UNIVERSITÀ DEGLI STUDI DI SALERNO

DIPARTIMENTO DI SCIENZE ECONOMICHE E STATISTICHE

Ph.D. in Economics and Policy Analysis of Markets and Firms

Curriculum: Public Economics

XXXIII Cycle

IPO Underpricing and Local Networks across Issuing Firms

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2020/2021

Acknowledgments

I am extremely grateful to Prof. Marcello D’Amato, my supervisor, for his guide throughout the various steps of the thesis, especially for his constant invitation to use critical thinking to improve my understanding of the issues and to improvement. I am also grateful to Antonio Acconcia, Federico II of Naples, for his uncompromising support, expert advice, and encouragement that have contributed to my personal development and the growth of the present work. The current version of the thesis has also benefited from comments made by referees Prof. Luca Pennacchio, Parthenope University of Naples, and Prof. Alfredo Del Monte, Federico II University of Naples. Finally, I would like to thank Prof.ssa Alessandra Amendola, Ph.D. Coordinator, for her support and guidance during the entire period.

IPO Underpricing and Local Networks across Issuing Firms

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Introduction

Going public represents a source of external financing that firms can access during their life cycle. A company goes public through an initial public offering (IPO), which satisfies a capital-raising function, usually referred to as the issuance of shares in the primary market, and a trading function concerning financial transactions among investors in the secondary market. Through an IPO, companies can disseminate their shares on a stock exchange and gain access to a broader amount of capital for an unlimited period of time. Thus, the going public decision provides a source of finance alternative to the bank system that, in some cases, facilitates the provision of capital for financing new projects. However, the conventional wisdom suggests that it is merely a step in the company's growth process, even if, in several issues, the need for founders and other shareholders to convert their shares into cash at a future date is prevailing to the aim of raising new capital for the company.

In sum, the initial public offering is a procedure implemented basically through three main steps: 1) the investment bank[1] (underwriter), which manages the issuance, underwrites[2] the securities of the issuing firm (issuer); 2) subsequently, the underwriter sells shares to the public of investors at the offer price during the initial public offering; in the end, 3) the investors, who are the holders of securities, can decide to hold or exchange shares in the stock market, wherein the listing price of firm's securities is established for its first time.

[1] I use the terms underwriter and investment bank interchangeably.

[2] The investment bank underwrites shares from the issuer through an underwriting agreement. Usually, it is used the "firm commitment" underwriting, which provides that the underwriter purchase the entire issue of shares from the issuer and attempts to resell them to investors.

Scholars and practitioners have long taken care of the price difference that is often produced between the second and third steps of the IPO process defined above, the so-called IPO underpricing puzzle. This last precisely defined as the change between the closing price of the first listing day and the offer price disclosed at the offer date. Several pieces of evidence show that this difference is systematically positive on average. Ritter and Welch (2002) document an average underpricing of 18% for IPOs in the U.S. between 1980-2001 in one of the most extensive reviews. Historically, continental Europe's IPO markets have been overcome by the U.S. ones in terms of proceeds volume and IPOs number. Although the high volume of IPOs in the U.S. during 2000, continental European IPO volume exceeded that of the U.S. for the first time in that period, and the recorded average underpricing achieved the same level (Ritter, 2003).

One of the crucial features of the IPO market is that, once the issuing firm and its underwriter set an offer price and the number of shares that will be issued, any excess demand for the issue cannot be adjusted, and they are usually translated into a high price in the secondary market. Therefore, setting the right offer price against the investors' demand should reduce the IPO underpricing.

Typically, the standard explanation provided by theoretical models of mainstream IPO underpricing literature of the 1980s concerns the role of asymmetric information related to the value of firms' securities. We can make distinctions in the literature about asymmetric information, following the dichotomy between *Private information on demand-side vs. supply-side* and *Private information on supply-side vs. demand-side.* In the first category, investors are the informed part of the overall asset demand. The issuer has to face a placement problem since it deals with an unknown demand for its stock, where some investors are more informed than others. To avoid an unsuccessful issue, risk-averse firms underprice shares to allow investors to participate in the deal and compensate them for the informational rent (Rock, 1986; Welch, 1992; Benveniste and Spindt, 1989; Beatty and Ritter, 1996). In the second, the issuer is more informed than investors about the value of their shares. Therefore, investors can face a market lemons problem. To distinguish from the pool of low-quality issuers, high-quality ones may attempt to signal their quality by underpricing their shares as low-quality ones cannot bear the underpricing cost (Allen and Faulhaber, 1989; Grinblatt and Hwang, 1989; and Welch, 1989; Carter and Manaster, 1990; and Chemmanur and Fulghieri, 1994).

Theorists have focused on asymmetric information in the transaction between the issuer (or underwriter) vis-à-vis investors concerning the initial public offering's value. Instead, my contribution addresses the information transmission across geographically dispersed issuers that exchange information about what underwriter to hire, showing a first result about the matter of local information transmission in the IPO underpricing framework.

However, the present work also provides evidence on another strand of literature that focuses on investigating the role of geographic location and spatial proximity in the financial market. Generally, financial economists documented geographic frictions concerning the distance in defining the investor's portfolio choice. In particular, they show that investors tend to hold in their portfolio shares of nearby companies, i.e., the so-called "local bias," arguing that the proximity of financial operators from the firm headquarter allows an informational advantage due to better access to soft information about the firm (Coval and Moskowitz, 2001; Ivkovic and Weisbenner, 2005; and Bodnaruk, 2009). Others claim that investor preference towards local stocks is related to behavioral underpinnings, i.e., familiarity bias, the tendency to invest in stocks that are geographically and socially close to the investor (Huberman, 2001; Grinblatt and Keloharju, 2001b; Barber and Odean, 2005; and Massa and Simonov, 2006). Finally, a growing literature tries to establish the geographic location effect related to observational learning and social learning in the context of financial decisions, arguing that investors market participation and portfolio choice is related to a local peer effect (Hong, Kubik and Stein, 2008; Brown et al., 2004; and Pirinsky and Wang, 2006).

In the related literature above, studies concerning the relationship between the IPO underpricing and geographic dimensions are mainly based on the spatial distance between the issuer and major financial centers, where investors are assumed to be located. They argue that local bias reduces the underpricing due to the "superior local information" owned by investors geographically nearest to issuing firms. In these studies, proximity to financial agglomerations reduces the ex-ante uncertainty related to the initial public offering value, shooting up the offer price. Looking at IPOs in three leading European countries, namely France, Italy, and Germany, between 1996-2009, Acconcia, Del Monte, and Pennacchio (2011) employ geographic proximity between the firm's headquarters and the central domestic stock exchange as a proxy for the ex-ante uncertainty about the IPO's value by investors. They show a greater underpricing for firms distant from a domestic financial center. In a related vein, Huang, Liu, and Ma (2019) implement an analysis on IPOs in China from 2008 to 2012. They use the spatial distance between issuer headquarter and main metropolitan areas and show that issuing companies located at a significant distance perform a higher underpricing. Baschieri, Carosi, and Mengoli (2014) analyze a sample of Italian IPOs between 1999-2007 and employ a spatial dispersion index formulated by Johnson and Zimmer (1985) to measure how the IPO's geographic location, related to nearby most populated areas, is spatially isolated or clustered. They observe that IPOs nearer populated cities produce slightly more underpricing than those isolated. Whereas Nielsson and Wójcik (2016) analyze a sample of IPOs in the U.S. from 1986 to 2014. Defining firms in rural areas as those located 100 miles or more from most populated cities, they observe that rural ones experience a lower IPO underpricing than those in urban areas. They argue that companies located in rural areas are affected by the local bias due to nearby investors, who have less financial expertise.

By contrast, in this work, I argue that IPO performance is affected by public equity dispersion in space, representing a different source of geographic heterogeneity that involves spatial distances across issuers. Several pieces of evidence exhibit geographic dispersion regarding the spatial pattern of public equity companies' headquarters in domestic financial markets. Wòjicik (2009) documents that domestic stock markets have a higher spatial concentration of listed companies in urban areas than in rural areas. This evidence is called "Financial center bias" by the author. Second, Klagge and Martin (2005) argue that public equity concentration does not depend on the capital market's spatial organization, suggesting that the going public decision may not be affected by proximity to leading financial institutions. Third, Loughran and Schultz (2006) show that firms far away from financial centers are less likely to rely on external equity financing. They wait longer before going public and are less likely to conduct seasoned equity offerings. Thus, firms located in urban areas more likely to go public. These pieces of evidence highlight spatial heterogeneity in distances among public equity companies' headquarters. Hence, the present study exploits geographic distances across issuing firms to investigate the effect on the IPO underpricing due to information stemming from local networks across them. Thus far, to explain the underpricing, the related research has exploited the variability concerning the spatial proximity between the issuer and financial centers to account for local bias, neglecting spatial distances across issuing firms and hence the relevance of spillovers sourced by interactions across them. Whereas I support that the spatial proximity of an issuing firm relative to other issuers (or public equity companies) is a proxy for information transmission. Thus, I aim to measure the effect of social learning due to information externalities at the local level, which is provided by observing the behavior or interacting with their local peers.

Therefore, defining networks across issuing firms at the spatial level is crucial to define spatial interactions across issuers and to evaluate how they matter in decision-making processes about IPO performance. For such a purpose, I focus on geographic proximity between issuers that have adopted the same underwriter mainly for two reasons. First, from the sociology literature, "companies near one another with commonly related aims" (similar structure of opportunity) have greater possibilities to interact in geographic space (Soreson and Stuart, 2001). Further, managers who operate in the same location are more likely to establish networks and form worthy relationships with peers, influencing their investment and management practices (Gao et al., 2011; Kedia and Rajgopal, 2009; Chen et al., 2017). Second, the firm's choice about the investment bank for underwriting the primary issue is crucial for the IPO performance. Indeed, the underwriter carries out several essential functions: assessing the issuance's value and related risks, underwriting the issuer's shares, pricing the shares (i.e., set the offer price), and performing the marketing and placement. Thus, observing which underwriter has been chosen by their local peers may help to reduce the search cost, take advantage of its reputation in a local community, and fill the information gap.

The identifying assumption used in the present work is that proximity of other issuers might facilitate valuable information exchange for the financial advisors' decision-making process. Thus, issuing firms near one another are more likely to hire the same investment bank for the IPO since they should be involved in a local network. Therefore, I test if belonging to a local network makes a difference for the IPO underpricing.

Further, the spatial proximities to other issuers have substantial implications in the learning process because agents learn more from others who are nearer. Indeed, the social learning mechanism should characterize information transmission for those belonging to local networks, influencing the choice of the underwriter and, consequently, the offer price. Actually, according to the sociology literature, the probability of interaction among agents is due to homophily and propinquity factors in geographic space. Individuals near one another (propinquity), who have the same opportunity-based system (homophily), have more likelihood of interacting among them also tacitly. Thus, spatial heterogeneity in the firm's locations generates differences in social learning[3]. Issuers who are spatially close have more probability of mimicking than their isolated peers since they can transmit information through two channels: face-to-face interactions and observations.

According to the social learning mechanism based on pure information externalities, agents should care about the behavior of other agents if they reveal payoff relevant information (Gale, 1996). Therefore, I expect that IPOs involved in local networks perform a high offer price relative to the after-market price (i.e., low underpricing) because they should care about nearby peers' underwriters, whether they can get more significant IPO proceeds.

[3] Generally, the social learning occurs in any situation in which agents learn by observing the behavior or interacting with others (Gale, 1996).

On the other hand, information stemming from others can take over the own private one (i.e., herding behavior) in the IPO decision-making process of an issuer. Therefore, we can talk of herding behavior as a coordination mechanism based on observing others, which produces behavior patterns correlated across individuals (Dovenow and Welch, 1996). In this case, issuers that rely on local public information, who ignore their own information, are likely to incur a systematic mistake, leading them to choose underwriting banks that perform a lower offer price relative to the after-market price.

Since several underwriting banks work in the IPO market, we can observe multiple local networks established in the same area. However, the aim is to distinguish between issuing firms involved in a spatial network from those not involved. In such a way, to individuate who chose underwriters relying on local informational externalities and who rely on their own private information (or others source of information). To define if an issuer is involved in a local network, I use the spatial dispersion index (I-index) formulated by Johnson and Zimmer (1985) based on point-to-point distances. Because it allows us to obtain a specific value for each issuer, thus assessing how individually an issuer is geographically placed relative to its peers.

Moreover, the I-index has good statistical properties, and its expected value is equal to two under normal distribution, which can be attributed to the case of a homogeneous spatial arrangement of individuals belonging to the same cluster of peers in geographic space. Therefore, according to the I-index, issuers spatially clustered, who chose that specific underwriter, are involved in a local network because they rely on local information externalities. At the same time, those isolated from their peers chose a specific underwriter based on different sources of information. Thus, the distance across peers (issuers that chose the same underwriter) can be considered a measure of interaction (also tacit), which should capture the learning behavior at the spatial level. Consequently, the identification assumption about the regression of the I-index against the IPO underpricing concerns whether the choice of new issuers to localize near their peers is exogeneous. Therefore, if new firms localize near existing listed public equity companies (or issuers) to take informational advantage regarding the IPO, the I-index should be endogenously determined. However, since the potential going public decision should usually be ex-post the choice of where to localize its headquarter in the timing of a firm life-cycle, it should be reasonable to assume that the I-index could capture exogenous variations of spatial proximities across issuing firms. Of course, the I-index could be endogeneous determined if spatial networks are correlated to the geographic concentration of a specific industry, for example, as it usually occurs in the high-tech industry. Further, the I-index could be related to the local underwriting activity of a specific investment bank, which might deliver a market power structure.

Analyzing data on IPOs between 2011-2018 in the United States and the European continent, I provide evidence that geographic distances across issuing firms matter. Specifically, in the United States, the underpricing for issuers involved in a spatial network is 4,39 percentage points lower than those not involved in a spatial network. Companies that rely on local information externalities, which have adopted the same underwriters as nearby peers, gain higher proceeds in economic terms. According to social learning, the result for the U.S. suggests issuer learn from local information externalities produced by nearby peers, choosing the same underwriter that performs a higher offer price relative to the after-market price. In this case, an issuer should not be affected by any local information because it considers only the payoff relevant one.

In contrast, the underpricing for issuing firms in the European continent that chose the same underwriter as their local peers is 3,23 percentage points greater than those not belonging to a local network. In this case, social learning could generate behavioral convergence toward mistaken actions due to the local public information that overcomes the private one (i.e., herding behavior). Therefore, since firms care about negligible information, issuers observing others choose underwriters who perform a higher underpricing.

These results represent the first evidence regarding the effect of spatial distances across issuing companies (who chose that specific underwriter) on the IPO underpricing. However, even if I try to figure out the effect of information transmission due to social learning at the spatial level, other potential transmission mechanisms could characterize the results. First, firms involved in a local network may exploit it to choose the most relevant local underwriter to certificate their high value. Therefore, reducing the underpricing level for high-value companies (Chemmanur and Fulghieri, 1994). Further, the I-index could measure the local market power of the underwriter. The upstream[4] IPO market should be based on differentiated underwriting services, where some investment banks can detain a market power concentration. Therefore, at the local level, the underwriting industry could be best characterized as series of oligopolies, wherein local market power results in greater underpricing for issuers that are less focused on maximizing IPOs proceeds (Liu and Ritter, 2010).

Relative to the literature, the contribution is twofold. First, this is the first work to exploit spatial distances across issuing firms that adopt the same underwriter to account for the role of local networks in the IPO underpricing framework. Second, this study provides a comparison between

[4] the upstream IPO market concerns the competitive interaction among underwriters to get the mandate from issuers.

the United States and European continent IPO data for the first time, showing how firms in different countries, which behave in the same way, produce different outcomes in terms of underpricing.

The results point to non-negligible consequences in terms of IPO underpricing. For the U.S. sample, the mean underpricing is about 4 percentage points lower for firms that choose the same underwriter as nearby companies. This suggests that the issuer cares about other local peers' behavior when the information externalities are relevant, leading to correct actions, i.e., the underwriter that performs a lower offer price relative to the aftermarket price. In contrast, for the European continent sample, the average underpricing is about 3 percentage points higher for firms that choose underwriters as their local issuers in the European continent. Hence, the result suggests that individuals' private information should be surmounted by the local public information stemming from local networks, which leads to erroneous decisions, i.e., underwriters that perform a higher level of underpricing.

The remainder is laid out as follows. Chapter 1 discusses the IPO underpricing puzzle and the significance of spatial proximity in financial decisions. In particular, it presents several foundations regarding the IPO institutional framework and the literature related to the decision of going public. Evidence and theoretical pattern about the IPO underpricing puzzle and the interplay between the geographic dimensions and financial decisions are also discussed. Chapter 2 is devoted to the framework of analysis, and it discusses the general outlines and rationales of the research questions and methods, the role of local interactions across issuers, how to measure spatial proximity across issuing firms, descriptive statistics, and the main results related to the analysis of the impact of local interactions across issuers.

Chapter 1 - IPO underpricing

1.1 How and why going public

Going public is a process where a previously private unlisted company becomes a publicly traded and owned entity. Thus, it implies having shares of a firm on a stock exchange, which goes public via an initial public offering (IPO). The stock exchange serves two primary purposes: to raise new equity capital, which is usually regarded as the primary market, and enable trading of securities in the secondary market.

The shares sold at the IPO can be either newly created (primary shares) or existing shares (secondary shares). In the case of new shares, the proceeds from selling these to investors accrue to the issuing firm. Whereas the selling of existing shares, the proceeds accrue to the original shareholders. Usually, many IPOs consist of a combination of two kinds.

There are several steps involved in the going public process. Typically, the first step is making sure that the company can satisfy the regulations imposed by the stock exchange and regulatory authorities. It is important to note that going public involves two separate procedures. First, the searching for investors that are willing to buy shares. Second, the shares have to be admitted to the stock exchange, making it possible for investors to trade shares in the market.

In most countries, the sale and trading of securities about the going public's process are subject to careful regulation, that differs somewhat across countries, even if it typically involves the financial sector regulators, such as the Securities and Exchange Commission (SEC) in the U.S. or the Financial Services Authority in the United Kingdom. Usually, a public authority defines rules and regulations concerning firms' admission to the official market.

After deciding which exchange list on, the next stage concerns the design of the initial prospectus. This stage typically involves several intermediaries such as auditors, lawyers, and investment banks. The initial prospectus production starts with the information-gathering phase, during which the underwriter works closely with the prospective issuing firm to perform due diligence and produce the required information to satisfy the appropriate regulatory constraints. One of the most critical decisions in the offering is the issue price. During the information-gathering phase, the underwriter analysts form some initial forecasts as prospective market values about the issuer. Generally, they produce a research report, representing a briefing document for investors to introduce the company before the preliminary prospectus is produced. Usually, the briefing document is distributed to investors during a "pre-marketing period" over which institutional investors often are invited to submit feedback to the underwriter. Finally, the information-gathering phase ends with the initial prospectus publication, which usually includes an initial price range[5] for the shares. This range is based on the valuations produced by investment bank analysts and feedbacks from the pre-marketing. Only when the final price for the issue is fixed, the official prospectus is produced.

