterized by a very high degree of uncertainty, where the potential future shareholders are looking for valuable information to define the convenience of the investment. The entrepreneurial venture, on the other side, has all the data needed and, in order to attract investors, it must signal its quality in a proper way.

A last remark about the mentioned context must be taken into consideration. The cost of dishonesty characterizing the IPO environment is related to the fact that an enterprise could misrepresent its real value and quality to get higher valuations. This situation decreases the trust of investors, increases the uncertainty characterizing the IPO market and drives out of the market the companies with good future business opportunities - as they do not succeed in getting a fair valuation and they prefer to use other sources of fund.

1.2. Signalling Theory

After having displayed the issue (i.e., ex-ante information asymmetry), we aim now to explain the meaning of signals and how they help to solve market problems

generated by ex-ante information asymmetry.

First of all, a definition of signal must be given. We define signals as '*conduct and observable attributes that alter the beliefs of, or convey information to, other individuals in the market about unobservable attributes and intentions*' (Ndofor and Levitas, 2004). This mechanism is used to overcome imperfections in the market.

As a matter of fact, when information asymmetry is present, the market usually experiences failures, situations in which the allocation of goods is not optimal. When this happens, another possible efficient equilibrium exists enabling the parties involved to be better-off. Signalling can be a way to solve these issues and reach an improved condition in the marketplace.

To explain how signals work, we refer to Spence's (1973) seminal contribution (see also Spence, 2002).

As an example of a context in which parties are likely to experience imperfect information, the author comments the job market.

The job market is one where uncertainty is really high. The employer has to decide between many applicants for the same opening and he has to base his decision on some visible factors that the counterparties are willing to provide, paying a cost, in order to be chosen.

Spence argues that '*to hire someone, is frequently to purchase a lottery*'. The employer has to pay to the employee a wage, which can be equivalent to the money one would take, with certainty, in lieu of the lottery. This is less than the actual value of the lottery. Hence, he has to bet on the productiveness and quality of the appointed candidate.

In the case the employer is risk neutral, the wage is the marginal contribution[4] that the

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4 *The marginal contribution values the impact that the candidate can have on the organization. Hence, it is necessary to compare the value of the company with the candidate as an employee to the value of the same hiring firm, but without the candidate (that is the as-is situation).*

worker provides to the company.

The employer must decide which applicant to hire and the salary to give to the winning one. The level of wage depends on the perception the employer has of the lottery he is entering. As a matter of fact, the employer cannot know the marginal product before hiring the candidate: he has some expectations based on the observable characteristics of the aspirant employee, such as education, race, sex, criminal records and so on.

Spence highlights the difference between certain types of features of the applicant which are defined[5] and other typologies of attributes which the employee can alter. The first ones include, for example, sex and race and the author calls them '*indexes*', while the second category accounts for education and qualifications, and they are defined as '*signals*'.

More precisely a signal is defined as any information or behavior that one party uses in order to notify its qualities to the other one. Signals and indexes can be considered as parameters which can shift the probability related to the employer's beliefs influencing his perceptions by providing additional and valuable data.

'*Potential employees, therefore, confront an offered wage schedule whose arguments are signals and indexes*'. Employees can work just on signals, as already stated, while indexes are fixed and cannot be modified. Of course, in order to obtain a qualification or education (or any kind of signal), the employee should be available to pay a certain cost[6], under the condition of maximization of the difference between offered remuneration and signalling expenses[7].

Signalling costs are not confined to the monetary ones, but they include also psychic,

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5 *They are static, they cannot be changed by the actor, since they are intrinsic of the person.*

6 *As we will see afterwards, there are cases in which the party that pays the signalling cost is not the one that emits the signal.*

7 *The difference between the offered remuneration and the signalling costs represents the utility function of the aspirant worker. He obviously wants to maximize such equation.*

reputation and time related expenses. This broad definition is required to take into account the fact that signals can be of different types and they are implemented in several areas.

It is important to assume that signalling costs are negatively related to productivity[8] of the perspective employee, otherwise everyone will invest in the same signal paying the same cost, and this will not enable the employer to distinguish the candidates.

A simple model that helps to explain the properties of signalling in the labor market is the following.

Let us assume that there are two distinct groups of candidates who differ from each other for their peculiar characteristics. The first cluster (portion q of the population) has a productivity of 1, with a cost for education equal to y. The second batch (remaining portion $1- q$ of the population) has productivity of 2 and a cost for education equal to $y/2$.

The employer believes that there is a level of education (y^*) for which, if $y < y^*$ the productivity is 1 with probability 1, and if $y \geq y^*$ productivity is 2 with probability 1. Given these conditions, the wage level that will be offered will be 1 if $y < y^*$ and 2 if $y \geq y^*$.

So, the person who decides to set $y < y^*$ will have no incentive to pursue additional education, increasing y, because of the employer's initial expectations. On the other hand, the worker that sets $y \geq y^*$ will have the incentive to achieve exactly y^* units of education. Thus, in this case, the beliefs of the employer are satisfied and an equilibrium in the job market can be reached. The first group will set $y=0$ if $1 > 2 - y^*$, while the second one will consider $y = y^*$ just if $2 - y^*/2 > 1$. Putting together the two conditions,

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8 *In this case, Spence talks about productivity as a valuable quality of the employee, indeed he describes it as 'what the individual is worth to the employer'. In general, it can be whatever positive quality the party wants to signal.*

the expectations of the employer are satisfied when $1 < y^* < 2$.

It is worth mentioning that, if no signal is provided, each person would be paid the unconditional expected marginal product $(q + 2 (1 - q))$.

An important remark must be added at this point: the number of people in each category does not affect the equilibrium, due to the assumption that the marginal product does not change with the number of candidates hired.

In conclusion, since there is an information problem, we need a mechanism that enables employers to choose among applicants in an efficient way. The signal of education helps to assign the job to the best workers reaching Pareto optimal solutions.

Of course, the results of the model change if different employer's expectations are assigned to the two groups. There exist also equilibria in which all the applicants select $y = 0$ or in which all candidates select $y = y^*$. These outcomes depend on the conditions set at the beginning of the analysis.

It is important to mention that a potential signal, like education, becomes effective just in the case it is negatively related to productivity, which means that, to higher productivity workers, the expense to bear to signal is lower than for less productive employees. Hence, taking into consideration the previous example, if low productivity applicants have the same signalling expense of high productivity candidates, it is convenient for all the population to invest in such signal. This scenario does not allow to distinguish among potential workers, not overcoming the inefficient condition.

But, do also indexes have an impact and, if this is the case, what kind of impact do they have? To answer this question, Spence uses as example the sex characteristic. Let us assume that sex is uncorrelated with productivity and that women and men have the same level of productivity and education. Since they have an identical level of signalling cost, they should have the same probability to be chosen by the employer.

In conclusion, we can say that indexes have a potential impact on the equilibrium, so different candidates potentially have different probabilities to get the job and to have a certain level of wage. There are, in fact, externalities and the individuals that belong to the same portion of the population are treated in the same way, but differently from the ones in other groups that present other characteristics.

Spence explains in detail how the mechanism works in the labor market, but what about the other markets? What are the actors involved? What is their role? It is important to identify the fundamental features of a signalling scenario, which means defining the signalers, the receivers, the observed signals, the unobserved quality and the boundary conditions (Bergh et al., 2014).

The signalling framework can be applied to many contexts, that are the ones in which information asymmetries arise. Despite the different origination arena, the way in which signals work as well as the conditions to reach an optimal output are the same as the one in the labor market.

First, the presence of two kinds of actors is essential. On one side there is the party that needs to conceive information and on the other side the one that has to receive such information. The signaler wants to be noticed in order to facilitate the allocation of the resources made by the other party. The receiver, on the contrary, has to take a decision without having a complete set of ex-ante information. The signaler has a certain motivation to certify his quality, and, for this reason, he sustains a specific cost to convey his high-quality status on the market. It is, in fact, the first mover, the one that triggers the signalling process.

Signalling theory, thus, specifies how signal senders and observers can distinguish between and separate high-quality from low-quality actors based on observable signals.

Signals should have the following characteristics:

- *Observability*. The receiver should be able to recognize and understand the signal and it should be able to use it to make an optimizing choice. A credible signal must be not only expensive for the signaler (Certo and Ireland, 2011), but also observable by the receiver. Despite this fact, the observability of the signal is a necessary and not sufficient characteristic of it.
- *Informative content.* The signal must bring additional information to the receiver. To be an informative signal, to increase the level of information present on the market, the action intended to signal has to cost less for actors that have certain additional positive features than for the ones that do not have such peculiarities (Montiel et al., 2012)[9].
- *Cost of the signal*. The signal, to be effective, must be costly. The expense should be negatively related to the attribute that the actors do have. That is to say that high-quality entities will sustain a lower cost to signal their status, while for low-quality ones the cost will be higher. This means that for the latter entities the signalling expenses are higher than the derived benefits, leading them to decide not to signal.

The information given by the signal can also be of different nature. When a company wants to signal its high-quality status, it can do it by addressing different actors in the market, but for each kind of player, the type of signal required is not the same. If we take, for example, the case of biotech companies going public, we can see that the signal can have a commercial nature, when the firm uses as signal the affiliation with reputable underwriters, or a scientific nature, when given by the affiliation with a prominent university. In the case they are both implemented, we talk about multiple signals.

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9 *Coming back to Spence, this positive quality was the worker's productivity, which distinguished actors on the market.*

Multiple signals can have an additive nature or not. Sometimes, affiliation with different prestigious affiliates of a certain type can be seen by investors as additively valuable, as opposed to others which are just redundant (Pollock et al., 2010). Additive signals can be identified in the example provided before. Given the fact that the third parties act in different sectors and have specific knowledge, financial for the underwriter and scientific in the case of the university, they certify peculiar aspects of the same enterprise. Hence, they provide signals which are additive in nature. This aspect is important also for the quantity and type of resources the company is able to get. As a matter of fact, signals may be combined in additive or substitutive ways to influence the number of alliances formed (Gulati and Higgins, 2003; Lee, 2001).

On the other hand, if the counterparties work in similar domains, they are certifying the same characteristics of the focal corporation. Signals provided are, thus, redundant, since they transmit the same information content to the stakeholders.

At this point an explicative example is required. Let us consider an entrepreneurial venture in the biotech sector. This has to signal its own quality to attract investors at the moment of its Initial Public Offering. To do so, it can implement many strategies, for example deciding to be backed by a reputable Venture Capitalist. If it gets services from such professional investor it means that it has successfully passed the tough selection process, hence it can demonstrate its good status to the stakeholders. The relationship between the young company and the VC is able to create a separating equilibrium for those that are trying to distinguish high- and low-quality companies.

In the displayed case the signaler that has triggered the process is the startup, the receivers are the investors interested in the enterprise, while the content of the signal is represented by the quality of the business backed by the VC.

Some writers have focused their attention on the way to create a separating

equilibrium involving a third party that bears the signalling expenses (Sanders and Boivie, 2004). To understand this, a good example is the one of new entrepreneurial ventures, characterized by high levels of uncertainty, lever on prestigious underwriters and/or Venture Capitalists to signal their status. These counterparties know very well that they are bearing most of the signalling costs, since their capital and reputation are on the line. Hence, they can generate a separating equilibrium leading people outside the deal believe to be able to recognize the quality of the backed firms (Gulati and Higgins, 2003). This example is useful even to understand another concept: the signalling expense is not only the monetary one (in the described scenario the capital injected in the business), but it can also have an intangible nature, as the prestige of the actor bearing such exposure.

It is important to point out that, for a signal to be valuable, it must create a separating equilibrium.

A separating equilibrium is an equilibrium in which the sender's message reveals its quality. This entails the fact that the uninformed agent, ex-post, can recognize effectively between high- and low-quality entities by their actual behavior and characteristics (Kreps and Wilson, 1982).

More broadly, we can say that a separating equilibrium is created when the actors involved in the transaction make optimal decisions on the base of weights given to returns and costs of investing in a certain signal.

Bergh et al. (2014) have defined the main features distinguishing a separating equilibrium:

- *Information asymmetries*. All the parties involved in the transaction are affected by information problems and suffer from adverse selection and moral hazard. That is why they use signals.

- *Signal costs*. The correlation between signal quality[10] and its cost is negative: the higher the quality of the sender, the lower the cost for it to acquire the signal. This increases the effectiveness of the signal.
- *Pareto optimizing condition*[11]. A Pareto optimizing condition should be reached, bringing the receiver to choose the efficient solution. In this case, no other possible scenarios exist that increas the utility of one of the two parties, that is to say that no other possible solutions make better off both the counterparties involved.
- *Experience*. It should confirm the quality of the signal and the information it conveys. Following Spence reasoning, the high-quality worker should perform in a way that his higher salary is justified by his performance.

Having defined the characteristics and the conditions for signals to be effective and create a separating equilibrium, we now shift the attention to the several fields of application of this theory.

Many authors (Heil and Robertson, 1991; Weigelt and Camerer, 1988) have shown the impact and the importance of signals on strategic management. Since strategic decisions[12] are characterized by information asymmetries between the firms and their stakeholders, signals are particularly important in this realm, as they can help to eliminate the gap between what the stakeholders want to know about the company and what they actually know (Miller and Triana, 2009). An example of strategic decision characterized by high level of uncertainty is the undertaking of an

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10 *The signal's quality is related to the sender's quality.*

11 *A Pareto efficient allocation is one in which it is not possible to improve the welfare of an economic agent without reducing the welfare of another entity.*

12 *Strategic decisions are choices which affect the structure and the long-term performances of the company, influencing its growth and survival. Their impact on the organization is extremely high, since it is not confined in limited boundaries like an operating business unit, but, despite this, they are not taken as frequently as operative decisions. They require a systemic view of the entire company, for this reason they concern the Upper Echelons of the hierarchy of the enterprise.*

Initial Public Offering. As a matter of fact, stakeholders and investors do not have complete information about the conditions and quality of the firm issuing shares, and, for this reason, they require some mechanisms to decide whether the investment is valuable or not. Affiliation with a reputable underwriter can signal the commercial quality of the corporation, while, for example, affiliation with a top-ranked university can provide information on the quality of the projects and researches the firm is undertaking, especially in knowledge-intensive industries.

Further studies have tested the signalling theory, studying the enterprise's shareholders (Certo, Daily, Covin and Dalton, 2001) or debtholders as receivers (Elliot, Prevost and Rao, 2009).

A particularly challenging area of application, characterized by a high level of information asymmetry, is the one of knowledge-intensive industries, like the one investigated in this thesis.

As a matter of fact, firms have to find a way in order to signal the value of knowledge to both the capital and the labor market (Ndofor and Levitas, 2004), but they have to pay attention to the leakage of information made by the competitors[13]. According to researchers, knowledge does not need to be transferred for its value to be certified, but signals can transmit information about the quality of a company's products. The capability of enterprises to protect the knowledge but, at the same time, to take advantage of its full value by revealing it, would bring the corporation to have a competitive advantage and it would also explain the asymmetric distribution of knowledge resources (Liebeskind, 1996).

The aim of this thesis is the analysis of a specific signal, where the signalling cost is supported by a third party, in our case the university that is affiliated to the

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13 *This is the problem of spillover, that arises in the moment in which competitors steal confidential information from the company.*

company. This is true in the sense that just the academic partner has its reputation on the line and it can lose something in the case the business will not succeed.
The sender is the biotech entrepreneurial venture that is undertaking an Initial Public Offering: it has to convey information about the quality of its technology in order to convince potential investors to buy its shares. On the other side of the transaction, investors are defined as the receivers of the signal.

Moreover, a second step involves the assessment of the impact of the affiliation with a reputable university on the formation of alliances with other entities, which could be academic institutions, other biotechnology entrepreneurial ventures and pharmaceutical firms. Hence, while the signaler (i.e., biotech startup) and the content of the signal (which is the scientific legitimacy of the enterprise) are the same of the previous investigation, the receivers are the potential partners, still stakeholders of the corporation.

All these considerations must be related to the main characteristics of the biotech industry, which is a knowledge-intensive industry and its functioning is based on tacit knowledge. For this reason, finding a way to certify the quality of the business is even more difficult and important than in other sectors.

1.3 Entrepreneurial Venture

An entrepreneurial venture is a young and small company that has been established to realize and commercialize an innovative idea (Carland, Hoy, Boulton and Carland, 1984) .

In order to enlarge its business and grow, it needs many types of resources, not only money, but also knowledge, real estate, network, machineries and so on. This is why it has to resort to the market.

In most of the cases, finding all the resources required by the young firm is complex. This is mainly because the company lacks any track record about its past and it cannot signal its quality in an effective way. When this happens, we talk about '*funding gap*' and '*knowledge gap*', which are divergences in the market that leave some of the needs of the enterprise unmet. As a matter of fact, to reach a certain level of expansion, the organization needs to be supported in a proper way, benefitting the entire economy[14].

Therefore, it is appropriate to talk about '*entrepreneurial ecosystem*' as the place where demands of startups are matched with the requirements of investors. This ecosystem enables individuals, enterprises and even the society to effectively interact, generating economic wealth and prosperity (Prahalad, 2005). An important feature of this scenario is represented by the unique presence of professional investors. This is motivated by the need to provide fundings and even help the firm in a broader set of activities[15].

Huge uncertainty surrounding entrepreneurial ventures makes the mentioned match difficult, entailing a relevant problem of information asymmetry (Cosh et al., 2009). The younger, smaller and more knowledge based the company is, the more the imbalance increases[16].

To support this thesis, Berger and Udell (1998) have argued that '*the most important characteristic defining small business finance is informational opacity*'. The necessity to overcome this problem arises, limiting the effect of information asymmetry through the implementation of signals.

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14 *Startups are considered one of the most important engine of growth for market development (Kressel and Lento, 2012).*

15 *The main investors for a young and innovative business are Business Angels, Venture Capitalists and Private Equity Funds. All of them have specific characteristics and give peculiar contributions, hence they intervene in certain stages of the lifecycle of a startup.*

16 *The company does not have a track record, the awareness of the clients about the enterprise is lower, its business is mainly based on tacit knowledge bringing just a small number of investors to be interested in investing in it.*

The signals adopted by an entrepreneurial venture are aimed at conveying information about the unobservable characteristics of the business. In the case of young firms, they play even a more relevant role, given the high degree of uncertainty affecting the business.

A first cluster of signals is composed by patents, alliances and team experience (Hoenig and Henkel, 2014), elements that certify the unobservable quality of the technology at the base of a startup, allowing to attract investors. Indeed, according to Stuart et al. (1999) at the time of the investment decision, potential future shareholders rely upon these factors in order to capture more information about the status of the company and understand its real value.

Hoenig and Henkel (2014) found that Venture Capitalists value patent highly, even if it is not considered a real signal of the goodness of the enterprise's technology. In addition to this study, Hsu and Ziedonis (2013) have stressed the dual sources of advantage of patents, which, firstly act as isolating mechanism in the product market and then attract attention especially when new firms lack alternative ways to convey their quality and they are at the very first stages of their lifecycle.

If the startup does not have any patent, it can convey information about its quality through strategic alliances. Indeed, as it has been shown by Stuart, Hoang and Hybels (1999), third parties evaluate the young enterprise through the analysis of the alliances that are in place and if they are with prominent partners. It has been demonstrated that these companies will perform better than comparable ventures without associates. This outperforming scenario is explained by the fact that the endorsed entrepreneurial venture can exploit the experience, the physical resources (e.g., laboratories and facilities) of another entity and the tacit knowledge coming from the interactions of experts. All these factors lead startups to achieve higher growth rates and overcome sooner the '*valley of death*' than similar companies not benefitting

from strategic relationships.

Moreover, the young and small firm uses the experience of its team to signal its status. Indeed, experienced employees are more efficient and effective in problem solving, they have deeper knowledge of industry specific problems and they can even bring useful network connections, as Hsu (2007) sustains. Thus, the company leverages on the founders and employees' previous experience to grasp funding opportunities from the market.

Furthermore, it is interesting to point out the impact on investors of the prestige of managers and/or directors. Pollock, Chen, Jackson and Hambrick (2010) showed that the higher the number of prominent employees the larger the impact, evidencing the additive nature of the signals.

As a matter of fact, reputation is built over time, bringing valuable companies to attract top talents year after year. The more the firm is able to engage prestigious workers, the higher the scientific capability and the valuation the entity gets.

Another cluster of signals is the one related to the appointment of Venture Capitalists. They are entities that provide financial resources and competencies to organizations in order to develop and grow the business in a proper way. VC funding is a fundamental milestone in the lifecycle of a startup and it allows to convince the stakeholders about its status. Indeed, they are professional investors, that back just companies with good business potentialities, so they certify their characteristics in an effective way. As a matter of fact, if a small and young enterprise receives the support of such investors it means that it is valuable.

Moreover, according to Elitzur and Gavious (2002) being backed could be seen even as a signal of the effort put by the founders of the firm to manage the business in a proper way, since they have decided to realize and make an enterprise grow rather than '*take the money and run*'.

To support the hypothesis about the real effect of Venture Capitalists on the startup's business, it is interesting to consider the paper by Davilaa, Fostera and Gupta (2002). They highlight that after a VC funding the entrepreneurial venture is able to enlarge its business hiring new employees. So, these investors help the organization even in attracting new fundamental resources.

Furthermore, many researches have shown that entrepreneurial ventures are willing to pay more for being backed by prestigious Venture Capitalists, since they give broader opportunities to the firm and a wider network of business connections. This fact has been demonstrated by Hsu (2004), who found that, on average, entrepreneurs pay a 10%-14% premium to be backed by highly reputable investors and they are three times more timely in accepting such deal. The finding of the mentioned author is in line with the signalling theory, that says that prominent dealers allow the startup to signal in a better and more credible way its unobservable quality.

Moreover Stuart, Hoang and Hybel (1999) have demonstrated that entrepreneurial ventures backed by VC and even those that have strategic alliances with other corporations reach faster the public market and they have higher chance to receive larger valuations.

Uncertainty surrounding the startup is even higher in knowledge-intensive sectors, as the one considered in this thesis. In this arena the role of signals becomes fundamental.

Among all the signals analyzed the attention will be posted on the effect of affiliations and strategic alliances in the context of Initial Public Offerings. In this environment, uncertainty is a limit to be overcome finding a way to convince investors to provide funds.

1.4. Initial Public Offering

An entrepreneurial venture or in general a company when in need of fundings has three main ways to collect them: divest part of its assets, causing a decrease in its size, ask more debt in the form of loans or bonds, increasing its risk, or raise equity capital.

Probably the most interesting case is the last one and, among the possible equity issue types, the most challenging is the Initial Public Offering (IPO).

Through an IPO firms create the floating capital[17] and they start to be listed on an Official Stock Exchange. Their shares will be easily traded improving their current level of liquidity. Obviously, this is an extraordinary operation, as it is not related to the core business of the enterprise, and, for this reason, it must be approved by the shareholders' meeting. Moreover, when a company is listed, its ownership structure changes and the present stockholders are diluted (Ritter, 1987).

An Initial Public Offering brings many benefits as well as many costs and risks (Ritter, 1984). On one hand, the firm will find advantages coming from the financial field, the operational area and the organizational domain[18]. On the other hand, the IPO process is extremely expensive. The enterprise must be compliant with many requirements, in terms of size, age, profitability, appointment of financial

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17 *The floating capital is composed by all the traded shares on the Official Stock Exchange. Hence, the higher it is, the better the liquidity of the company's stocks, and, at the same time, the more relevant the risk of an hostile takeover.*

18 *In the financial field the advantages are related to lower cost of capital due to the lower perceived risk, access to financial markets, hence higher bargaining power towards banks. Concerning the operational area, the company finds benefits related to the certification effect, an improved visibility and the marketing lever. Finally, in the organizational sphere, it is remarkable an effective implementation of incentives like stock options, a better control of information and an improvement in the supervision made by institutional and professional investors.*

intermediaries, frequency of Financial Statements disclosure and so on, and it must even publish a detailed prospectus and carry out a marketing campaign to increase the awareness and the appeal of the offering. Moreover, this operation is very risky: the company is not sure about the final outcome, which could even be a failure. In this case, the firm would be forced to withdraw the offering, facing sunk costs, image and reputation damage.

The IPO process is composed by many phases, which have peculiarities and difficulties to overcome (Ritter, 1998).

Everything starts with the selection of the advisors. These figures are fundamental, since they must support the firm in financial and legal activities. They are selected through a *beauty contest*, in which the entrepreneurial venture submits requests to several counterparties to present their proposals, that, then, will be selected on the base of many factors. For example, the reputation of the advisor is taken into account, an analysis of the costs and fees that the company will have to pay is developed, and advisory, financial networks as well as additional services are considered.

Private banks provide several advisory services. When they operate as underwriters, they guarantee the deal, buying the remaining shares according to a stand-by agreement or a best offer base. If they act as global coordinators, they supervise the entire listing process. Finally, if they are market makers, they submit bid and ask proposals to maintain a correct level of liquidity on the outstanding stocks (Ellis, Michaely and O'Hara, 2000). It is interesting to point out that an Initial Public Offering can have more than one underwriter, especially if it has a very large size and it is spread over many countries[19].

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19 *In the case in which the IPO interests many countries it may be necessary to publish different prospectuses and to be compliant to the local rules.*

The second step is the definition of the prospectus which is required by the market authority[20]. As a matter of fact, this kind of equity issue targets the general public composed by small retail investors, that are, on average, uninformed and with low competences in the sector of the enterprise and in the financial field. Hence, this document must contain all the information required to take the decision of investing or not, in order to protect potential future stockholders. Details required are, in general, the history of the company, quantitative and qualitative information about the business, the industry and the products, corporate governance, main risk factors, future strategies, Financial Statements and accounting ratios[21], number of issued shares and their price, name of the underwriters, the profile of the adequate investors and how to join the equity issue (Hanley and Hoberg, 2010).

At the actual offering moment, shares are placed in the market. Every IPO is composed by a private placement to institutional investors[22] and a public offering to the retail ones. Moreover, the shares placed can be primary, newly issued stocks to raise capital, and/or secondary, shares that are sold to give an exit opportunity to current shareholders. In the latter case, usually a *lock-up period* is defined. This entails the fact that a part of the current stockholders, such as Venture Capitalists, cannot liquidate their stake in the company until a certain period contractually stated (Field and Hanka, 2001). This provision has a double effect: on one hand it gives a positive signal to the market about the future value of the entrepreneurial venture and, on the other hand, it avoids that a relevant number of shareholders sells a huge amount of shares causing a pressure on the supply that turns into a decrease in price.

Usually, the Initial Public Offering presents a mix of primary and secondary stocks.

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20 *The market authority must also approve the listing prospectus.*

21 *Usually of the last three years.*

22 *Examples of institutional investors are insurance companies and hedge funds.*

The third step of the process is the stock allocation. The issue period lasts from one to three weeks. After that moment, it is possible to state if the IPO is oversubscribed or undersubscribed[23] (Amihud, Hauser and Kirsh, 2002). Being part of one of the two scenarios depends also on the price that has been set. In the case it is too high, the collected capital is large but the chance of a successful IPO is low, while if it is too small the underwriter probably has less difficulties in placing stocks, but it has to face a lower collection of funds and a higher dilution of the existing shareholders, due to a relevant wealth transfer.

In the case of undersubscription, depending on the size of the demand and offer, the IPO size can be reduced or, in the worst situation, withdrawn.

In the opposite situation, there will be a pro-rata allocation[24] or even a random allocation of shares to retail investors - depending on what has been stated in the prospectus, while institutional investors will be rewarded according to the strategic, long-term objectives of the underwriter. Moreover, in this case, the private bank can exercise the *Greenshoe Option*, increasing the quantity of offered stocks (Muscarella, Peavy III and Vetsuypens, 1992)[25].

Another interesting provision given to the investment bank is the *claw-back clause,* which enables a transfer of a part of the offering from one side to the other one, in the case institutional investors oversubscribed the offering, while retail investors undersubscribed it or vice versa (Bertoni and Giudici, 2014).

Finally, we find the listing and aftermarket phase. A peculiar and frequent aspect of this final stage is underpricing. It happens when IPO shares are offered at a discount compared to the real equilibrium market price. The average underpricing for

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23 *If the demand is oversubscribed it means that the demand for shares is higher than the supply. In the case of undersubscription the opposite condition is verified.*

24 *For example, if the demand is two times the supply, each retail clients will receive half of what he has asked.*

25 *Until a maximum of 10%-15% of the initial IPO size.*

European Initial Public Offerings is between 5% and 7% (Loughran and Ritter, 2004).

Ibbotson (1975) has listed the main theories that explain underpricing:

- *Market fads and irrational behaviors*. The former are related to the main trends affecting the market. On the other hand, underpricing can also be caused by an irrational behavior of investors. A good example is given by *herding*: an investor decides to buy some stocks of a given company just because everyone is doing that.
- *Leave money on the table*. Underpricing is a costly signal, thus it can be done just by enterprises with good future potentialities as they will recover this lost opportunity.
- *Winner's curse*. The uninformed investors are not able to distinguish cold IPOs from the hottest ones, while professional traders and institutional investors have more information and can properly choose where to invest. For this reason, there will be high demand for good offerings and the probability of getting those shares will be lower than the chance of being rewarded in the less interesting equity issues. This brings a rationing of the demand. Thus, to maintain investors interested in the offering, the hottest companies offer their stocks at a lower price than their actual values (Rock, 1986).
- *Leave a 'good taste in buyers' mouth'*. In this case underpricing is considered a sort of gift to clients, with investors rewarded for having provided funds to the company by the firm itself that is giving the securities at a lower price than their real value.
- *Reward institutional investors*. Underpricing is a way to repay the kindness of institutional investors that have revealed valuable information during the '*roadshow*' realized by underwriters in the *bookbuilding* activity.
- *Avoid possible litigations*. If someone that has bought the IPO stocks sees negative returns in the market, he can rise claims against the company.
- *Bribery and corruption*. For example, a private bank could ask to an entrepreneur

to be the underwriter, promising that, in reward for that and for the possibility of doing underpricing on his shares, they will allocate him mispriced stocks of future IPOs, guaranteeing certain returns.

The most interesting form of market failure that can be observed in the context of Initial Public Offerings is the one related to information asymmetries.
In perfectly competitive markets agents are fully informed about prices, quantities and other relevant variables. In the stock market, as in many others, it can be noted that one party has more information about the transaction and the underlying than the other one. For this reason, this kind of trading place is characterized by information asymmetries (Morse, 1980). The issuer of the security knows the actual value of the shares, while investors can just attribute them an expected value, which will be different and lower than the actual one, especially for good quality companies. This causes adverse selection and under-provision, entailing a lower incentive for good quality enterprises to offer their stocks on the market, since they will collect a lower amount of money than the one expected.

At the same time, a hidden action problem exists. The investors do not know in advance if their money will be used to finance good quality projects. In this case, a hidden action problem arises after the provision of funds (i.e., after the listing moment), causing under-provision.

Despite these problems, the IPO firm has many methods to overcome these market failures. We will explain them in detail in the following chapter.

All these remarks must be related to the theory of the Efficient Market Hypothesis - EMH (Fama, 1965), which states that the market price of the stocks of a company always reflects the information that is publicly available. In the moment in which new information is provided, the share price is automatically modified,

adjusted upward if positive data have been shared, or downward in the case the new information is negative. If this is true, information is one of the most important factors that guarantees the success of the finance activity of the organization, especially in the equity market. Hence, the entrepreneurial venture must disclose all the information required to be valued in a fair way.

Another important aspect of Initial Public Offerings that should be taken into consideration is the long-run underperformance (Ritter, 1991). As a matter of fact, on average the IPO company experiences worsen performance in comparison to the market index. The beta[26] of the enterprise is higher than one, which is the beta of the market portfolio (i.e., neutral), meaning that the firm's shares do not move as the market does, reaching a higher return.

One of the reasons why the company underperforms in the long-run is related to the fact that its probability of survival is lower as it is riskier than the market itself (Ritter, 1991).

Other possible explanations are given by overoptimism surrounding the equity issue or analysts' opportunistic behaviors. If, after the listing, the enterprise does not get the expected results, the market will realize it and investors will start to sell the shares causing a sudden decrease in their price (Ritter, 1991).

The last possible reason why there could be long-run underperformance is the exploitation of a '*window of opportunity*'. According to this theory, companies are taken public when the value of their future growth opportunities is almost over, when profitability in the future will be lower showing poor operating performance after the listing moment. The market realizes that the business has been taken public just to exploit an opportunity. Hence, investors start to lose interest and divest (Ritter, 1991).

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26 *Beta is a measure of the systematic risk characterizing a company: it gives the sensitivity of the standard deviation of the returns of the investment against the standard deviation of the returns of the market portfolio. The market portfolio is characterized by the highest level of diversification, since it includes all the stocks available on the market. Hence, the level of risk that cannot be offset through diversification (i.e., systematic risk).*

Chapter 2

Literature Review

The aim of this chapter is to define a deep understanding of the problem at hand by analyzing the literature already available on it.

The Initial Public Offering process is a complicated one, with problems related to the perception of investors on the company and information asymmetries.
Because of this fact, enterprises have to signal their quality to the market and they can do it following ad hoc strategies.

The ones we will carefully analyze in the following sections are affiliations and alliances that the entrepreneurial venture can make with prominent entities. These actions certify quality, since a selection process has already been undergone by esteemed partners that have all the competences to screen the counterparties. The signal provided is credible, since they put in line their reputation when they define links with companies characterized by uncertain value.

2.1 Signalling Theory in Initial Public Offerings

Undergoing an IPO is one of the most important phases in the lifetime of an entrepreneurial venture. As it has already been explained extensively in the previous section, the process of collecting money on the stock market is a complex and costly one. The reasons behind this are several, but mainly related to the concept of information asymmetry that leads to adverse selection and moral hazard. This is enforced by the Pecking Order theory (Donaldson, 1961), which explains how the cost of financing

increases with asymmetric information. For this reason, firms usually avoid the equity market and prefer internal forms of capital raising (through either the divestment of part of the outstanding assets or the excess cash that is available) or debt increase (in form of either loans or bonds).

Equity is less preferred, because when the company issues new shares the stakeholders believe that managers are collecting funds just because the enterprise is currently overvalued. As a matter of fact, investors do not have complete knowledge about the quality of the firm undergoing a public offering. There will be thus adverse selection, since the new shareholders lack information on the quality of the stocks offered. This will cause under-provision, since bad quality securities generate a negative externality on good quality ones.

On the other hand, moral hazard arises in the moment in which one side of the market, the investor in this case, lacks information on the actions of the other side – the entrepreneurial venture. A hidden action problem takes place after the equity issue, when new stockholders do not know how managers will use their money, due to an absence of complete control on their actions. The directors of the enterprise can act opportunistically pursuing their own goals instead of maximizing the value for shareholders. This is an ex-post issue, but it influences a lot the decision to invest in the company causing a possible under-provision of capital and a consequent impossibility to eliminate the '*funding gap*' - typical feature of a startup. Hence, the IPO corporation must provide many details about its corporate governance to show a method to control the day-to-day operations, guaranteeing the achievement of shareholders' goals.

As a consequence, these two factors lead to an under-provision of capital and the entrepreneurial venture, in order to solve such problem, sells its IPO shares at a discount in comparison to their real value. There is an intuitive positive relationship between the cause and the effect, raising the level of underpricing when uncertainty increases (Ritter and Welch, 2002).

Due to the high degree of uncertainty and the incomplete information surrounding the IPO context, signalling theory is particularly important: the enterprise needs to signal its good quality in order to be considered as a potential deal by investors, especially retailers, and to decrease the underpricing.

There are many ways in which the company can signal its quality status and they can be divided into two main categories: endogenous and exogenous. The former category includes actions originated inside the organization, while the latter refers to signals coming from the outside – links that the firm has in place with actors that do not belong to it.

The first type of endogenous signals on which an entrepreneurial venture can leverage on is represented by its Upper Echelons.

Certo (2001) has stated that the features of the BoD influence the organizational legitimacy, that, in turn, affects positively the market performance and reduces the IPO underpricing. The relevant effect on the IPO share price is explained by the fact that a larger set of information about the company's status is available to investors, who can properly evaluate it.

This finding is supported also by Certo, Daily and Dalton (2001), that have demonstrated how the characteristics of the board impact on the perception of investors during an Initial Public Offering. The authors found that board size and board reputation are negatively related to the underpricing. Indeed, according to their results, potential future shareholders may attribute to bigger pool of directors a larger access to resources, leading them to broader and more interesting business opportunities. Moreover, the greater the size of the BoD, the wider the exchange of ideas and the knowledge transfer, allowing the achievement of better performance.

On the other hand, Kilduff, Angelmar and Mehra (2000) focused on the

analysis of the relationship between the Top Management Team (TMT) and the IPO results. They have shown that the cognitive diversity (i.e., the different backgrounds of the managers) affects positively the firm's performance. Furthermore, members of high-performing teams tend to signal in an effective way the value of the company during the equity issue and they can even have a deeper impact over the long-run, avoiding the common worse results of the enterprise in comparison to the market index (Zimmerman, 2008).

This finding is supported and advanced by Higgins and Gulati (2006), who analyzed the impact of the career histories of top managers on investors valuation. They argued that stakeholders, for assessing the value of a corporation, take into consideration the past employment affiliations with prominent downstream organizations, with firms that work in other industries, and the previous roles charged to the Chief Executive Officer of the IPO entrepreneurial venture. All these aspects are used to understand if the competencies of the Upper Echelon are industry specific (so greater knowledge of the sector) or if they are broader (thus considering more dimensions at the same time). Even if they bring different kinds of contributions, their heterogeneous competencies enhance the strategy and competitiveness of the firm in the market[1].

To emphasize even more the importance of the educational prestige of the company's executives it is possible to rely upon the results of Lester, Certo, Dalton, Dalton and Cannella (2006), who showed that the greater the legitimacy of the firm the higher is its IPO valuation. This is because investors have a better perception of the enterprise and they believe that it will have good business opportunities in the future.

Similarly, Cohen and Dean (2005) have argued that the legitimacy of the TMT will be directly linked to the valuation at IPO. This result is explained by the fact that

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1 *This study is focused on the biotech industry, which is the sector considered to carry out the empirical tests in this composition. Being a knowledge-intensive area, the experience and knowledge of the workers play a fundamental role.*

investors associate managerial credibility to the organization's economic potential under conditions of uncertainty. Thus, stakeholders consider Top Management Team's legitimacy as an indicator of the economic potential value of the entrepreneurial venture. Moreover, the authors found a positive relation between the signal and the long-run performance of the organization, outcome that confirms the persistency over time of the analyzed signal.

Finally, Pollock, Chen, Jackson and Hambrick (2010) have pointed out that the number of reputable non-executive and executive directors is negatively related to the IPO underpricing. This means that, the more they are and the more prestigious they are, the better it is, since each of them brings additional value to the corporation[2].

All these findings are enforced by the results of Deeds, Decarolis and Coombs (1997), who have found that the scientific capability of the startup positively affects the Initial Public Offering valuation.

The last type of endogenous signal is the one provided by shareholders.

The founders of the entrepreneurial venture can give an important signal, as stated by Bruton, Chahine and Filatotchev (2009), retaining their ownership stake during the IPO. In this way, the problems coming from adverse selection are decreased causing a reduction in the underpricing[3]. However, moral hazard is even worsened, since, as the stake of founders raises, the risk of experiencing an opportunistic behavior increases. Thus, this signal works just to certify the quality of the business.

Even the *lock-up period* for current stakeholders can tell something about the unobservable good nature of the entrepreneurial firm, since it shows that the company

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2 *The authors have found positive linear relationships between the number of prestigious non-executive directors and IPO valuation, and the number of executive directors and IPO valuation.*

3 *As the empirical results of the paper show, there is a curvilinear relationship (U-shaped) between founders' retained equity stake and the IPO underpricing.*

has still viable opportunities for the future (Arthurs, Busenitz, Hoskisson and Johnson, 2009). Moreover, the higher the uncertainty around the moment in which the enterprise will become profitable, the longer the *lock-up period* should be. This provision is aimed at retaining professional investors, like the Venture Capitalists, that give a fundamental support to the business.

Entrepreneurial ventures exploit also exogenous signals to certify their quality. In this case the actors that are adding relevant information about the viability and sustainability of the business are external and they are professionals in their field[4]. So, it is possible to make a classification based on actors' specialization domains, which can be scientific, organizational or financial. In the scientific sphere we find universities and research centers. Venture Capitalists have competencies related both to the financial world and to the organizational one, while underwriters specialize themselves mainly in the accounting and financial area. This way of clustering is related to the fact that counterparties with different competencies give differential contributions to the business, certifying specific features and provide peculiar signalling contents.

If a firm is university-based or it has academics in its Top Management Team can publicize this aspect in order to extract some benefits. Indeed, Bonardo, Paleari and Vismara (2011) have shown that investors positively value the university affiliation, since it can signal the quality of the idea and technology at the base of the startup reducing the uncertainty around the business. Furthermore, the authors have found that the valuation given by stakeholders during the Initial Public Offering is even higher in the case in which the Upper Echelons of the hierarchical structure vaunt the presence of professors. As a matter of fact, stakeholders value partnerships according

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4 *They are not working inside the company, but they are working for it. Moreover they have contacts with the enterprise for a limited time horizon.*

to the skills and capabilities they convey to the focal firm. For this reason, academic ties can be highly considered by investors, since they bring resources and knowledge to the company, other than prestige.

If the firm does not have any university affiliation, it can rely upon other exogenous signals, like partnerships with other corporations. Through collaborations with enterprises that work in the same industry, the entrepreneurial venture has the possibility to share costs, risks, difficulties of realizing a project, as well as the benefits coming from it (Baum and Oliver, 1991; Miner, Amburgey and Stearns, 1990; Stuart et al., 1999). Moreover the process reaches a better outcome, in a more efficient way. For this reason, it is possible to talk about alliances that are strategic for the business (Gulati, 1998; Pollock and Gulati, 2007). If the partnership is with a prestigious organization, it is even more relevant and valued more favorably by the stakeholders (DeCarolis and Deeds, 1999; Stuart et al., 1999).

These kinds of agreements can be of different types and each one of them conveys different signals to the market. They can be distributed along the value chain, differentiated between upstream, horizontal and downstream alliances.

As shown by Gulati and Higgins (2003), the effects of such agreements are not contingent to the conditions of the IPO market. As a matter of fact, it could be either a cold or a hot period for the equity market, but the information provided by this signal has the same effect on stakeholders.

Startups are usually backed by Venture Capitalists to ensure a rapid growth. When they are endorsed by such investors, they signal their quality in an effective way, especially during cold periods on the IPO market, when the stakeholders are not willing to purchase shares (Gulati and Higgins, 2003). Moreover, if these third parties are reputable they are certifying a very good quality of the corporation, deeming it

possible to demonstrate that the highest reputation of VCs implies the largest effect on the performance of the equity issue.

On the other hand, it is not possible to say that the more they are the better it is, since their relationship with the Initial Public Offering valuation is not linear[5]. Despite this fact, it is interesting to point out that if the entrepreneurial venture is backed by a prominent Venture Capitalist it will have the possibility to attract more institutional investors, that will increase the number of retailers interested in the capital issue, raising the probability to carry out a successful IPO (Higgins and Gulati, 2006).

Finally, entrepreneurs can rely upon the signalling value of reputable investment banks, which have been appointed as underwriters for the listing processes. Indeed, Carter, Dark and Singh (1998) have shown that they are a certifying factor positively valued by the investors. As a matter of fact, the more prestigious the unrolled investment bank, the higher its effect on the equity issue causing a reduction of the discount applied on the IPO shares. The authors have also demonstrated that in the long-run companies backed by prominent investment banks have lower underperformance if compared to similar enterprises that have hired less prestigious private financial institutions. Thus, this signal seems to be persistent over time.

Higgins and Gulati (2006) have shown that the effect of these counterparties is even more beneficial during hot periods for the equity market. Indeed, with an increase in the number of entities interested in going on the public market, the competition among investment banks lowers. For this reason, they can select the firms to back, generating a higher signalling effect, since they will choose just the best organizations among the corporations undertaking the listing process.

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5 *Pollock, Chen, Jackson and Hambrick (2010) have demonstrated that the number of reputable VCs has a positive curvilinear relationship with the IPO valuation, since an additional Venture Capital does not bring an additive value of the same magnitudo.*

Previously we have discussed about the relation between number of underwriters, IPO size and location. Evidence shows that for larger and for cross-country equity issues more than one investment bank must be appointed. So, it is interesting to see that the effect of multiple underwriters on the stock performance is not additive, but a positive nonlinear relationship exists (Pollock, Chen, Jackson and Hambrick, 2010).

A final important factor to be considered is the relationship between the signal and post-IPO performance. Signalling certifies quality at the time of the issue, enabling the enterprise to reach positive results in the short-run, while, in the long-run, it has been demonstrated that only underwriter reputation and patents, among all the signals, contribute to improve the performance of the company (Deb, 2013).

All these signals are important for the entrepreneurial venture undertaking the Initial Public Offering, but obviously, they cannot be leveraged all together. That is why this thesis will focus the attention on the signalling effect of affiliations with prestigious universities on the IPO performance in the short-term, in order to asses if they have a real impact (decrease of the underpricing) or just a certifying value (showing the quality of the business).