The next step to the prospectus publication is the marketing stage, during which the issue is marketed to investors. This stage can take a variety of forms. Typically, underwriters encourage their companies to undertake "roadshows," which consist of senior managers made presentations in several locations, usually those with a high concentration of institutional investors. Contrary to

[5] The range that gives indications about the possible offer price.

shared beliefs, roadshows may represent a way for an investment banker to gather information from investors about their views of the company and its valuation. Since issuers usually are not allowed to disclose any information not contained in the preliminary prospectus when meeting potential investors. Thus, the marketing phase generates additional information regarding potential investors' intentions, valuable for the pricing and allocation phase.

As discussed above, the initial public offering is a complex process consisting of several stages supported by the underwriting bank. When a company decides to go public through an initial public offering, before it starts selecting the stock exchange, it has to select an investment bank, which provides services about the advising and the underwriting of shares. An investment bank's selection process is usually based on its general reputation, research coverage in its specific industry, and distributional expertise. This last is related to investors kind (retail or institutional) with whom investment bank usually deals. In some cases, past relations between the investment bank and the issuing firm may influence the choice outcome. However, the selection of an investment bank is a two-way process, whereby the bank chooses its client as carefully as the company should choose the investment bank for underwriting the issuance.

The most common type of underwriting arrangement is "firm commitment." In this case, the underwriter purchases the entire issuance of securities from the issuer and then attempts to resell the securities to the public of investors. The underwriter's fee for the IPO is commonly called gross spread, which consists of the difference between the price at which the bank buys and subsequently sells the issue.

The public offering may be managed by one underwriter or by multiple managers. When there are multiple managers, an investment bank is chosen as lead underwriter (or book-runner). The lead makes all arrangements with the issuer and establishes the issuance plan, and it is primarily responsible for the due diligence phase, pricing, and placement of the stock.

The lead underwriter is also responsible for forming a team of underwriters, the so-called underwriting syndicate, to assist in selling shares to the public. Once the security issue is brought to the market, the underwriter has to perform some additional functions. These include stabilizing the after-market price, providing analyst recommendations, and making demand and supply for shares in the stock exchange.

Why firms go or do not go public is perhaps one of the most critical questions related to the IPO framework. In most cases, the typical answer is to raise equity capital for future investments or the desire to create a public equity market in which founders and other shareholders can convert some of their wealth into cash at a future date. However, firms' possible purposes of going public and whether those purposes can be achieved by other tools such as private equity or debt are still questioned.

The first strand of the formal theory argues that going public facilitates the firm acquisition, helping shareholders get a higher value for their companies than what they get from an outright sale (Zingales, 1995). Brau and Fawcett (2006), using a survey on 336 IPOs, find that the primary reason to go public is to issue public shares for using them in future acquisitions. Second, market-timing is a relevant determinant of the decision to go public. Lucas and McDonald (1990) develop a model of asymmetric information where firms delay their going public process if their value is currently undervalued by the market, given their knowledge. In Choe, Masulis, and Nanda (1993), firms prevent their issue during a period characterized by a few other good-quality companies' issues. Lowry (2003) observes that many companies go public during periods of higher investor sentiment (market sentiment), which overvalues their true worth. Third, according to Pagano, Panetta, and Zingales (1998), going public is related to ex-ante firm characteristics. They explore IPOs in Italy and found that larger companies with a high industry market-to-book ratio[6] are more likely to go public and that companies going public after significant investment activity and periods of abnormal growth to achieve a balanced budget. Fourth, according to Bodnaruk et al. (2008), going public is related to owners' diversification. They find that private firms hold by less diversified individual shareholders are more likely to go public, selling a substantial portion of their shares at the time of the IPO or soon afterward. Furthermore, being a public firm is a certification practice, which reduces the uncertainty related to the company. The process for going public requires significant transparency and biding constraints, which increase the confidence of suppliers and consumers about its value and well-being (Lowry, Michaely e Volkova, 2019)

[6] The industry market-to-book is a measure that compares the book value to its market value for a particular industry.

1.2 Underpricing puzzle

A. *Some evidence*

When companies decide to go public, the price of equity they sell at initial public offering tends to increase on the first day of trading, resulting in a substantial price discount that is commonly called underpricing—the most widespread explanation about underpricing concerns the asymmetric information of the issuing firm's value. To attract sufficient interest to the IPO, the issuer must leave enough "money on the table" to compensate investors. Thus, asymmetric information reflects as an indirect cost of raising equity finance. Historically, the underpricing is more severe in the United States, which averaged more than 20% in the 1990s, while it began to be relevant in the European continent in the same period.

The initial public offering is one of the corporate transactions[7] that have received significant attention, as this generally represents the first time that firm-specific information will be made available to the public. Consistent with any financial regulatory body, any company undertaking an IPO must disclose several details about the future uses of the capital raised from the IPO and its accounting information. This information makes it possible for potential investors to carefully evaluate the prospect of taking an equity position at the IPO time. IPO research has always been interested in investigating the factors that affect IPO performance, which may help potential investors evaluate IPO investment opportunities. IPO performance can be measured in several ways. The dominant performance indicator found in IPO literature is underpricing. The IPO

[7] Corporate transactions are financial actions that affect the resources of a company. These can be within the business or business-to-business transactions, business-to-consumer transactions or business-to-government transactions. Every time a company agrees to take some action - such as make a payment in exchange for anything of value - it creates a legal contract. Therefore, organizational transactions are also contracts.

underpricing, also called first-day return, consists of the percentage difference between the price at which shares are sold to investors during the initial public offering and the price at which shares are subsequently traded in the market. Underpricing is a common occurrence for firms undertaking an IPO. Stoll and Curley (1970), Lounge 1973, and Ibbotson (1975) are the first ones to document a systematic increase of the closing price on the listing date from the offer price defined at the issue date. They reported an average positive performance of around 16% during the 1960s.

One of the most comprehensive IPO reviews provided by Ritter and Welch (2002) documents an average first-day return[8] of about 18% related to 6249 IPOs in the U.S. during the period between 1980-2001. However, underpricing represents a relevant burden to a firm's owners, as shares sold for a personal account are sold at a lower price, whereas the value of shares retained afterward the IPO is diluted. The company seems to leave lots of money "on the table[9]" for investors.

One of the crucial features of the IPO market is that, once the issuing firm and its underwriter set an offer price, any excess demand for the issue cannot be adjusted, and usually, they should be translated into a high price in the secondary market. Therefore, setting the right offer price relative to the investors' demand can reduce the underpricing

Table 1 shows that the first-day return is remarkable in the U.S. during the last four decades. Underpricing has tended to fluctuate a great deal, averaging 6% in the 1980s, 13% in 1990-1998, 52% in 1999-2000 (internet bubble), and 14% in 2001-2019.

[8] The first-day return (or initial return) is a synonym for the IPO underpricing.
[9] The amount of money left on the table is defined as the closing market price on the first-day of trading minus the offer price, multiplied by the shares offered.

The United States arguably has the most active IPO market worldwide due to companies going public and the aggregate amount of capital raised. Historically, continental Europe's IPO markets have been overcome by the U.S. IPO market. Although the high volume of IPOs in the U.S. during 2000, continental European IPO volume exceeded that of the U.S. for the first time in that period (Ritter, 2003). Table 2 lists the average first-day returns for 20 countries in the European continent. The number reported is from scores of studies by different authors.

Notwithstanding several slight differences in financial requirements between European and U.S. stocks exchange, several papers have documented the decline of fixed-price[10] mechanisms and auctions for selling IPOs in Europe (Biais and Faugeron, 2002; Sherman, 2005; and Ljungqvist, Jenkinson and Willam, 2003). The growth of book-building[11] during the 1990s, which is the primary practice of pricing and allocation of shares used for IPOs in the U.S. Furthermore, in the same period Newmarket for IPOs of growth firms[12] were established in Europe in order to develop stock markets, as the Neuer Markt in Germany, The Nuovo Mercato in Italy, The Nieuwe Markt in the Netherlands, and the Nouveau Marchè in France. This change in stock market organization was not the first time that markets for young growth companies were realized. For instance, Nasdaq started in 1971, whereas London's Unlisted Securities Market (USM) started in the 1980s, but it was replaced by the London Stock Exchange's Alternative Investments Market (AIM) in 1995.

[10] Under fixed price, the company going public determines a fixed price at which its shares are offered to investors. The investors know the share price before the company goes public.
[11] The book-building is the IPO procedure that have dominated the IPO market in the last few decades both in US and the Europe continent, which provides a price's range into the initial prospectus as described in the previous paragraph.
[12] A growth company is one in which its business generates positive cash flows or earnings faster than the overall economy. Growth companies typically reinvest their earnings back into the company as opposed to paying out dividends to continue spurring growth.

Table 1: Mean First-day Returns and Money Left on the Table, 1980-2020

The sample is IPOs with an offer price of at least $5.00, excluding ADRs, unit offers, closed-end funds, REITs, natural resource limited partnerships, small best efforts offers, banks and S&Ls, and stocks not listed on CRSP (CRSP includes Amex, NYSE, and NASDAQ stocks). Proceeds exclude overallotment options, but include the global offering size. The amount of money left on the table is defined as the closing market price on the first-day of trading minus the offer price, multiplied by the shares offered.

		Mean First day Return		Aggregate	Aggregate
Year	**No. of IPOs**	**Equal-weighted**	**Proceeds-weighted**	**Amount Left on the table**	**Proceeds**
1980	71	14.3%	20.0%	$0.18 billion	$0.91 billion
1981	192	5.9%	5.7%	$0.13 billion	$2.31 billion
1982	77	11.0%	13.3%	$0.13 billion	$1.00 billion
1983	451	9.9%	9.4%	$0.84 billion	$8.89 billion
1984	171	3.7%	2.5%	$0.05 billion	$2.02 billion
1985	186	6.4%	5.6%	$0.23 billion	$4.09 billion
1986	393	6.1%	5.1%	$0.68 billion	$13.40 billion
1987	285	5.6%	5.7%	$0.66 billion	$11.68 billion
1988	105	5.5%	3.4%	$0.13 billion	$3.88 billion
1989	116	8.0%	4.7%	$0.27 billion	$5.81 billion
1990	110	10.8%	8.1%	$0.34 billion	$4.27 billion
1991	286	11.9%	9.7%	$1.50 billion	$15.39 billion
1992	412	10.3%	8.0%	$1.82 billion	$22.69 billion
1993	510	12.7%	11.2%	$3.52 billion	$31.44 billion
1994	402	9.6%	8.3%	$1.43 billion	$17.18 billion
1995	462	21.4%	17.5%	$4.90 billion	$27.95 billion
1996	677	17.2%	16.1%	$6.76 billion	$42.05 billion
1997	474	14.0%	14.4%	$4.56 billion	$31.76 billion
1998	281	21.9%	15.6%	$5.25 billion	$33.65 billion
1999	476	71.2%	57.4%	$37.11 billion	$64.67 billion
2000	380	56.3%	45.8%	$29.68 billion	$64.80 billion
2001	80	14.0%	8.4%	$2.97 billion	$35.29 billion
2002	66	9.1%	5.1%	$1.13 billion	$22.03 billion
2003	63	11.7%	10.4%	$1.00 billion	$9.54 billion
2004	173	12.3%	12.4%	$3.86 billion	$31.19 billion
2005	159	10.3%	9.3%	$2.64 billion	$28.23 billion
2006	157	12.1%	13.0%	$3.95 billion	$30.48 billion
2007	159	14.0%	13.9%	$4.95 billion	$35.66 billion
2008	21	5.7%	24.7%	$5.63 billion	$22.76 billion
2009	41	9.8%	11.1%	$1.46 billion	$13.17 billion
2010	91	9.4%	6.2%	$1.84 billion	$29.82 billion
2011	81	13.9%	13.0%	$3.51 billion	$26.97 billion
2012	93	17.7%	8.9%	$2.75 billion	$31.11 billion
2013	158	20.9%	19.0%	$7.89 billion	$41.56 billion
2014	206	15.5%	12.8%	$5.40 billion	$42.20 billion
2015	118	19.2%	18.9%	$4.16 billion	$22.00 billion
2016	75	14.5%	14.2%	$1.77 billion	$12.52 billion
2017	106	12.9%	16.0%	$3.68 billion	$22.98 billion

2018	134	18.6%	19.1%	$6.39 billion	$33.47 billion
2019	112	23.5%	17.7%	$6.93 billion	$39.18 billion
2020	165	41.6%	47.9%	$29.66 billion	$61.86 billion
1980-1989	2,047	7.2%	6.1%	$3.30 billion	$53.99 billion
1990-1998	3,614	14.8%	13.3%	$30.07 billion	$222.38 billion
1999-2000	856	64.6%	51.6%	$66.79 billion	$129.47 billion
2001-2020	2,258	16.7%	17.2%	$101.57 billion	$592.02 billion
1980-2020	**8,775**	**18.4%**	**20.1%**	**$201.73 billion**	**$1,001.86billion**

Source: https://site.warrington.ufl.edu/ritter/

Table 2: Equally weighted average initial returns for 54 countries

Average initial returns are constructed in different manners from study to study. In general, in countries where market prices are available immediately after offerings, the one-day raw return is reported. In countries where there is a delay before unconstrained market prices are reported, market-adjusted returns over an interval of several weeks are reported. All of the averages weight each IPO equally.

Country	Source	Sample-Size	Time-period	Avg. Intial-return
Austria	Aussenegg; Dealogic	106	1971-2018	6.2%
Belgium	Rogiers, Manigart & Ooghe; Manigart DuMortier; Dealogic	154	1984-2017	11.0%
Bulgaria	Nikolov	9	2004-2007	36.5%
Cyprus	Gounopoulos, Nounis, and Stylianides; Chandriotis	73	1997-2012	20.3%
Denmark	Jakobsen & Sorensen; Ritter	173	1984-2017	7.4%
Finland	Keloharju; Dealogic	209	1971-2018	14.2%
France	Husson & Jacquillat; Leleux & Muzyka; Paliard & Belletante; Derrien & Womack; Chahine; Ritter; Vismara; Dealogic	834	1983-2017	9.7%
Germany	Ljungqvist; Rocholl;Vismara; Dealogic	779	1978-2014	23.0%
Greece	Nounis, Kazantzis & Thomas; Thomadakis, Gounopoulos & Nounis	373	1976-2013	50.8%
Ireland	Dealogic	38	1991-2013	21.6%
Italy	Arosio, Giudici & Paleari;	413	1985-2018	13.1%

	Cassia, Paleari & Redondi; Vismara; Dealogic			
Netherlands	Wessels; Eijgenhuijsen & Buijs; Jenkinson, Ljungqvist, & Wilhelm; Ritter	212	1983-2017	13.3%
Norway	Emilsen, Pedersen & Saettem; Liden; Dealogic; Fjesme	266	1984-2018	6.7%
Poland	Jelic & Briston; Woloszyn; Sieradzki	350	1991-2019	11.7%
Portugal	Almeida & Duque; Dealogic	33	1992-2017	11.5%
Russia	Dealogic	64	1999-2013	3.3%
Spain	Ansotegui & Fabregat; Alvarez Otera;	199	1986-2018	9.2%
Sweden	Rydqvist; Schuster; de Ridder	405	1980-2015	25.9%
Switzerland	Kunz, Drobetz, Kammermann & Walchli;	164	1983-2018	25.2%
United Kingdom	Dimson; Vismara; Levis; Doukas & Hoque	5,185	1959-2016	15.8%

Source: https://site.warrington.ufl.edu/ritter/files/Int.pdf

B. *Patterns in IPO underpricing*

Typically, reviews about IPO underpricing classify theories based on whether the information between issuer, underwriter, and investors is assumed to be asymmetric or not. Whereas the present work also considers the role played by the underwriter and its implications on the IPO underpricing. This further classification criterion is motivated by the underwriter's institutional role covered during the entire IPO process. As the previous paragraph argues, the investment bank is selected to manage the initial public offering, and it must engage in three main functions: advising, underwriting, and placement, which affect the final IPO outcome. Therefore, theories are classified based on two criteria. First, considering the asymmetric information, we can distinguish between Private information on the demand side versus the supply side and vice-versa. Second, considering the underwriter's role, whether it covers an active or passive role within models for underpricing.

Private information on demand-side vs. supply-side

Theories with private information on the demand side, investors can get information about the overall asset demand. Therefore, the issuer has to face a problem of placement since it deals with an unknown demand for its stock. In this category, we can distinguish between those in which underwriters who have a passive role as the "winner's curse[13]" (Rock, 1986) and the "informational cascade" (Welch, 1992), and those in which underwriters have an active role as the information Revelation theory (Benveniste and Spindt. 1989) and the ex-ante uncertainty (Beatty and Ritter, 1996).

Rock (1986) assumes that information asymmetry occurs due to an unknown demand of the issuer's shares characterized by two types of investors: informed investors and uninformed ones. The first group consists of investors with financial expertise and better knowledge about the issuing firm's value. Hence, these will make purchase orders only if the offer price is lower than the true value of the IPO, namely those more attractive. The second group consists of uninformed investors with scarce financial skills and lack special knowledge about issuing firm value. Therefore, they participate indiscriminately in each offering, even those not particularly attractive. Uninformed ones may incur the winner's curse problem because they likely win bad offerings, those with an offer price higher than their real value. Accordingly, informed investors would bid for more successful firms, leaving uninformed investors with a disproportionate number of unsuccessful IPOs. If that is the case, the uninformed will want to exit from the

[13] In economics, the winner's curse occur when the winner of an auction is a bidder with the most optimistic evaluation of the asset, paying it more than its actual value

market, leaving the informed investors alone. In Rock's model, the participation of the uninformed one at the offering is considered necessary since the informed investors' demand is not sufficient to fill all the shares issued, even if the issue is attractive. Since the issuers are risk-averse, they prefer to discount the value of their shares to attract uninformed investors, compensating them for their possible losses. However, this does not remove the allocation bias against the uninformed, since they will be crowed out by informed ones in the most underpriced offerings, but they will not expect to make losses on average, even after adjusting for rationing. Implicit in the winner's curse model is the proposition of "null initial abnormal return" on average for the uninformed investors. Indeed, Koh and Walter (1989) documented the primary empirical evidence, which uses information about the shares rationing in the IPO, showing that investors balance their losses (null return) on average in Singapore.

In the information cascades hypothesis, Welch (1992) assumes that investors hold perfectly accurate information about the issuing firm in aggregate. In any case, information regarding the value of the issuing firm is highly uncertain for investors. The Information cascades hypothesis provides that potential investors rely their investment decisions not only on their own private information about the offering, but also on information stemming from purchase orders of investors who preceded them. Therefore, later investors take into account the actions of their predecessors as a signal of what information they hold. Thus, they will emulate the purchasing decisions of the previous ones, implying a "cascade" whereby new investors do not care about if their private information. Welch's model predicts offering can be successful or falling rapidly, the investors' demand of shares is so elastic that also risk-neutral issuers convey to discount their shares to avoid an unsuccessful issue. Amihud, Hauser, and Kirsh (2003) provided empirical evidence supporting the information cascades hypothesis, who found that frequently IPOs tend to be undersubscribed or vastly oversubscribed, with only a few cases in which offerings overpriced moderately.