2.2 Alliances

Since the perimeter of analysis of this composition, the biotechnology sector, shows an extremely important incidence of alliances (Hagedoorn, 1993) and taking into consideration that the network formation and industry growth are influenced by the development and maintenance of the social capital (Walker et al., 1997), a review of the literature on such relationships must be carried out.

An entrepreneurial venture is usually affected by information asymmetry problems, especially in the moment in which it decides to go public. As a matter of fact, uncertainty around the correct value of the firm scares investors, who are willing to invest less than what they would have in the case the company was older and more stable.

As Stinchcombe (1965) argues, a higher rate of failure exists among young entrepreneurial firms. This is because they lack established work roles and partnerships and because their track record is actually nonexistent.

For this reason, as we have extensively remarked, the corporation has to signal its quality to the market by implementing several actions. One of the complex and interesting methods is related to the development of alliances and partnerships with established entities.

As a matter of fact, we can easily argue that a firm that makes an alliance conveys a signal of quality to the market, since it is able to get additional resources and, at the same time, it can increase the perception on its capabilities. That is why investors know that the enterprise which establishes an alliance with the focal firm puts its reputation on the line, betting on the actual quality of the startup.

As Gulati (1998) explains, '*strategic alliances are voluntary agreements between independent firms to develop and commercialize new products, technologies or services*'. On the other hand, Pollock and Gulati (2007) define strategic alliances as '*any voluntarily initiated cooperative agreement between firms that involves exchange, sharing or co-development, and can include contributions by partners of capital, technology or firm-specific assets*'.

High-technology industries have seen a rapid increase in strategic alliances propagation, which, most of the times are critical to the success of the ventures

(Hagedoorn, 2002; Powell et al., 1996). This is because, in high-tech sectors, the uncertainty around the success of a project is even higher, leading to a greater value of the signal conveyed. As it has been documented by many researchers (Arora and Gambardella, 1990; Kenney, 1986; Liebeskind et al., 1996), in the case of the biotechnology industry, the increasing importance of alliances is evidenced by an additional motivation, which is innovation.

As a matter of fact, the biotechnology sector is an industry focused on the development of novel pharmaceuticals. This process is a multiyear one, that starts with the identification of medicine targets, active principles of actual drugs. Validation of the characteristics that these targets have is the following step, carried out in order to understand what is their role in biochemical processes. Once the validation is certified, they are screened against molecules to establish their role in curing the disease in question. A series of additional testing stages is then defined, to which clinical testing follows. Of course, the development process and the drug itself must be in compliance with the standards and regulations in place.

The description of this industry and how it works highlights the reason why it is particularly problematic in terms of information asymmetry. As a matter of fact, the multistage process has been estimated to be lasting, on average, 10-15 years, where the major components of the whole procedure are the development stages, almost impossible to be valuated and completely understood by the investors.

Moreover, the value chain of the drug development process comprehends three different characters.

First, at the upper level of the hierarchy, there are universities and research centers. They enable the transfer of rights on discoveries made by researchers to third entities. Second, we have biotechnology firms, which are companies born to develop commercially viable products based on those researches. They are said to be an organizational medium to bring university science to the market. Finally, we find

pharmaceutical corporations, which engage in almost all the steps of the value chain, even though they devote a higher effort in financing clinical trials and marketing products.

This description highlights how the biotech entrepreneurial venture has the chance to develop over time many links along the value chain.

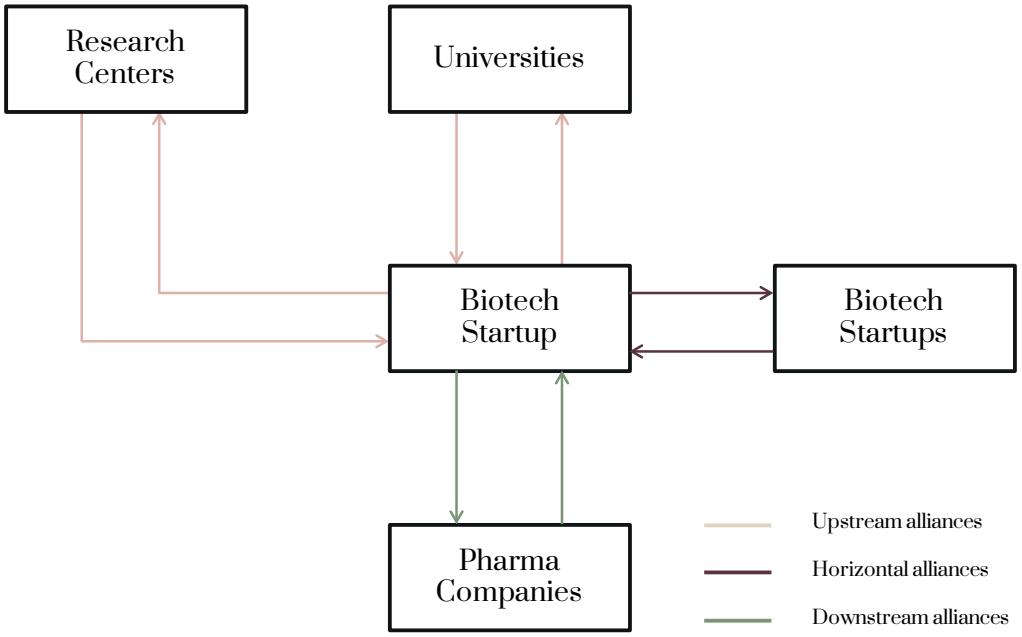

Figure 1 _ Drug Development Value Chain

Historically, alliances and partnerships began to flourish in the 80s, when firms realized that it was not so convenient to work always alone, strategy that was too expensive, inefficient and risky (Lorange, 1993).

Still nowadays, companies continue to develop strategic relations to enhance their competitive level and reach better outcomes and performances. Indeed, partnerships provide different kinds of resources to the focal company. They can, for example, grant complementary assets (Pisano, 1990), as well as increase the status and legitimacy of the enterprise itself (Baum and Oliver, 1991; Miner, Amburgey and Stearns, 1990; Stuart et al., 1999).

Lorange (1993) sustains that firms make alliances mainly for four reasons.

They want to defend themselves, to catch up, to remain or to restructure.

First, a defense position is usually taken when the enterprise's product and portfolio are of primary importance. In this case, the company wants to get access to new competencies, markets and technologies in order to maintain a competitive advantage over time. So, the firm can collaborate with other well established corporations[6] or it can join its forces with startups - this is the case in which the enterprise wants and needs to have some insights on new and fresh ideas, technologies and processes.

The second reason is to catch up. This happens when the business is still core to the venture, but it is not a leader in the sector. An alliance, in this case, would bring the firm to overperform in respect to its competitors improving its positioning and, as a consequence, its earnings.

The third motivation is to remain. Here, the enterprise is a leader in its segment, but the business for which the corporation wants to make a partnership has a relatively low impact on the portfolio of the company. Thus, it will make alliances to remain active and increase its efficiency in that particular segment.

Finally, the corporation could want to make partnerships to restructure. This is the case in which the firm is a follower, thus it is not playing a leader role, and the business has a relatively marginal role in the overall strategy. Despite this fact, it does not want to give up a similar opportunity.

After having stated the main motivations for realizing a partnership, the attention must be posted on the impact that strategic alliances can have on some aspects of the focal firm.

It has been documented that an entrepreneurial venture's alliances can enhance the number of patents that the company is able to develop (Shan et al., 1994).

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6 *In this case, the main goal of the alliance is the one of developing an outcome whose success is based on the reputation built during the previous years of business.*

As a matter of fact, a higher innovation rate is observed in smaller biotech firms, rather than in bigger ones and the startup's innovation rate does not increase the number of partnerships of smaller ventures with big firms, but depends on it. Or even, the same variable can improve the rate of product innovation, since interactions between companies make possible to share ideas, competences and expertises that lead to a more innovative outcome (George et al., 2002; Kelley and Rice, 2002).

Stuart et al. (1999) have demonstrated the impact of the collaborations with external entities on the number of sales, especially the foreign ones. Indeed, in the moment in which the company is endorsed by enterprises that work in other countries or on a global scale, it has the chance to enlarge its geographical presence. On the other hand, when the alliance is developed with a research entity, benefits entail the transfer of rights on discoveries to the company itself.

Another interesting advantage is presented by the fact that the network of alliances the enterprise has can even influence the chance to establish future alliances. In particular, with an increase in the number of downstream partnerships the firm can build more upstream relationships with '*a domino effect*' (Stuart, Ozdemir and Ding, 2007).

Several researchers have already studied the benefits that partnerships can have on the financial performance of the company. Empirical evidence exists confirming a positive relationship between the value at IPO of biotech companies and the level of prominent strategic alliances the firm has developed before the listing year (DeCarolis and Deeds, 1999; Stuart et al., 1999). Moreover, it has been demonstrated that entrepreneurial ventures with a higher number of partnerships tend to go public faster (Stuart et al., 1999).

Pollock and Gulati (2007) even looked at the period after the equity issue,

evidencing the impacts that these kinds of signals[7] have on the visibility of the company on the market, reducing uncertainty and enabling the focal enterprise to increase its chance to form post-IPO alliances.

Despite all these positive and general remarks, it is necessary to take into consideration the fact that not all the types of partnerships bring the same resources and value to the focal company. In an effort to understand the potential benefits a firm can get from a certain relationship, we try to define a taxonomy of alliances, first distinguishing between strategic and non-strategic ones.

Strategic alliances are the ones that affect the overall company and they are able to create a competitive advantage over the competitors. These kinds of relations are developed to reach a common objective between the two entities involved (Mockler, 1999). Since the two corporations are usually in competition they tend to remain independent one from the other (Isoraite, 2009)[8].

On the other hand, non-strategic alliances are defined as relationships that the enterprise has with partners that bring value to the firm even if they do not have a crucial role in the business.

We can, then, distinguish among different kinds of alliances along the value chain[9]. In this case, the definition varies from sector to sector, since the resources the company needs, change depending on the business activity.

For example, in the biotechnology industry, the possible strategic alliances an

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7 *The signals they refer to are market response to the IPO offering, affiliation of the firm with reputable underwriters and Venture Capitalist, number of analysts studying the company after the listing moment.*

8 *Strategic partnerships should be approved by the senior management, since they change the corporate strategy at the macro level.*

9 *According to the definition of value chain proposed by Porter (1979), the activities are divided into primary and support. While the former are related to physical production, sale, maintenance and support of an outcome, the latter are aimed at supporting the primary operations.*

entrepreneurial venture can make involve three types of partners (Baum et al., 2000). We, therefore, define the following relationships:

- *Upstream alliances*: strategic alliances with universities, academic institutions and research centers[10].
- *Horizontal alliances*: partnerships developed with other biotechnology firms, at the same stage of growth of the focal entrepreneurial venture.
- *Downstream alliances*: relationships with companies distributing and directly marketing drugs (i.e., pharmaceutical corporations).

Each of these links brings different types of resources to the focal firm as well as specific benefits and difficulties.

Upstream alliances are developed to capitalize on academic knowledge and bring to the market the discoveries made in research centers and academic institutions. They are usually done in the first stages of the research and product development, phases in which the need to acquire information is at its peak (Rothaermel and Deeds, 2006). These partners are able to provide access to laboratories, facilities and social networks, other than to the knowledge developed in the institution.

On the other hand, horizontal alliances are established to share resources with other biotech entrepreneurial ventures, trying to take advantage of economies of scale. The main goals of this type of relation are related to the possibility to share the costs of the project, together with its risks while sharing benefits and returns coming from the realization of a successful outcome.

Finally, downstream alliances are aimed at getting resources necessary to commercialize the products developed by either universities or biotech startups (Rothaermel and Deeds, 2006). In this way the biotech venture has the possibility to access the manufacturing, regulatory and marketing knowledge in order to acquire

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10 *The model we develop in this dissertation distinguishes between the two kinds of upstream alliances, defining two different variables related respectively to universities and research centers relations.*

the capabilities necessary to bring the product to the market.

All these kinds of partners have different characteristics, and, for this reason, are able to provide valuable resources in an additive manner to the focal enterprise. Research centers and universities are usually large institutions, which have the main objective to create and spread knowledge. Biotechnology firms concentrate on the creation of new products and technologies, facing the problems of resource constraints we have mentioned above. In the end, pharmaceutical companies are usually internationally established firms, with large availability of resources and competences.

The distinction among different kinds of alliances is also based on the type of knowledge that can be extracted from the partnership. Biotech ventures are known to be dependent on the information provided by research centers and universities, transforming it into viable products. This relationship can be directly seen in the number of cited papers in the patents developed by the firm (McMillan et al., 2000). Then, once the product has been developed, the knowledge required by the company changes, revolving around the need to commercialize properly the technology. For this reason, biotech entrepreneurial ventures can acquire mainly marketing and management competences from downstream alliances.
These differences enable the focal firm to get specific advantages on the base of the type of alliance it makes.

The complexity and ambiguity of the contracts underneath the alliances taken into consideration are related to the problematic transfer of knowledge. The issue associated to incomplete contracts is always present, since the rights correlated to the output are not well distributed among the actors involved and claims are very frequent (Baum, Calabrese and Silverman, 2000). Moreover, Alvarez and Barney (2001) have demonstrated that relationships with large and established companies can put at risk the performance and even the long-term survival of the entrepreneurial venture, as

they tend to take most of the value created by such collaborations.

Generally, upstream alliances are characterized by high complexity, since the value of the knowledge transferred is usually undefinable and the risk of leakage of information to competitors is really high (McMillan et al., 2000).

On the other hand, horizontal alliances with other biotech ventures are usually done to reach economies of scale and decrease costs. The knowledge, in this case, is more identifiable and has a clearer value, so the effort required to the firm is lower. But, despite this, the risk of spillover is extremely high, bringing the focal company to lose precious knowledge.

Finally, downstream links are based on more explicit and identifiable knowledge (Teece, 1992), that is focused on marketing and distribution (Rothaermel, 2001). The possibility that the contractual conditions proposed by the established pharmaceutical company are not optimal for the biotech startup can be a concrete issue. As a matter of fact, when the focal firm enters in a partnership with a downstream partner, it is highly probable that this second entity will take property of the highest proportion of the rents coming from the project. This is particularly true in the case of financially strapped startups, in weak negotiating positions, which must enter alliances under less attractive terms (Lerner and Merges, 1998).

All the described types of alliances are relevant especially in knowledge-intensive industries, like the one that is under investigation in this thesis. Indeed, competitive advantage in the biotech sector comes mostly from the interactions between experts or even young and brilliant employees, exchanging tacit knowledge[11]. Tacit knowledge has been thought to be promoting efficiency and competitive advantage (Droege, 2003). It comes directly from interactions between human beings, even

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11 *Defined as 'knowledge difficult to articulate' (Nonanka and Takeuchi, 1995).*

though it is difficult to be defined in verbal form. For these particular characteristics, it is usually challenging to be shared and it requires strong ties inside the organization or among partners to be diffused (Hansen, 1999).
Moreover, through such direct contacts it is possible to share facilities and, more in general, physical resources needed to reach high quality outcomes.

Despite all these considerations, it is common knowledge that the most frequent type of collaboration in the sector under investigation is represented by the downstream one. As Teece (1986) said, biotechnology entrepreneurial ventures often have innovative ideas for drug development, but they up-to-date assets to produce and commercialize them, which, in turn, are owned by pharmaceutical companies. Indeed, most of the existing studies consider biotech firms as the originator or the broker of the technology, which has to be placed in the market through strategic relationships with pharma enterprises (e.g., Barley et al., 1992; Robinson and Stuart, 2007; Rothaermel, 2001).

In this composition, we analyze the interaction between alliances and affiliations with prestigious universities, trying to understand whether alliances can play the role of mediator in the IPO valuation of the focal entrepreneurial venture. But before assessing if the strategic links mediate the effect of the affiliated university's prestige on the IPO valuation, it is necessary to study the connection between the aforementioned variable and the alliances ones (i.e., evaluating if the affiliation with a prominent academic institution affects the partnership formation process).

Chapter 3

Theory and Hypotheses

The first aim of this composition is to develop and test an econometrical model that assesses the impact of an explanatory variable (i.e., the prestige of the affiliated university) on the valuation obtained by the entrepreneurial venture during an Initial Public Offering. Then, we try to evaluate whether the same explanatory variable can unfurl the level of alliances the company has made. The following step involves the estimation of the effect of the number of links on the Tobin's Q. In the end, we implement a model that helps to understand if the impact of the explanatory variable is mediated or not.

In order to achieve the mentioned purposes we have analyzed the entrepreneurial literature, especially the one related to the listing process and the alliances formation. The aforementioned review has helped us to identify gaps in the literature, related mainly to the mediating effect that alliances could have on the signalling effect of the prestige of the affiliated academic institution.

The following sections address the issues met and propose how to fill the identified missing research. Therefore, four hypotheses for the first model and nine for the mediation one are presented together with the logical paths that have brought to such propositions.

3.1 The Effect of Affiliation with a Prestigious University on IPO Valuation

A hot topic of the entire entrepreneurial literature is the interaction between

signals and the valuation obtained by firms during Initial Public Offerings. Indeed, as it has been previously discussed, investors are surrounded by huge uncertainty, which leads the company to offer its stocks at a discount compared to the real equilibrium price. This action is implemented in order to increase the appeal of the shares as well as their demand. Thus, to overcome underpricing and reach a higher valuation at IPO, the enterprise transmits several signals. One of the many possibilities is to rely upon the affiliation with reputable Venture Capitalists or underwriters: the customers will be more prone to invest in such firms, knowing that prominent venture backers have all the competences and expertise to distinguish good deals from bad ones (Higgins and Gulati, 2006).

Another way to signal the quality of the underlying product or service is the affiliation with a university. Many studies have assessed the importance and the frequency of the relation between biotechnology firms and universities (Audretsch and Stephan, 1996; George et al., 2002; Powell et al., 1996).

As a matter of fact, this relation is very important for the company itself, since it brings many benefits (Moray and Clarysse, 2005). First, the entrepreneurial venture has access to the resources and the network of the academic institution. It has, then, the possibility to exploit the knowledge accumulated by its academics in specific fields (Crane, 1965). Moreover, it can attract a higher number of investors despite the lack of a track record - the main characteristic of a startup (Junkunc, 2007). Finally, the affiliation enables it to get a greater attention from the market, that results in a better analyst and media coverage (Loughran and Ritter, 2004), a higher chance of receiving funds from Venture Capitalists (Wright et al., 2006), of being target of a M&A deal (Bonardo et al., 2010; Meoli et al., 2013) and of obtaining a larger IPO valuation (Bonardo et al., 2011).

All these advantages are even more relevant when entrepreneurs are affiliated

with a prestigious university. Researchers have studied in deep the differences between university-based firms and similar companies without ties with academies (Bonardo et al., 2011). Despite this, it is possible to highlight the absence of a comparison between signals conveyed by prestigious academic institutes and the ones provided by ordinary academies, even though this distinction has been deeply investigated for Venture Capitalists and underwriters (Carter et al., 1998; Gulati and Higgins, 2003).

We argue that a prominent entity delivers a signal of quality that cannot be sent by a similar but non prestigious academic institution. This proposition is supported by many reasons.

First, reputable universities vaunt experts and resources of higher quality enabling the entrepreneurial venture to access better scientific knowledge. This aspect is much more important in the industry investigated in this thesis.

Being a knowledge-intensive sector, interactions between experts in many fields are fundamental to deliver a successful product. Tacit knowledge can be considered one of the main competitive advantages that a biotech company holds, so the access to valid resources in this industry is even more value adding than in other ones. Furthermore, the affiliation enhances the contacts between two completely different worlds, the academic and the entrepreneurial one. While scientists have great expertise and erudition derived from previous studies and researches, entrepreneurs have innovative ideas coming from experience and ambition. The two actors have heterogeneous backgrounds, but the common purpose brings them to get in touch. This gives the possibility to follow brilliant and fresh ideas exploiting previous findings to realize a product characterized by a greater quality.

The benefits of the affiliation with a prestigious university are related not only to the product market. Indeed, prominent entities are well known all around the world, hence enterprises can leverage on the name of its affiliate to increase the customers awareness, enlarge the pool of investors and the interest in their products. As Wright

et al. (2006) have demonstrated, a university-based company has a higher opportunity of being backed by Venture Capitalists; in the moment in which it is affiliated with a prestigious academic institution, the probability of receiving funds from a prominent professional investor is much larger. This, in turn, will bring other benefits: improve its business practices, acquire new competences, increase its size and the speed of the Initial Public Offering process.

Moreover, such company will get greater attention from media and analysts, that will disseminate an additional amount of data decreasing the uncertainty and the information asymmetry that surround stakeholders.

Finally, as reputable Venture Capitalists and underwriters, prestigious universities want to protect their reputation and image. Thus, they have an incentive to support just entrepreneurial ventures that have brilliant ideas and good future potentialities.This selection process is feasible thanks to the superior abilities characterizing prominent academic institutions, that make them a reliable certification signal. Indeed, such entities have all the expertise to evaluate the scientific rigor of the products of a firm, increasing its scientific legitimacy. Furthermore, thanks to the costs borne by prestigious universities in the affiliation with startups, a separating equilibrium is reached and a certification effect is defined.

This is well explained by the following example. Let us suppose that Oxford University wants to support just the best projects, in order not to tarnish its reputation. It has a greater chance to get in touch with brilliant ideas than other less known institutions (e.g., Brunel University) and, at the same time, it can more easily identify good deals because of its pool of excellent experts. On the other hand, the impact of a failure on the image of the university is greater than in the case of a non reputable academic institute, since the signalling cost that it bears is extremely high. All these factors lead to very different certification effects, letting the prominent university to provide a more effective signal, since it certifies just good quality firms.

Ultimately, the benefits coming from the affiliation with a reputable university are translated into a higher valuation during the Initial Public Offering. Indeed, investors have more information about the entrepreneurial venture, thanks to the improvement in media and analyst coverage and its scientific status, thanks to the relations with a prestigious academic institute. Moreover, many industry experts help stakeholders in decoding the received data, since they are not easily understandable by an actor with limited scientific knowledge.

As a result the uncertainty on the quality of the enterprises' projects is lowered and the issue related to adverse selection is partially overcome bringing the stakeholders trust the certified value (Sine et al., 2003).

The perceived risk is decreased and investors are prone to finance the company attributing a fairer price during the IPO[1]. This means that the real benefits of being affiliated with a prominent university affect the financial area of the business too.

To sum up, we expect that the IPO valuations obtained by entrepreneurial ventures closely related to prestigious universities are higher than the ones reached by similar companies either non university-based or affiliated with ordinary academic institutions.

Hypothesis 1: An entrepreneurial venture affiliated with a prestigious university experiences a higher IPO valuation.

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1 *A lower perception of risk in financial terms translates into a lower cost of capital. For the sake of simplicity, let's consider just the shareholders. The equity cost of capital, defined through the Capital Asset Pricing Model (CAPM), is the minimum remuneration required for the risk that they suffer (Sharpe, 1964). Lowering such risk exposure means decreasing the cost of equity generating a better scenario for both the firm and the stockholders. Indeed, the former has the possibility to have more satisfied investors, while the latter perceive as safer their investment.*

3.2 The Combined Effect of Affiliation with a Prestigious University and the Scientific Prestige of Upper Echelons

We have argued that the affiliation with a prestigious university has an effect on the financial valuation of the entrepreneurial venture: during the Initial Public Offering it leaves less money on the table, thanks to a higher valuation of investors. Furthermore, this relation provides substantial benefits, that can be considered real: the access to the previously accumulated knowledge of academics, the use of its state of the art laboratories and facilities, contacts with the network of the institution and legal and administrative support.

Reviewing the entrepreneurial literature under our considerations, the relationship between the Upper Echelons' prestige and the one of the academic tie on the IPO valuation seems not to be taken into account.

Many studies have demonstrated that the Upper Echelons[2] of an enterprise deeply influence the perception that a stakeholder has on a firm. For example, Certo, Daily and Dalton (2001) have found a negative relation between the reputation of the members of the Board of Directors and the short-run underpricing, while Kilduff, Angelmar and Mehra (2000) have posted the attention on the effect of the cognitive diversity inside the Top Management Team on the price of the IPO stocks[3].

The belief that the background of the employees of a company is a relevant determinant of its performance is a *trait d'union* of many researches. This rises the need to develop a deep analysis of the Upper Echelons and their impact on company valuation during the listing process.

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2 *The Upper Echelons of a company are composed by non-executive directors, executive directors and by top managers, thus by the Board of Directors and the Top Management Team (Donald et al., 1984).*

3 *Explained in detail in Chapter 1.*

The consequent deduction is that the signalling value of affiliation with a prestigious university is less important in the moment in which the entrepreneurial venture has reputable directors and managers.

In order to understand this second hypothesis, an example may be useful. Let's consider two identical biotech startups: they have been founded in the same year and they have identical size offerings, geographical presence and comparable financial structure[4]. In summary, they are direct competitors. Their Board of Directors and Top Management Team show an identical size, with the only difference being their background. The first one has directors with a renowned education, who have obtained important certifications in prestigious colleges (e.g., PhD at Oxford University) and are currently authors of publications in prestigious scientific newspapers (e.g., "Nature"). An investor that has just this limited set of information considers as less risky the first company because of the certification effect provided by its prominent Upper Echelons. He will perceive a lower degree of uncertainty and will trust more that business, believing that the outputs realized have a superior quality. This scenario is highly supported by the findings of previous studies. At a certain moment, new information, concerning the affiliation of both of them with prestigious universities is disclosed. The investor receiving this news will change his perception: he will adjust the valuation of the companies and the enterprise that will benefit more from the affiliation is the second one (i.e., the one without well known directors).

We can, then, infer that the impact of the university prestige is influenced by the reputation of the Upper Echelons.

Given the uncertainty surrounding investors, unable to quantify the firm's scientific capabilities, shareholders have no choice other than beat on their quality.

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4 *The hypothesis about the financial structure is very important: a comparable way of financing leads to a similar leverage (Debt on Equity), thus a similar risk exposure and cost of capital. Indeed, the leverage can be considered a proxy of the risk taken by the enterprise.*

In the moment in which they know that such entrepreneurial venture is affiliated with a renowned academic institution they are aware of its access to many valuable resources and it realizes products in collaboration with experts. The differential effect of new available information is completely different: it is higher in the case in which entrepreneurs do not have other signals that state their scientific legitimacy.

This belief can be considered in line with the finding of Stuart et al. (1999), that demonstrated that close relations with prominent entities have a less significant signalling value if a broad amount of information about the quality of the company is already available.

Therefore, we argue that affiliation with a prestigious university has a higher positive impact on the price obtained during an Initial Public Offering when the enterprise has less reputable directors and managers in its hierarchy. Despite this, the substantial benefits of such affiliation (i.e., the real advantages) are relevant in both cases.

> *Hypothesis 2: The effect of the affiliation of an entrepreneurial venture to a prestigious university on its IPO valuation is higher if the scientific prestige of its Upper Echelons is lower.*

3.3 The Combined Effect of Affiliation with a Prestigious University and Venture Capitalists Reputation

An entrepreneurial venture is defined as a young and small company whose aim is to commercialize ideas about something completely new or to realize in a new way something that has been already invented (Carland, Hoy, Boulton and Carland, 1984).

Thus, we can say that the main features of a similar organization are youth and innovativeness. Such characteristics bring to two obvious consequences: lack of history and track records and a certain difficulty in finding capital to finance its activities.

In order to overcome the knowledge and finance gap, it is fundamental to be backed by Venture Capitalists. A Venture Capitalist is a professional investor that supports an entrepreneurial venture from its development stage until a certain date contractually defined[5]. It is a venture backer that provides financial resources, competences, experts and network to let the small business grow. Hence, receiving the support of a VC is a fundamental milestone for a startup, which gives it the opportunity to grow faster than other non-backed firms, improving its products or services and its business practices (Pearce and Barnes, 2006).

A Venture Capitalist may offer synergies with other companies in its portfolio (Hsu, 2004) or with the VC itself, in the case it is a corporation operating in the same industry of the startup (in this case we talk about Corporate Venture Capitalist, CVC). A Corporate Venture Capitalist is probably the most effective investor that a startup can obtain, due to the value added services that it provides (e.g., access to its corporate management and its technical expertise), the signal of quality that it conveys and the complementary resources and capabilities which it brings. On the other hand, a VC investing in entrepreneurial ventures that work in the same industry bears a high risk of spillover.

Furthermore, a Venture Capitalist can help the young enterprise to recruit managers (Hellman and Puri, 2002), to appoint underwriters (Gompers and Lerner, 2004) and to reach a fairer price for its IPO shares thanks to the signal of quality that it

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5 *According to the scope of this thesis, the expiration of the contract between the startup and the Venture Capitalist, that coincides with the exit of such investor from the deal, is represented by the Initial Public Offering.*

provides (Brav and Gomper, 1997).

In the moment in which the entrepreneurial venture is particularly brilliant it has the possibility to get in touch with the most prestigious VCs and all the displayed benefits are accentuated. As a matter of fact, it will recruit the most expert managers and prominent underwriters (Bradley et al., 2015) and it will obtain a greater IPO valuation (Chemmanur et al., 2011; Nahata, 2008).

With the objective of reaching a successful IPO, Venture Capitalists support the enterprise through time. On the other hand, underwriters have an event-based role, helping the firm just during the listing process, being appointed just in the moment in which the conditions to realize an Initial Public Offering are achieved. While the latter are contingent to the IPO, the former are necessary conditions to reach the IPO[6].

This is not the single difference between the two venture backers. Indeed, Venture Capitalists provide a broad set of competences[7], while underwriters give a narrower support related to the financial area only. As a matter of fact, the value added services of the two counterparties are completely different. The former helps the entrepreneurial venture in the financial and commercial area as well as in the construction of a social network and in the improvement of its operating activities, while the latter advises it just in the financial domain. Even though both players have a positive selection effect, prestigious VCs show a stronger treatment effect[8] (Bertoni et al., 2016).

Therefore, a partial overlap between the certification effect of the two counterparties is identified, caused by the fact that both Venture Capitalists and

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6 *Even startups that were not supported by Venture Capitals realize Initial Public Offering. Some empirical studies have demonstrated that VC backed companies experience better results (e.g., Ritter, 2015).*

7 *I.e., capital, financial expertise, legal and administrative support, business and industrial knowledge and network.*

8 *The selection effect refers to the ability of a venture backer to identify and invest in the so-called 'good cherry', that is the good entrepreneurial venture. The treatment effect is related to the ability of the venture backer to build a successful company. Thus, if the selection effect is defined as 'picking a winner', the treatment effect is fixed as 'building a winner'.*

underwriters signal the quality of the startup in the business and financial sphere. Hence, despite having a positive impact on IPO valuation, the two signals are not additive.

It is now interesting to study the relation that stands between the signal provided by Venture Capitalists and the one conveyed by a prestigious university.

We argue that the two relations have a positive and additive effect on the price obtained during the listing process.

In order to understand such proposition, it is necessary to compare the intrinsic features of the two venture backers and the characteristics of the relations with an entrepreneurial venture.

A startup which is affiliated with a prestigious university has several benefits, that have already been discussed. Such advantages are mainly related to the product market. In this case, the company has the possibility to use the facilities and resources of the academic institution, to interact with its experts and to exploit its patents. The social network that the university has allows to get a new base of suppliers, experts, clients and even partners. Moreover, an investor has a perception of a higher scientific legitimacy because of the certification effect provided by the counterparty. All these aspects together lead to a more favorable IPO valuation. Thus, we can say that the substantial benefits of being affiliated with a prestigious university affect the financial market. As a matter of fact, the academic institute certifies the innovativeness and the quality of the idea of an entrepreneurial venture, factor that is even more relevant in the biotechnological sector as the products that must be evaluated are extremely complex. On the other hand, the Venture Capitalists are more financial and business oriented, so they convey another type of signal that seems to be not in overlap with the one provided by the scholars.

To sum up, the signal given by a reputable Venture Capitalist is different from

the one conveyed by a prestigious university, but both are positively related to the IPO valuation. Therefore, the two signals are not replacing each other.

> *Hypothesis 3: The impact of affiliation of an entrepreneurial venture with a prestigious university on its IPO valuation is positive and additive in respect to the impact of affiliation with a reputable Venture Capitalist.*

3.4 The Combined Effect of Affiliation with a Prestigious University and Underwriters Reputation

In order to undertake an Initial Public Offering the entrepreneurial venture must be supported by an investment bank whose principal aim is to place the newly issued shares guaranteeing a successful IPO. At least one bank must be hired, but the greater the size of the deal, the higher the number of underwriters that is usually involved. This relation is justified by the necessity to share risks and the consequent costs of a big campaign.

Literature shows several studies on the interaction between underwriter and valuation at IPO pointing out the fundamental role of the investment bank during the listing process.

Booth and Smith (1986) developed a model based upon the assumption of asymmetric information between insiders, the present shareholders, and outsiders - the prospective subscribers to the new issue. The authors suggested that the issuing firm may be viewed as effectively exploiting the brand of an underwriter to certify that the issue price reflects private information.

This research has been deepened by Carter and Manaster (1990) and Carter et

al. (1998), who demonstrated that the endorsement of prestigious underwriters leads to a fairer price during the process of being listed on an Official Stock Exchange. This is explained by the signalling value of such relation. Reputable investment banks have a base of investors on which they can rely upon during the phase of *bookbuilding*[9]. Asking more information to such clients gives them the possibility to lower underpricing (Merton, 1987). Another relevant benefit coming from such stable pool of investors is the limited presence of '*flippers*'. '*Flippers*' are speculative clients looking for opportunities in the IPO market, buying the IPO shares at a discount and selling them during the first day of the aftermarket to exploit positive absolute returns (Aggarwal, 2002). We can say that they buy stocks just for short-term extra gains, showing no real interests in the company and its business. Hence, they represent a problem for the organization, since they suddenly sell many shares, pressuring the supply and causing, as in all economic transactions, a decrease in the price. A lower price in the first day of the aftermarket should be always avoided, as it implies losses for the shareholders of the IPO company. Moreover, '*flippers*' alter the liquidity of the listed stocks. They are a serious problem, that makes tougher the work of the underwriter. As a matter of fact, an investment bank during an Initial Public Offering has to define the correct price for the newly created shares, place them attracting the highest amount of institutional investors and provide liquidity during the aftermarket by supporting the price[10] (Ellis et al., 2000). Hence, having a limited number of '*flippers*' in the shares buyers' base is a fundamental aspect.

Finally, an obvious but crucial benefit must be pointed out. The more

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9 *Bookbuilding is an activity carried out by the underwriter to build the price-demand function for the IPO stocks. The investment bank collects information about the attractiveness of the securities and assesses the price for the single stock. The data gathered from institutional investors are non-binding expressions of interest in the securities. This phase of the Initial Public Offering process is fundamental for the definition of the right IPO price.*

10 *Supporting the price of the shares in the aftermarket is one of the typical activities carried out by the underwriter. It has to avoid sudden decrease in the price in order not to create dissatisfactions in the shareholders pool. Hence, it has to buy many stocks to increase their market value.*

prestigious you are the greater the attention posted on you. This will capture also the attention of investment banks, implying a more spread media and analyst coverage.

Furthermore, Krigman et al. (2001) have demonstrated that the most reputable underwriters are associated not only to a stable and better pool of investors, but even to the most prominent financial analysts. This benefit is even more relevant if we consider the fact that the listing process is not just a merely financial one, since it has also all the characteristics of a marketing campaign (Cook, Kieschnick and Van Ness, 2006). Before going public the uncertainty around the result of the deal is enormous: investors could want not to subscribe the offer, customers could believe that the IPO stock price is too high, stakeholders could not have enough information to correctly judge the placement. To face this situation the entrepreneurial venture has to increase the awareness of the market by spreading information needed to properly evaluate the offer. This is an expensive process, but it is required to achieve better results during the Initial Public Offering and improve the attractiveness of the shares. In such moments the company is advised by the hired investment bank, since it provides even marketing services like searching the proper primary market, defining the right moment to be listed (Lee, 2005) and persuading investors to buy new securities (Hansen and Pinkerton, 1982; Kraus and Stoll, 1972). Furthermore, in the moment in which the enterprise is endorsed by a prestigious investment bank it can exploit its reputation to facilitate the marketing campaign, being the brand of such venture backer well known.

To have a comprehensive picture of the relationship with a reputable underwriter it is necessary to consider even the other side of the medal. As in all the deals, there are benefits and cons. Indeed, the affiliation with a prestigious investment bank is extremely expensive. Hsu (2004) has shown that entrepreneurs pay a premium from 10% to 14% in order to be backed by a highly reputable investment bank. This is justified by the possibility to leverage the reputation of the underwriter and by the superior quality of the services provided.

Moreover, being endorsed by a prominent investment bank is not simple. As a matter of fact, it has to protect its image and reputation avoiding relations with startups that could nick its status. For this reason, it prefers to invest in solid companies which are associated to less risky IPOs (Beatty and Ritter, 1986). This makes the appointment of a reputable underwriter tough, especially for an entrepreneurial venture that lacks track records.

After a review of the literature, another missing point that it is interesting to address is the interaction between affiliation with reputable underwriters and prestigious universities in the IPO valuation.

We expect a positive relation, since both the signals are negatively related to the short-run underpricing (i.e., both the appointment of a prominent investment bank and the affiliation with a well known academic institution lower the underpricing characterizing the listing moment). Moreover, we believe that such signals are additive, since they certify different aspects of the same enterprise.

Indeed, underwriters are expert in a very specific domain, the financial one. They gather all the data about the entrepreneurial venture to assess a fair price. They certify that such value is coherent with the characteristics of the firm. Despite this, they are not able to properly judge the innovativeness and the scientific capabilities of entrepreneurs. These features are well examined by universities due to their field of specialization. So, we can argue that academics certify the scientific legitimacy of the venture. On the contrary, such entities are not prepared to analyze the business practices and the financial structure of an enterprise. So, on one hand the certification of the business and financial area is accomplished by the investment bank, on the other hand, the scientific quality is verified by the university. The more prestigious they are, the more effective the certification effects are. Therefore, the two different signals cannot be redundant for the intrinsic features of the signalers.

To sum up, we believe that reputable underwriters and universities convey positive and non redundant certification effects, that bring to a better valuation during the Initial Public Offering.

Hypothesis 4: The impact of affiliation of an entrepreneurial venture with a prestigious university on its IPO valuation is positive and additive with respect to the effect of the appointment a reputable underwriter.

3.5 Mediation Model

3.5.1 The Effect of Affiliation with a Prestigious University on Alliances Formation

By definition, a startup is a company with limited resources. It has to find lateral ways to collect them. One of them could be to make alliances with partners along the value chain.

Given the knowledge-intensive environment we focus on, alliances with proper entities become crucial to obtain the right support and information.
As a matter of fact, a positive relationship between the number of strategic alliances and the entrepreneurial firm performance has been documented (Shan et al., 1994).

According to Rothaermel and Deeds (2006), the links that a company has with the outside can be classified looking at the stage of the value chain in which the partner is placed. Hence, each type of alliance has its own benefits, risks and costs. These different characteristics provide more or less space for moral hazard and imperfect information problems. For this reason, the impact of the alliance on IPO valuation could be more or less evident. The positive effect on the value of the IPO

firm depends on the fact that alliances act as signals of firm's managerial and assets quality to the stock market (Nicholson, Danzon and McCullogh, 2005). So, to enhance its initial performance, the company can establish a network of relations, minimizing the costs and risks and maximizing the benefits. The advantages consist in resources and knowledge, but also the possibility to partner with competitors which have the same objectives of the focal firm (Baum, Calabrese and Silverman, 2000). So, we can say that the benefits have a dual substance. On one side mere financial benefits can be defined, entailing cost savings, decrease in the capital expenditures (CAPEX) and reduction of the cost of capital, while, on the other side, we find advantages coming directly from the resources shared by the partners.

We have to note that several alliances with partners that are similar one to the other can bring lower benefits than alliances with differentiated companies, both because the information available is less concentrated on one subject, but also because too many links with entities of the same type can spark conflicts and cause spillover of information, reducing the value brought by the alliance.

The positive impact of the number of alliances on IPO valuation has been extensively studied and analyzed. But, what if the alliances had just a role of mediator between the signalling effect of affiliation with prestigious universities and the valuation itself?

In this case, the signal - relevance of the academic institution - would help the company to increase the number and quality of different types of relationships established before the IPO moment, that, in turn, would influence the value of the stock. Should this happen, the signalling effect would be mediated by the partnerships of the focal enterprise. If this is the case, our aim is the one to demonstrate the presence of a positive relationship between the prestige of the affiliated academic institution and the different typologies of alliances and then their impacts on the IPO value.

The affiliation with a prominent university certifies the scientific capability of the biotechnology entrepreneurial venture increasing the level of attention posted on the company. Indeed, many actors will be interested in the startup causing an increase in the amount of links that it has with external and independent entities. As a matter of fact, given the substantial discrepancy between alliances at distinct levels of the value chain, the effect that the reputation of the academic institution has on them could be different, more or less intense. Moreover, in line with the alliances literature, we expect that the magnitude of the effect that the affiliation with a reputable university has on the downstream partnerships is relevant (Stuart et al., 1999). If this happens, it is possible to confirm the role of technology broker taken by the startup in the biotech sector.

Our expectations are of a positive relationship between the affiliation with a prestigious academy and the different types of links the company is able to make, therefore we formulate the following hypotheses.

Hypothesis 5: The affiliation with a prestigious university has a positive impact on the number of upstream alliances (i.e., universities or research centers) the firm is able to make.

Hypothesis 6: The affiliation with a prestigious university has a positive impact on the number of horizontal alliances (i.e., biotechnology companies) the firm is able to make.

Hypothesis 7: The affiliation with a prestigious university has a positive impact on the number of downstream alliances (i.e., pharmaceutical companies) the firm is able to make.

3.5.2 The Impact of Alliances on IPO Valuation

As already stated, a firm needs to establish relationships with the outside in order to acquire different valuable resources and knowledge. This is especially true in the case of entrepreneurial firms, which do not have a highly diversified business portfolio and are surrounded by uncertainty (Baum and Silverman, 1999). Moreover, the sector which is investigated in this composition is a knowledge-intensive one, where making alliances with capable partners is even more valuable. As a matter of fact, one of the main challenge of a young biotech company is to develop products through a long development process in order to generate returns (Powell, Koput and Smith-Doerr, 1996). Since this cycle is really long and it entails an initial investment of great magnitude, the firm will be very far from generating revenues when trying to go public (Pisano, 1991). Hence, in the IPO context, alliances become even more relevant, given the uncertainty surrounding investors. As a matter of fact, the lack of information about the hidden qualities of the focal company can bring investors either to invest in low-potential firms or to miss good opportunities on the market. Since investors need to find a way to decrease the uncertainty affecting the deal, they will look for observable characteristics which can certify the quality of the enterprise itself.

One way in which biotech companies can try to alleviate the uncertainty surrounding stakeholders is to ally with major pharma and healthcare corporations, engaging in downstream activities. At the same time, alliances with universities and research centers can be defined, as well as with other biotechnology ventures, certifying scientific and research abilities. They all can play a signalling role in the IPO process, informing stakeholders about the quality of the projects and of the firm itself.

A distinction should be made between cold and hot IPO periods. As Gulati et al. (2003) infer, the signal provided by alliances is more or less intense depending on the conditions of the market in which the transaction is defined. During hot markets,

the concerns of a biotech company to sustain its research and development process is not as pressing as in the case of cold moments, in which funding resources are less available. During periods of scarcity, young ventures try to establish partnerships with stable pharmaceutical companies in order to find alternative sources of funds (Lerner and Merges, 1996). This entails the fact that, in such moments, pharmaceutical corporations face requests from multiple biotech firms, needing to do a more severe selection among them. The process described above impacts on the strength of the signal provided by alliances formation. During cold periods, the signalling value is stronger, with downstream firms paying particular attention to the characteristics of the entrepreneurial venture to avoid missing opportunities (Pisano and Mang, 1993). But, regardless of the type of market momentum the company decides to go public, the alliances the firm has established will have a positive impact on the IPO valuation.

Establishing a collaboration, the firm must consider the stage of the value chain of the prospective partner, due to the differential benefits it can provide.

In conclusion, we formulate the following hypotheses, arguing that, with a distinction among alliances types, the impact on IPO valuation is always positive.

Hypothesis 8: The number of upstream alliances the firm has developed before going public has a positive impact on the firm valuation at IPO.

Hypothesis 9: The number of horizontal alliances the firm has developed before going public has a positive impact on the firm valuation at IPO.

Hypothesis 10: The number of downstream alliances the firm has developed before going public has a positive impact on the firm valuation at IPO.

3.5.3 The Role of Alliances in the Relationship between Affiliation with a Prestigious University and IPO Valuation

In order to establish a successful venture an entrepreneur needs many factors: at first a brilliant idea, then competences, resources and money to transform it into a product or service. This is not only an operational matter, but it is even a financial and social one (Ahmad and Seymour, 2008).