In the theory of the "information revelation" (book-building[14] literature), Benveniste and Spindt (1989) suggest that the common practice of "book-building" can help the Investment bank to get information from better informed investors, who are typically the institutional ones. It is assumed that institutional investors may know more than the issuer about the prospect for the company's competitor or the economy as a whole. Since the assumed pricing mechanism is the book-building process, the underwriter may solicit "indications of interest" from potential investors after setting the preliminary offer price range. Through book-building, underwriting banks can extract information about the issuer's value from investors. However, to incentivize investors to disclose their information, the underwriter discounts the share price and offsets them by allocating discounted shares. Thus, an investment bank may select a high offer price, which exceeds the initial offer price range's upper bound, when information is positive (strong demand) Furthermore, underwriters and investors may interact through several new IPOs. These repeated interactions allow the investment bank to threaten investors because it can exclude them from participating in future issues, disincentivizing investors to lie about their information. Nevertheless, the dynamic version of the information revelation theory implies that the underwriter should incentivize habitual investors instead of occasional issuers, given that banks'

[14] This theory is based on the book-building process, the mechanism by which an underwriter builds a book of potential investors and the prices and number of shares they are willing to purchase. The book-building process is intended for the underwriter to assess demand and obtain information from potential buyers about what price buyers are willing to pay.

underwriting activity depends more on future cooperation with formers than on pricing any given IPO fully.

The most cited evidence that supports book-building theories regards the offer price revision, which may occur during the filling period (between the publication of the informative prospect and the initial offering). Hanley (1993) shows that the underwriter does not adjust the price upward to keep the underpricing constant when the demand is strong. Instead, he observed a tremendous underpricing when the price is revisited upwards (overcome the initial offer price range's upper bound). The author contends this extra underpricing as an informational rent needed to induce the investors to reveal their high-demand information.

Another strand of literature documents the relationship between the underpricing and "ex-ante uncertainty," whereby asymmetric information is related to investors. It stems from an empirical implication provided by Ritter (1984) and formalized by Beatty and Ritter (1986). In this case, the underpricing should increase due to the ex-ante uncertainty surrounding an issue. It is considered a strand whereby the underwriter plays an active role as its reputation may reduce the ex-ante uncertainty. Beatty and Ritter provide an insightful result. Investors engaged in information production implicitly invest in a call option on the IPO, which they will exercise if the "true" price goes beyond the strike price, namely the price at which the shares are sold during the primary market. The value of this option increases to the extent that evaluated uncertainty increases so that more investors will become informed. Thus, more informed ones raise the required underpricing since an increase in the number of informed traders aggravates the winner's curse problem. The theoretical framework of underpricing ex-ante uncertainty has been translated into lots of empirical models by several academics, aiming to find proxies for the ex-ante uncertainty. We may cluster these into five groups, which consist of features about the issuer: issuing, informative prospect, underwriter certifications, and variables concerning the after-market.

Private information on supply-side vs. demand-side

Another strand of theoretical IPO underpricing literature regarding private information on the supply side versus the demand side, the issuer is more informed than investors about the value of their shares. Therefore, investors face a market lemons problem because bad quality issuers are willing to sell their shares when the average market value goes beyond theirs. To distinguish themselves from the pool of low-quality issuers, high-quality ones may attempt to signal their quality by underpricing their shares. Theories concerning this strand of literature are Signalling theories (Allen and Faulhaber, 1989; Grinblatt and, Hwang 1989; and Welch, 1989), in which underwriters have a passive role, and theories based on the underwriter reputation (Carter and Manaster, 1990; and Chemmanur and Fulghieri, 1994), in which underwriters play an active role.

In Signalling theories, scholars assume that firms are more informed about their future cash flows than investors and the underwriter. This last does not cover an explicit role in this class of model. In this framework, the underpricing is used as a tool by better quality issuers to deter lower quality issuers from imitating. Another implicit assumption is related to equity ownership that is transferred to new shareholders by older ones. Under this assumption, early shareholders' purpose is to maximize proceeds in two steps: a fraction sold at the issue date and the remainder in the open market. Signaling real value is profitable to high-value companies as it allows a higher price to take place in the secondary market if separation from low-quality issuers is feasible. Therefore, high-value firms face a trade-off between costly signaling and higher future proceeds. The three pioneering IPO signaling models are Allen and Faulhaber (1989), Grinblatt and Hwang (1989), and Welch (1989). Among these, Grinblatt and Hwang's study is more comprehensive. Here, investors are uncertain about the present value of the firms' future cash flows and their variance. Therefore, risk-averse entrepreneurs employ two signals: their retention rate and the level of underpricing. Hence, owners who retain a broad fraction of shares reveal their knowledge about the high future cash flow.

The signaling models generate a rich set of empirical implications concerning the relationship between underpricing and the probability, size, speed, and announcement effect of subsequent equity sales. Welch (1989) documents in favor of signaling theory that about a quarter of U.S. flotations from 1977 to 1982 within three years of going public, raising significant amounts of money relative to their IPO proceeds. Michaely and Shaw (1994) reject signaling, and they find no evidence of both a higher propensity to return to the market for a seasoned offering[15] (SEO) and a higher propensity to pay dividends for IPOs that were more under-priced.

One of the most completed studies in the underwriter reputation theory regards Chemmanur and Fulghieri (1994). They assume that issuers held their private information, who know their type (high or low). The underwriter as investors cannot distinguish among issuing firms, but it can evaluate the issuer. Indeed, its function is to produce information that it reports to investors. Since these last cannot observe the underwriter's resources and effort during its investigation phase about issuing firm, they rely on past issues performance to measure underwriter credibility.

[15] A seasoned offering or secondary equity offering (SEO) or capital increase is a new equity issued by an already publicly traded company. Seasoned offerings may involve shares sold by existing shareholders (non-dilutive), new shares (dilutive) or both.

Therefore, the investment bank faces a dynamic trade-off since imposing a binding evaluation is costly in the short term, as it will underwrite only a small fraction of issuing firms going public. It is profitable in the long run, as the underwriter less likely underwrites bad quality issuers, and its reputation will not be damaged. This theory has several implications. First, the greater the underwriter's reputation, the lower the asymmetric information in the IPO market. Second, reputable underwriters deal with many underwriting contracts of valuable issuers. Since high-value firms are those most affected by adverse selection, they will be incentivized to exploit the underwriter's reputation to signal their own value.

In the asymmetric information framework from the supply side, it is essential to mention a further model that considers the asymmetric information between the issuer and the underwriter. This theory focuses on potential agency problems between these two. Banks may be assumed to be better informed about investor demand than issuers. Therefore, underwriters have to face a trade-off, whereby the underpricing reduces both the risk of failing to place stock and their unobservable effort costs in marketing and distributing an issue. On the other hand, since underwriting fees are typically proportional to gross proceeds and thus inversely related to underpricing, investment banks may be incentivized to minimize underpricing. Baron and Holmström (1980) and Baron (1982) construct a screening model that focuses on the underwriter's benefit from underpricing. In this framework, the issuer offers a schedule of contracts on which the investment bank self-selects a combination of IPO price and gross spread, given information. To induce optimal use of the underwriter's superior information about investor demand, the issuer delegates to the bank the pricing decision. If the demand is low, he selects a high underwriting fee and a low price, and vice versa if the demand is high. This schedule optimizes the underwriter's unobservable selling effort by making it dependent on market demand. To test the principal-agent model of Baron, it is possible to investigate the underpricing experienced when the underwriter has an equity stake in the company. In this vein, Murscella and Vetsuypens (1989) find that when underwriters themselves go public, their shares are just as underpriced even though there is no monitoring problem. This evidence does not favor the Baron's model, although it does not refute it either.

Underpricing and the non-competitive IPO market

The mainstream literature of the 1980s interested in the underpricing puzzle has focused its attention on asymmetric information. Instead, another research line considers the competitiveness of the underwriting market, i.e., underwriters' strategic interaction, and challenges the assumption about the perfect competition in the IPO market. This literature contends the underpricing and other stylized facts, as the underwriting fees clustered at 7%. This latter was documented by Chen and Ritter (2002), which show that underwriting spreads for medium-size IPOs clustered at precisely 7% [16] , and the clustering becomes more severe over time, arguing likely collusion in the underwriting market. This work raises lots of questions about the status of competition in the IPO market. Subsequently, Torstila (2003) and Hansen (2001) question the conclusion that clustering at 7% does not necessarily reflect collusion. Torstila finds several spread clusters in many IPO markets worldwide and that many countries have more significant clustering than the U.S., even if he notes that the level at which most other countries' spreads cluster is lower than that in the United States. Hansen (2001) sustains that clustering at 7% represents efficient

[16] Their work inspired a class-action lawsuit against 27 banks accused of collusion.

contracting, so an equilibrium competition among underwriters into the IPO market rather than implicit collusion. Moreover, the author tests if lead banks earn abnormal profits from 7% IPO through underpricing and observes that market structure indexes do not affect underpricing.

In sum, most of the IPO literature supports the assumption about the perfect competition into the underwriting market. The concentration of spreads at 7% and the large underpricing seem at odds with a competitive market, yet a relevant number of underwriters is strongly inconsistent with a monopolistic industry. Hoberg (2007) and Liu and Ritter (2011) suggest reasons for these apparent contradictions.

Hoberg (2007) holds that underpricing are due to persistent specific factor for each underwriter, which is called "underwriter persistence phenomenon" and is related to investment bank quality. Thus, actual underpricing is driven by some underwriters, which performed high underpricing in the past. Hoberg found that the past abnormal initial returns (or past underpricing), a proxy for informed underwriter (or high quality), is one of the most significant predictors of the actual initial returns as some underwriters tend persistently to underprice stocks. Moreover, price revision is positively related to past abnormal initial returns. Thus, high-quality underwriters attract valuable issuers. Furthermore, high-quality underwriters characterized by past abnormal initial returns increase their market shares. Thus, if all underwriters in the market have the same quality, the competition vanishes abnormal return persistence.

Liu and Ritter (2011) develop a theory of IPO underpricing based on differentiated underwriting services, for which competition is localized in the upstream IPO market[17]. Based on their

[17] the upstream IPO market concerns the competitive interaction among underwriters to get the IPO mandate from issuers.

intuition, the underwriting industry is characterized as a series of local oligopolies due to issuers' preference for non-price dimensions related to differentiated services that only a limited number of underwriters can provide. Therefore, investment banks can earn some extra-rent due to market power, which is translated into larger underpricing. This last is profitable for the underwriter through two practices: soft-dollar commission and spinning (Loughran and Ritter, 2002, 2004). Liu and Ritter focused their attention on analyst coverage non-price dimension. They conclude that it positively affects Initial return. Furthermore, they construct a Herfindahl index for the specific underwriter based on the size of IPOs underwritten, the reputation, and the underwriting expertise industry. They show a positive relationship between underpricing and local oligopolies.

1.3 Geographic dimensions and financial decisions

Financial economists document several frictions associated with the role of the firm's location and proximity from other agents in stock markets. In particular, great attention was paid towards the geographic proximity between companies and potential investors in defining the investor's portfolio choice. Consistent evidence claims that investors tend to hold shares of nearby companies in their portfolios. This phenomenon is commonly called local bias. The standard explanation is that the proximity of financial operators to the firm headquarter allows an informational advantage due to easier access to soft information[18] related to the firm. Coval and Moskowitz (2001) analyze the distance from mutual funds' headquarters to stock companies they hold in their portfolio. They find that U.S mutual fund managers are biased towards nearby companies. Since geography proximity is inversely related to the cost of collecting information as investors may improve monitoring and get private information about nearby firms. Ivnkovic and Weisbenner (2005) examine households' stock investment in the continental United States from 1991 to 1996. They found that individual investors exhibit local bias more considerably than the U.S. mutual funds managers do. Proving remarkably evidence about superior local information[19], comparing investors' local investments with their relative non-local investments. This evidence is robust among the non-S&P 500 stocks, which are less widely known and

[18] Stein (2002) uses the term soft to describe the type of information that cannot be directly verified by anyone other than the agent who produces it. Gertler (2003) uses the therm tacit for knowledge that cannot be created successfully through exchange of information at distance, but necessitates frequent face-to-face contact. Agnes (2000) found that the financial industry requires face-to-face interaction (conferences, site visits, dinners and informal meetings, etc.) obviously facilitated by spatial proximity.

[19] the access of local investors to tacit, non-standardized information about issuers.

therefore more likely hit by asymmetric information. Another possible explanation for investor preference towards local stocks may be related to behavioral underpinnings, i.e., familiarity bias, the tendency to invest in stocks that are geographically and socially close to the investor or held for an extended period. Huberman (2001) documents that investors prefer holding local stocks in their domestic portfolio. Examining investors' portfolios in the U.S. in late 1996, he finds that investors, who are costumers of regional operating companies[20], more likely invest in local phone companies that provide their services than far away phone companies. Grinblatt and Keloharju (2001b) show supporting evidence from Finland, in which investors prefer to hold stocks about firms near where they live, which have managers that communicate in their same native language and have the same cultural background. They claim that local bias is strong for investors who live outside Helsinki in communities where social ties are easier to form. Massa and Simonov (2006) observe a portfolio holding of Swedish investors and show that investors tend to invest in stocks that are more professionally close or concerning nearby companies. They claim that investors earn higher returns owing to the informational advantage obtained through familiarity. Barber and Odean (2005) study stocks in the U.S. and observe that investors cannot consider all securities in their investment decisions. They argue that investors tend to invest among stocks that have attracted their attention, as companies advertised by the local news.

Geographic proximity also plays an essential role in the context of equity analysis. Malloy (2005) argues that financial analysts near firms' headquarters have an information advantage over other analysts; therefore, they produce more accurate earnings forecasts. These last significantly impact the securities price of firms located in small cities and remote areas.

[20] Also known as an RBOC, concerning local telephone companies that were created in 1984 as part of the breakup of AT&T.

Local bias could interfere with firm financing decisions as well. Loughran and Schultz (2006) observe the financing decisions of rural and urban firms. Rural firms are defined as those located far away from any more populated[21] metropolitan areas relative to urban firms. They demonstrate that rural firms with few expectations go public or increase their capital through a seasoned equity offering. In particular, they wait longer before going public, as first, they want to reduce asymmetric information that characterizes them. When rural companies do equity issuance, there is less competition to underwrite the offering. Therefore, a less prestigious underwriter may often be accessible to rural firms. Consistent with this view, Loughran and Schultz (2005) and Malloy (2005) document that investment bankers provide lesser analyst coverage for rural firms than urban companies.

A growing literature tries to establish the impact of social learning in the financial decision and geographic dimensions framework. Ellison and Fudenberg (1995) say: "economic agents must often make decisions without knowing the costs and benefits of possible choices," and thus often "rely on whatever information they obtain via casual word-of-mouth." Hong, Kubik, and Stein (2008) support this view, documenting a local "word-of-mouth" effect in money managers' trades. Furthermore, Hong, Kubik, and Stein (2004), using data from the Health and Retirement study, find that sociable individuals, those who interact with neighbors or attend church, are more likely to invest more in the stock market than less sociable individuals. Brown et al. (2008) provide evidence of causal community effect in the context of stock market participation in the U.S. Their results suggest that a higher fraction of stock market investors in the community may have a multiplier effect, making it more probable that other individuals will also begin

[21] Centres of any metropolitan area of 1,000,000 or more people.

participating. Pirinsky and Wang (2006) find strong evidence of the degree of co-movement in stocks' returns from the same geographic area. They do not support economic fundamentals and local economic activity explanations. They suggest that price formation in equity markets has a significant geographic component associated with local investors' decision investments. On the other hand, Bernile et al. (2015) demonstrate that local economic conditions may affect liquidity, as the deteriorating local economy can make local investors more risk-averse and more pessimistic, which lowers liquidity stocks owing to fewer investments.

Local interactions across peers over a geographic space affect corporate decisions. Managers learn by observing the actions and performance of their peers. Thus, companies are likely to engage in herding behaviors[22], resulting in management practices and financing and investment decisions (Hirshleifer and Siew 2009). Therefore, the firm geographic location has relevance because it may simplify interactions through face-to-face transmissions and observational learning. A strand of literature documents that agglomeration economies explain the geographical concentration of investments and economic activities (Marshall, 1920; Krugman and Venables, 1995, 1996). Moreover, geographic proximity has been shown in the literature to facilitate access to information in economic decision-making. (Krugman, 1991; Audretsch and Feldman, 1996; Kaustia and Knupfer, 2012). Glaeser et al. (1992) suggest that if geographic proximity simplifies information transmission, the learning process is expected to be relevant in

[22] The herding behavior occurs when individuals' private information is overwhelmed by the influence of public information. Agents do what others are doing instead of making independent decisions. Generally, herding behavior can be increased by various factors, such as fear, uncertainty, or fashionable leaders. Herding requires discretness of actions set, and the coordination of the decision or the ability to observe the actions of others. Therefore, agents tend to converge on similar behavior, acting collectively as a part of a group, often making decisions as a group that they would not make as an individual.

metropolitan areas where many companies localize. In this context, information can flow more quickly from firm to firm.

Gao, Lilian, and Qinghai (2011) examine publicly traded U.S. firms between 1983 and 2003, providing extensive evidence of how the firm's headquarter impacts corporate financial policies. They observe that corporate geographic location may explain cross-sectional variations in the company capital structure and pay-out policies. Firms located in the same metropolitan areas display similar leverage ratios and similar levels of cash holdings. These companies also exhibit a similar pattern of issuing equity and debt. Suggesting that managers who work in the same location are more likely to establish networks and form worthy relationships with peers. Therefore, they interpret the location effect as mostly representing a "local peer effect."

Kedia and Rajgopal (2009) show that a firm geographical location explains broad-based option usage. Analyzing companies associated with metropolitan statistical areas over the years 1992-2004, they argue that a firm's social interactions with its local peers affect option grants. Thus, a firm's broad-based option grants are positively related to other companies' option grants in the U.S., especially when the firm's stock price co-moves with stock prices of other firms in the same MSA. Finally, Chen, Huang, and Lin (2017) investigate how observational learning that derives from leader companies' outcomes acquisition decisions affects follower firms' acquisitions activity. They show that firms located in the exact central location (MSA) as their innovation leader are more likely to undertake an acquisition, suggesting that geographic proximity amplifies the learning effect as it facilitates access to information in economic decision-making.

In the sociology literature, the likelihood of interactions among agents in the geographic space is affected by two factors: propinquity and homophily[23]. Sorenson and Stuart (2001) explore how interfirm networks impact the spatial pattern of investments in the U.S. venture capital market. They find that geographic and industrial distances impact the likelihood of investment in a venture capital firm target, suggesting that interactions (or exchange) across economic agents derive from their opportunity-based system. Stuart and Sorenson (2003) investigate the effect of geographic proximity to establish biotechnology firms. They argue that spatial propinquity remarkably increases the probability of generating relationships in a social and professional context, necessary to realize a new organization. Owen-Smith and Powell (2004) contend that non-relational features of formal inter-organizational networks as geographic propinquity affect information flow through a network. They argue that the Boston biotechnology community affects the relationships between network position and access to spillovers.

Companies may carry out a specific choice and generate better performance through knowledge and information collected using networks composed by other firms. Therefore, interactions across individuals in these networks are channels by which information is transmitted (also tacitly), resources are exchanged, and new useful relationships are formed for their purposes. In the corporate finance literature, a large body of work is interested in the degree of Board and CEO connectedness. Lacker et al. (2013) examine a sample of director belonged to U.S. listed companies from 2000 to 2007. They show that firms with the best-connected boards earn substantially higher future returns than firms with the worst-connected boards. In a similar vein,

[23] The propinquity refers to physical proximity between two agents, and it is one of the main factors leading to interactions. For example, individuals living near one another have higher propinquity than those living in distant places. At the same time, homophily is the tendency to associate or interact with similar others. Therefore, individuals with similar characteristics have more chances of forming relationships easier. At the spatial level, similar agents usually prefer to locate near. Both two factors affect the likelihood of interaction.

El-Khatib et al. (2015) study the effect of CEO connectedness on merger performance. In organization theory literature, Huggins and Johnson (2010) study a firm's characteristics that use the inter-firm Network to access information and innovations. The following work supplied a distinction between two kinds of "network sources" (Coleman, 1988). First, social capital, which consists of social relations, is detained by individuals. Second, the network capital consists of strategies and target relations that are hold by firms. Their results suggest that firms using local networks to collect information and undertake innovations. Furthermore, social capital is more employed between firms that usually interact with individuals of their own region. Finally, they argue that social capital results to be correlated to company size and the spatial set-up (arrangement) of the Network, opposing network capital that seems to be independent of these two factors.

A. *IPO and geographic dimensions*

Most financial studies, which usually document the local bias puzzle, consider the spatial distance as the geographic dimension. Thus, local bias is the investors' propensity to hold in their portfolio shares of nearby companies (Coval and Moskowitz, 2001; Loughran and Schultz, 2005; Gurun and Butler, 2012).

According to this literature, Nielsson and Wójcik (2016) analyze a sample of IPOs in the U.S. from 1986 to 2014. They observe that firms located in rural areas perform a lower IPO underpricing than ones situated in urban areas, suggesting a more significant local bias for the former. Their main conjecture is that companies located in rural areas experience a lower underpricing due to nearby investors' superior local information, which reduces the ex-ante uncertainty about IPO value. The principal spatial dimension used to discriminate between rural and urban firms supporting their evidence is the distance between the issuing firm's headquarter and urban centers, wherein there is a more relevant share of the population with financial expertise[24]. This measure is related to capture the local bias better, as several scholars report that the bias is strong in areas characterized by a low degree of sophistication of investors (Grinblatt and Keloharju, 2001; Bernile, Kumar, and Sulaeman, 2012).

Huang, Liu, and Ma (2019) implement an analysis on IPOs in China from 2008 to 2012, which shows how a lower distance between issuing firm headquarter and main metropolitan areas reduces the IPO underpricing. They argue that principal metropolitan cities are centers where the entire China financial community is centered, including investment banks, financial analysts, and institutional investors. Therefore, issuing companies located at a significant distance perform a higher underpricing. Furthermore, they suggest that the greater the geographic distance between issuing firms and metropolitan centers, the greater the burden of collecting information and monitoring activity. In sum, investors require higher compensation for remote firms owing to their elevated ex-ante uncertainty. This result is related to treacherous territory in China, which lacks several communication lines, making it challenging to reach firms going public. Indeed, when the railway network was strengthened in 2007 by the government, the decrease in underpricing was observed due to more accessible communication lines, which reduce the cost of collecting information. In a related vein, Acconcia, Del Monte, and Pennacchio (2011) analyze IPOs in three leading European countries, namely France, Italy, and Germany, between 1996-2009. They argue that geographic proximity between the firm's headquarters and the central

[24] The number of employed in the financial sector.

domestic stock exchange is a good proxy for the ex-ante uncertainty about the IPO's value. The work shows a great underpricing for firms located a long way from a domestic financial center. They suggest that nearness to a domestic financial center matter during the IPO process, as it represents the location of both the stock market and the main financial actors (e.g., institutional investors and investment banks) who collect information about their prospective stock investments. Therefore, collecting information is too hard for peripherical firms, so the asymmetric information increases the cost that these last have to bear for going public.

In the literature that makes a crossover between financial puzzles and spatial dimension, some studies used other measures to capture the location effect instead of using the single spatial distance from financial centers. For example, Baschieri, Carosi, and Mengoli (2014) analyze a sample of Italian IPOs between 1999-2007 and employ a spatial dispersion index formulated by Johnson and Zimmer (1985) to measure how the IPO's geographic location spatially is isolated or clustered, related to nearby most populated areas. They observe that IPOs nearer populated cities produce slightly more underpricing than isolated ones. They suggest that clustered IPOs face higher demand for local investors than isolated IPOs. That means increasing the after-market price, which corresponds to a higher initial return for investors. In contrast, isolated IPOs from populated centers have a low demand. As a consequence, the increment of the price is low in the after-market.

The firm decision concerning the investment banker's choice for the underwriting of equity issuance may be affected by geographic dimensions as well. Corwin and Schultz (2005) analyze IPO in the U.S. from 1997 to 2002; they observe that underwriters are more likely to be chosen by issuing firms if both are in the same state or a neighboring state. They suggest issuers chose local banks because of their superior ability to place shares to local investors over other banks. Similarly, Mooney (2014) finds that IPO underpricing is lower for IPOs in which the issuer belongs to the same region of the investment bank. These pieces of evidence support the view that local underwriters may be used as a factor to attenuate the ex-ante uncertainty related to the IPO.

Chapter 2 - Research question and framework of analysis

2.1 Research aim

The present study aims to investigate how networks across nearby firms affect IPO underpricing. A company headquarters's spatial location represents a channel that facilitates information transmission through face-to-face interactions and observation with their peers. Thus far, the related literature has neglected the role of interactions across local companies and their likely influences on the corporate decision-making process.

The interest is motivated by the dispersion in the geographic spatial distribution of public equity companies that characterize domestic financial markets worldwide. According to Loughran and Schultz (2006), firms in rural areas, those far away from metropolitan centers, are less likely to rely on external financing equity than those in urban areas. Wòjicik (2009) documents that listed companies are more concentrated in urban areas than in rural areas. This evidence is called "Financial center bias," and it is significant in countries characterized by an underdeveloped stock market, wherein there is a low level of capitalization due to a few listed firms. The author argues that information generates spatial heterogeneity into the domestic financial market owing to soft information that is not easily transferable. As a result, local financial relations and the spatial concentration of actors related to the financial market should explain public equity spatial heterogeneities.

Klagge and Martin (2005) discuss whether the financial system's spatial organization may impact small and medium firms' public equity distribution across regions of a domestic financial market.

Comparing spatially centralized financial systems, like the U.K., and decentralized financial systems, as in Germany, they argue that public equity concentration does not depend on the capital market's spatial organization. Instead, they contend that public equity localization is due to the growing relevance of economics of scale and scope, suggesting that the going public decision may not be affected by proximity to leading financial institutions.

This study supports the idea that domestic spatial heterogeneity of public equity companies' headquarter drives interactions across nearby firms since it should represent a source of information and knowledge for making decisions (e.g., the underwriter choice) and to improve own performance (e.g., less underpricing). Several financial economists document that economic agents located in the same area tend to emulate their peers. For instance, local investors make their portfolio choices rely on information obtained via the local "word-of-mouth" (Hong, Kubik, and Stein, 2004; Brown et al., 2004; Pirinsky and Wang, 2006). Managers who operate in the exact location are more likely to establish networks and form worthy relationships with peers, influencing their investment and management practices (Gao et al., 2011; Kedia and Rajgopal, 2009; Chen et al., 2017). The IPO process involves tacit knowledge that cannot be generated by exchanging information at a distance but necessitates recurrent face-to-face contacts (Wòjicik, 2009).

Thus, the purpose is to exploit spatial distances across public equity companies to measure the effect on the IPO underpricing produced by firms involved in a local network, which can be used to exchange valuable information to realize a successful initial issue. In particular, I aim to measure the effect of social learning at the local level, namely how local information externalities provided by observing the behavior or interacting with nearby peers affect issuers' actions concerning what underwriter to hire. Therefore, the main problem is to detect pertinent local interactions for the IPO process, as companies might have preferences of interacting that might lead them to discriminate among nearby firms. To address the problem of detecting spatial interactions across companies in the IPO context, the work focus on issuing firms geographically near one another, which have adopted the same underwriter, mainly for two reasons. First, from the sociology literature related to the studies of spatial interactions, nearby individuals in geographic space may have correlated purposes, i.e., the same opportunity-based system, and therefore a greater probability of interacting (Soreson and Stuart, 2001). According to this view, they may exchange information tacitly, observing nearby firms' actions that have preceded them as well. Indeed, in the initial public issue case, the proximity of other companies that are already public or going public helps the inexperienced issuer to assess the costs and benefit of an IPO, avoid mistakes, and emulate their peers' successful practices (Wòjicik, 2009). Second, the firm's choice of the underwriter for going public represents one of the most crucial decisions that an issuing firm can take, as it can determine the IPO's success (or failure). The underwriter carries out several essential functions: assessing the issuance's value and related risks, underwriting the issuer's shares, pricing the shares (i.e., set the offer price), and performing the marketing and placement. Further, it represents the party appointed to put in contact issuing firm with investors. Thus, observing which underwriter was chosen by their local peers may be helpful for several reasons as reducing the search cost, relying on a bank considered reliable by the local community, and fill the information gap. In the framework of geographic spatial dimensions, local relevant underwriters may attenuate ex-ante uncertainty related to IPO because of its territorial experience that allows it to hold ties with companies and investors. Corwin and Schultz

(2005) document that the issuer more likely chooses an underwriter if it places in the same state. In Mooney (2014), underpricing is lower for IPO in which the issuer belongs to the same region of the investment bank.

The main assumption used in the present work is that proximity of other issuers might facilitate information transmission concerning the company's choice regarding financial advisors. Then, two nearby firms might exchange valuable contacts (e.g., underwriter), representing future business sources (IPO). Therefore, issuing firms near one another have more likelihood of adopting the same investment bank for the IPO if they interact across them, producing similar effects on their IPO underpricing conditional to several covariates.

Since several underwriting banks work in the IPO market, we can observe multiple local networks established in the same area. However, the interest is to distinguish between firms involved in a local spatial network from those not involved, in order to individuate who makes decisions about the underwriter to hire based on local information externalities (i.e., local public one) than on those that rely on their own private information (or other different sources).

To define if an issuer is involved in a local network, I use the spatial dispersion index (I-index) formulated by Johnson and Zimmer (1985) based on point-to-point individual distances, which provides a firm-specific value that defines how an issuing firm is geographically located relative to other firms' headquarter that have adopted the same underwriting bank. Accordingly, the I-index allows us to get a value per firm, which points out whether the underwriter for the IPO is chosen as its peers. In other words, to detect if the issuer is engaged in a local network (or networks), we observe how local firms, which choose the same underwriter for the first issue, spread around a generic firm's headquarter that chose the same bank. Thus, if the company is isolated from its peers, it is not involved in a local network, vice-versa, if it is clustered to others.

The I-index provides several advantages over previous geographic dimensions that have tried to measure local effects due to peers. First of all, it does not consider geographic boundaries. Thus, firms near one another that headquarters in different regions are taken into account. Second, it has an advantage in measuring accuracy. Since geographic proxies that measure local effects are defined per region, they do not consider that areas are heterogeneous in terms of the number of localized firms over a region. Whereas the I-index provides specific value for each company included in the sample, geographic heterogeneity is taken into account within a region.

In conclusion, the present work aims to explain IPO underpricing using the spatial dispersion of public equity companies' locations, exploiting the heterogeneity provided by the spatial distances across issuing firms to account for possible spatial interactions. For such purpose, I use the spatial dispersion index (I-index) of Johnson and Zimmer, which measures how an agent is located relative to their peers, to define issuing companies near one another who chose the same underwriter as those belonging to local networks. Therefore, the central question of interest is whether belonging to a local network makes a difference in the IPO underpricing. As we have seen, several studies consider the distance between issuing firms' headquarters and financial centers. However, they neglect interactions among nearby companies and their influence in the decision-making regarding the IPO process. Whereas I suppose that firms near one another, those into local networks, are more likely to interact and base their decisions on what other make.

2.2 Local Networks: emulating own local peers

A. *Spatial proximities and local networks across issuing firms*

This paragraph aims to argue how interactions across local firms occur at the spatial level and why spatial networks across them may produce local informational externalities. Since the identifying assumption used in the present work is that nearby firms might exchange valuable contacts, e.g., underwriter, representing future business sources for an IPO, the main question to discuss regards why spatial proximities among companies are relevant to detecting local interactions. Other economic studies that employ spatial distance do not contend why it can be considered a proxy that accounts for the possible spatial interaction between two near agents, neglecting some important stuff provided by other social sciences.

Thus, the starting point is to get what factors produce interactions among companies at the spatial level. The sociology literature documents that the probability of interaction between two individuals is affected by two factors: homophily, which regards the tendency to ties with similar others, and propinquity, which regards the physical distance between two agents. Beginning with Bossard (1932), many studies have investigated the importance of propinquity in determining the likelihood of interaction, which increases sharply when two individuals live near one another. In comparison, a parallel line of research claims that the probability of forming a relationship is a function of distance in space, whereby dimensions are attributes (e.g., social attributes, so social space). Therefore, the location of individuals is relevant both in geographic space and space composed by characteristics. Then, the greater is proximity, the greater the likelihood of a random interaction in any space. Although the research on sociology regarding geographic propinquity and homophily has focused primarily on how forming friendships and marriages, the same process that localizes these kinds of relationships might also generate interaction based on economic exchange in physical and social space.

Furthermore, dimensions of propinquity and homophily are affected by a higher heterogeneity among actors. So, the effect of geography distance on the probability of interaction varies from individual to individual. Analogously, also demographic attributes differ from the extent that individuals structure interaction. According to the latter, homophily may be produced as the result of two main factors. The first is individuals' preferences to interact with similar others. Differences in demographic attributes used to measure homophily derive from the underlying preference distribution for the similarity. The second is the structure of opportunity. In this case, the concentration of individuals with similar demographic characteristics is produced based on daily activity arrangements, mostly due to their purposes. Considering this last factor, we argue that differences in the propinquity and homophily in exchange economic systems derive from heterogeneity across individuals in their opportunity to trade (Sorenson and Stuart, 2001). In the framework of the initial public offering, the opportunity to trade is likely to be formed among firms, which have in common the aim of going public. Thus, more significant propinquity, namely entities close to one another, conditioned to homophily, therefore having the same aims in common, generate interactions. In that case, the connection across individuals is more likely if companies with similar purposes related to the financial market are near one another. Therefore, local firms with similar purposes have more probability of interacting and establishing local spatial networks across them.

Since issuing firms update continuously into the IPO market, local networks across issuers are more dynamic. Thus, they are not characterized by repeated and frequent interactions because information related to the decision of going public is exchanged once at the time of IPO. Therefore, weak ties across firms may widen spatial networks, thus increasing emulation among peers. From the sociology literature, we know that strong ties require more time and effort. Maintaining them needs frequent interactions (Granovetter, 1973). Indeed, the likelihood of interaction decreases as the distance increases, more sharply for strong ties than weak ties, which demand less effort to maintain them. Moreover, strong ties imply multiple and duplicate information and limitations on spreading networks because it is allocated more effort on a few and close relations. In other words, strong ties might cause the increment of knowledge homogeneity, decreasing the utility of networks themselves (Westland e Bolton, 2003).

Further, exploiting the information about what underwriter is employed for the IPO adds another factor of homophily at the local level because it provides another attribute that makes a further distinction, which delivers local clusters among issuers. Therefore, the interaction is more likely since firms that have chosen the same underwriter could have also tacitly interacted ex-ante to the IPO. In other words, I argue that spatial proximities across individuals with similar opportunity based-system, who aim to exchange information, increase the likelihood of interaction. Since the exchanged information concerns what underwriter to hire, it is possible to observe who issuing firms near one another have chosen the same investment bank for their own IPO. Thus, we could infer that issuers who hire the same bank interacted ex-ante.

However, local spatial networks might produce two main implications. First, it may cause the geographic concentration of a specific industry, as it usually occurs in the high-tech industry.

According to the economic view, new firms locate near existing ones of the same type to establish local markets for scarce inputs (such as skilled labor) or gain positive feedback related to nearby companies' knowledge (Arthur, 1990; Krugman, 1991). Thus, social and professional relations distribution tends to cluster in geographic space (e.g., town) and space composed of individuals' attributes (e.g., industry).

Second, firms' spatial clusterization may have relevant implications on a particular investment bank's underwriting activity in some areas. Since it may be a source of information, underwriters must be aware of several underwriting opportunities before underwriting them. Several financial actors tend to disseminate information in the public financial market, but these may be missing, mostly for young firms, and whether they belong to a new market segment (industry). Therefore, in the absence of relevant information for making decisions about underwriting some issuing firms, the previously established professional and social relationships may represent one of the primary vehicles for the investment bank to collect information (Cooney et al., 2015; and Corwin and Schultz, 2002).

In sum, the present paragraph defines the role played by spatial distances in forming a local network. Previous studies used spatial distance to account for possible interactions at the local level, and they do not care about factors that affect the likelihood of interaction through spatial proximity. Using sociology notions, I provide a broader and more detailed discussion about what factors affect interactions at the local level and why it is possible to use the geographic proximity between firms to measure it. Since propinquity and homophily factors characterize the kind of interaction among considered agents, issuers near one another (propinquity) that hired the same underwriter (homophily) had better chances to transmit information ex-ante the IPO spatially.

The information transmission can also occur tacitly as actions (chosen underwriter) and payoffs (proceeds outcome) of local predecessors are observable. However, when we consider firm spatial clusterization, other kinds of clusters are allowed as professional and social ones. Further, once local networks across issuers occur, the underwriting activity of some banks is affected at the spatial level as well. Therefore, these elements need more attention to the development of the framework of the present analysis.

B. *I-index*

Local networks across issuing companies are measured employing a spatial dispersion index formulated by Johnson and Zimmer (1985). In the beginning, ecologists adopt it to compute spatial patterns of living organisms, i.e., propensity to make clusters in a given area (Gomelyuk e Shchetkov, 1999; Lee et al., 2006). It has also been used in several corporate finance studies as a proxy to define the spatial pattern (distribution) of listing firms. These studies aimed to measure how listed companies' dispersion around an issuing firm's headquarter affects its market value (Carosi, 2016; Baschieri et al., 2014). In contrast, the present work uses to measure the spatial dispersion across issuing firms that make the same actions, i.e., adopting the same underwriting bank. To account for possible interaction among those who aim to exchange information at the spatial level.

The I-index is a synthetic measure based on point-to-point individual distances, and it aimed to explore the arrangement of individuals' populations (animal and plant species) in a region. Therefore, it is possible to understand the aggregation level among entities belonging to the same group, which is more relevant than density proxies. It provides essential information about individuals' local interactions and how clusters spatially place in a geographic area.