Most of the time, a young corporation lacks deep knowledge and the consequent understanding of the competing environment (Stinchcombe, 1965) and it has inefficient and rough business practices and routines (Sorensen and Stuart, 1999).

Furthermore, in the moment in which the entrepreneurial venture works in a high-tech industry, where the realization of the output is extremely expensive, long and difficult, getting the right resources on time is even more relevant to accomplish the defined goals.

Hence, an interorganizational network can be an important support factor for the business. But, given the intrinsic features of a startup, building partnerships with other entities is not a simple process. Moreover, at increasing levels of uncertainty the process becomes tougher.

Stuart et al. (1999) have demonstrated the importance of the interorganizational network of a young firm, which affects the company's ability to acquire the required resources to flourish, since it helps third parties to judge the quality of the focal business by considering the relations that it has in place. Moreover, the authors have argued that much of the benefits coming from the alliances is related to the transfer of the status, with stakeholders relying on the endorsements mostly when there is a limited observability of relevant factors. As a matter of fact, they have demonstrated that the alliance has a reciprocal effect. On one hand, it positively affects the focal firm IPO valuation thanks to the reputation and the resources of the partner, on the other

hand it puts the prestige of the partner at risk, increasing the incentive of the allied to properly evaluate the quality of the startup.

The affiliation with an academic institution can bring similar advantages to the focal firm, but certain differences can be pointed out. Universities are able to assess the scientific capability of the entrepreneurial venture, hence they certify their status in a credible way. Such signal is extremely useful in convincing investors to finance the business, improving the perception of the stakeholders and attracting new potential partners at the same time. Indeed, to be affiliated with an academic institute the company needs to be selected by the entity's experts, who, in this way, certify its quality. This brings other organizations to be willing to collaborate with it, as they are more confident about the scientific status of the biotech entrepreneurial venture.
Hence, we uphold the findings of Stuart et al. (2007), who say that relationships with an academic institute increase the probability to make strategic alliances with pharmaceutical corporations, since the startup acts as a technology broker [11] standing in between the two entities.

Furthermore, given the positive influence of strategic alliances and of the affiliation with a prestigious university on the company's IPO valuation and given the higher probability to make alliances in the case the firm is affiliated with a reputable academic institute, we want to assess if the effect of the affiliation with prestigious universities on the IPO valuation is mediated or not by the outstanding alliances.
This investigation is motivated by the desire to deeply analyze the biotechnology sector: due to its intrinsic features (high number of alliances, where the startup acts as an intermediary in the relationship between universities and pharmaceutical

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11 *Broadly speaking, a broker is an intermediary whose aim is to mediate between two actors facilitating their connections (Burt, 1976). Hence, the brokerage function assumes several roles depending on the context; in the case analyzed, the broker (i.e., the biotech startup) has to transfer in a value adding way the technology licensed by the university to the pharma company.*

corporations) it is relevant to assess the interaction between the affiliation with a prestigious academic institute, the partnerships and the IPO valuation.

We argue that the impact of the affiliation with a renowned academic institution on the Tobin's Q is mediated by the number of strategic alliances that a company has been able to form in the years before the Initial Public Offering, since the signal provided by the university effectively influences the perception of the stakeholders about the company itself. Hence, such signal has a direct effect on alliances formation, which in turn affects the IPO valuation.

Hypothesis 11: The impact of affiliation of an entrepreneurial venture with a prestigious university on its IPO performance is mediated by the upstream alliances that the firm is able to create before the IPO year.

Hypothesis 12: The impact of affiliation of an entrepreneurial venture with a prestigious university on its IPO performance is mediated by the horizontal alliances that the firm is able to create before the IPO year

Hypothesis 13: The impact of affiliation of an entrepreneurial venture with a prestigious university on its IPO performance is mediated by the downstream alliances that the firm is able to create before the IPO year.

Chapter 4

Research Design

The aim of this chapter is to explain the source of the data used in the models developed. To define the main sets of information required for the analysis, previous studies on Initial Public Offerings and alliances formation have been reviewed taking in mind the hypotheses to be assessed.

The starting point of data research has been the EURIPO database, which has been used to find name and prospectus of the European biotechnology entrepreneurial ventures that went public in Europe in the period between 1990 and 2009. The listing document for the companies in the sample has been analyzed in order to gather the fundamental data for our empirical investigation.

The first information collected concerns the scientific background of the Board of Directors and the Top Management Team as well as details on the universities found in the sample. To build the variables that define the prestige of such entities, an additional ad hoc database, Scopus, has been used.

A second set of data collected from the listing prospectus concerned the alliances established by the startup before the Initial Public Offering.

In order to explain the scenario under investigation quantitative analyses have been carried out. Finally, the variables to test the proposed hypotheses have been built.

4.1 Data and Sample

In order to realize this composition several information needed to be gathered and properly evaluated. According to the scope of the thesis the attention has been posted not just on the moment of the Initial Public Offering, but even on the previous years, starting from the foundation of the entrepreneurial venture to that event. The necessity to take into consideration different periods of time derives from the intention to assess the impacts of one action (i.e., the affiliation with a prestigious university) on two different phenomena: the valuation of the company at IPO and the formation of alliances.

All the sets of information collected have been suggested by previous studies and our hypotheses, that in turn are derived from a review of the entrepreneurial literature.

In order to achieve the previously displayed goals, the main source of information taken into consideration has been the offering prospectus. Since the startup's founders, owners and even executive managers are legally accountable for the information disclosed in the IPO prospectus and since such document must be approved by supervisory authorities (Shrader and Siegel, 2007), it is considered a reliable source of data to be used as the starting point of our empirical investigation.

As it has been previously discussed in Chapter 1, the listing prospectus has to expose a complete set of information including the history of the company, the background of its founders and Upper Echelons, accounting and financial information, future strategies and all the features of the IPO process.

The first piece of information that has been collected from the listing document regards the affiliation with university. We rely upon the definition of university-based firm provided by Bonardo et al. (2011), who define an enterprise as university-based,

in the moment in which it has been either established to capitalize the academic researches carried out by the university or it has been created by some academics.

To assess if an academic institution is prestigious or not, the stakeholders can rely upon many definitions provided by literature, but for this study we have decided to consider a bibliometric indicator: we gathered the total numbers of citations received by a specific university in the twenty years before the Initial Public Offering of the affiliated firm. Scopus[1] was the source from which this information was collected. We have taken into consideration just the following publication subject areas: Agricultural and Biological Sciences, Biochemistry and Genetics, Chemical Engineering, Chemistry, Dentistry, Health Professions, Immunology and Microbiology, Medicine, Neuroscience, Nursing, Pharmacology, Toxicology and Pharmaceutics, Veterinary. The displayed subject areas have been selected in the set proposed by Scopus in order to highlight just the publications related to the reference industry. For example, papers in the accounting and financial domains have not been taken into consideration, not being in line with the scope of the investigation.

The second set of information to be found in the prospectus is the affiliation with Venture Capitalists and underwriters. While not all the IPO companies analyzed were backed by VCs, all of them have had at least one underwriter in their listing process. This heterogeneity derives from the fact that some entrepreneurial ventures are able to go public without the support of a professional investor like a Venture Capitalist, even though the relation with such venture backer can help the enterprise to improve its performance and certify its quality in the moment of an Initial Public Offering. On the other hand, having an investment bank that guarantees the listing process is fundamental, since none can go public without an underwriter.

Information about the two mentioned relations are conveyed in the front page

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1 *Scopus by Elsevier is a bibliographic database containing papers and their characteristics (i.e., authors, abstract, contents, year and journal of publication, total number of citations).*

of the prospectus and furtherly specified in the document.

An evident difference between the two sets of data presented in the listing document stands out. As a matter of fact, information about Venture Capitalists and underwriters is easily accessible by stakeholders, while details about university affiliation are less evident. This difference is an obvious consequence of the studies previously conducted. Many researchers have devoted attention to the signalling value of the relationship with reputable professional investors and investment banks (Carter and Manaster, 1990; Carter et al., 1998; Chemmanur and Krishnan, 2012; Megginson and White, 1991), but none has deeply studied the benefits coming from the affiliation with a prestigious university.

Then, attention has been given to financial information (e.g., profitability and leverage). Such data are really important in the valuation obtained by the firm during the Initial Public Offering. Indeed an investor is willing to pay more for a solid entrepreneurial venture with good returns and financial leverage.

As it has been demonstrated by Modigliani and Miller (1958), by expanding the total debt of an enterprise, its leverage enlarges increasing the company risk exposure. Such firm will be considered riskier by its stockholders, leading them to require higher returns on the equity capital, enlarging the firm's cost of capital and worsening its financial stability. Hence, the financial leverage of a firm is a fundamental information used to understand more about the business and assess the risk perception of the stakeholders.

More in general, all the financial and accounting data disclosed in the listing prospectus that influence the IPO valuation are taken into account.

In order to complete the set of information required to evaluate the impact of affiliations with prestigious universities on the price obtained by the firm when it goes public, we have considered the composition of its Upper Echelons.

From the review of the IPO literature, it was possible to understand the

importance of the features of the Upper Echelons, which are composed by the Board of Directors and the Top Management Team. Thus, in the analysis of the listing document we looked for the number of directors and their backgrounds in terms of education and business experiences. Then, the focus shifted to the identification of the 'scientists', that are either directors or top managers of the enterprise with a '*Philosophiæ Doctor*' (PhD) and a certain number of publications. After having selected the members of the Upper Echelons with such certification, Scopus has been used to evaluate the total number of publications and citations for each of them in the following subject areas: Agricultural and Biological Sciences, Biochemistry and Genetics, Chemical Engineering, Chemistry, Dentistry, Health Professions, Immunology and Microbiology, Medicine, Neuroscience, Nursing, Pharmacology, Toxicology and Pharmaceutics, Veterinary. The total number of publications and citations considered for each scientist is confined to the twenty years before the Initial Public Offering. The decision to focus on such time horizon derives from one of the purposes of the thesis, that is the assessment of the impact of productiveness and reputation of the Upper Echelons of an enterprise on its IPO valuation. Thus, what happens in the year of the listing process and in the following ones is irrelevant for the study. Furthermore, we have taken into account even top articles published on "Cell", "Nature" and "Science", which are the best in class journals for the subject areas that have been considered relevant in the thesis.

Finally, the last set of data which has been taken into account is related to alliances.

In order to assess if a relationship with an external entity is an alliance or not, we have resorted to the definition of Guo et al. (2005): an alliance is a joint venture, a licensing agreement, a Research and Development collaboration or a supply, manufacturing, marketing or distribution contract.

Hence, we have enumerated the relations that a company has in place with external and

independent bodies[2] that follow such definition and that the entrepreneurial venture has been able to build before the IPO year. Making a step further, we distinguished three main typologies of alliances: upstream, horizontal and downstream. According to the definitions shown in Chapter 2, upstream alliances are partnerships either with universities or research centers, downstream relations are links with pharmaceutical companies, while horizontal alliances are ties with other biotech entrepreneurial ventures. An important aspect of the collected information that must be remarked is represented by the fact that the attention has been placed just on strategic alliances, since they are '*voluntary agreements between independent enterprises to develop and commercialize new products, technologies or services*' (Gulati, 1998). Moreover, such contracts, among all the possible agreements are the ones which bring the highest value to the business. Alliances that are established with neither academies, nor pharma or biotech companies are defined by a specific variable (*OTHERS*), as they are not considered strategic for the enterprise.

All the data about the mentioned types of relations are displayed in specific sections of the IPO prospectus named 'Research and Developments', 'Partnerships' or 'Product Developments'.

The sample consists of all the biotechnology entrepreneurial ventures that went public in Europe during the period from 1990 and 2009. In order to obtain a list of the European biotech companies that undertook a listing process in the defined timeframe, the EURIPO database has been used as referral source of data. This decision is motivated by the fact that EURIPO has been used also in previous studies (e.g., Chambers and Dimson, 2009). In the aforementioned database name and prospectus of the biotech enterprises have been found.

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2 *In order to define the alliances we have considered just external and independent bodies, therefore relations with the parent company have not been taken into account.*

As a result, our sample comprises 254 European biotechnology entrepreneurial ventures[3], competitors and working in specific niches. These are Diagnostics, Genetics, Immunology, Instruments, Investigation of new drugs and protein engineering and Services. Moreover, the analyzed companies are spread in specific geographical areas, with headquarters in different countries all over Europe (e.g., France, Germany, Italy, United Kingdom).

In the end, it is important to highlight the fact that all the variables are detected at the moment of the IPO with exclusion of university affiliation, corporate spinoff, country and industry dummies, which are evaluated at the year of foundation of the venture. On the other hand, since alliances have been established from the foundation year until the listing date, they are placed in a wider time horizon.

The analysis is confined to the biotechnology sector. Being a knowledge-intensive industry, interactions among different entities to exchange tacit wisdom are a fundamental source of competitive advantage. Furthermore, in this specific sector it is even more tough to convince potential investors to take part to the Initial Public Offering because of the complexity of the products and services delivered by the company and the lack of track records - typical characteristic of a startup.

Hence, according to the goals of the composition and the features of the biotechnology industry, such sector appears to be the ideal candidate for our investigation.

On the other hand, boundaries in time horizon and geographical spread have been set to limit the size of the database that has been built. This allows to increase the efficiency of the model without sacrificing the quality of the results, since a statistically

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3 *The biotechnology startups have been identified entering the code 4573 of the Industry Classification Benchmark (ICB). The ICB is the official tool used by the European Stock Exchanges to classify the industries. The number 45 represents the Healthcare sector, while 7 and 3 select respectively the Pharmaceuticals and Biotechnology industry and the Biotechnology sector.*

significant sample has been taken into consideration.

A last remark on the sample must be taken into consideration. In the dataset that has been built there are university-based firms and companies that do not have links with academic institutions. This is required not to alter the results. Indeed, if we take into consideration only corporations that are affiliated with universities would not be possible to properly judge the impact of the prestige of the affiliated academic institutes. The same reasoning can be applied in the alliances case, including both entrepreneurial ventures that have many links with other entities and enterprises that have no contracts with external and independent parties.

4.2 Quantitative Analysis

In order to properly understand the scenario used to test the hypotheses proposed in this thesis, some quantitative statistics have been carried out.

The sample is composed only by European companies. The greatest proportion has headquarters in the United Kingdom (43.31%, that is to say 110 out of 254), while the European country that appears less frequently in the database is represented by Italy (just 10 entrepreneurial companies are Italian, that means only 3.94% of the whole set).

The segment in which the competition is higher is the Diagnostics one, which accounts for 87 firms out of 254 (34.25% of the total).

A peculiarity of startups is represented by the negative earnings that they register at the beginning of their lifecycle. This feature is verified even in this case, where 66.53% of the entrepreneurial ventures are not profitable at the moment of the IPO.

Regarding the Upper Echelons just 45 corporations in the database do not have scientists. To define a scientist we have checked for managers and directors that hold a PhD in the areas of our interest, then, if such certification is present, we have verified if the scholar in question has published some articles. Out of the firms not holding PhDs, just 6 are affiliated with an academic institute.

On average, companies have 3.24 scientists, with a peak of 14 Phd holders and a minimum of 0. Considering the distribution of the articles published by scientists, the mean is equal to 32.44, while the one by enterprises is 105.12. Just a small percentage of prestigious top workers, the 17.98%, did not publish papers in the time horizon that starts from the birth of the company until its listing year. The average number of citations per firm amounts to 3,182.02, while the one per scientist is equal to 982.06. Concerning the top publications, the holders of a Phd have an average of 37.70, whereas a mean of 122.17 publications in top journals per company can be defined.

Another interesting parameter is represented by the distribution of companies affiliated with universities. 65 entrepreneurial ventures are affiliated with universities (i.e., 25.59% of the sample) and the vast majority of the university-based firms is English (in the sample there are 38 English university-based startups). This number could be explained by two different factors: on one hand the Official Stock Exchange of UK is the most developed one in Europe, on the other hand the English academic network is very prestigious. Indeed, 9 of the 20 most prominent universities found in the sample are English and the most prestigious one is the University of Cambridge. Furthermore, 35 of the university-based enterprises are affiliated with top ranked academic institutions, accounting for the 53.85% of the affiliated firms and just the 13.78% of the whole sample.

Finally, a relevant benefit of the affiliation with a reputable university can be found in the sample: startups which have close relations with a prestigious academic institution have started the listing process before other similar businesses that are

neither affiliated nor related to prominent universities: 61% of university-based firms went public five years after the foundation.

It is interesting to highlight that while 100% of the entrepreneurial ventures has appointed at least one investment bank, just 42.52% has been backed by a Venture Capitalist. These numbers are empirical evidence of the fact that if it is possible to go public without a VC, it is not achievable to undertake a listing process without the support of at least one investment bank.

Concerning the alliances, other quantitative statistics must be considered. First, the most abundant type of strategic alliance is represented by the downstream ones. This finding is in line with previous studies on alliances in the biotechnology sector (Stuart et al., 2007). Indeed, 308 are downstream relations, 258 are upstream and 121 are horizontal for a total of 687 alliances in the sample under analysis. Furthermore, in our dataset 57 firms with upstream links have established even downstream relationships with pharmaceutical corporations (i.e., 52.78%, since the startups that have upstream alliances are 108).

It is now interesting to focus on the total number of upstream relationships to highlight the ones with already affiliated university. They count just for 17.05% of the whole set of upstream alliances, that is to say 44 relations out of 258.

Only 8 out of 65 university-based firms did not create any alliance with external and independent entities, thus it is possible to say, in accordance with the literature, that the vast majority of affiliated entrepreneurial ventures has signed some cooperation agreements (87.69%). The same sentence does not hold for the startups which do not have any affiliation with an academic institute: 68 firms out of 189[4] (35.98%) did not sign any agreement with other actors before the Initial Public Offering.
Moreover, 34 of the university-based firms show a total number of alliances that is higher than the mean of the sample, that is 2.70.

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4 *189 is the number of non university-based companies in the sample.*

4.3 Variables Used in the Model

4.3.1 Dependent Variable

Tobin's Q

Since the purpose of our analysis is the one to asses the impact of different variables on the valuation obtained by an entrepreneurial venture during its Initial Public Offering a reliable indicator of this value is required.

We decided to use the Tobin's Q ratio (*TQ*), which supposes that the total value of the stocks on the market should be similar to their replacement cost. Hence, it is calculated as the ratio between the market value of assets, sum of the book value of stocks in the moment of the offer less the book value of common stocks, and the book value of assets.

$$Tobin's\ Q = \frac{Market\ Value\ of\ Assets}{Book\ Value\ of\ Assets}$$

In the regression models, we limit the values of Tobin's Q to a maximum of 15. This transformation is needed to avoid IPO valuations that are too different and not comparable among the sample[5]. Indeed without such operation the results of the empirical investigation would not be significant.

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5 *The entrepreneurial ventures in the sample show very different Tobin's Q values: the minimum value is 0.48, while the maximum one is equal to 7,342.26.*

4.3.2 Explanatory Variables

University affiliation

The university affiliation (*UNI_Affiliation)* is a dummy variable highlighting the fact that the company taken into consideration is affiliated or not with a university. According to the definition of Bonardo et al. (2011), university-based firms are enterprises which are directly founded by researchers working for a specific academic institution or firms born to commercialize academic discoveries and researches. Hence, the variable assumes the value one in the moment in which the company is affiliated, otherwise it takes the value of zero.

This parameter does not make any distinction on the prestige of the academic institution, as its aim is to find out and simply represent if the entrepreneurial venture is university-based.

University prestige

According to literature many different definitions of university prominence can be proposed. We have decided to adopt the following ones.

The prestige of the academic institute (*UNI_Prestige*) is measured by counting the number of citations the university's publications have received in the 20 years before the IPO of the affiliated firm (Colombo et al., 2017, mimeo).

The second measure of prestige (*UNI_Prestige_Pub*) taken into consideration is the number of articles published by the academic institution in the 20 years before the IPO of the affiliated company.

The third way in which we measure the reputation of a university (*UNI_Prestige_Rank*) is the inverse of the ranking, where ranking used is the Times Higher Education (THE)

World University Ranking at the year of IPO[6].

The first measure of prestige (*UNI_Prestige*) has been used for the regression analyses, while the other ones have been used in order to carry out some robustness tests.

Venture Capitalist backing

The Venture Capitalist backing (*VC_Backing*) is a dummy variable, whose aim is to represent if an entrepreneurial venture is supported by at least one Venture Capitalist or not.

Hence, it assumes the value one in the moment in which the company has one or more mentioned professional investors, zero otherwise.

Venture Capitalist prestige

The prestige of Venture Capitalist (*VC_Prestige*) is measured, similarly to Nahata (2008), as the cumulative market capitalization of Initial Public Offerings backed by the same Venture Capitalist over the full sample.

The same company can be backed by more than one VC, in this case we take the maximum value of the indicators calculated.

Underwriter prestige

The prestige of UWs (*UW_Prestige*) is calculated as the proceeds raised by the investment bank taking public companies in the sample, divided by the capital raised by all the IPOs present in our database. Only lead and co-lead underwriters are considered (Colombo et al., 2017, mimeo).

When more than one bank underwrites an issue, the proceeds (and number of Initial Public Offerings) are equally split among all lead banks, as Aggarwal et al. (2002) and

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6 *For the Initial Public Offerings that have been carried out before the year 2004 we have considered the ranking of 2004.*

Abrahamson et al. (2011) have previously done in their works.

Scientist prestige

Scientist prestige (*SC_Prestige*) is a variable introduced in order to take into consideration the reputation of the members of the Upper Echelons of the entrepreneurial venture. It is built as in Colombo et al. (2017, mimeo) and it counts the total number of citations obtained by the members of the Upper Echelons in the twenty years before the Initial Public Offering year. The publications are related just to the subject areas previously defined.

The variable is then normalized when included in the regression models. The source of information is the database Scopus.

Following prior researches (Pollock and Rindova, 2003; Sine et al., 2005), prestige measures are orthogonalized using the orthog command in STATA. Orthogonalizing variables transforms them such that the common variance for each measure is partialed out and the correlation among the orthogonalized parameters is zero, while each variable's unique correlation with the dependent variable is retained (Cohen et al., 2003).

Upstream, horizontal, downstream, other alliances and total alliances

In order to recognize when a company has an alliance we have resorted to the definition of Guo et al. (2005). They argue that an alliance is a joint venture, a licensing agreement, a Research and Development collaboration or a supply, manufacturing, marketing or distribution contract.

According to the definition of Rothaermela and Deeds (2006), we have divided the alliances in upstream, horizontal and downstream.