The I-index is exploited in the present analysis to define issuing firms belonging to a local network, i.e., those spatially close among them who have adopted the same underwriter to go public. The computation of the I-index considers spatial distances[25] between a single issuer headquarter, which is underwritten by a specific investment bank, and all other headquarters of issuing companies (peers) underwritten by the same bank. The aim is to get an individual-specific measure that shows as an IPO is geographically located (clustered or isolated) relative to other IPOs made by the same underwriter. Thus, the I-index can be defined in this way:

$$I_{ij} = \frac{(R+1)\sum_r^R d_r^4}{(\sum_r^R d_r^2)^2}$$

In this formula, *i* is the generic IPO underwritten by bank *j*, and *R* are all other IPOs underwritten by *j* except *i*. The d_r is the shortest distance on spherical space between *i* and *r* (dove *r=1, …, R*), where their places have been determined using geographical coordinates of relative issuing firms' headquarters. Therefore, we have as many spherical distances as IPOs underwritten, *R*, by the investment bank, *j*. Hence, there will be multiple local networks as the number of active banks, *j*, increases in the underwriting market.

The I-index for a specific issuer decreases if the distances between the issuer taken into account and all other peers who have chosen the same bank increase. While it increases if the number of

[25] See the appendix.

issuing firms who chose the same underwriter increase by one additional firm. In this case, to raise up the I-index, this later has to be located near the considered issuer's headquarter.

Therefore, the lower is the I-index value per a specific individual, the farther the distance from other individuals. In this case, the firm's headquarter is isolated compared to other firm headquarters locations, which hired the same underwriter. Whereas the higher the I-index, the closer the individual distance to all others. In this case, the firm headquarter is likely part of a spatial cluster with other issuing firms that adopted the same bank for their IPO.

Generally, in a spatial dispersion analysis, the benchmark consists of testing if individuals' spatial behavior follows the hypothesis that usually is called the random spatial pattern. In this case, Individuals with a specific attribute in common do not concentrate on a geographic area.

Under the hypothesis of random pattern, since accounted distances are assumed to be exponentially distributed, the I-index distribution can be approximated by its limiting normal[26] distribution, and its theoretically expected value equals to $E(I) = 2$. Therefore, the I-index represents a proxy for testing departures from the normal distribution, in which individuals might belong to other spatial patterns as scattered or clustered ones. Therefore, to distinguish between firms involved or not in a spatial network, we can take the I-index's theoretical expected value (under the random pattern assumption) as the benchmark to define who is in a spatial cluster (local network) or not. Thus, if $I > 2$, a firm is in a clustered spatial pattern, whereas if $I \leq 2$, it is isolated from others.

Finally, the I-index represents a valuable tool to investigate whether a firm, which realized an IPO, is involved in a local spatial network and then uses the information externalities sourced by

[26] Under the spatial random pattern hypthotesis, V_rs that constitute the I-index are distributed as exponential variables, therefore, the ration between the sum of squares over the square of the sum of exponential variables converges to a normal distribution under the standard central limit theorem (Moran, 1955).

local peers than on different sources of information. Since the I-index takes into account propinquity and homophily factors, i.e., the spatial proximity between issuers (propinquity) that hired the same underwriter (homophily), it could be considered a measure of local interactions, by which local information transmission should be captured. Thus, it is possible to test if belonging to a local network makes a difference in IPO underpricing.

The identification assumption about the regression of the I-index against the IPO underpricing concerns whether the choice of new issuers to localize near their peer is exogeneous. For example, the I-index can be endogenously determined if new firms, ex-ante the IPO, chose their headquarter in such a way to localize near public equity companies to take informational advantages about the IPO by them. Thus, the choice concerning the underwriter to hire is not exogenous because the choice of location is affected by the IPO underpricing of others. However, since the going public decision is ex-post the choice of where to localize relative to the timing of a firm life-cycle, it should be reasonable to assume that the I-index measure exogenous variations of spatial proximities across issuing firms. Otherwise, for example, we should observe that the IPO underpricing of younger issuers, i.e., those with lower age at the time of an IPO, could be more affected by local networks because young firms might decide their headquarters in perspective of a future listing to get relevant information for the decision making process of an IPO.

Further, the I-index could capture the effect due to the spatial clusterization of a specific industry. For instance, new firms may locate near existing ones of the same industry to establish local markets for source inputs or gain positive feedback related to nearby companies' knowledge (Arthur, 1990; Krugman,1991). In this case, the I-index could be driven by issuers that choose the same underwriter because they belong to the same industry. Consequently, the information regarding what underwriter to hire might not be attributable to local peers. However, the I-index could be correlated to investment banks underwriting local activities as well. The spatial clusterization of issuing firms that choose the same underwriter may be due to the underwriter's degree of specialization to treat firms with particular features, and therefore, resulting in a possible market power concentration at the local level. In this case, spatial industry agglomeration could overlap with the underwriting activity as the investment bank can experience IPOs of a specific industry. However, in the paragraph concerning the empirical analysis of the effect of local networks on IPO underpricing, several variables are allowed to control for these possible endogeneity problems.

C. *Social learning*

Local networks across firms should affect the level of IPO underpricing through the processing of information stemming from their local peers, especially those concerning the chosen underwriting banks. Social learning occurs when agents can learn by observing the behavior of others. To evaluate the local network's effect due to social learning, I have distinguished between issuers that rely on information stemming from local networks, which derives from peers' behavior, from those not involved in a local network that regard on own private information.

Spatial clustered firms that have adopted the same underwriters weigh more public information in their decision-making process than on isolated ones. Indeed, Learning is often local: agents learn more from others who are nearer, either geographically or through professional or social networks (Hirshleifer and Siew, 2009). However, Spatial heterogeneity in firms' location generates differentials in social learning, thereby in the decision-making process. Managers who work in the same geographic area have more probability of mimicking than their isolated peers, as they can transmit information by mainly two channels: face-to-face interactions and observation.

If actions and payoffs taken by local peers are observable, and the number of predecessors involved in a local network should be informative, an issuing firm considers the behavior of others, pursuing correct actions. In this case of pure informational externalities, the issuer's payoff (proceeds) is unaffected by the actions of other local issuing firms (Gale, 1996). An issuer can care about the behavior of other peers only if it reveals payoff-relevant information, which allows those who observe to make a better decision. Thus, information collected through local networks should lead to choice investment banks that perform a low underpricing. However, we have to account that local networks may reduce the implicit cost of equity when other frictions that might affect the local IPO underwriting market are negligible.

On the other hand, social learning at the local level could generate a different scenario wherein issuers can rely on public information stemming from local peers because they are assumed to be better informed, neglecting their private information. In this case, an agent cares about the behavior of others even if it does not reveal payoff relevant information. Therefore, issuing firms are engaged in herding behavior. Generally, herding behavior could be defined as behavior patterns that are correlated across individuals (Dovenow and Welch, 1996). In particular, I consider the herd that can lead to systematic erroneous decision-making by the entire population. Further, herding can occur when several other frictions are relevant, usually related to uncertainty and information. Therefore, firms that rely totally on public information stemming from local networks may produce a low IPO performance in terms of the implicit cost of equity (i.e., high underpricing).

If the uncertainty about issuing firms' quality is broad, managers may choose the same investment banks as their local peers, relying on local information externalities information to maintain a good state of reputation with investors. In this case, the source of behavioral convergence is network externalities (or strategic complementarities). Taking a specific decision makes sense if many other agents do as well, given that one agent's action affects the payoff to others for taking that action. Therefore, if an issuing firm diverges from an earlier decision-maker, investors may infer that likely both issuers are of low quality. Whereas, if it takes the same action as its predecessor, investors may infer that the bad outcome is occurred by chance, even in the case of low performance (Scharfstein and Stein, 1990). Accordingly, more low-value local issuers may want to exploit information collected by local networks to get a good reputation.

Further, if the search for each underwriter requires a fixed cost, in that case, firms' incentive to collect information can declines. Therefore, issuing firms may find optimally to rely on peers' decisions rather than incur search costs. Therefore, costs for information may lead to incorrect actions because the superior alternative decision might still be hidden, then local issuer may commit the IPO underwriting to investment banks that might perform a greater underpricing (Cao and Hirshleifer, 1997b).

Further, environmental uncertainty makes it harder for some agents to predict the outcome of a particular decision. The implication is that younger and smaller issuers, those more inexpert, are more uncertain about the consequences of their choices about an IPO's success, whereas other issuers of high-value, with more precise information, are more likely to influence them (Deutsch and Gerard, 1955). At the local level, high-value firms, those older and larger, might be "fashion leaders" (Bikhchandani, Hirshleifer, and Welch, 1998). Inexperienced firms could follow "leaders" going toward a likely incorrect action, as high-quality issuers will take their decisions according to their benefits maximization. However, environmental uncertainty can amplify the herding behavior toward the incorrect action when followers belong to industries hit by shocks (Chen, Huang, and Lin, 2017).

In sum, local networks might produce social learning by issuers that lead downward the underpricing level of involved issuers under stable market conditions, wherein information externalities are relevant. On the other hand, if local issuers are heterogeneous or producing private information is costly, herding behavior may lead to adverse decisions about what underwriters hire, which could positively affect underpricing.

2.3 Data and Methodology

A. *The Sample*

Data concerns IPOs from 2011 to 2018 stem principally from the "Deal Analytics" extension of Thomanson Reuter Eikon, which covers information about characteristics of initial public issues (offer price, proceeds, book-runner, etc.) and accounting information about the issuer. Following the empirical IPO underpricing literature, we exclude unit offering, REITs, ADRs, IPOs belong to the financial sectors, and ones with offer prices lower than 5 dollars.

To compute the I-index mentioned in the previous paragraph, we collect issuers' headquarters information like zip codes and addresses from the Bureau van Dijk – Orbis. These enable us to identify geographical coordinates of latitude and longitude, gathering them from Google Earth. Finally, our sample consists of 618 IPOs in the U.S. and 499 in the E.U., with relative 151 book-runners[27].

The dependent variable of the analysis is the IPO underpricing. The firm *i*'s underpricing is defined as

$$Underpricing_{i,t} = \frac{\left(First\ closing\ price_{i,t} - Offer\ price_{i,t}\right)}{Offer\ price_{i,t}} \cdot 100$$

Where both the first closing price and offer price are collected by the "Deal Analytics" extension of Thomanson Reuter Eikon, the measure of underpricing is the standard one used in several works. In well-developed stock markets, and if there are no constraints about price fluctuations from day to day, the full extent of underpricing is evident reasonably quickly, just by the end of

[27] Book-runners are lead underwriters involved in the financial industry. They are also known as lead arrangers or lead managers. Some companies may require multiple book runners to manage the issue when it is too large.

the first day of trading. Utilizing later prices, like ones at the end of the first week of trading, usually make little difference (Ljungqvist, 2001).

B. *Identifying Firms involved in Local Networks*

To define firms involved in a spatial network, we can discern companies into two groups through a categorical variable: *Network*. If a firm adopts the same underwriting bank of its nearby peers, therefore its I-index should be higher than two, the categorical variable *Network* will code as $Network = 1$. If a firm adopts a different bank from its nearby firms, the *Network* dummy is set to 0. In this case, a firm is far away from those who have adopted the same underwriter.

In other words, issuing firms in the *Network* group are those that chose the investment as their local peers. At the same time, those who do not hire the same underwriters as the nearby local issuer and those who are far away from issuers who have chosen the same bank are not in the *Network* group.

Further, whether an issuer hires multiple investment banks for its IPO, its choice will be coded as involved in a Network for those underwriters that are also chosen from nearby peers at the local level. The univariate results in table 2.1 show that:

1. The overall mean underpricing for firms that choose investment banks as their local peers is 3.71 percentage points lower than the overall mean underpricing for firms that are not involved in a local network. This difference is statistically significant at 1%.
2. US firms that choose investment banks as their local peers exhibit 4.48 percentage points lower mean underpricing than those not involved in a local network, which chose a different underwriter from their local peers. This difference also is statistically significant at 1%.

3. The mean underpricing for firms in the European continent that choose investment banks as their local peers is 1.30 percentage points greater than the mean underpricing for firms that rely on a different underwriter from the one chosen by local peers. This difference is statistically insignificant and economically small.

Table 2.1 – Underpricing Across the Two Categories and Macro Geographic Areas.

	Overall		*US*		*EU*	
Underpricing	*Network* = 1	*Network* = 0	*Network* = 1	*Network* = 0	*Network* = 1	*Network* = 0
Mean	14.39	18.11	18.89	23.37	6.84	5.54
Std. dev.	26.39	28.85	29.36	31.88	18.13	13.07
Min	-88	-89.82	-88	-89.82	-24.36	-21.11
Max	172.53	174.13	167.16	174.13	172.53	55.78
Median	6.70	10.5	12.01	17.5	2.93	3.35
No. of obs.	2293	823	1436	580	857	243
	(73.59%)	(26.41%)	(71.23%)	(28.77%)	(77.91%)	(22.09%)

Underpricing is measured as the first-day price run-up: where the first trading day closing price is taken from the "Deal Analytics" extension of Thomanson Reuter Eikon. Information about the geographic locations of firms' headquarter has been handle collected by Google Earth. I define *Network* = 1 if at least one of the underwriting banks chosen by an issuer is due to public information stemming from local peers when the I-index is higher than two. *Network* = 0, if other banks or none that underwrite an IPO are chosen relying on private information when the I-index for a specific firm is lower or equal than two. I split the sample based upon the geographic breakdown of countries provided by the Thomanson Reuter Eikon database. The US sample includes observation of all the member states of the United States. The EU sample consists of firms localized in several countries of the European continent: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Italy, Jersey, Lithuania, Luxembourg, Monaco, Netherlands, Norway, Poland, Portugal, Republic of Ireland, Romania, Russian Federation, Spain, Sweden, Switzerland, and United Kingdom. The Overall sample is a combination of the two.

The IPO underpricing distribution is positively skewed, as the mean is greater than the median within each considered group and for the following geographic subdivisions. Thus, there is a significant frequency of occurrence of positive IPOs underpricing values compared to negative ones. However, the European continent's underpricing phenomenon is less massive than one produced by IPOs in the United States between 2011-2018.

To better understand the difference in the IPO underpricing picked up by the specific spatial discontinuity individuate dividing firms into two clusters through the I-index at level 2, we can compute the median for the I-index distribution of firms with an I-index above two and split them into two groups, and repeat the same for the I-index distribution of those below 2. In this way, it is possible to observe if there are differences in IPO underpricing within-groups, *Network* = 1 and *Network* = 0. In table 2.2, the results show the difference in the IPO underpricing is detected between the two groups, i.e., at the cut-off that is defined at the level of the I-index expected value. Indeed, the within-groups defined through their respective median do not reveal differences among firms in the IPO underpricing, which are quantitatively and statistically irrelevant. As discussed above, the unconditional mean between *Network* = 1 and *Network* = 0 is negligible for firms in the European continents as well.

Table 2.2 - Underpricing Mean Differences Between and Within the Two Categories.

	Overall			*US*			*EU*		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Network	-3.71**			-4.48**			1.30		
	[1.09]			[1.48]			[1.24]		
$Med_{Network=1}$		-0.84			-1.50			-0.10	
		[1.10]			[1.55]			[1.24]	
$Med_{Network=0}$			1.43			0.201			1.30
			[2.01]			[2.64]			[1.69]
N	3116	2293	823	2016	1436	580	1100	857	243

The table presents the Underpricing mean difference: 1) between *Network* = 1, if the I-index>2, and *Network* = 0 otherwise; 2) within *Network* = 1 group, taking as a benchmark its I-index median firm, indeed $Med_{Network=1}$ is dummy coded 1 if a firm within *Network* = 1 is above the median; 3) within *Network* = 0 group, taking as a benchmark its I-index median firm, indeed $Med_{Network=0}$ is dummy coded 1 if a firm within *Network* = 0 is above the median. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

C. *The likelihood of hiring the same underwriter*

The crucial assumption used in the present work is that geographic proximity facilitates the information exchange regarding what underwriter to hire for going public. Therefore, that issuing firms clustered in space are more likely to use the same underwriter.

In this section, I estimate a logit model to compute the odds ratio to determine if being involved in a local network increases the likelihood of hiring the same underwriter as neighboring firms. In estimating the logit model, I use all IPOs in the sample and include one observation for every eligible underwriter for each IPO[28], where the set of eligible underwriters consist of those that made at least an offering in the same listing period of a given IPO. This results in approximately 95,000 observations. Because the logit model includes multiple observations for each IPO, standard errors are adjusted to allow for IPO specific-effects. The model assumes that observations for a particular IPO are correlated, while observations across IPOs are independent.

The examined dependent variable is set to one if a particular underwriter is hired and zero otherwise. The main regressor is the categorical variable *Network*, which discerns the issuing companies in two groups: those involved in a local network because they adopt at least one underwriter like their nearby peers, which have an I-index greater than two, and those with an I-index value lower or equal than two, which are not involved in a local network. The other independent variables include offer and underwriter characteristics to control for possible correlations with the main regressor.

Table 2.3 presents results about the logit model expressed in terms of the odds ratio. The model is estimated using the entire sample of IPOs, consisting of firms in the United States and those in

[28] I use the same methodological approach used in Corwin and Schultz (2005) for computing the likelihood of inclusion of a particular underwriter in the IPO syndicate.

the European continent. The leading regressor coefficient represents the odds ratio for the investment bank to be hired as an underwriter for the public issue if the firm is involved in a local network.

The columns in table 2.3 compare the odds ratios for the regressor *Network* that account for several sets of covariates. The first column does not consider any covariates. The result shows the odds of being hired as the underwriter for an IPO if an issuing firm is involved in a local network is 1,8 times as larger as the odds for an investment bank of being hired if the firm is not involved in a local network. In other words, being in a local network increases the likelihood of hiring particular underwriters. Column 2 includes four sources of fixed effects to control possible spurious correlations between the main regressor and unobservable fixed factors. The first is the year fixed effect, which controls the market-timing of going public. Therefore, firms decide to hire a particular investment bank because it is one available in that period. The second is the industry fixed effect based on 48 industry Fama-French clusterization (1997). It is included because the choice of what underwriter to hire could be correlated to the behavior of other firms that belong to the same industry. Thus, firms involved in a local network could emulate firms in the same industry rather than those spatially close to them. The third is the underwriter fixed effect, which controls possible fixed unobservable characteristics that affect the decision to hire a specific underwriter. These characteristics might be spuriously correlated with the variable *Network* since firms involved in a local network can choose an investment bank relying on its characteristics instead of the information exchange with nearby peers. The last fixed effect is the exchange list effect. It is included since some issuing firms may choose a particular underwriter because it lists several IPOs in specific stock exchanges. The result in the second column shows a slight decline due to upward bias related to positive correlations of fixed factors with the variable *Network*. In the third column, I include other covariates further to fixed effects. It considers observable underwriter time-varying characteristics and the offer characteristics. The observable time-varying underwriters' characteristics are defined at the underwriter level. They are underwriter industry expertise, which is defined as the natural logarithm of one plus the number of IPOs in the same industry based on Fama-French 48 industries that a given lead underwriter has underwritten in the five years before an IPO. In the same vein, state experience is computed based both on states in the European area and states in the U.S. As Corwin and Schultz (2005) argue, investment banks with more local experience are also more able to place shares to the public of local investors and to evaluate their demand for shares correctly. Further, the underwriter industry distance is included as a measure of homophily that controls for the similarity between IPOs underwritten by the same bank. It is defined as the percentage of previous IPOs underwritten by an investment bank in industries other than the underwritten actual issuing firm's industry (Sorenson and Stuart, 2001). Through the underwriter's market share defined as shares of the total number of IPOs underwritten in the IPO market of a specific industry in the previous five years (Bajo et al., 2015), it is possible to deliver potential endogeneity issues raised by correlations between firms' decision-making criteria about what underwriter to hire and the underwriter's reputation and its market power.

The controls for observable offering characteristics are included, similar to Corwin and Schultz's probit model (2005). They are proceeds, i.e., the natural logarithm of one plus the product between the offer price and shares sold at the offering, usually regarding the offering size (Beatty and Ritter, 1985); No.book-runner, the natural logarithm of one plus the number of underwriter managers, which is a proxy of information production negatively related to the ex-ante uncertainty (Corwin and Schultz, 2005); and over-allotment option, a dummy variable coded one if the underwriter manager allocates additional shares in the after-market during 30 days subsequent the offering. Even the result in column 3 shows a possible upward bias estimation comparing it with the previous columns. Indeed, the odds of being hired as the underwriter if an issuing firm is involved in a local network is 1,2 times[29] larger than the odds of investment banks hired if the firm is not involved in a local network.

In sum, the results point out that the odds of investment bank hired by firms involved in a local network is larger than those hired by firms not involved in a local network. This means that particular underwriters are more likely to be adopted by issuing firms that are near one another at the spatial level. In other words, issuing firms clustered in space are more likely to engage the same underwriter for their IPO.

Table 2.3 - the likelihood of hiring the same Underwriter.

	(1)	(2)	(3)
Network	1.84***	1.67***	1.22***
	[0.12]	[0.10]	[0.05]
Proceed			1.12***
			[0.01]
Overallotment			0.9748
			[0.02]
US			0.94
			[0.05]
No. Book			2.10***
			[0.10]
one_UW			0.83***
			[0.04]
Industry distance			0.94
			[0.05]

[29] The coefficients for the two samples, the United States and the European continent, are pretty similar to the overall result in table 2.3.

UW mktshare			0.68*
			[0.12]
Industry exp.			0.95
			[0.02]
State exp.			0.97
			[0.01]
IPO wave			1.09**
			[0.03]
Δp^{+}			1.00
			[0.00]
Fixed effects		Yes	Yes
N	95201	95201	95201

This table presents odds ratio estimates for underwriters of being hired if the issuing firm is involved in a local network. The sample consists of initial public offerings conducted in the European continent and US between 2011-2018. The dependent variable is a categorical coded one if the investment bank is hired as the underwriter for the IPO. Year, industry (Fama-French 48), underwriter, and exchange fixed effects are included for each model except for column 1. The controls for underwriter time-varying observable are: underwriter Industry experience, underwriter state experience, underwriter industry distance, and underwriter market power over five years. To controls market spillover effects, I include the industry IPO wave over five years. The square brackets are listed standard errors adjusted to allow for IPO-specific effects.* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

D. *Firm and Offering Characteristics*

The previous research has indicated that the ex-ante uncertainty concerning the issuing firm's value and offering characteristics significantly impact the IPO underpricing (Beatty and Ritter, 1996). This section is going to discuss differences in firms and offering characteristics between the two groups abovementioned. Table 2.3 summarizes some of the collected data from the "Deal Analytics" extension of Thomanson Reuter Eikon. However, even if differences between the two groups are almost not statistically significant, we can infer some defining features about the sample.

The overall results show that firms involved in a local network are larger companies, as their assets' value in terms of dollars is higher than those not involved. However, this result is different when we compare US and European continent firms. Indeed, the firm size is almost the same between US firms involved in a local network and those not. Instead, firms in the European continent are characterized by a higher value of Assets than US firms. As the overall result, firms involved in a local network are small compared to those not involved.

Further, the average firm Age at the time of the IPO between the two groups is quite similar for each different geographic area. However, companies in the European continent go public when they are older compared to their US peers. This evidence is in line with Pagano, Panetta, and Zingales (1998), who found that larger and older companies are more likely to go public in Italy to reduce the surrounding ex-ante uncertainty.

Observing flow balance sheet indicators, we might observe that firms belonging to the cluster Network = 1 are more capital intensive. For instance, the difference between EBITDA and EBIT represents a significant share of the EBITDA indicator. Thus, depreciation and amortization are a relevant fraction of their gross flows. This insight is particularly relevant for US firms.

Table 2.4 – Summary Statistics for Firm and Offering Characteristics at the Time of the IPO.

	Overall		*US*		*EU*	
	Network=1	*Network=0*	*Network=1*	*Network=0*	*Network=1*	*Network=0*
Assets	2421.1	3169.0	1690.0	1791.7	3658.6	6438.5
	(10348.0)	(17410.5)	(6326.8)	(6879.2)	(14775.9)	(29964.8)
Revenues	1561.8	1147.0	1132.2	1181.5	2253.0	1066.7
	(3882.1)	(2478.5)	(2485.9)	(2599.9)	(5350.3)	(2173.3)
EBITDA	208.2	164.0	114.0	162.3	349.1	167.4
	(704.8)	(577.6)	(574.6)	(648.7)	(844.8)	(399.3)
EBIT	92.12	61.55	27.64	53.40	192.3	78.12
	(405.3)	(275.3)	(298.0)	(307.3)	(515.0)	(193.9)
Age	15.41	14.12	11.19	12.29	22.48	18.47
	(34.80)	(21.52)	(17.47)	(20.39)	(51.49)	(23.51)
Proceed	484.1	441.8	414.9	403.4	600.2	533.3
	(1186.7)	(1077.1)	(1275.9)	(1104.1)	(1010.0)	(1006.3)
Invprice	7.309	7.581	6.776	6.376	8.196	10.50
	(4.096)	(3.796)	(2.731)	(2.026)	(5.572)	(5.233)

Primary	15.75	16.07	15.70	15.64	15.87	17.53
	(35.78)	(39.19)	(22.70)	(19.94)	(54.36)	(74.11)
Secondary	27.61	32.38	15.00	13.25	36.31	52.09
	(62.40)	(70.38)	(35.10)	(30.15)	(74.49)	(91.54)
Overallot.	2.988	2.969	2.516	2.519	3.936	4.196
	(5.454)	(4.005)	(3.201)	(2.828)	(8.221)	(6.004)
No.of BR	7.070	7.372	8.139	8.472	5.280	4.745
	(4.955)	(5.103)	(5.341)	(5.340)	(3.578)	(3.223)
$Du_{med>Age}$	0.483	0.487	0.469	0.472	0.467	0.523
	(0.500)	(0.500)	(0.499)	(0.500)	(0.499)	(0.501)
Tech	0.283	0.273	0.336	0.305	0.195	0.198
	(0.451)	(0.446)	(0.472)	(0.461)	(0.396)	(0.399)
Biotech	0.197	0.188	0.248	0.221	0.112	0.111
	(0.398)	(0.391)	(0.432)	(0.415)	(0.316)	(0.315)

The following table reports the mean and standard deviation into the square bracket for several offering and firm observable features, maintaining the sample subdivision of table 2.1. The information about firms' financial statements and those concerning the offering characteristics are collected from the "Deal Analytics" extension of Thomanson Reuter Eikon. They are recorded in Millions of US dollars. Age is measured in years between the firm foundation and IPO issuing date. Invprice is the reciprocal of the midpoint of the filing price range in the informational prospectus. Primary is the amount of shares issued directly by the issuer at the IPO date. Secondary is the amount of shares sold by original shareholders at the IPO date. No.of BR is the number of Book-Runner (i.e, underwriters) that serve a single IPO. Overallotment is the amount of additional shares allocated by the underwriter in the after-market. $Du_{med>Age}$ is a dummy equal 1 if a firm is above the median corresponding to their cluster. Tech and Biotech are dummies coded 1 based on the technological and biotechnological firms classification provided by the Ritter website (https://site.warrington.ufl.edu/ritter/files/IPOs-Tech.pdf, December 31, 2020).

The primary insights about offering characteristics regard the average amount of proceeds and the number of secondary shares sold by pre-issuer shareholders. The former is higher for firms involved in a local network in the European continent. Extensive value offerings are usually related to high-quality firms. The latter is relevant for European firms that are not involved in a local network. However, low-quality firms' shareholders tend to diversify their portfolios, selling more shares at the IPO (Grinblatt and Hwang, 1989).

These summary statistics highlight several heterogeneities between the two defined clusters and, in particular, between the two geographic areas analyzed. The value of assets, revenues, and EBITDA is pretty different between the United States and the European continent. Furthermore, the Age at the time of IPO is Higher for European firms on average. However, In both areas, we may observe that firms involved in a local network are of high quality. Thus, we need to check whether the evidence is robust to controls.

2.4 The impact of local Networks on IPO underpricing

A. *Multivariate Analysis*

To estimate the impact on the IPO underpricing, relating to firms that rely on information stemming from local networks, namely the effect of choosing the same underwriter as their local peers, the following empirical model is regressed,

$$(1) \qquad Underpricing_{i,j.t} = \alpha + \beta Network_{i,t} + \lambda_t + \gamma_f + \theta_j + \eta_s + \vartheta Z_{i,j,t} + \delta X_{i,t} + v_{i,t}$$

β measures the IPO underpricing mean-difference between firms involved in a spatial network across local firms and those that are not involved in a spatial network; λ_t is a year fixed effect, γ_f is an industry fixed effect (classified by Fama-French 48 industries); θ_j is an investment bank fixed effect; η_s is an exchange list fixed effect; Z is a vector of time-varying controls concerning underwriters; and X denotes a vector of additional control variables defined per issuer, to be discussed below.

The coefficient β represents the effect on the IPO underpricing due to the local networks effect, wherein companies rely on information deriving from local issuers into their decision-making process concerning the underwriting bank to hire.

Several controls are included to allow for sources of endogeneity, mainly due to possible factors that could be correlated with the regressor *Network*. However, I also include canonical control variables, which are usually considered in the empirical literature of IPO underpricing. They are considered for accuracy purposes of point estimation as well.

The inclusion of the year fixed effect carries out two main functions. First, it allows controlling for a worldwide component related to the market-timing of going public. Firms tend to postpone their equity issue if they are undervalued by the market, delaying IPOs until a bull market offers better pricing (Lucas and McDonald, 1990). The market provides information spillovers to entrepreneurs for issuing equity, who respond to growth opportunities signaled by higher prices (Subrahmanyam and Titman, 1999; Schultz, 2000). Therefore, there may be cyclicality in the issuing activity that drives the number of IPOs issued and their subsequent pricing. Second, year fixed effects control for monetary policy shocks. As is well known, the expansionary monetary policies lead to an increase in stock markets as firms' financial conditions improve due to a lower credit cost and a rising of future cash flows and assets value in balance sheets. Thus, increasing the value of stocks.

The industry fixed effects based on 48 industry Fama-French clusterization (1997) are included to address unobservable firm characteristics in the analysis. In addition, they control potential endogeneity related to industry-specific characteristics, which may be correlated with firms' financial decision-making criteria. For instance, entrepreneurs may choose a particular investment bank for their issue or decide to go public in a specific exchange list since other firms that belong to the same industry cluster do as well. Industry effects also address geographic industry agglomeration that may be positively associated with firms involved in a local network. Furthermore, the uncertainty of firms' value is positively correlated with underpricing. Moreover, firms that belong to more opaque industries may keep away from the loan market and raise their capital in the equity market. Therefore, opaque industries are more likely to be underpriced on average by the market (Schenone, 2004). Thus, the industry-fixed effects should allow for the possible upward bias due to opaque firms.

Through the underwriter fixed effects, it is possible to control for unobservable bank characteristics. The IPO underpricing has persistent underwriter-specific components, as some investment banks persistently discount shares underwritten mainly due to asymmetric information among investment banks (Hoberg, 2007). Further, banks well established in the underwriting business tend to make aggressive use of allocations of Hot IPOs (those more underpriced) to executives of issuing firms and their venture capitalists through their brokerage accounts[30] (Loughran and Ritter, 2003). Including underwriter fixed effects should control this heterogeneity source as well. Since countries in the European area are endowed with their domestic stock markets, exchange list fixed effects will be added in the regression model to account for differences between stock exchanges related to stock requirements. In this way, particularly for countries in the European continent, we may also control country fixed effects owing to the decentralized stock market organization at the geographic level.

As other factors may drive the issuer's choice about the investment bank, the equation specification also controls for time-varying underwriter characteristics, Z, consisting of four variables: industry expertise, state expertise, market share by industry, and industry distance. All these variables are defined at the underwriter level, varying per year. Thus, we use industry experience proxy: the natural logarithm of one plus the number of IPOs in the same industry based on Fama-French 48 industries that a given lead underwriter has underwritten in the five years before an IPO. Liu and Ritter (2011) argue that underwriters, to win a particular IPO

[30] This is the corruption hyphotesis formulated by Loughran and Ritter (2003).

mandate, need to show that they understand its business and successfully market the firm to investors. Therefore, a way to demonstrate such industry expertise is to provide records of similar firms that underwriters have taken public in the past. In the same vein, state experience is computed based both on states in the European area and states in the U.S. As Corwin and Schultz (2005) argue, investment banks with more local experience are also more able to place shares to the public of local investors and to evaluate their demand for shares correctly. These two proxies are non-price dimensions related to issuers' preferences that bias the issuing firm's choice about the underwriter.

Further, the underwriter industry distance is included as a measure of homophily, controlling for the similarity between IPOs underwritten by the same bank. It is defined as the percentage of previous IPOs underwritten by an investment bank in industries other than the underwritten actual issuing firm (Sorenson and Stuart, 2001). This measure allows controlling for bias due to correlated behaviors of firms belonging to the same industries. Through the underwriter's market share defined as shares of the total number of IPOs underwritten in the IPO market of a specific industry in the previous five years (Bajo et al., 2015), it is possible to deliver potential endogeneity issues raised by correlations between firms' decision-making criteria about the underwriter's reputation and its market power.

It is well argued in the IPO underpricing literature a positive relation between the ex-ante uncertainty related to the value of an IPO (Beatty and Ritter, 1996). Therefore, to control for the IPO ex-ante uncertainty, we include several canonical proxies about the offering and firm observable since issuing firms can hire the same underwriter banks of nearby issuers because they would reduce their ex-ante uncertainty.

The controls for observable offering characteristics are included: Proceeds, i.e., the natural logarithm of one plus the product between the offer price and shares sold at the offering, usually regarding the offering size (Beatty and Ritter, 1985); Invprice, the reciprocal of the midpoint in the range price published in the preliminary prospectus, a measure of issuer risk that captures the effect of the choice price level (Bajo et al., 2015); No.book-runner, the natural logarithm of one plus the number of underwriter managers, which is a proxy of information production negatively related to the ex-ante uncertainty (Corwin and Schultz, 2005); and over-allotment option, a dummy variable coded one if the underwriter manager allocates additional shares in the after-market during 30 days subsequent the offering, IPOs that prevent the option usually have a less prospective underpricing.

The controls for observable firm characteristics are the: Firm's size, measured by the natural logarithm of one plus the amount in terms of dollars of total assets before the IPO; firm's age at the time of the IPO, namely the natural logarithm of one plus the number of years between the issue's year and the founding's year of the company. Valuable and older firms should be less undervalued from the market. Furthermore, tech and biotech dummies are included since technological industries are difficult to value as firms tend to be younger, growth companies, and therefore they have a prospective high level of uncertainty (Liu and Ritter, 2010). Controlling these two macro industries allows us to address the likely upward bias related to the *Network* dummy since they tend to cluster spatially (Stuart and Sorenson, 2003).

Finally, to take into account the endogeneity related to spillover effects stemming from investors' information and the IPO market as a whole, we include price revision[31] proxies to deliver for the

[31] The standard measuere of the price revision is the percentage difference of the offer price from the filing range price's midpoint.

price partial adjustment phenomenon occurring in the period from the filing[32] to the IPO date (Hanley, 1993). This phenomenon is related to investors' private information revealed to the underwriter, which adjusts the offer price relative to the expected offer price (midpoint). Accordingly, these controls allow disentangling possible changes in the underpricing due to market spillovers information stemming from local networks.

Therefore, the proxies used to account for the price adjustment are those employed in Hoberg (2007): positive adjustment, max[revision,0], and negative adjustment, min[revision, 0]. Further, to allow the other prediction that firms learn from overall IPOs contemporaries' effort, it is included the average underpricing over 60 days before the issue date and its standard deviation as a measure of the noise information generated by other IPOs (Benveniste et al., 2001). Therefore, these two proxies control for “hot” and “cold” IPO market cyclicality. Moreover, we consider the natural logarithm of one plus the number of IPOs in the same 48 Fama-French industries that went public in the previous five years of a given IPO to address potential picking up general industry activity (IPO wave).

Referring to the spatial correlation among issuers that chose the same investment bank, since the regressor of interest *Network* varies at the group level, which in turn corresponds to another sub-group level related to a specific investment bank, the IPO underpricing of firms underwritten by the same bank may tend to be correlated. For instance, they may receive the same treatment for an underwriter or are interested in the same underwriting services. Therefore, to account for error dependencies across underwriter and year, standard errors are adjusted for two-dimensional clustering at the underwriter and year level, as well as for heteroskedasticity.

[32] The filing date is the first public filing of the registration statement filed with the Securities regulators and Exchange Commission for an initial public offering.

B. *Results*

The baseline model results are shown in Table 2.4, which reports those for the United States sample, and Table 2.5 reports those for firms in the European continent. Each table displays seven versions of the model: the first reports the univariate result as in table 2.2, the second consider only the fixed effect controls, the other ones from 3 to 6 take into account fixed effects and alternately the four groups of controls discussed above, and the last one considers all control variables.

Table 2.4 lists estimates for the pool of issuing firms in the United States. The central regressor coefficient represents a mean difference between the two defined groups.

The Findings provide evidence about local networks and geographic proximities across issuing firms. The results show that an issuer that relies on local networks, since it adopts an equal underwriter as nearby issuers, significantly marks down IPO underpricing: *Network*'s coefficient estimate is negative and statistically (p-value<0,01), and economically significant for all model variants listed in table 2.4. *Ceteris paribus*, the underpricing is about 4 percentage points lower for firms that choose at least an underwriter as nearby peers than the underpricing of those that choose at least a different underwriter from their local peers (as reported in table 2.4, model 7).