To define the upstream alliances the number of relations that a company has with

universities has been counted. Moreover, from the number of alliances with universities we have deducted the ones that are with the affiliated academic institution *(UP-AFF)*. This takes into account the fact that is simpler to establish an alliance with the affiliated entity. Regarding the alliances with teaching hospitals and research centers, we have decided to build another indicator (*RC*) due to the differences between the relations with an academic institution and either a teaching hospital or a research center. On the other hand the horizontal (*HORIZONTAL*) and downstream alliances (*DOWNSTREAM*) variables are respectively the number of collaborations with other biotechnology companies and the ones with pharmaceutical firms.

Hence, to sum up all these indicators, we have proposed a variable that is the sum of the upstream (excluding from the pool of collaborations the ones established with the affiliated universities), horizontal and downstream links (*ALL-AFF*).

Furthermore, we have defined the indicator representing non-strategic alliances (*OTHERS)*, which counts the relations that the enterprise has with external and independent entities that do not belong to the mentioned categories (e.g., supplier of power, supplier of papers, lessor of automobiles for the Upper Echelons members). Since these relationships are not value adding as the strategic ones and since they are not fundamental in the realization of the final output, they are not strategical for the business. Hence, we have decided to build a separate indicator to isolate their contribution.

The information about all the typologies of collaborations has been taken directly from the listing prospectus of the entrepreneurial venture. Hence, in our analysis we take into account just the co-operations which have been established before the Initial Public Offering.

The natural logarithm plus 1 has been applied to all the values in order to make the distribution more symmetrical and closer to the normal one.

Finally, a last aspect that is important to remark about the construction of these

variables is related to the decision not to implement dummy variables. A dummy variable is simple to be used, but the information that it brings is limited. It is necessary to count the number of relations that a company has in place and not just account for their presence or not, to have a better understanding of the network established before the IPO.

4.3.3 Control Variables

Firm size

According to prior research, we control for the size of the company (*Firm_Size*), calculated as inflation-adjusted sales in the year prior to the IPO. All the computations are in million of Euros and they are based on the Purchasing Power Parities (EU27=1) (Colombo et al., 2017, mimeo).

When the amounts were not reported in Euro, the conversion has been made using the yearly average exchange rates in the listing year.

In the regression models, this variable is used after applying the natural logarithm to the value representing the size of the firm in the sample.

Firm age

This indicator (*Firm_Age*) is measured in years from the foundation of the entrepreneurial venture to the listing date.

When included in the regression models, the natural logarithm is applied to the value plus 1.

Profitability

Profitability (*Profitability*) is measured as return on assets of the IPO corporation (Colombo et al., 2017, mimeo).

Leverage

The financial leverage (*Leverage*) is defined as the ratio of the outstanding debt to total assets in the year prior to the Initial Public Offering (Colombo et al., 2017, mimeo).

Prone to IPO

The variable (*ProneIPO*) is the inverse of Mills Ratio calculated as in Heckman (1979) with a correction for the selection of companies that went public instead of remaining private. The source of data for the private firms is Amadeus (Colombo et al., 2017, mimeo).

Dilution ratio

The aim of this parameter (*DilutionRatio*) is to assess the wealth transfer from the existing shareholders to the new ones or vice versa. Hence, it is the ratio between the stocks offered during the Initial Public Offering and the number of shares outstanding before that moment. Sources of information are EURIPO and Dealogic.

Participation ratio

This variable (*ParticipationRatio)* measures the amount of secondary stocks offered during the IPO on the total amount of shares sold. The sources of these data are EURIPO and Dealogic.

Patents

Patents (*Patents*) are defined as the number of already registered patents to be found in the US and European Patent Office which have been developed by the firm before the Initial Public Offering date.

Natural logarithm has been applied to all the values.

Upper Echelon size

This variable (*UE_Size*) accounts for the number of board members and top executive managers. In the regression, natural logarithm is applied.

Upper Echelon Business experience

This parameter (*UE_BusinessExperience*) measures the percentage of the management that has already experience in managing either biotechnology or pharmaceutical companies.

Non-executive directors

In this case, the variable (*UE_NonExecutive*) counts the number of non-executive directors in the Board of Directors. The non-executive directors are part of the Board of Directors and their aim is to promote best practices (Pass, 2004). They do not take part to the day-to-day operations and management of the enterprise, but they are involved in the policy making, planning and they have to monitor the executive directors in order to ensure that the interest of the shareholders is always pursued.

Total number of MBA top workers

The indicator (*UE_MBA*) counts the number of Upper Echelons members that have the MBA (Master in Business Administration) certification.

Total number of PhD top workers

This variable (*UE_PhD)* accounts for the number of directors and top managers that have the PhD certification.

Corporate spinoff

It is a dummy variable (*Corporate_Spinoff*) introduced to register if the IPO

entrepreneurial venture has been established around activities originally developed by a parent enterprise. It codes one if it is a corporate spinoff, zero otherwise.

Country dummies

Dummy variables have been built to take into consideration the country in which the company has been located and listed. Since the sample is composed just by European biotech entrepreneurial ventures, the countries that appear in the database are the following ones: UK, Germany, France and Italy. All the enterprises of the database which are not located in the previously listed geographical areas (e.g., Poland) have been allocated to the "other country" column.

Industry dummies

Dummy variables have been introduced to control for the different possible sub-industries characterizing the sample. The segments present in the database are: Immunology, Diagnostics, Investigation of new drugs, Protein Engineering, Instruments and Services.

Interaction between university prestige and prestige of scientists

This indicator (*UNI_Prestige x SC_Prestige)* evaluates the interaction between the university prestige and the reputation of the scientists characterising the Upper Echelons of the entrepreneurial venture. It has been built by simply multiplying the value of the two variables considered separately.

Interaction between university prestige and prestige of Venture Capitalists

The parameter (*UNI_Prestige x VC_Prestige)* assesses the interaction between the signal given by the university prestige and the one provided by the reputation of the Venture Capitalists supporting the company.

It has been developed by multiplying the value of the two variables considered separately. In the case in which the firm is not backed by any VC, the interaction has a value equal to 0.22882.

Interaction between university prestige and prestige of underwriters

This indicator (*UNI_Prestige x UW_Prestige)* analyzes the interaction between the university prestige and the reputation of the underwriters that guarantee the listing process of the enterprise.

It has been built by simply multiplying the value of the two variables considered separately.

At this point it is important to remark some adjustments that have been adopted in the models. Indeed, before any model development it is necessary to analyze the data which have been collected and clean them.

Outliers are very frequent; they are data which have been not correctly gathered or which show very different values in comparison to the others composing the sample. Hence, in these cases a winsorization process has been necessary. The typical boundary which has been used for eliminating the outliers is equal to 98%.

Moreover, sometimes variables can have a distribution which is far from the normal one, with asymmetrical shape, median different from the mean, values of kurtosis and skewness far from zero. In this case the natural logarithm of the values (plus 1, if required) has been applied.

Chapter 5

Methodology

5.1 Theory of Multiple Regression Models

In order to establish the validity of the proposed hypotheses and to evaluate the interdependency of the various attributes, we formulated a model based on multiple linear regression. Indeed, we have to evaluate the impact of the reputation of the affiliated university (explanatory variable) on the IPO valuation (dependent variable) and its interaction with other indicators of prestige.

As a matter of fact, regression models are used to predict the future value of a target variable by exploiting a causal link found on data belonging to the past.

Given a dataset D, with a certain number m of observations and an amount $n+1$ of attributes, we can distinguish one target variable and n other variables that will have an explanatory role in respect to the target. The target attribute is called dependent variable, while the other n attributes have the role of independent variables. Hence, the aim is to explain the target parameter through a defined set of independent variables. The process of identifying the functional relationship between the attributes follows the identification of a function f, called hypothesis.

In multiple linear regression models, the $n+1$ coefficients can be calculated using the least squares principle, which implies the minimization of the sum of the

squared errors (OLS regressions)[1]. It is important to introduce also values called residuals, which represent the difference between the ordinate of the points and the regression line.

Given the matrix **X** associated with the dataset, let us modify it by adding an m-dimensional vector with all components equal to one to the left and let us denote the vector **w** as the vector composed by the intercept **b** and all the regression coefficients. Then, the following equality can be written:

$$y = \boldsymbol{X}w + e$$

From this, we can derive the sum of the squared errors, which will be:

$$SSE = \sum_{i=1}^{m} e_i^2 = \| e \|^2 = \sum_{i=1}^{m} (y_i - w^t x_i)^2 = (y - Xw)^t (y - Xw)$$

By minimizing this equation, we are able to obtain the values of the response variable **Y** predicted by the model, also called fitted values:

$$\hat{y} = \boldsymbol{X}\hat{w} = (\boldsymbol{X}(\boldsymbol{X}^t \boldsymbol{X})^{-1} \boldsymbol{X}^t)\, y = \boldsymbol{H}y$$

On the other hand, the values of the residuals are:

$$e = y - \hat{y} = (\boldsymbol{I} - \boldsymbol{H})\, y$$

Regression models are relatively simple, but the significance of the results obtained should be verified for them to be valuable.

First of all, we require to establish some assumptions on the residuals. They should be normally distributed, with mean equal to zero and standard deviation

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1 *The Ordinary Least Squared or Linear Least Squared, in statistics, is a way in which the unknown parameter can be estimated from a regression model. This involves the minimization of the sum of the squared errors, given by the deviations predicted from the actual empirical data.*

sigma. Moreover, they should be independent among each other and their standard deviation should be constant[2].

Secondly, we need to analyze the significance of the regression coefficients. The characteristics they should have to be significant are related to their confidence interval, which should not contain the value zero, and they should have a t-value greater than 2 and a p-value lower than 0.05, for a confidence level of 95%.

Furthermore, to express the percentage of variance explained by the model, the coefficient of determination can be calculated which should be as close as possible to one. In addition, it is important to check that the explanatory variables are not affected by multicollinearity.

In econometrics, a further problem could occur and should be addressed. This is called endogeneity: it happens when the explanatory variable is correlated with the error term. In a broader sense, an endogeneity issue arises in the moment in which there is a variable which is correlated to both the independent and dependent parameters of the model. This additional variable can be already included or not in the model. There are three main sources of endogeneity: omitted variables, reverse causality or measurement error.

5.2 Theory of Mediation Models

The relationship between two parameters is often more complex than a direct causal link (Fairchild and MacKinnon, 2009). For this reason, we aim to specify the effect of affiliations on IPO valuations, taking into consideration a third hypothetical

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2 *This means that they have to respect the homoscedastivity property.*

variable, which can have the role of mediator. In our case it is represented by the alliances that the firm was able to make before the listing year.

Three types of causal relationships are commonly presented: direct causal effect, mediated causal effect and moderated causal effect.

A direct causal effect links directly an independent variable to a dependent one with a cause-effect relationship. This connection is the one evaluated in the first, second and third model.

A mediator is represented by a third variable, which connects the cause to the effect. It plays a dual role in a causal relationship. On one hand, it plays the role of dependent variable for the independent one of the general model, and, on the other hand, it assumes the role of predictor of the outcome of the general model.

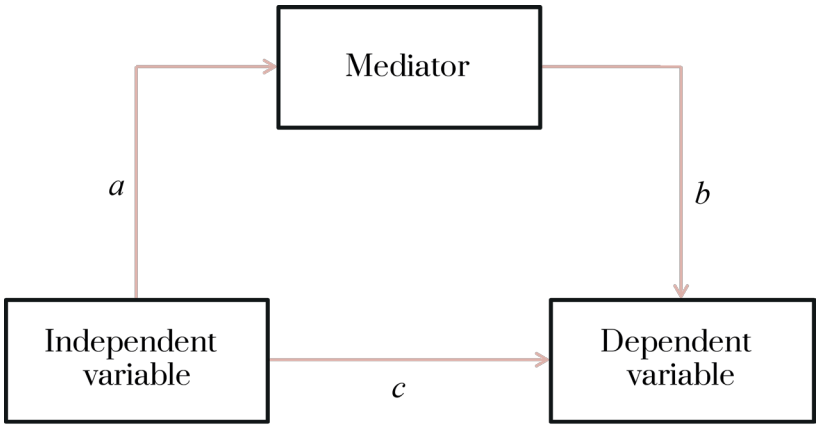

Figure 2 _ Theoretical Mediation Model

In order to define a mediation model four steps must be implemented (Baron and Kenny, 1986; James and Brett, 1984; Judd and Kenny, 1981):

- *Evaluate the correlation of the causal variable with the outcome*. This means that it is necessary to demonstrate that the independent parameter is able to explain the dependent one. Hence, analyze the link c (see Figure 2).
- *Investigate the correlation between the causal variable with the mediator variable.* This

phase involves the treatment of the mediator as if it was a dependent variable and the assessment of the relation a (see Figure 2).

- *Show that the mediator influences the outcome*. In this case, the outcome will be the dependent variable, while the mediator and the causal variables will be the independent ones. So the connection b is analyzed (see Figure 2).
- *Establish the complete mediation effect*. This entails the inclusion in the regression of both the independent variable and the mediator. If the coefficient of the mediator loses significance and the one of the independent variable maintains it, mediation does not take place.

After the definition of the mediation model, the significance of the outcome has to be estimated.

Sobel (1982) proposed a test which defines the magnitude of the indirect effect as a nonlinear function of the structural parameter. The final aim of this t-test is the one to determine whether the reduction in the signalling effect caused by the introduction of the mediator in the model is statistically significant. This means assessing if the interaction between the dependent variable and the independent one is significantly reduced after the inclusion of the mediator.

In order to implement this test some checks must be done. First of all, the mediating variables should be normally distributed. Moreover, since the distributions of the coefficients of the mediator and independent variables should be multiplied, the sample should be large enough. As a matter of fact, the product of two normally distributed variables results in a skewed distribution. In the case the sample is large enough, this asymmetry is not considered a problem.

After having discussed about the general framework of the mediation model, it is possible to translate everything in our specific terms (see Figure 3).

The idea underlying the first two steps is to predict the effect that the prestige of the

affiliated university has on the value of the entrepreneurial venture at the moment of the Initial Public Offering and on the number of alliances established by the firm. Going on with the model, it is possible to point out the perspective completely different taken by the third step: even if the dependent and control variables are the same, the independent one is the number of alliances. Hence, now the purpose is to assess the effect of the alliances on the IPO valuation. The fourth stage, on the other hand, is aimed at evaluating the combined effect of the two variables (i.e., affiliation with reputable university and partnerships), trying to understand whether the level of alliances the firm has made can act as mediator in the relationship between the signaletic value of the university prestige and the valuation of the enterprise at the Initial Public Offering.

It is interesting to highlight the distinction between several types of alliances; this decision is motivated by the will to deeply analyze the relationship between the ties and the academic affiliation. Indeed, we carry out analyses considering the total number of links and specific kinds of collaborations time by time. In this way it is possible to find out which typology of alliance assumes the role of mediator in the relation between the academic prominence and the IPO valuation.

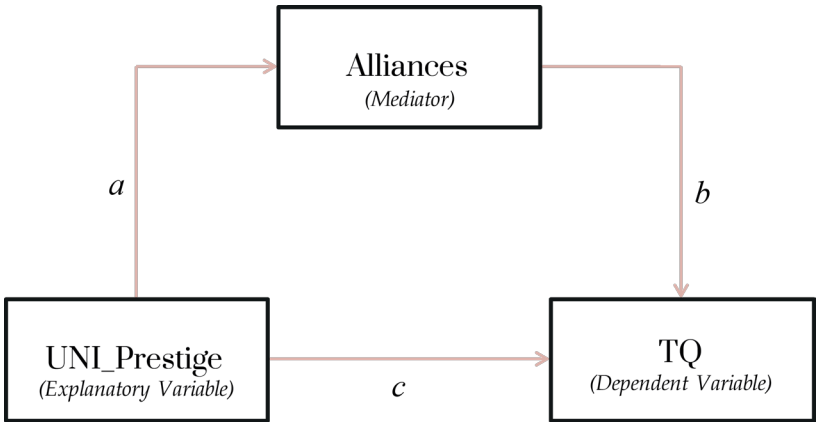

Figure 3 _ Contextualized Mediation Model

Practically talking, in order to calculate the coefficients and evaluate the significance of the model developed, we used a software called STATA, which automatically defines the regression line when the dependent and a set of independent variables are uploaded. Furthermore, the model is automatically validated by the software, which excludes variables that are affected by multicollinearity, calculates the confidence interval of the regression coefficients and the portion of variance explained by the developed model.

Chapter 6

Results

6.1 Results

Table 2 shows the correlation matrix, while Table 3 presents the descriptive statistics of all the variables considered.

The aim of the correlation matrix is to assess the level of correlation between couples of variables. On the main diagonal we have the correlation of the variable with itself, that is equal to 100%.

The first interesting values we must consider are the ones assessing the relation between prestige variables and the dependent one. We find that the highest correlation is between university prestige and TQ (equal to 0.2976) and it is followed by Venture Capitalist prestige (0.1202), underwriter prestige (0.0896) and scientist prestige (0.3048). The common trait among all the measures of reputation is the positive relationship with the IPO valuation.

All the variables valuating the academic prominence are positively related to the dependent one and the mostly correlated parameter is the one used in the investigation.

University affiliation is positively correlated with the value of the company (0.1910) and it presents even a high positive correlation with the prestige of the academic institute (0.7578). On the other hand, the link with the outside that shows the greatest correlation with the Tobin's Q is the affiliation with an academic institute (with a correlation coefficient of 0.1910), followed by VC backing and alliances.

The type of partnership that has the highest correlation with the university affiliation is represented by the upstream one, with a coefficient equal to 0.1399.

As it is possible to denote, the mean of the variable assessing the prestige of the affiliated universities (204.71) is much higher than the one registered for the reputation of the scientists (2.76). This can be easily explained by the fact that the academic institution presents a greater number of experts that publish articles, while each organization has a much more limited set of scientists writing papers.

Going further in the analysis of the descriptive statistics, it is interesting to point out the fact that, while the minimum number of alliances for all the types taken into consideration in this composition is 0, the maximum value varies a lot. For the upstream collaborations it is 3, for downstream relations 4 and for the horizontal links the highest amount is 2. While the greatest mean is 1.15, registered by the connections with pharmaceutical companies.

In Table 4, results of the regression analyses are reported.

Model (I) presents the baseline model of the first empirical investigation, which evaluates the impact of the affiliation with prestigious universities on the valuation obtained by the firm during the Initial Public Offering (represented by *TQ*). The regression includes all the signal variables (*UNI_Prestige, SC_Prestige, VC_ Prestige, UW_Prestige*) with several additional control variables to properly assess the first hypothesis.

The parameter *Firm_Size* has a negative and significant coefficient ($p<0.01$) showing that the smaller entrepreneurial ventures are the ones which obtain larger IPO valuations, with the investor believing that they still have good business opportunities for the future. This entails the fact that startups do not exploit the so called '*window of opportunity*'. This result is in line with previous findings (e.g., Meoli et al., 2013).

Another outcome consistent with the literature is the one concerning the leverage of the firm. Its coefficient is positive and statistically significant ($p<0.01$) evidencing that more indebted IPO enterprises reach greater Tobin's Q values (Jensen and Meckling, 1976).

Going further in the analysis of the results, it is possible to find evidence of the positive relationship between *Profitability* and *TQ*, with more profitable companies getting larger valuations at the listing date. This could be an issue for a startup, since it usually has negative earnings at the moment of the Initial Public Offering.

Then, an investigation of the impacts of the Upper Echelons' features on the IPO valuation can be done. In order to measure the scientists' prestige we have considered the total number of citations received by the papers in the twenty years preceding the IPO and, obtaining a positive and statistically significant ($p<0.01$) relationship between such parameter and the Tobin's Q, we have confirmed results previously found in literature (Certo, Daily and Dalton, 2001). We have even analyzed the effect of the total number of Upper Echelons' members that have either an MBA or a PhD certification in order to better evaluate the reputation of the top lines of the hierarchy. If the former has a negative coefficient, the latter vaunts a positive one showing that in the biotech industry holding a scientific recognition can have an impact on the firm and its perceived value. However, both variables are not statistically significant.

Finally, the links of the entrepreneurial venture with outsiders have been evaluated.

Empirical evidence of the importance of the profile of the counterparties has been found. Indeed, while the variable *Uni_Affiliation* is not statistically significant, the ones assessing the prestige of the counterparties (*UNI_Prestige, VC_Prestige, UW_Prestige*) are extremely significant ($p<0.01$) and positively related to the IPO valuation.

Then, in order to test the validity of the second hypothesis (i.e., the affiliation with prestigious university is much more important for companies with lower

scientists' prestige) a variation of the baseline model is proposed. In this case we find a parameter (*UNI_Prestige x SC_Prestige*) with a negative and extremely significant ($p<0.01$) coefficient, that confirms the proposition.

The third model demonstrates that the signal provided by an academic institution is additive to the one conveyed by a Venture Capitalist and both of them are positively related to the IPO valuation. In fact, the variable *UNI_Prestige x VC_Prestige* is not statistically different from zero and has a negative coefficient.

The fourth model investigates the proposition regarding the interaction between the certification given by the underwriter and the one delivered by the university prestige. The variable *UNI_Prestige x UW_Prestige* has a positive not statistically significant coefficient, which shows that the two links are not redundant and positively related to the *TQ*.

A last version of the first regression model evaluates all the parameters together and confirms the findings of the previous models.

Robustness analyses (see Table 5 and Table 6) have been developed by substituting the university prestige variable calculated on the base of the number of received citations with two different and new reputation parameters: one based on the number of publications in the twenty years before the IPO and the other one computed as the inverse of the ranking position of the academy in question in The Times Higher Education Ranking.

Results obtained are consistent with the previously described models, with university prestige measures always positively related to the value of the Tobin's Q and statistically significant and the academic affiliation never significant. This confirms the signalling power of the variable, regardless of the way in which it is constructed.

Let's now devote the attention to the analysis of the results of the mediation

model.

The first step is represented by the regression of the Tobin's Q on the university prestige, controlling for several factors, to demonstrate the positive link between the explanatory attribute and the dependent one. This investigation has already been carried out, being it the baseline model. Hence, Table 4 presents the results.

As second stage, we regressed the several types of alliances on the university prestige. Results are displayed in Table 7. As it is possible to see, the reputation of the affiliated academic institute has a positive impact on the alliances formation process, even though its statistical significance is not high. Considering the case in which we exclude from the pool of total relationships the number of links that the company has established with the affiliated universities, the variable of university reputation becomes statistically significant, contrary to all the other cases.

On the other hand, the variable *UNI_Affiliation* has a positive and significant ($p<0.01$) coefficient in the regression in the case of upstream alliances, while a lower statistical significance ($p<0.1$) in the case of downstream ones.