Table 2.5 – The Impact of Local Network on the Firm's Cost of Equity in an IPO in The United States

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Network	-4.48**	-5.49**	-5.48**	-5.46**	-5.73**	-4.39**	-4.39**
	[1.52]	[1.90]	[1.87]	[1.92]	[1.86]	[1.61]	[1.53]
Proceed			1.24				-4.65***
			[0.97]				[1.16]
Invprice			-0.11				-0.93**
			[0.34]				[0.34]

Overallotm.			-24.69***				-21.18***
			[1.40]				[1.37]
No. Book			-7.52**				-1.30
			[2.65]				[2.55]
One UW			0.20				12.56
			[11.36]				[11.11]
Asset				-2.00***			0.52
				[0.44]			[0.55]
Age				0.44			-0.50
				[0.82]			[0.54]
Tech				2.54			0.01
				[3.07]			[2.41]
Biotech				-9.46*			-7.63*
				[4.48]			[3.39]
Industry dist.					-7.21		-7.13*
					[3.86]		[3.29]
UW mktshare					-1.68		8.83
					[12.49]		[12.25]
Industry exp.					1.43		0.91
					[1.68]		[1.51]
State exp.					3.103**		2.25**
					[0.97]		[0.80]
IPO wave						1.21	0.21
						[1.82]	[1.99]
Avg Unp.						0.62***	0.50***
						[0.08]	[0.09]
Std. dev Unp.						0.02	0.12
						[0.07]	[0.08]
Δp^{+}						0.01***	0.01***
						[0.00]	[0.00]
Δp^{-}						0.00***	0.00***
						[0.00]	[0.00]
Fixed effects		Yes	Yes	Yes	Yes	Yes	Yes
N	2016	2016	1986	1953	2016	2016	1924

This table presents OLS estimates for the *Network* regressor regarding the baseline model defined previously. The sample consists of initial public offerings conducted in the United States between 2011-2018. The dependent variable is underpricing. Year, industry (Fama-French 48), underwriter, and exchange fixed effects are included for each model except for column 1 (univariate result). The controls for underwriter time-varying observable are: underwriter Industry experience, underwriter state experience, underwriter industry distance, and underwriter market power. The controls for firm characteristics are: firm's size, firm's age at the time of the IPO, tech and biotech dummies. To controls market spillover effects, I include price revision, the average underpricing level over 60 days before the issue date and its standard deviation, and th IPO industry wave. The square brackets are listed standard errors adjusted for clustering at the underwriter and year level and heteroskedasticity. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

To better understand the economic significance, we can consider that underpricing is about 4 percentage points higher for firms in the cluster *Network* = 0. Therefore, in terms of lost IPO proceeds, the cost of not doing as nearby issuers is 7,17*M*, which is 4% of the IPO proceeds of this median-sized firm (164,24*M*).

Comparing the two models 1 and 2 in table 2.4, we can look at the upward bias due to fixed effects, mainly related to unobservable underwriter fixed effects, which increase the overall result by one percentage point. This estimate points out that issuers who belong to a local network that chose the same underwriter as their local peers should be correlated to persistent unobservable that characterize each underwriter. However, underwriter fixed characteristics could be one of the main confounding factors because firms should choose that specific bank for its features rather than rely on information stemming from local peers. Further, the impact of local networks on the IPO underpricing downturn as we allow for market spillovers control variables. However, the coefficient estimated for the U.S. sample is pretty stable across the seven columns, which allow for different groups of control variables.

This result highlights that proximity to other issuers who chose the same investment bank matters because it may represent a channel of local information transmission. Since the impact of local networks on the IPO underpricing is negative, the result suggests that issuers care about information externalities stemming from local peers if they are pay-off relevant, which allows them to choose the underwriter that performs a lower IPO underpricing.

Table 2.5 displays estimates for the sample consisting of firms in the European continent. In this case, the results point to issuers that hire the same underwriter as local peers increase the IPO underpricing level. The mean difference between *Network* = 1 and *Network* = 0 is positive and statistically and economically significant (p-value<0,01), especially for models 3 and 7.

Table 2.6 – The Impact of Local Network on the Firm's Cost of Equity in an IPO for Issuers in the European Continent

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Network	1.30	2.62*	3.44**	2.79*	2.44	2.73*	3.23**
	[1.06]	[1.27]	[1.17]	[1.30]	[1.33]	[1.14]	[1.13]
Proceed			2.56**				2.87**
			[0.78]				[0.99]
Invprice			-0.16				-0.25*
			[0.12]				[0.12]
Overallotm.			-11.88***				-9.67***
			[1.16]				[1.11]
No. Book			-11.60***				-9.12**
			[2.46]				[2.99]
One UW			-7.48*				-2.89
			[3.04]				[3.02]
Asset				0.33			-0.54
				[0.34]			[0.49]
Age				1.02			0.92
				[0.55]			[0.51]
Tech				-2.54			1.05
				[2.05]			[2.13]
Biotech				-1.35			-0.54
				[4.31]			[3.70]
Industry dist.					-1.62		-0.44
					[2.30]		[1.86]
UW mktshare					3.48		9.79
					[8.02]		[8.32]
Industry exp.					-0.53		-1.87
					[1.82]		[1.89]
State exp.					0.58		0.25
					[1.11]		[1.00]
IPO wave						0.17	1.66
						[1.32]	[1.98]
Avg Unp						0.90***	0.72***
						[0.10]	[0.11]
Std. dev Unp						-0.08	0.02
						[0.10]	[0.11]
Δp^{+}						0.00	0.00
						[0.00]	[0.00]
Δp^{-}						0.00***	0.00**
						[0.00]	[0.00]
Fixed effects		Yes	Yes	Yes	Yes	Yes	Yes
N	1100	1100	1086	1058	1100	1092	1039

This table presents OLS estimates for the *Network* regressor regarding the baseline model defined previously. The sample consists of initial public offerings conducted in the European continent between 2011-2018. The dependent variable is underpricing. Year, industry (Fama-French 48), underwriter, and exchange fixed effects are included for each model except for column 1 (univariate result). The controls for underwriter time-varying observable are: underwriter Industry experience, underwriter state experience, underwriter industry distance, and underwriter market power. The controls for firm characteristics are: firm's size, firm's age at the time of the IPO, tech and biotech dummies. To controls market spillover effects, I include price revision, the average underpricing level over 60 days before the issue date and its standard deviation, and the IPO industry wave. The square brackets are listed standard errors adjusted for clustering at the underwriter and year level and heteroskedasticity. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

The underpricing is about 3 percentage points[33] higher for firms that choose at least an underwriter as their local peers than the underpricing of firms that choose at least an underwriter, which differs from those chosen by nearby issuers (as reported in table 2.5, model 7).

To understand the economic significance of this result, consider the median firm in *Network* = 1. This firm underpriced three percentage points higher than that of a similar ex-ante firm in *Network* = 0. This underpricing amounts to 7.53M in terms of lost proceeds.

The point estimate of the *Network*'s coefficient is not stable across the seven columns of table 2.5. Taking as the benchmark the univariate result of the first column, the results over the subsequent columns show a downward bias since their impact is about two times larger than the unconditional mean (first column). In particular, the downward bias is relevant when control variables concerning the offering features, which are proxies for the ex-ante uncertainty of the IPO value, are allowed. This result points out that issuers belonging to local networks are positively correlated with the ex-ante uncertainty of the IPO value. Indeed, the *Network* point estimate goes up since the coefficients of offering control variables are of negative sign. Further, for the European sample, since issues of wide size increase the level of IPO underpricing, the ex-ante uncertainty should be higher for wide offerings than the small ones, vice-versa for IPOs in

[33] The result becomes even more robust if we shrink the sample to the major European countries: France, Germany, Italy, Netherlands, and Spain.

the U.S. sample[34].

However, the downward bias does not stem from the ex-ante uncertainty related to the firm characteristics. Indeed, even if companies in a local Network have less asset value in terms of dollars, the most significant part consists of mature and capital-intensive (EBITDA>EBIT) businesses. Further, the number of secondary shares sold by shareholders relative to the issued primary ones is lower than that of firms not involved in a local Network (even if higher than shares sold in the US), arguing that shareholders of issuing firms belong to *Network* = 1 do not tend to diversify their portfolio to reduce the risk associated to firm's future value.

The impact of local networks on the IPO underpricing is positive for firms in the European continent. However, contrary to the US result, spatial proximities to other peers that chose the same underwriting bank for their own IPO increase the implicit cost of equity. In this case, the result suggests that issuers rely on information stemming from local peers even if they provide mistaken information. Therefore, a possible herding behavior might occur because local information provided by peers could overcome their own private one. Thus, an issuing firm could also consider the not pay-off relevant information, which leads them to hire the underwriter that performs a higher IPO underpricing.

Typically, to explain the underpricing, the related research has exploited the spatial heterogeneity concerning the distance between the issuer headquarter and financial centers to account for local bias. In contrast, I use the geographic heterogeneity regarding spatial distances across issuing firms to account for possible local interactions. However, even if these results are completely different, they show that spatial proximities across issuing firms that chose the same bank

[34] The coefficient estimate for the IPO proceeds, which is a proxy for the offering size, is -4,63 for the U.S. sample and 2.19 for the European sample.

substantially affect the IPO underpricing.

In sum, the results point to non-negligible consequences about the effect of local networks on IPO underpricing, and therefore in terms of IPO proceeds. Moreover, they highlight two contrary effects for the two analyzed samples. In the U.S., belonging to a local network reduces the implicit cost of equity by about 4 percentage points. While for the European sample, it increases by about 3 percentage points. However, even from the related research, it is possible to point out differences in the evidence between studies that use different national samples. For example, Nielsson and Wójcik (2016) show a lower underpricing for issuers far away from the most populated financial centers in the United States. Whereas, Acconcia, Del Monte, and Pennacchio (2011), exploiting a European sample, show that issuers near financial centers exhibit a lower underpricing.

Therefore, the two opposite effects showed by the present work could be related to different factors that characterize domestic IPO markets, which require additional future developments.

C. *Discussion of results*

The results discussed in the previous section show that belonging to a local network makes a difference in the IPO underpricing. In particular, spatial distances across issuing firms that chose the same investment bank for their IPO matter. This result is either statistically and economically significant given the strength and magnitude of the effect of local networks on the underpricing.

The identifying assumption of the present work is that firms near one another who have adopted the same underwriter are more likely to interact at the spatial level. Therefore, to measure the possible local interaction, I use the spatial dispersion index (I-index) formulated by Johnson and

Zimmer (1985), representing a synthetic measure for each issuer of how it is located against others that chose the same underwriter.

The I-index takes into account exogenous spatial variations. Since the going public decision is ex-post the choice of where to localize own headquarter relative to the timing of a firm life-cycle, it is reasonable to assume that issuing firm's decision of where to localize is exogeneous against the headquarters of other companies that are public or decided to go public over geographic space. Therefore, firms do not place near existing issuers to take informational advantage concerning the IPO process. However, I consider only distances between those who hired the same bank for their IPO. This should avoid some endogeneity problems related to possible spatial clusterization (e.g., industry agglomerations). In any case, I control for the possibility that the I-index could be correlated to other sources of spatial concentrations.

Therefore, since the results indicate a robust impact on the IPO underpricing for firms belonging to a local network, these raise the question of why belonging to a local network matters. In particular, why spatial distances across issuing firms that make the same decision, i.e., to hire the same underwriting bank, make a difference for the IPO underpricing.

Further, relying on the samples of IPOs for firms in the United States and those in the European continent, I show two opposite effects for the two macro areas. In the U.S sample, belonging to a local network reduces the underpricing. While for the European sample, local networks increase it. Consequently, these raise an additional question of why belonging to a local network produces contrary effects for the analyzed samples.

I argue as a possible transmission mechanism the role played by information transmission at the local level. Since the I-index can also be considered a synthetic measure that accounts for how many nearby firms adopt the same bank, it can assess the learning process at the local level. Indeed, The proximity to other issuing firms should be intended as the weighting factor of local information transmission in the decision-making process. Moreover, it accounts for local interactions since distances between issuing firms near one another that adopt the same investment bank are considered. Thus, the I-index defines who relies on local information externalities for their decision-making process regarding the IPO. Thus, according to social learning, the result of the U.S. sample provides two possible implications. First, issuers can care about underwriters hired by others if they perform high IPO proceeds. In this case, agents are not affected by the actions of nearby peers because the only reason an agent should care about the behavior of other agents is if they reveal pay-off relevant information. Second, issuers can rely only on local information, neglecting their own private information, thereby producing herd behavior. As a result, herding leads toward the correct decision for the U.S. case since issuers following others choose underwriters that perform a high offer price against the after-market price.

On the other hand, the European continent sample result suggests that issuers belonging to a local network are involved in a herding behavior, where issuers observing others make systematic erroneous decisions. Thus, they choose underwriters that perform low IPO proceeds because other issuers choose the same. In this case, the behavioral convergence of herding toward erroneous actions could be related to network externalities (or strategic complementarities). As was previously argued, network externalities can be produced in some environments to get or maintain the reputation. For example, issuers choose the same underwriter as their local peers for reputational purposes.

2.5 Further results

Since the I-index considers whether near issuers choose the same underwriters for their IPO to measure possible spatial interactions, other potential transmission mechanisms could be relevant at the spatial level. Given that the I-index could account for the local underwriting activity of specific banks and not properly for the role of information transmission across local peers. In particular, I investigate the role played by the certification effect and the influence of the market power for issuing firms involved in a local network.

A. *Certification effect*

Firms involved in a local network may exploit it to choose the most relevant local underwriter to certificate their high value. According to Chemmanur and Fulghieri (1994), the underwriter's main task is to produce and disseminate reliable information about an IPO, which is more valuable as the investment bank's reputation is high. Therefore, issuers exploit the underwriter as a mechanism of certification of their value. The main implication is that more high-type issuers prefer to use the most prestigious investment banks' underwriting services, even if they have to pay a higher fee. That is why high-value firms are those most affected by adverse selection. Further, since market participants know that reputable underwriters deal with high-type issuers, it is not needed to underprice them to convince investors. Thus, the adverse selection is costlier for low type (e.g., younger and smaller companies), which are difficult to estimate their value correctly. Thus, at the spatial level, I suppose that most relevant investment banks disseminate reliable information about issuing firms, owing to their reputation based on the experience of past

IPOs underwritten over a specific geographic area. Hence, high-value issuing firms use local networks as a tool to choose the most relevant underwriter at the local level for signaling their value. Thereby, the average magnitude of the underpricing should go down for high-type companies involved in a local network. Therefore, we can define high-value type as older and larger companies at the IPO date because their valuation is affected by a lower uncertainty than younger and smaller ones, and generally, they are affected by low risk. Thus, the average magnitude of the underpricing should go down for older and larger companies involved in a local network. Moreover, we can also define high-value companies as those in which pre-issue shareholders retain a large part of secondary shares relative to primary shares issued during the IPO, given the lower cost of forgone diversification since their future cash flows are less uncertain. Whereas low-value companies are characterized by significant future cash flows uncertainty, then the cost of forgone diversification is higher. Therefore, the underpricing level is lower for firms involved in a local network with a large fraction of retained shares, i.e., those with pre-issue shareholders' portfolios less diversified.

To analyze the certification effects of local networks, I include an interaction term between the variable *Network* and proxies to define the high-value company in the regression model discussed in the previous section. In particular, in table 2.7, I enter the natural logarithm of the company's age at the time of IPO interacted with *Network*. In the same vein, I make the same for the natural logarithm of the total asset amount in table 2.8 and the ratio of secondary shares sold by pre-issue shareholders at the IPO date over the total sold shares in table 2.9. Each variable interacted with the main regressor is defined in terms of deviation from their respective mean. This allows decreasing the variance of the product (interaction term). Each table presents results both for the US and European samples. In table 2.7, the coefficient on the interaction term with Age is 1,57 percentage points for the US sample (Column 2) and -1,52 for the European sample (Column 4), and both are not statistically different from zero. Even if the t-test of the two results is not statistically significant, the F-test rejects the null, where the coefficients *Network* and the one of interaction are equal for both models at the level of statistical significance of 1%. Note that including the interaction term in the set of regressors has only a slight effect on the point estimate of the *Network* coefficient.

Table 2.7 – The Impact of Local Network on the Firm's Cost of Equity in an IPO – Certification effect with the Age proxy

	(1) US	(3) US	(1) EU	(3) EU
Network	-4.39**	-4.16**	3.23**	3.52**
	[1.52]	[1.50]	[1.13]	[1.15]
Age	-0.50	-1.54	0.92	2.22*
	[0.54]	[0.81]	[0.50]	[0.96]
Network x Age_		1.57		-1.52
		[1.05]		[0.96]
F-test		8.97		9.62

This table presents OLS estimates for the *Network* regressor and its interaction with the variable Age, which is defined in terms of deviation from its mean. The sample consists of initial public offerings conducted in the European continent and U.S. between 2011-2018. The dependent variable is underpricing. Year, industry (Fama-French 48), underwriter, and exchange are the fixed effects included for each column. The controls for underwriter time-varying observable are: underwriter Industry experience, underwriter state experience, underwriter industry distance, and underwriter market power. The controls for firm characteristics are: firm's size, firm's Age at the time of the IPO, tech and biotech dummies. To controls market spillover effects, I include price revision, the average underpricing level over 60 days before the issue date and its standard deviation, and the IPO industry wave. The square brackets are listed standard errors adjusted for clustering at the underwriter and year level and heteroskedasticity.* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

In table 2.8, the interaction term with Asset is 1,77, which is significantly different from zero at 5% in column 2 (US sample), while the coefficient for the European sample is not statistically significant. The F-test rejects the null for both models in columns 2 and 4, even if the result for this last column (European sample) is not economically relevant.

Table 2.8 – The Impact of Local Network on the Firm's Cost of Equity in an IPO – Certification effect with the Asset proxy

	(1) US	(3) US	(1) EU	(3) EU
Network	-4.39**	-4.31**	3.23**	3.25**
	[1.52]	[1.47]	[1.13]	[1.14]
Asset	0.52	-0.73	-0.53	-0.32
	[0.55]	[0.65]	[0.49]	[0.59]
*Network x Asset_*		1.77**		-0.25
		[0.57]		[0.51]
F-test		11.58		6.87

This table presents OLS estimates for the *Network* regressor and its interaction with the variable Asset, which is defined in terms of deviation from its mean. The sample consists of initial public offerings conducted in the European continent and U.S. between 2011-2018. The dependent variable is underpricing. Year, industry (Fama-French 48), underwriter, and exchange are the fixed effects included for each column. The controls for underwriter time-varying observable are: underwriter Industry experience, underwriter state experience, underwriter industry distance, and underwriter market power. The controls for firm characteristics are: firm's size, firm's Age at the time of the IPO, tech and biotech dummies. To controls market spillover effects, I include price revision, the average underpricing level over 60 days before the issue date and its standard deviation, and the IPO industry wave. The square brackets are listed standard errors adjusted for clustering at the underwriter and year level and heteroskedasticity.* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Whereas, in table 2.9, the impact of the interaction term between the ratio of the secondary shares over the total shares sold at the IPO and the categorical variable *Network* is both economically (6,82) and statistically significant (p-value<5%) for the model in column 2 (US sample). Whereas, for the European sample, the result is not statistically different from zero. The F-test confirms this as well.