Thus, we conclude that the academic affiliation positively influences the alliances formation process increasing the chance to establish similar partnerships due to the proximity to the institutions. This outcome is worth especially for upstream relations and it is consistent with previous researches (Pollock and Gulati, 2007; Stuart et al., 1999).

The third step of our mediation model consists in analyzing the impact of the several types of alliances on the IPO valuation; the obtained results are shown in Table 8. The links are positively related to the *TQ*, but the coefficients obtained are not statistically significant. Hence, we can already exclude at this stage the possibility of the mediation role covered by the alliances; despite this we will present also the following step of the investigation.

The subsequent stage of the mediation model evaluates the interaction between

the two phenomena previously analyzed. Until now, we have demonstrated that the affiliation with a prestigious university has a positive impact on the IPO valuation and on the alliances formation and that the collaborations are positively related to the Tobin's Q. The aim now becomes the one to evaluate the interaction between the two links on the defined dependent variable. Results are shown in Table 9.

The outcomes do not confirm the proposed mediation hypotheses: while reputation of the affiliated academic institute remains statistically significant ($p<0.01$), the alliances variables lose their significance. This means that the signalling effect of the university prestige is not mediated by the level of alliances the company has in place. The link is straightforward, influencing the value of the Tobin's Q directly.

Finally to validate the outcomes on the relationship among the affiliation with a prominent university, the alliances and the IPO valuation we have carried out a Sobel-Goodman test. The proportion of the dependent variable (*TQ*) that is explained by the mediator (*ALL-AFF*) is pretty low almost reaching the zero (equal to 0.02037). From this result it is possible to confirm that the effect of the affiliation with a reputable academic institution on the IPO valuation is not mediated by the alliances that have been built before the listing date.

Chapter 7

Discussion

7.1 Discussion

The aim of this composition is twofold.

First of all, it wants to demonstrate the positive and significant impact that affiliation with a prestigious university has on the IPO valuation. An important study on the effect of university affiliation has already been done (Bonardo et al., 2010), even though it doesn't take into consideration the reputation of the affiliated academic institution. Moreover, many studies on the effect of the prestige of underwriter (Carter and Manaster, 1990; Carter et al., 1998; Chemmanur and Krishnan, 2012), Venture Capitalist (Megginson and White, 1991) and Board of Directors (Higgins and Gulati, 2006) on the IPO valuation have been carried out, but they analyze separately each of these phenomena. Hence, the additional effort we try to make is the one to evaluate the combined impact of those different reputable actors on the IPO valuation, as Colombo et al. (2017, mimeo) have done.

Then, a second purpose can be defined. This derives from a review of the literature and the intrinsic features of the industry under investigation. The aim is to assess if the reputation of the affiliated university has a real impact on the valuation obtained by the firm at the listing date or if it is mediated by the alliances that the company has in place before the listing date. As a matter of fact, there had already been studies evaluating the impact of alliances on IPO valuation (Chen et al., 2008), but nobody has investigated the mediator role that those alliances could play in the signalling process of university reputation.

The results obtained from the regressions confirm our expectations, highlighting how the prestige of the university positively affects the valuation reached by the entrepreneurial venture at the Initial Public Offering. As a matter of fact, it is not the affiliation that brings a signalling value, but it is directly the prestige of the affiliated academic institution. The more prominent is the counterparty, the more effective the signal conveyed is, certifying a superior scientific quality, affecting the financial market and shaping the perception of investors. This finding is relevant, since it uncovers that being affiliated with an ordinary university does not bring an effective signal about the scientific legitimacy of the company. Having stated that, the entrepreneurial venture must display the academic affiliation details in an organized way in the prospectus. Indeed, an action is defined as a signal if it is observable by the stakeholders, that are the receivers of the conveyed information.

On the other side of the market investors should also be conscious of the possibilities they have, paying higher attention to enterprises that signal their quality through the prestige of the affiliated university.

This is an interesting outcome, but it is much more interesting the evaluation of the interaction between the signal provided by the university and the one conveyed by the scientists characterizing the Upper Echelons of the firm. Indeed, we have demonstrated that the higher the reputation of the top workers of the organization, the lower the effect of the prestige of the affiliated academic institute on the Tobin's Q. This can be motivated by the fact that prominent directors and managers do already certify the capability of their enterprise, so the information given by the affiliation is not additive as it belongs to the same domain and it does not convey any additional message. This is true if we think that the most prestigious managers (i.e., workers that have excellent certifications in their specialization area and are authors of several publications) have many job offers, with a chance to select the corporation to join on the base of several factors, like the quality of the projects that it follows. Wanting to

preserve their reputation, they will decide to work in good quality companies.
On the other hand, in the case the prestige of the top employees of the entrepreneurial venture is quite low, the company will benefit more from the reputation of the affiliated university, as it will acquire a signal that effectively influences the perception of stakeholders.

By adding another variable to the baseline model (*UNI_Prestige x VC_Prestige*) it has been possible to evaluate the interaction between signals conveyed by the affiliated university and Venture Capitalists. In this case, the outcome is different showing that the two actors are certifying two different qualities of the company, bringing an additive certification effect. Indeed, the academic institution deals with the scientific sphere only, while VCs are professional investors that have a broader set of competencies.

A similar result has been found in Model (IV), where the parameter *UNI_ Prestige x UW_Prestige* has been introduced to evaluate if the signals provided by the academic institute and the underwriter are redundant or not. As a matter of fact, they are additive, as they certify two different domains, respectively the scientific sphere and the financial one.

Thus, looking at the results obtained, it is possible to conclude that just the signal given by the university prestige and the one provided by the scientist reputation are redundant, since both of them certify the scientific legitimacy of the IPO entrepreneurial venture.

The most important contribution we provide to the entrepreneurial literature concerns the identification of the lack of a mediation effect in the link between the signalling value of the prestige of the affiliated university and the valuation of the entrepreneurial venture at IPO. As a matter of fact, the models presented in Table 9 highlight how the significance of the coefficient of the previous mentioned variable

does not diminish including the alliances parameters in the regression. Even categorizing the alliances by type, to assess whether one type of relationship has a greater impact than the other ones, we lack evidence of a mediation effect. This means that the value brought by the reputation of the affiliated academic institution is directly reflected on the Tobin's Q, influencing investors and reducing the typical IPO underpricing. Despite this, it is possible to argue that the affiliation with a university positively influences the number of alliances that the focal corporation is able to make, while the prestige of the affiliated academic institute seems to be less significant in building collaborations. The results obtained reveal the importance of the presence of a link with a university rather than the relevance of the reputation of the affiliated. We can infer that, in the process of development of a collaboration, what matters is the network and the institutional proximity: an enterprise that is affiliated with an ordinary academic institute has a greater chance to establish alliances than a similar organization non university-based, but it has the same probability of another company affiliated with a prominent university. This positive relation explains the fact that the enterprise attracts the attention of more entities thanks to the certification given by the academic institute, thus enlarging the pool of potential investors and partners.

We argue that entrepreneurs leading small biotech companies do not need to increase the number of ties they define to amplify the signalling effect of the prestige of the university. Indeed, this last factor has an information content that directly influences investors, who will enlarge the amount of money they are available to spend in order to get the shares of the focus enterprise. Alliances, on the other hand, provide direct access to resources and competences and, as demonstrated by conspicuous literature, directly impact the value of the company at the IPO. But despite this, they are not a medium in the link between reputation of the academic affiliation and Tobin's Q.

In conclusion, we can say that this composition adds fresh knowledge to the entrepreneurial literature. While the reputation of the single venture backers have

been already studied and their effects on IPO valuation have been demonstrated, the combined impact of different measures of prestige has just been developed (Colombo et al., 2017, mimeo). The models developed highlight the interaction between signals of reputation of different nature, related to university affiliation, scientists in the Upper Echelons, Venture Capitalists and underwriters, defining their additive nature or their redundancy. This is important because allows us to better understand the certification effect behind the signal and to identify the qualities that have been certified.

Furthermore, this study can help entrepreneurs in the definition of the quantity and type of links that it is better to establish and in the disclosure of information on such relationships in order to attract more investors.

Moreover we believe in the importance of practitioners being aware of the role the company's alliances can have on the signalling effect of reputable affiliated universities. In demonstrating the lack of a mediation effect, we highlight the relevance of the aforementioned signal as a direct sign of the scientific legitimacy of the entrepreneurial venture, to be exploited by entrepreneurs and stakeholders in order to face information asymmetries and their consequences.

7.2 Limitations and Suggestions for Future Research

Our work has, however some limitations which could be exploited in future research papers.

First of all, we have to highlight the limited boundaries of the analysis carried out. As a matter of fact, data used to develop the models belong to European biotech companies which have gone public between 1990 and 2009 only. This entails a bias and it could be hardly generalized to all biotech enterprises, since we have limits in terms

of timing, geography and type of equity issue.

The fact of considering just IPO entrepreneurial ventures is motivated by the difficulty to get financial information of privately held firms, as they do not have the obligation to periodically disclose their data.

Moreover, the limited perimeter which has been taken into consideration derives from the impossibility to deeply analyze all the biotechnology corporations that have undertaken an Initial Public Offering process, consequence of the magnitude of the empirical investigation that should be realized.

Furthermore, the listing prospectus discloses a limited set of information about the alliances that the focal firm has been able to establish. This is a relevant drawback, since the duration of a link can deeply influence the perception of the stakeholders (Stuart et al., 2007). In order to fix this concept an example seems to be appropriate. Let us consider two biotech entrepreneurial ventures that have established contacts with the same pharma corporation in the same period. While the former has a partnership which will be ended some months after its IPO, the latter will be kept for many years with a good chance to be extended. The perception of the stakeholders about the two relationships is completely different: they evaluate more positively the second collaboration, since it has still the possibility to bring value for a long period of time.

The second remark concerns the sector we do evaluate. We study companies acting in the biotech industry, but we are aware of the fact that many other sectors are knowledge based and, for this reason, could be affected by the same kind of processes and conditions. As research documented (Stuart et al., 2007), biotechnology enterprises are particularly prone to have a brokerage role in the relationship between universities and pharmaceutical companies. As a matter of fact, they can be described as value adding intermediaries in the drug development process. It is important to highlight that we do not argue that biotechnology startups are the only private entities

to have formal and informal ties with academic institutions. We just argue that they are a suitable counterparty both for universities and for pharma firms and this confers them a pivotal role in the drug development process. On the other hand, we have to sustain the fact that many other knowledge-intensive industries have direct links with academic institutions and, for this reason, could be subject to an analysis of the same type.

As a matter of fact, a general model, looking transversally across industries could be a topic for future research.

A last remark can be defined. Since the focus of this thesis is the assessment of the impact that the prestige of the affiliated university has at the IPO and on the alliances formation, the boundaries in terms of timing are clear: we take into consideration only the years before the listing moment and the Initial Public Offering itself. What happens after the IPO is not an issue for us. Despite this consideration, it would have been interesting to evaluate the performance of the ventures in the long-run, in order to understand if the signal provided by the prestige of the academic institution related to the quality of the projects is persistent through time (Colombo et al., 2017, mimeo).

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Appendix

Table 1 _ Variables Description

Dependent Variable	
TQ	TQ is calculated as the ratio between the market value of assets, sum of the book value of stocks in the moment of the offer less the book value of common stocks, and the book value of assets.

Independent Variables	
UNI_Prestige	University prestige is measured by using the total number of citations (in thousands) received in the twenty years before the IPO by the papers published by the parent university in the following biotech-related disciplines: Medicine; Biochemistry and Genetics; Nursing; Dentistry; Chemistry; Pharmacology, Toxicology and Pharmaceutics; Agriculture and Biological Sciences; Neuroscience; Immunology and Microbiology; Veterinary; Health professions; Chemical engineering. In the regression model this variable is standardized by its standard deviation and mean. Values are then orthogonalized (Colombo et al., 2017, mimeo).
UNI_Prestige_Rank	University prestige is measured as the inverse of the ranking, where ranking is the Times Higher Education (THE) World University Ranking at the year of IPO (we use the 2004 ranking for IPOs before this year). In the regression model, values are orthogonalized.
UNI_Prestige_Pub	University prestige is measured by using the total number of articles (in thousands) published by the parent university in the twenty years before the IPO in the following biotech-related disciplines: Medicine; Biochemistry and Genetics; Nursing; Dentistry; Chemistry; Pharmacology, Toxicology and Pharmaceutics; Agriculture and Biological Sciences; Neuroscience; Immunology and Microbiology; Veterinary; Health professions; Chemical engineering. In the regression model this variable is standardized by its standard deviation and mean. Values are then orthogonalized.
VC_Backing	VC endorsement is a dummy variable used to assess if the IPO entrepreneurial venture is backed by at least one VC (indicator is equal to one) or not (null value).
VC_Prestige	VCs prestige is measured, similarly to Nahata (2008), as the cumulative market capitalization of Initial Public Offerings backed by the same Venture Capitalist over the full sample.
UW_Prestige	UWs prestige is measured as the proceeds raised by the investment bank taking public companies in the sample, divided by the capital raised by all the IPOs present in our database. Only lead and co-lead underwriters are considered (Colombo et al., 2017, mimeo). When more than one bank underwrites an issue, the proceeds (and number of Initial Public Offerings) are equally split among all lead banks, as Aggarwal et al. (2002) and Abrahamson et al. (2011) have previously done in their works.
SC_Prestige	Scientist prestige is built as in Colombo et al. (2017, mimeo) and it counts the total number of citations obtained by the papers published by the members of the Upper Echelons in the twenty years before the Initial Public Offering. The publications are related just to the subject areas previously defined. When included in the regression model, the variable is normalized. The source of information is the database Scopus.

ALL - AFF	Strategic alliances are given by the total number of links of the firm, excluding the collaborations with the affiliated universities. In the regression, the natural logarithm plus 1 has been used.
UP - AFF	Upstream alliances accounts for the number of links that a firm has with universities, excluding the collaborations with the affiliated universities. In the regression, the natural logarithm plus 1 has been adopted.
RC	Alliances with research centers counts the number of links that a firm has with them. In the regression, the natural logarithm plus 1 has been implemented.
HORIZONTAL	Horizontal alliances are the total links that a company has with biotech firms. In the regression, the natural logarithm plus 1 has been used.
DOWNSTREAM	Downstream alliances register the amount of collaborations that a firm has with pharma companies. In the regression, the natural logarithm plus 1 has been used.
OTHERS	Alliances with 'others' measures the number of non strategic connections that the firm has. In the regression, the natural logarithm plus 1 has been used.

Control Variables	
UNI_Affiliation	University affiliation is a dummy variable highlighting the fact that the company is affiliated with a university. According to the definition of Bonardo et al. (2011), university based firms are enterprises which are directly founded by researchers working for a specific academic institution or firms born to commercialize academic discoveries and researches.
Firm_Size (Sales, €m)	Firm size is calculated as inflation-adjusted sales in the year prior to the IPO in millions of Euros, using Purchasing Power Parities (EU27=1) (Colombo et al., 2017, mimeo). When the amounts were not reported in Euros, the conversion has been made using the yearly average exchange rates in the listing year. In the regression model, this variable is used after applying the natural logarithm to the value representing the size of the firm in the sample.
Firm_Age	Company age is measured in years since incorporation. When included in the regression models, the natural logarithm is applied to the value plus 1.
Profitability	Profitability is measured as return on assets in the year prior to the Initial Public Offering (Colombo et al., 2017, mimeo).
Leverage	Leverage is measured as the ratio of debt to total assets in the year prior to the Initial Public Offering (Colombo et al., 2017, mimeo).
ProneIPO	Prone to IPO is the inverse of Mills Ratio calculated as in Heckman (1979) with a correction for the selection of companies that went public instead of remaining private.
DilutionRatio	Dilution ratio is the ratio between the stocks offered during the Initial Public Offering and the number of shares outstanding before that moment.
ParticipationRatio	Participation ratio is the percentage of the secondary stocks offered during the IPO on the total amount of shares sold. The sources of these data are EURIPO and Dealogic.
Patents	Patents are defined as the number of already registered patents to be found in the US and European Patent Office which have been developed by the firm before the IPO date. The natural logarithm has been applied in the regression.

UE_Size	UE size accounts for the number of board members and top executives. In the regression, natural logarithm is applied.
UE_Experience	UE experience measures the percentage of management that has already experience in managing either biotech or pharmaceutical companies.
UE_NonExecutive	UE non-executive represents the percentage of non-executive directors of the Board of Directors.
UE_PhD	UE with PhD is the number of members of the Upper Echelons of the IPO company that have the PhD certification.
UE_MBA	UE with MBA accounts for the number of Upper Echelons members that have the MBA certification.
Corporate_Spinoff	Corporate spinoff is a dummy variable that assumes the value of 1 if the firm has been established on ideas originally developed by a parent corporation, 0 in the opposite case.
Country dummies	Country dummies are variables introduced to take into consideration the country in which the company has been located and listed. Since the sample is composed just by European biotech entrepreneurial ventures, the countries that appear in the database are the following ones: UK, Germany, France and Italy.
Industry dummies	Industry dummies are variables built to control for the different possible sub-industries characterizing the sample. The segments present in the database are: immunology, diagnostic, investigation of new drugs, protein engineering, instruments and services.

Table 2 _ Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)
(1) TQ	1																												
(2) UNI_Prestige	0.2976	1																											
(3) UNI_Prestige_Rank	0.2309	0.4813	1																										
(4) UNI_Prestige_Pub	0.1217	0.4541	0.5553	1																									
(5) ALL - AFF	0.0361	-0.0001	-0.0591	0.0008	1																								
(6) UP - AFF	0.1399	0.5401	0.2896	0.1831	-0.0627	1																							
(7) RC	-0.0099	0.0694	-0.0083	-0.0019	0.5414	0.0624	1																						
(8) HORIZONTAL	0.1222	0.0563	-0.0545	-0.0080	0.4880	0.0411	0.3111	1																					
(9) DOWNSTREAM	0.0589	-0.0168	-0.0142	0.0517	0.6103	-0.0626	0.0587	0.2929	1																				
(10) OTHERS	0.0103	-0.0487	-0.0692	-0.0014	0.5770	-0.0895	0.0673	0.1735	0.1964	1																			
(11) UNI_Affiliation	0.1910	0.7578	0.3540	0.1795	-0.0381	0.6311	0.0388	0.0541	-0.0799	-0.0873	1																		
(12) VC_Backing	0.1286	-0.0000	-0.0114	0.0963	0.1503	-0.1047	0.1188	0.1397	0.1587	-0.0540	0.0000	1																	
(13) VC_Prestige	0.1202	-0.0000	0.0166	0.0283	0.0660	-0.0040	-0.0084	0.0854	0.0890	-0.1260	-0.0000	0.4798	1																
(14) UW_Prestige	0.0896	0.0000	0.0012	0.0330	0.1945	-0.1083	0.0638	0.1070	0.2005	0.1646	0.0000	0.0000	-0.0000	1															
(15) SC_Prestige	0.3048	0.3030	0.1775	0.1442	0.2129	0.2672	0.1892	0.1779	0.2177	-0.0215	0.2463	-0.0000	-0.0000	-0.0000	1														
(16) Firm_Size	-0.3571	-0.2204	-0.2247	-0.1695	0.0721	-0.2490	0.0132	-0.0241	0.0632	0.1254	-0.2004	-0.0600	-0.0430	0.0269	-0.2087	1													
(17) Firm_Age	-0.2038	-0.2008	-0.1347	-0.0723	0.0529	-0.1225	0.0232	-0.0086	-0.0260	0.1271	-0.1538	0.0228	0.0601	-0.0388	-0.1759	0.4250	1												
(18) Profitability	-0.1192	-0.0669	0.0185	0.0519	-0.0670	-0.0958	-0.0006	-0.0509	-0.0279	-0.0625	-0.0504	-0.0163	0.0129	-0.0119	-0.1719	0.2650	0.1423	1											
(19) Leverage	0.2333	0.0390	-0.0360	-0.0650	-0.0016	0.0626	-0.0779	-0.0140	-0.0099	0.1043	0.0100	0.0138	-0.0323	-0.0236	-0.0521	-0.0997	-0.0268	-0.3177	1										
(20) Patents	-0.0106	0.0153	0.1186	0.1209	0.1014	-0.0438	0.0915	0.1046	0.1940	-0.0283	0.0160	0.1292	-0.0073	0.0790	0.2078	0.0728	-0.0107	0.0669	-0.0383	1									
(21) UE_Size	-0.0320	0.1076	0.0759	0.0832	0.2291	-0.0027	0.0799	0.0786	0.1759	0.1112	0.0429	0.1054	-0.0219	0.0229	0.2207	0.0604	0.0290	-0.0294	-0.0027	0.0604	1								
(22) UE_PhD	0.0801	0.2069	0.1768	0.1316	0.2447	0.1488	0.1325	0.2114	0.2914	0.0025	0.1719	0.1735	0.0124	0.0192	0.4625	-0.1043	-0.0575	-0.0901	-0.0346	0.1847	0.4435	1							
(23) UE_Experience	0.0676	0.1990	0.0641	0.0467	0.0473	0.1539	0.1602	0.1612	0.0917	-0.1769	0.2154	0.1317	-0.0097	-0.0191	0.2344	-0.1646	-0.1678	-0.0973	-0.0095	0.0871	-0.1175	0.3201	1						
(24) UE_NonExecutive	-0.0750	-0.0401	0.0283	0.0751	-0.0189	-0.0099	0.0018	-0.0355	0.0268	-0.0731	-0.0762	0.0895	0.1049	0.0105	0.0357	-0.1029	0.0151	-0.0662	-0.0248	-0.0138	-0.0096	0.0536	-0.0083	1					
(25) UE_MBA	-0.0629	0.0778	0.1213	0.0666	0.1150	-0.0132	0.1497	0.0892	0.1542	-0.1009	0.0500	0.1231	-0.0402	0.0615	0.1936	-0.0287	-0.0228	0.0331	-0.0684	0.1925	0.3752	0.4589	0.2758	0.1365	1				
(26) DilutionRatio	0.0789	-0.0362	-0.0163	0.0102	-0.0661	-0.0213	0.0403	-0.0800	-0.0418	-0.1134	-0.0205	-0.0808	0.0942	0.1513	-0.1307	-0.1864	-0.0872	0.0302	-0.0300	-0.0932	-0.0774	-0.0618	0.0017	-0.0129	-0.0270	1			
(27) ParticipationRatio	0.2030	-0.1873	-0.1047	-0.0983	-0.0229	-0.1295	-0.0827	-0.0570	-0.0733	0.1632	-0.1980	-0.0154	0.0693	0.0131	-0.3517	0.3292	0.2531	0.1221	-0.0117	-0.0702	0.0026	-0.2549	-0.4483	-0.0481	-0.2344	-0.1340	1		
(28) ProneIPO	0.0902	0.1188	0.0706	0.0859	-0.0120	0.0755	0.0653	-0.0070	-0.0095	-0.1158	0.0689	0.0092	-0.0337	0.0670	0.1309	-0.2321	-0.7079	-0.1133	0.0104	-0.0875	-0.0423	0.0546	0.2366	0.0324	0.1367	0.0893	-0.2857	1	
(29) Corporate_Spinoff	-0.0402	-0.3467	-0.1312	-0.0999	0.0679	-0.2887	-0.0826	-0.0250	0.1264	0.0238	-0.4207	0.0745	-0.0503	0.1008	-0.0719	0.0694	-0.1414	-0.0442	0.0850	0.0536	0.1093	0.0027	0.0408	-0.0113	0.1035	-0.0583	-0.0112	0.1247	1

Table 3 _ Descriptive Statistics

	Observations	Mean	Median	Std dev.	Minimum	Maximum
TQ	254	3.94	2.94	2.99	0.52	12.76
UNI_Affiliation (%)	254	25.59	0	43.72	0	1
UNI_Prestige	254	204.71	184.34	225.93	0	581215.00
VC_Backing (%)	254	42.13	0	49.47	0	1
VC_Prestige	254	0.36	0.24	0.29	0	9.99
UW_Prestige	254	0.19	0.15	0. 15	0	9
SC_Prestige	254	2.76	0.42	7.07	0.00	87.88
ALL - AFF	254	4.43	3.00	4.97	0.00	12.00
UP - AFF	254	0.81	0.00	1.45	0.00	3.00
RC	254	0.70	0.00	1.34	0.00	3.00
HORIZONTAL	254	0.43	0.00	0.90	0.00	2.00
DOWNSTREAM	254	1.15	0.00	2.11	0.00	4.00
OTHERS	254	1.11	0.00	1.79	0.00	3.00
Firm_Size (Sales, €m)	254	40.29	4.38	135.13	0.00	742.00
Firm_Age	254	9.53	7.00	11.76	0.00	888.17
Profitability	254	-0.51	-0.11	2.26	-4.66	1.73
Leverage	254	0.75	0.44	0.70	0.00	10.24
ProneIPO	254	0.56	0.58	0.12	0.05	0.99
DilutionRatio	254	0.52	0.39	0.83	0.00	3.33
ParticipationRatio	254	0.15	0.00	0.27	0.00	1.00
Patents	254	40.44	7.00	108.24	0.00	470.00
UE_Size	254	9.43	9.00	5.13	0.00	27.00
UE_Experience	254	0.34	0.35	0.13	0.00	0.62
UE_NonExecutive	254	0.28	0.28	0.19	0.00	0.67
UE_PhD	254	0.23	0.20	0.23	0.00	0.81
UE_MBA	254	0.18	0.12	0.21	0.00	0.83
Corporate_Spinoff	254	0.35	0.00	0.48	0.00	1.00

Table 4 _ Model One - University Citations

Variables	*Model (I)*	*Model (II)*	*Model (III)*	*Model (VI)*	*Model (V)*
UNI_Prestige	1.299748***	1.419338***	1.293178***	1.297247***	1.412354***
	(.4034984)	(.3961897)	(.4043437)	(.4035772)	(.396439)
UNI_Affiliation	-1.357074	-.8361296	-1.365936	-1.360078	-.8331895
	(.9243982)	(.9172257)	(.9260465)	(.9245648)	(.9175607)
VC_Baking	-2.202891	-2.104543***	-2.174401***	-2.270486***	-2.146856***
	(.6842556)	(.6697753)	(.6874962)	(.6879866)	(.6758716)
VC_Prestige	1.071771***	1.022131***	1.038705***	1.097068***	1.010318***
	(.3120495)	(.3055118)	(.3188039)	(.3132141)	(.3131863)
UW_Prestige	.5302348*	.6547829**	.5219976*	.4352632	.5362284*
	(.2706487)	(.2672615)	(.2715377)	(.2882024)	(.283666)
SC_Prestige	.2893668***	.3317094***	.2918167***	.2889972***	.3356518***
	(.0963333)	(.0950471)	(.0966013)	(.0963509)	(.0952196)
Firm_Size	-.2182872***	-.2084252***	-.2158079***	-.2239577***	-.211813***
	(.0541568)	(.0530415)	(.0544485)	(.0544873)	(.0535956)
Firm_Age	-.3115429	-.4149523	-.3187475	-.2997311	-.413122
	(.5527439)	(.5414069)	(.5538072)	(.5529773)	(.5418869)
Profitability	.1930023	.2228559*	.1938586	.1963061	.2288059*
	(.1248972)	(.122461)	(.1251098)	(.1249664)	(.1225746)
Leverage	.4514753***	.4511504***	.4481491***	.4504614	.445895***
	(.1155773)	(.1130229)	(.1159366)	(.1156023)	(.1132273)
Patents	-.0525785	-.135442	-.0494008	-.0455112	-.1259433
	(.1590254)	(.1574627)	(.159397)	(.1592234)	(.1576655)
UE_Size	.2994672	.3714091	.2938692	.2647403	.325792
	(.7227297)	(.707082)	(.7239768)	(.7237601)	(.7081462)
UE_PhD	.0015025	.0200035	.0022196	.0087101	.0300393
	(.1368295)	(.1339191)	(.1370576)	(.1370591)	(.1341857)
UE_Experience	-1.578903	-1.508919	-1.542646	-1.379609	-1.226099
	(2.598892)	(2.541538)	(2.604007)	(2.60762)	(2.551145)
UE_NonExecutive	-1.447269	-1.468151	-1.359587	-1.467316	-1.386082
	(1.423984)	(1.392525)	(1.43598)	(1.424385)	(1.402724)
UE_MBA	-.2180578	-.2362488*	-.2179169	-.2199147	-.2388838
	(.4034984)	(.1395215)	(.1427977)	(.1426048)	(.1395806)
DilutionRatio	.0637528	.0728491	.0634819	.0951564	.1100788
	(.339447)	(.3319558)	(.3399964)	(.3410781)	(.3336219)
ParticipationRatio	-.8286223	-.8871417	-.8621301	-.8066142	-.9036878
	(1.227959)	(1.200946)	(1.231592)	(1.228387)	(1.203224)
ProneIPO	-1.858257	-2.077878	-1.954166	-1.921899	-2.277206
	(3.312179)	(3.239638)	(3.322536)	(3.31342)	(3.246213)
Corporate_Spinoff	.5773057	.5433994	.5826469	.6236129	.6037045
	(.6337544)	(.61983)	(.6348606)	(.6356972)	(.6217973)
UNI_Prestige x SC_Prestige		-.0688119***			-.0710935***
		(.0205252)			(.0206009)
UNI_Prestige x VC_Prestige			-.1623298		-.197253
			(.3083796)		(.302149)
UNI_Prestige x UW_Prestige				.2096167	.2486902
				(.2183222)	(.2143497)
Constant	10.60563***	11.11419***	10.64714***	10.68487***	11.27551***
	(3.772811)	(3.692544)	(3.779737)	(3.774372)	(3.695614)
R-squared	0.3952	0.4242	0.3960	0.3977	0.4291
Adj R-squared	0.3169	0.3468	0.3147	0.3167	0.3464
Observations	254	254	254	254	254

Table 5 _ Model One - University Ranking

Variables	*(I) - Rank*	*(II) - Rank*	*(III) - Rank*	*(IV) - Rank*	*(V) - Rank*
UNI_Prestige_Rank	.6176459**	.5907344**	.605878**	.6065349**	.557036*
	(.2889182)	(.2843403)	(.2952523)	(.2893474)	(.2907261)
UNI_Affiliation	.185089	.8255739	.1859326	.1867018	.8494439
	(.7282156)	(.7491763)	(.7297905)	(.728598)	(.7507498)
VC_Baking	-2.155576***	-2.071872***	-2.145251***	-2.219064***	-2.128535***
	(.6933851)	(.6826424)	(.6967219)	(.6975271)	(.689499)
VC_Prestige	1.067558***	1.025472***	1.054649***	1.091226***	1.031264***
	(.3160614)	(.3112242)	(.3230252)	(.31738)	(.3194217)
UW_Prestige	.5538021**	.6650991**	.5503771	.4658746	.5571634*
	(.2740139)	(.2722157)	(.275117)	(.2919752)	(.2893891)
SC_Prestige	.3369101	.3779102***	.3377558***	.3364489***	.3800681***
	(.0965053)	(.0959605)	(.0968016)	(.0965571)	(.0962431)
Firm_Size	-.2063989***	-.1990673***	-.2057529***	-.2119671***	-.2044666***
	(.0554982)	(.0546479)	(.0557078)	(.0558903)	(.0551925)
Firm_Age	-.4566713	-.5559744	-.4587312	-.444994	-.5485084
	(.5587504)	(.5506603)	(.5600412)	(.559201)	(.5517884)
Profitability	.185256	.2134026*	.1859416	.1886363	.2195078*
	(.1267422)	(.125041)	(.1270589)	(.1268672)	(.1253737)
Leverage	.4845155***	.4857301***	.4829589***	.4833657***	.4818107***
	(.1168857)	(.1149739)	(.1173859)	(.116954)	(.1154039)
Patents	-.1007028	-.1715444	-.098481	-.0932692	-.1611933
	(.1627359)	(.1619037)	(.1634499)	(.163042)	(.1625416)
UE_Size	.4655451	.5402291	.4626512	.432837	.4984662
	(.7304424)	(.7189461)	(.7321483)	(.7317779)	(.7210212)
UE_PhD	-.0194581	-.0018464	-.018724	-.0123715	.0084627
	(.1390002)	(.136859)	(.1393453)	(.1393081)	(.1373777)
UE_Experience	-.7475125	-.6847765	-.7438063	-.5733982	-.4670512
	(2.641863)	(2.598724)	(2.647597)	(2.650714)	(2.610359)
UE_NonExecutive	-1.521727	-1.547819	-1.486777	-1.540336	-1.513256
	(1.441707)	(1.418145)	(1.454966)	(1.442616)	(1.43068)
UE_MBA	-.2290837	-.2452776*	-.2288999	-.2306806	-.2474149
	(.1443871)	(.142133)	(.1446999)	(.144474)	(.1423763)
DilutionRatio	.0497591	.0511926	.0489335	.0781073	.0839967
	(.3438612)	(.3382351)	(.3446232)	(.3455612)	(.3403246)
ParticipationRatio	-.9029549	-.9495258	-.9146633	-.8810261	-.9439856
	(1.244152)	(1.223898)	(1.248148)	(1.245053)	(1.227485)
ProneIPO	-2.244987	-2.42603	-2.276452	-2.297372	-2.546924
	(3.358091)	(3.303726)	(3.368846)	(3.360376)	(3.313114)
Corporate_Spinoff	.3381672	.2908855	.3410706	.3816777	.3465457
	(.6379873)	(.6277572)	(.6395158)	(.6402522)	(.6306677)
UNI_Prestige x SC_Prestige		-.0607876***			-.0627364***
		(.0208323)			(.0209511)
UNI_Prestige x VC_Prestige			-.0648293		-.1072115
			(.3184506)		(.3141376)
UNI_Prestige x UW_Prestige				.1937924	.2332715
				(.2213629)	(.2187452)
Constant	10.40396***	10.82933***	10.41992***	10.47661***	10.95681***
	(3.819645)	(3.759972)	(3.828647)	(3.822539)	(3.767944)
R-squared	0.3799	0.4027	0.3800	0.3820	0.4061
Adj R-squared	0.2996	0.3223	0.2966	0.2988	0.3201
Prob > F	254	254	254	254	254

Table 6 _ Model One - University Publications

Variables	*(I) - Pub*	*(II) - Pub*	*(III) - Pub*	*(IV) - Pub*	*(V) - Pub*
UNI_Prestige_Pub	.3541901*	.2582628**	.3501395**	.3551858*	.2506814*
	(.2749345)	(.2728767)	(.2754298)	(.2749759)	(.2731161)
UNI_Affiliation	.5232415	1.161029	.5031601	.5159548	1.155115
	(.7074437)	(.7323906)	(.7093328)	(.7075853)	(.7329689)
VC_Baking	-2.258681***	-2.161376***	-2.226034***	-2.328197***	-2.198737***
	(.698288)	(.6885315)	(.7015729)	(.7020758)	(.6949183)
VC_Prestige	1.092784***	1.048469***	1.055408***	1.118756***	1.032347***
	(.3180598)	(.3136157)	(.3249532)	(.3192365)	(.3215869)
UW_Prestige	.5405654*	.6522817**	.531284	.4429952	.5337084*
	(.2758361)	(.2745078)	(.2767055)	(.2937365)	(.2913216)
SC_Prestige	.3323598***	.3733669***	.3348859***	.3318839***	.3774888***
	(.0971381)	(.0967571)	(.097379)	(.0971533)	(.0969278)
Firm_Size	-.215254***	-.2099417***	-.2125385***	-.2210345***	-.2131616***
	(.0556868)	(.0548722)	(.0559645)	(.0560145)	(.0554261)
Firm_Age	-.4866095	-.5690065	-.493372	-.4744267	-.5663729
	(.5641281)	(.5563147)	(.5650832)	(.5643495)	(.5567759)
Profitability	.1894351	.2203372*	.1905056	.1927621	.2266971
	(.1277715)	(.1263034)	(.127974)	(.1278361)	(.1264329)
Leverage	.4821662***	.4818328***	.4782077***	.4810987***	.475914***
	(.1176826)	(.115893)	(.1180534)	(.1177047)	(.1161288)
Patents	-.0792637	-.1431907	-.0753705	-.0720924	-.1329697
	(.1635992)	(.1626944)	(.1639783)	(.1637906)	(.1629274)
UE_Size	.397127	.4846799	.3905566	.3610419	.4390181
	(.7360853)	(.7255538)	(.737262)	(.7371354)	(.7266689)
UE_PhD	-.0016729	.0162351	-.0008134	.0057049	.0264698
	(.1395224)	(.1375469)	(.1397369)	(.1397507)	(.1378293)
UE_Experience	-1.068961	-1.042049	-1.032284	-.8643285	-.7623012
	(2.652071)	(2.611756)	(2.656748)	(2.660874)	(2.621506)
UE_NonExecutive	-1.636001	-1.633585	-1.535677	-1.656697	-1.538734
	(1.453101)	(1.431002)	(1.465447)	(1.453467)	(1.441896)
UE_MBA	-.2105432	-.2300586	-.2104985	-.2124054	-.2329486
	(.1456024)	(.1435546)	(.1458181)	(.145636)	(.1436226)
DilutionRatio	.0173781	.0175749	.0172715	.0497675	.0547009
	(.3455707)	(.3403153)	(.3460825)	(.3472384)	(.3420382)
ParticipationRatio	-.8397513	-.8822115	-.877243	-.8172582	-.9023941
	(1.251607)	(1.232664)	(1.255118)	(1.252002)	(1.235036)
ProneIPO	-2.32544	-2.400353	-2.428201	-2.391948	-2.601336
	(3.392458)	(3.340971)	(3.402077)	(3.393641)	(3.347248)
Corporate_Spinoff	.3971902	.3386199	.4039828	.4452932	.3995536
	(.6428718)	(.6334347)	(.6439298)	(.6448841)	(.6354879)
UNI_Prestige x SC_Prestige		-.0596998***			-.0621517
		(.0211443)			(.0212308)
UNI_Prestige x VC_Prestige			-.1826675		-.215854
			(.3141869)		(.3101738)
UNI_Prestige x UW_Prestige				.2152218	.2474788
				(.2224888)	(.2200006)
Constant	10.6785***	11.00821***	10.72287***	10.76132***	11.16941***
	(3.852859)	(3.796061)	(3.85932)	(3.854363)	(3.799244)
R-squared	0.3719	0.3935	0.3728	0.3745	0.3986
Adj R-squared	0.2905	0.3119	0.2884	0.2903	0.3115
Prob > F	254	254	254	254	254

Table 7 _ Mediation Model - Step 2

Variables	*ALL- AFF*	*UP- AFF*	*RC*	*HORIZONTAL*	*DONWSTREAM*
UNI_Prestige	.074422*	.0171481	.0335379	-.0314851	.0017103
	(.0556133)	(.0116348)	(.0332133)	(.0270131)	(.0399545)
UNI_Affiliation	-.0961732	.3243382***	.0745578	.0510882	-.1790992*
	(.1282486)	(.0268307)	(.0765925)	(.0622944)	(.0921381)
Uk_Dummy	-.1735661	.0424392	-.1466959	-.2120431***	-.1058127
	(.1537176)	(.0321591)	(.091803)	(.0746655)	(.1104359)
Germany_Dummy	-.0671692	-.0506932	-.1483437	-.0924202	-.1658964
	(.1975009)	(.0413189)	(.1179512)	(.0959324)	(.1418912)
France_Dummy	.0859073	.0068266	.127484	-.2740201***	-.3176108**
	(.183195)	(.038326)	(.1094075)	(.0889836)	(.1316134)
Italy_Dummy	.174319	.0527607	.0744816	-.0130758	.0451558
	(.3027657)	(.0633413)	(.1808173)	(.1470628)	(.217517)
Industry_Immunology	-.112455	.0165781	-.0147928	-.0304471	-.1126329
	(.2479775)	(.0518791)	(.1480968)	(.1204505)	(.1781553)
Industry_Diagnostics	.8521504***	.025448	.2458004**	.1373751	.5729136***
	(.1720647)	(.0359975)	(.1027602)	(.0835772)	(.123617)
Industry_Genetics	1.065372***	.0760232	.4681228***	.3926502***	.7399007***
	(.2927742)	(.0612509)	(.1748502)	(.1422096)	(.2103387)
Industry_Drugs	.3944801**	.0136552	.2277346*	.0219195	.2403456*
	(.1946471)	(.0407219)	(.1162469)	(.0945462)	(.139841)
Industry_Instruments	.5363146***	-.0024798	.1532124	-.018142	.1456626
	(.1844431)	(.0385871)	(.1101529)	(.0895898)	(.1325101)
Constant	.8612823***	-.0276378	.1973275*	.3141084***	.3528053**
	(.18951)	(.0396472)	(.1131789)	(.092051)	(.1361503)
R-squared	0.1651	0.4283	0.0874	0.1155	0.1975
Adj R-squared	0.1272	0.4024	0.0459	0.0753	0.1610
Observations	254	254	254	254	254

Table 8 _ Mediation Model - Step 3

Variables	*TQ*	*TQ*
ALL - AFF	.0033412	
	(.3198783)	
UP - AFF		-2.311853
		(1.515897)
RC		-.0890318
		(.5535142)
HORIZONTAL		.94517
		(.6879686)
DOWNSTREAM		.1288357
		(.4634414)
OTHERS		-.1682827
		(.4604835)
UNI_Affiliation	.6256795	1.359531
	(.7075825)	(.8549856)
VC_Baking	-2.212468***	-2.463868***
	(.7026807)	(.7176445)
VC_Prestige	1.084431***	1.070227***
	(.3191707)	(.3258509)
UW_Prestige	.5480581	.435324
	(.2825969)	(.2900934)
SC_Prestige	.3346421***	.3478204***
	(.0980664)	(.0998772)
Firm_Size	-.2252349***	-.2367459***
	(.0554839)	(.0565402)
Firm_Age	-.4259115	-.2924708
	(.5642398)	(.5689984)
Profitability	.2045738	.2108856*
	(.1278471)	(.1276953)
Leverage	.4750173***	.4856681***
	(.117996)	(.1184736)
Patents	-.0503457	-.0485149
	(.1631637)	(.1636716)
UE_Size	.4455342	.3701289
	(.7445789)	(.7462116)
UE_PhD	.0042435	-.0011328
	(.1403004)	(.1417013)
UE_Experience	-1.282548	-1.515449
	(2.658799)	(2.72067)
UE_NonExecutive	-1.534529	-1.483962
	(1.456334)	(1.456662)
UE_MBA	-.222832	-.2285689
	(.1459698)	(.1475937)
DilutionRatio	.0058977	.0397782
	(.3468496)	(.3549069)
ParticipationRatio	-.8137257	-.7143332
	(1.256223)	(1.26617)
ProneIPO	-1.889336	-1.053629
	(3.388009)	(3.419632)
Corporate_Spinoff	.3550292	.4100338
	(.6444172)	(.6476289)
Constant	10.34422***	9.590002**
	(3.858437)	(3.929011)

R-squared	0.3672	0.3799
Adj R-squared	0.2853	0.2869
Observations	254	254

Table 9 _ Mediation Model - Step 4

Variables	*TQ*	*TQ*
UNI_Prestige	1.301035***	1.374449***
	(.4046161)	(.4054414)
ALL - AFF	-.030085	
	(.3135838)	
UP - AFF		-2.757333*
		(1.486812)
RC		-.1533379
		(.541102)
HORIZONTAL		.9970857
		(.6723023)
DOWNSTREAM		.04711
		(.4534118)
OTHERS		-.2098538
		(.4500478)
UNI_Affiliation	-1.364004	-.6211588
	(.9292612)	(1.019362)
VC_Baking	-2.197028***	-2.466422***
	(.6884916)	(.7011209)
VC_Prestige	1.071837***	1.055695***
	(.3127427)	(.3183769)
UW_Prestige	.5355796*	.4195562
	(.2769109)	(.283452)
SC_Prestige	.2903295***	.3073318***
	(.0970671)	(.0983057)
Firm_Size	-.2179228***	-.2293622***
	(.0544098)	(.0552812)
Firm_Age	-.311187	-.1576776
	(.5539829)	(.5573172)
Profitability	.192424	.1982476
	(.1253194)	(.1248107)
Leverage	.4515894***	.4632688***
	(.1158399)	(.1159342)
Patents	-.0537789	-.050265
	(.1598686)	(.1599038)
UE_Size	.3087485	.2018013
	(.7307652)	(.7307188)
UE_PhD	.0024186	-.0004734
	(.1374651)	(.1384387)
UE_Experience	-1.569319	-1.821044
	(2.606574)	(2.659554)
UE_NonExecutive	-1.446781	-1.398457
	(1.427152)	(1.423345)
UE_MBA	-.2186679	-.2271482
	(.1430247)	(.1441959)
DilutionRatio	.0646486	.1046337
	(.3403283)	(.3472624)
ParticipationRatio	-.8267851	-.69365
	(1.230833)	(1.237031)
ProneIPO	-1.858392	-.9609971
	(3.319529)	(3.341005)
Corporate_Spinoff	.5777406	.6410996
	(.6351768)	(.6363778)
Constant	10.60292***	9.870122**
	(3.781288)	(3.839434)
R-squared	0.3952	0.4108
Adj R-squared	0.3139	0.3193
Observations	254	254