Table 2.9 – The Impact of Local Network on the Firm's Cost of Equity in an IPO – Certification effect with the secondary shares% sold proxy

	(1)	(2)	(3)	(4)
	US	US	EU	EU
Network	-4.35**	-3.50**	3.21**	3.76**
	[1.52]	[1.32]	[1.13]	[1.31]
Ratio	6.62***	2.14	-0.53	1.09
	[1.84]	[2.84]	[1.24]	[2.09]
*Network x ratio_*		6.82*		-2.12
		[3.32]		[2.44]
F-test		6.85		3.17

This table presents OLS estimates for the *Network* regressor and its interaction with the ratio of secondary shares over the total shared sold at the IPO, which is defined as deviation from its mean. The sample consists of initial public offerings conducted in the European continent and U.S. between 2011-2018. The dependent variable is underpricing. Year, industry (Fama-French 48), underwriter, and exchange are the fixed effects included for each column. The controls for underwriter time-varying observable are: underwriter Industry experience, underwriter state experience, underwriter industry distance, and underwriter market power. The controls for firm characteristics are: firm's size, firm's Age at the time of the IPO, tech and biotech dummies. To controls market spillover effects, I include price revision, the average underpricing level over 60 days before the issue date and its standard deviation, and the IPO industry wave. The square brackets are listed standard errors adjusted for clustering at the underwriter and year level and heteroskedasticity.* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

The results show a different path from the classical impact of the IPO underpricing for high-value companies, which is usually documented in the past literature. In particular, the interaction term for the US sample, in table 2.7 and 2.8, shows that older and larger companies involved in a network suffer a greater underpricing than those in a local network that are younger and smaller. Two reasons may explain this. First, the pattern of IPO underpricing for high-value companies is changing. Second, the age and the size characteristics are not enough to identify the quality of a firm. Indeed, in table 2.9, the interaction between the *Network* and the proxy for the diversification of pre-issue shareholders portfolios is positive (US sample). This means that firms involved in a local network, where shareholders diversify their portfolios more, have a higher cost of the forgone diversification since their future cash flows have higher uncertainty than those less diversified. Thus, we can also conclude by comparing the statistical significance for the two samples and taking into account table 2.9 that the certification effect is more suitable for the US case.

B. *Market power effect*

The I-index could measure concentrations of IPOs underwritten by the same investment banks due to frictions concerning the underwriting market competition in a geographic area, which may positively affect the level of IPO underpricing for issuing firms involved in networks. According to Liu and Ritter (2010), the upstream IPO market[35] is based on differentiated underwriting services. Further, some issuing firms care about "non-price dimensions" of underwriting. Hence, getting a high offer price relative to the first listing price or getting a low gross spread (underwriting fees) is not a priority. Therefore, the underwriting industry is best characterized as series of differentiated oligopolies. Indeed, a limited number of underwriters can provide specific services and features. Moreover, several papers show that underwriters can benefit from underpricing IPOs through soft dollar commissions (Goldstein, Irvine, and Puckett, 2011) and spinning practices (Liu and Ritter, 2010). Indeed, Liu and Ritter predict that oligopolistic underwriters exercising their market power results in greater underpricing for issuers that are less focused on maximizing IPOs proceeds.

According to the market power mechanism, two elements should characterize the underwriting market structure and the correlated local networks between firms over geographic space. First, the preferences of local issuers for a particular non-price dimension increase their willingness to left more "money on the table." Hence, if non-price dimensions' value increases in some areas,

[35] the upstream IPO market concerns the competitive interaction among underwriters to get the mandate from issuers.

local dominant underwriters with differentiated services increase their market power, increasing the average IPO underpricing level. Second, if the number of investment banks that offer the same services increases over a geographic area, the rent decreases for that particular non-price dimension. In this case, the spatial concentration of issuers underwritten by the same banks reduces, resulting in a market equilibrium that goes toward the perfect competition with a lower underpricing.

Since the location of issuers' headquarter is just a discriminating factor that generates heterogeneity over firms' preferences about underwriting services. A series of spatial oligopolies may characterize local networks between firms through two possible non-price dimensions. First, issuing firms may care about the underwriter's local expertise, i.e., the degree of specialization of the territorial market patterns, which is related to the experience of past underwritten IPOs in the same geographic area. Hence, underwriters with local expertise may attenuate the ex-ante uncertainty related to the offering's success and are more able to place an issue to local investors. Second, the local concentration of IPOs underwritten by the same bank can be due to an industry agglomeration. In this case, the underwriter's industry expertise may be the relevant non-price dimension that produces differentiation between services required by local issuing firms. Thus, an underwriter's record of similar firms taken public in the past reduces the degree of substitution with competitors. Of course, these two non-price dimensions are not mutually exclusive, and a combination of them is possible. However, there could also be other non-price dimensions that are not observable, affecting the market power's spatial arrangements.

To evaluate the magnitude of the local network's effect due to the local market power, I compute the HHI and underwriter market share as two possible alternative proxies, both for the two non-price dimensions mentioned above. The average underpricing magnitude should be higher for issuing firms involved in local networks if they place in geographic areas (or industry) with a higher HHI or choose an underwriter with a high market share.

Tables 2.10 and 2.11 compare the results for the European and US sample for different interactions. In particular, in table 2.10, I enter two different interaction terms. First, *Network* interacted with HHI, which is based on the 48 Fama-French Industry classification (1997) to account for the industry expertise non-price dimension. Second, the interaction term with the underwriter market share, which is also based on the industry classification (48 Fama-French). Whereas, in the same way, in table 2.11, I include the interactions that consider the HHI and the underwriter market share, both based on local expertise. As in the previous paragraph, each variable that interacts with the main regressor is defined in terms of deviation from its mean.

In table 2.10, the coefficients on the interaction terms between *Network* and HHI are not statistically different from zero for both the samples, even if the F-test for the US sample (column 2) rejects the null at the significance level of 5%. At the same time, the coefficient of the interacted term with the underwriter market share is statistically different from zero only for the European sample (column 8).

Table 2.10 – The Impact of Local Network on the Firm's Cost of Equity in an IPO – Market power effect with the HHI and U.W. Mkt share for FF-48 proxies.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	US	US	US	US	EU	EU	EU	EU
Network	-4.36**	-3.90**	-4.36**	-4.10**	3.11**	2.24	3.14**	3.06**
	[1.52]	[1.49]	[1.52]	[1.48]	[1.11]	[1.18]	[1.12]	[1.11]
HHI(ff48)	-12.50	-35.43			-11.49	-25.84*		
	[8.86]	[18.18]			[6.34]	[11.45]		
*Net. x HHI_*		26.84				19.17		
		[16.84]				[11.22]		
Mkt share			-24.86***	-36.49**			-8.09	-21.74**
			[7.07]	[13.84]			[5.18]	[7.72]
*Net_ x Mkt_*				14.54				19.23*
				[13.83]				[9.03]
F-test		3.31		1.79		2.09		3.26

This table presents OLS estimates for the *Network* regressor and its interaction with the HHI and the Underwriter market share, which are both based on the Industry experience (Fama-French 48 classification) and defined as deviation from its mean. The sample consists of initial public offerings conducted in the European continent and U.S. between 2011-2018. The dependent variable is underpricing. Year, industry (Fama-French 48), underwriter, and exchange are the fixed effects included for each column. The controls for underwriter time-varying observable are: underwriter Industry experience, underwriter state experience, underwriter industry distance, and underwriter market power. The controls for firm characteristics are: firm's size, firm's Age at the time of the IPO, tech and biotech dummies. To controls market spillover effects, I include price revision, the average underpricing level over 60 days before the issue date and its standard deviation, and the IPO industry wave. The square brackets are listed standard errors adjusted for clustering at the underwriter and year level and heteroskedasticity.* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

In this case, the point estimate is economically relevant (19,23). Moreover, its respective F-test is near to the statistical significance level of 5%. Note that the point estimates of two interaction terms in columns 6 (HHI) and 8 (UW Mkt share) are quite similar. In table 2.11, none of the coefficients on the interaction terms are statistically significantly different from zero. Further, the F-test does not reject the null for each considered model as well. This could be related to two main motivations. First, the two proxies used to take into account the market power based on local expertise could not be suitable measures. Second, the main regressor could be a more accurate measure of market powers set at the spatial level since the Network dummy is based on the I-index that considers the heterogeneity in areas, and therefore, it could catch the most significant part of the spatial variability.

Table 2.11 – The Impact of Local Network on the Firm's Cost of Equity in an IPO – Market power effect with the HHI and U.W. Mkt share for State proxy.

	(1) US	(2) US	(3) US	(4) US	(5) EU	(6) EU	(7) EU	(8) EU
Network	-4.46**	-4.38**	-4.47**	-4.36**	3.26**	3.30**	3.22**	3.35**
	[1.53]	[1.52]	[1.53]	[1.51]	[1.15]	[1.14]	[1.14]	[1.14]
HHI(state)	8.94	4.34			5.17	16.57		
	[6.99]	[10.47]			[7.07]	[9.51]		
*Net x HHI_*		6.99				-15.32		
		[10.67]				[11.24]		
Mkt share			6.99	0.71			-1.41	9.41
			[6.40]	[11.28]			[5.40]	[9.40]
*Net x Mkt_*				9.32				-13.32
				[11.80]				[9.80]
F-test		1.11		1.32		2.74		2.84

This table presents OLS estimates for the *Network* regressor and its interaction with the HHI and the Underwriter market share, which are both based on state experience and defined as deviation from its mean. The sample consists of initial public offerings conducted in the European continent and U.S. between 2011-2018. The dependent variable is underpricing. Year, industry (Fama-French 48), underwriter, and exchange are the fixed effects included for each column. The controls for underwriter time-varying observable are: underwriter Industry experience, underwriter state experience, underwriter industry distance, and underwriter market power. The controls for firm characteristics are: firm's size, firm's Age at the time of the IPO, tech and biotech dummies. To controls market spillover effects, I include price revision, the average underpricing level over 60 days before the issue date and its standard deviation, and the IPO industry wave. The square brackets are listed standard errors adjusted for clustering at the underwriter and year level and heteroskedasticity. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

In sum, the market power effect predicts better the result for the European sample about issuing firms involved in a local network. In particular, issuers seem to have preferences for specific underwriters characterized by industry expertise. However, this effect should also be related to an industry agglomeration, generating market powers for specialized underwriters.

C. *U-shaped relationship*

In this paragraph, I verify if the opposite results found through the dummy variable *Network* for the US and European samples could be conciliated by non-linear effects. Therefore, a possible alternative is to include the I-index, on which the dummy *Network* is established, and its second polynomial degree terms directly in the regression model to verify a possible U-shaped relationship between the I-index indicator and IPO underpricing.

Table 2.12 presents results for the US (from column 1 to 4) and European samples (from column 5 to 8), allowing for non-linear effects to verify if coefficients conciliate between the two samples. Columns 2 and 4, where the square term is added, do not show statistically relevant results. In particular, the t-test of the second polynomial degree for both the two samples does not show a relevant statistical significance. Even if the F-test of column 2 rejects the null. However, even if the results are irrelevant, the impacts do not converge to the same sign for both samples. Finally, a U-shaped relationship does not fit the data and does not represent empirical evidence of bias due to non-linear effects. Thus, adopting the categorical variable *Network* remains the best option, which is also consistent with the I-index theoretical framework.

Table 2.12 – The Impact of Local Network on the Firm's Cost of Equity in an IPO – U-shaped relationship between Underpricing and the I-index.

	(1) US	(2) US	(3) EU	(4) EU
I-index	-1.14**	-2.41*	0.53	0.71
	[0.37]	[1.18]	[0.29]	[0.64]
(I-index)^2		0.07		-0.00
		[0.06]		[0.02]
F_test		4.46		1.69

This table presents OLS estimates for the *I-index* and its polynomial terms to verify the U-shaped relationship. The sample consists of initial public offerings conducted in the European continent and U.S. between 2011-2018. The dependent variable is underpricing. Year, industry (Fama-French 48), underwriter, and exchange are the fixed effects included for each column. The controls for underwriter time-varying observable are: underwriter Industry experience, underwriter state experience, underwriter industry distance, and underwriter market power. The controls for firm characteristics are: firm's size, firm's Age at the time of the IPO, tech and biotech dummies. To controls market spillover effects, I include price revision, the average underpricing level over 60 days before the issue date and its standard deviation, and the IPO industry wave. The square brackets are listed standard errors adjusted for clustering at the underwriter and year level and heteroskedasticity. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

D. *Institutional differences in the European sample*

The IPO market is different in the various European countries. Institutional differences could cast doubt on the average effect found in the European sample from mixing different countries.

Table 2.13 restricts the analysis to the European sample to show the effects of excluding several kinds of observations and verify if the positive impact results from the sample selection.

First, I observe if financial system characteristics drive the average effect. Therefore, I exclude market-based[36] financial system countries from the sample. Second, countries with a geographic decentralized stock market can produce a different effect of local networks on the IPO underpricing. Thus, I exclude IPOs made in Germany from the sample. Further, I observe the average effect of excluding IPOs listed in foreign stock markets outside the European continent (US stock exchanges). As IPOs that foreign (US) underwriters manage. Finally, excluding the most developed European countries in terms of stock markets, I verify if the effect is driven by observations that belong to other unusual countries' stock markets.

The point estimates of β (all statistically different from zero except in column 5) maintain the positive impact in the range 2,83-4,68. Instead, the point estimate in column 5 is nearly zero and

[36] Market-based countries in the European continent are Denmark, Turkey, Netherlands, Sweden, UK, and Switzerland, according to Demirguc-Kunt and Levine (1999, the World Bank Development Research group Finance).

not statistically significant, showing that financially developed countries drive the overall impact for the European continent sample.

Table 2.13 – The Impact of Local Network on the Firm's Cost of Equity in an IPO for Issuers in the European Continent – Sample selection.

	(1)	(2)	(3)	(4)	(5)
Network	4.68^{**}	2.83^{*}	2.72^{*}	3.09^{*}	0.96
	[1.42]	[1.23]	[1.16]	[1.29]	[0.70]
N	663	902	870	749	495

This table presents OLS estimates of the *Network* regressor regarding the baseline model defined previously for the sample of IPOs conducted in the European continent between 2011-2018, which excludes IPOs in market-based financial countries (1), Germany (2), IPOs listed in foreign stocks (3), IPOs managed by foreign underwriters (4), and IPOs in financially developed countries. The dependent variable is underpricing. Year, industry (Fama-French 48), underwriter, and exchange are the fixed effects included for each column. The controls for underwriter time-varying observable are: underwriter Industry experience, underwriter state experience, underwriter industry distance, and underwriter market power. The controls for firm characteristics are: firm's size, firm's Age at the time of the IPO, tech and biotech dummies. To controls market spillover effects, I include price revision, the average underpricing level over 60 days before the issue date and its standard deviation, and the IPO industry wave. The square brackets are listed standard errors adjusted for clustering at the underwriter and year level and heteroskedasticity. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Conclusion

The present study aims to cover evidence about the relationship between geographic dimensions and the IPO underpricing puzzle. Typically, to explain the underpricing, the related research has exploited the variability concerning the spatial proximity between the issuer and financial centers to account for local bias. Instead, since issuing firms are not always geographically concentrated near financial centers, I provide a new geographic heterogeneity source concerning spatial distances across issuers that have adopted the same underwriter for their IPO. This allows us to consider the role of local interactions in decision-making processes to evaluate how it affects IPO performance.

To measure how issuing firms are geographically arranged relatively to their peers, I exploit Johnson and Zimmer's spatial dispersion index (I-index), which assesses whether a firm is clustered or isolated from others. Under statistical assumptions of normality, the I-index takes a theoretically expected value equal to two for issuers distributed homogeneously in geographic space, establishing a benchmark to detect firms geographically clustered with the same attribute (e.g., underwriter). Therefore, issuing firms are distinguished into two groups, those involved in a local network since they hire the same underwriting bank as their nearby peers, who have an I-index above two, and those who adopted a different one, who have an I-index lower or equal to two.

The spatial proximities to other issuers have substantial implications in the learning process: agents usually learn more from others who are nearer. Further, in the sociology literature, the probability of interaction among agents is due to homophily and propinquity factors in geographic space. Thus, individuals near one another (propinquity), who have the same opportunity-based system (homophily), have more likelihood of interacting among them also tacitly. Thus, I suggest that spatial heterogeneity in the firm's locations generates differences in social learning. Managers who work in the same geographic area have more probability of mimicking than their isolated peers since they can transmit information by mainly two channels: face-to-face interactions and observation.

Relying on a sample of IPOs in the United States and countries of the European continent, I find a significant difference in the mean underpricing level between issuers that rely on local networks and those that do not rely on local networks. After controlling for several endogeneity sources, the multivariate mean-difference in the IPO underpricing shows: US firms that choose investment banks as their local peers exhibit 4.39 percentage points lower mean underpricing than those that choose a different investment bank. Whereas, for firms in the European continent that choose investment banks as their local peers, the mean underpricing is 3.29 percentage points greater than nearby issuers that rely on a different underwriter. Both these differences are statistically significant at 1%.

The results highlight that spatial proximities to other issuers imply different effects of local networks on the IPO underpricing between the two macro-area samples. According to the social learning mechanism, the estimate suggests that companies involved in a local network should be correctly informative in the United States, leading to a better decision. Thus, firms who choose to do as nearby peers perform an implicit low cost of equity. On the other hand, the result provided by the European continent sample suggests that social learning could have generated a different scenario at the local level, wherein issuers neglect their private information and rely on public information stemming from local peers because they are assumed to be better informed.

Therefore, we can talk of herding behavior because local information could overcome private information (or alternative sources of information). Indeed, in this case, issuers who rely on local networks also consider not paying off relevant information (Gale, 1996), leading to systematic erroneous decision-making. They choose underwriters that perform a high level of IPO underpricing.

However, since the local network definition is related to the underwriting activity of investment banks, other potential effects, which are not mutually exclusive to the learning mechanisms, have to be taken into account. The first potential one is the certification role of local relevant underwriters. Firms involved in a local network may exploit it to choose the most relevant local underwriter to certificate their high value. Thus, high-type exploits the investment bank as a mechanism to certificate their value to reduce the local adverse selection, hence, the underpricing level (Chemmanur and Fulghieri, 1994). As discussed in section 2.5, even if the evidence is not so strong for all provided proxies, this kind of effect is relevant for the U.S sample. In particular, firms with pre-issue shareholders that diversify their portfolios less bear a lower level of underpricing. Whereas, the second possible accounted effect considers that the upstream IPO market should be based on differentiated underwriting services, where some investment banks can detain a market power. Therefore local networks across issuing firms are the outcome of some market power frictions. Thus, at the local level, the underwriting industry should be best characterized as a series of oligopolies, wherein local market power results in greater underpricing for issuers belonging to a local network (Liu and Ritter, 2010). As shown in section 2.5, the European sample depicts a relevant result for market power. In particular, the coefficient on the interaction between the dummy *Network* with the underwriter market share based on 48 Fama-French industry clusterization is positive and statistically significant.

In sum, these results represent the first evidence regarding the effect of spatial distances across issuing companies on the IPO underpricing. As we have seen, possible local frictions are correlated with the local networks effect. Therefore, even if the present work shows interesting results, they require further development and greater attention to the interpretation.

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Appendix: the I-index

The I-index is defined in the following way: let E^m denote m-dimensional Euclidean space and select R random points (individuals), $r = 1, \ldots, R$, in a finite sub-region of E^m. Define X_r as the distance from r-th random point and the nearest individual in E^m, and V_r as the volume of the m-dimensional sphere having a radius X_r. Generically, the volume formula is: $V_r = \frac{\left[\Gamma\left(\frac{1}{2}\right)\right]^m \cdot X_r^m}{\Gamma\left(1+\frac{\mathrm{m}}{2}\right)}$, whereby $\Gamma(\cdot)$ is the gamma function, if n is an integer > 0, then $\Gamma(n) = (n-1)\Gamma(\mathrm{n}-1)$ and $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$. In the case of $m = 2$, the volume formula will be $V_r = \pi X_r^2$. The Johnson and Zimmer index is:

$$I = \frac{(R+1)\sum_r^R V_r^2}{\left(\sum_r^R V_r\right)^2}$$