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IPO underpricing: the case of firms listed on Euronext

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Abstract

Few corporate events have gathered as much attention from the business actors as initial public offerings (IPOs). Actors from the sector have always paid particular attention to the initial returns arising from the IPO's first day of trading. Often described as abnormally high and named IPO underpricing, these exceptional returns are subjected to an extensive amount of research. These papers mainly focus on determining potential explanations for the phenomenon. The novelty of this particular study lies in the presentation of a multivariate linear regression model that aims at testing four distinct information asymmetry theories on the Euronext market. The model integrates data of 150 IPOs from four different regions: Amsterdam, Brussels, Lisbon and Paris. The first objective is to investigate the magnitude of underpricing and an average initial returns of 6.28% is recorded. Second of all, this research discovers a significant positive correlation of market conditions with IPO underpricing and volumes. Then, based on the research sample, the present study finds strong support for one particular explanation theory. Indeed, the assertion of underwriter reputation and agency problem's influence on underpricing provides evidence for information asymmetry based approaches. Finally, to a minor extent, the behavioral explanation of underpricing migh be endorsed by the long-run underperformance of IPOs on the Euronext market.

List of acronyms

AIR: Abnormal Initial Return

CFO: Chief Financial Officer

EMEIA: Europe, Middle East, India & Africa

EU: European Union

GDP: Gross Domestic Product

GICS : Global Industry Classification Standard

IPO: Initial Public Offering

IR: IPO Initial Returns

LP: Lockup Period

OOA: Over-allotment arrangement

SEO: Seasoned equity offering

SME: Small and Medium enterprises

SOX: Sarbanes-Oxley Act

US: United state of America

VC: Venture Capital

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General Introduction

At a time when the record IPO of Saudi Aramco has been registered, 1115 owners had listed their companies across the three main regions, namely EMEIA, Americas and Asia-Pacific (EY, 2020). Initial returns on the first day of these IPOs were uniformly positive across those regions, their magnitude varying dependently of the market (Ritter, 2020). Underpricing is the name given to this phenomenon that has been extensively studied in the literature.

Three main types of actors generally participate in the IPO process. Firstly, the firm going public is called the issuer. Secondly, the underwriter is an investment banker who, in addition to performing the service of distributing the shares and helping in setting the price, bears the risk of the IPO by buying the initial shares from the issuer (Liu & Ritter, 2009). Finally, investors obviously participate in this IPO process, whether they are considered informed or uninformed.

IPOs follow a general process that is prevalent worldwide and described in FIGURE I.1. According to Katti and Phani (2016), there are six distinct phases in this process. The present work first starts by defining a preliminary step, which is the decision in itself. In SECTION 1.1, the motivations behind the decision to go public are presented and will provide the first valuable tools to understand the underpricing phenomenon.

FIGURE I.1: IPO process (Adapted from Katti & Phani, 2016)

Then, the research phase consists of the firm's first contact with the underwriter, a due diligence on the industry and market is usually performed. The following two phases respectively consist in requirement fulfilling and publicity of the issue. Underwriting and marketing have not appeared in the literature as significant factors of influence on the phenomenon, except for the latter having a relatively small impact through analyst coverage of the IPO.

The price determination phase is obviously at the core of this research. This step is first discussed in SECTION 1.2 and constitutes the backbone of every presented explanation on underpricing. Two theories will be documented on the pricing. On the one hand, underwriters and issuers purposely underprice IPOs, and the market adjusts the price to fair value on the first day of trading. On the other hand, underwriters and issuers set the price at fair value and investors drive the price up which results in abnormal initial returns.

As previously said, underwriters have the discretion to allocate the shares and it might create price distortion. Investment bankers can thus contribute in underpricing. This will be discussed in several parts of this work that will aim at explaining the agency problems that arise from the role and scope of action of underwriters.

Regarding the last phase of listing and trading, it will be studied through a practical example in CHAPTER 2. The goal is to assess if the underpricing materializes on Euronext and if it exists, the potential explanation of this phenomenon. The verification of research assumptions will be made with several statistical tools: mean, variance, Pearson coefficient, multiple linear regression.

The empirical analysis of this study focuses on companies that went public on Euronext from 2004 to 2019. This market was created in 2000 from the fusion of 3 stock exchanges: Amsterdam, Brussels and Paris. In 2005, a compartment for middle-sized companies had been created, namely Alternext, which has then been renamed Euronext Growth in 2017. The same year, a second compartment has been created, Euronext Access. The goal of this new compartment is to replace "Le Marché Libre" and offer simplified access to listing for growth start-ups and middle-sized companies (Euronext, 2020).

Euronext offers a real research opportunity due to these specificities, the data sample of the market contains companies from the main market and both compartments. The ability to compare between markets will make the present work more relevant to determine how underpricing varies depending on the context of observation.

Regarding the studied market, a language specification is necessary. This study will refer to Euronext as both the main market and its two components while Euronext Main will consist of Euronext Paris, Amsterdam, Brussels and Lisbon.

The main goal of this work is to assess if the phenomenon of underpricing exists on Euronext. Therefore, our main research question is the following:

RQ_1 :	*Is there evidence of IPO underpricing for companies listed on Euronext?*

As literature largely documented that IPO underpricing is pervasive around the world, we formulate the hypothesis H_1 :

- H_1 : IPO underpricing exists for companies that are listed on Euronext.

The two following sub-questions arise from the correlation observed in the literature between several factors and underpricing. Four main categories of theory on underpricing are developed in SECTION 1.5. This study will mainly focus on testing information-based theories on Euronext. This choice is made for two reasons. First, this theory has been largely documented and has found empirical supports on several markets. Second, available information in the database and in different sources such as Euronext website provides suitable proxies to investigate this theory and its frameworks. The proxy variables that will be used are based on the researches of reputable authors. The following question is then at the core of this work because it represents the primary objective of this study:

$RQ_{1.1}$:	*Which theories explain IPO underpricing on Euronext?*

Given the empirical proof advanced by several authors in favor of information asymmetry theories, the following hypothesis is put forward:

- $H_{1.1}$: Information asymmetry-based theories explain IPO underpricing on Euronext.

As documented by Van Hulle et al. (1993), investors' overoptimism might increase underpricing which then leads to long run underperformance. Based on this assumption, this study will test the link between IPO underpricing and long-run performance with a simple linear regression. This investigation is translated in the last research question :

$RQ_{1.2}$:	*What is the relationship between IPO long-run performance and underpricing on Euronext?*

As it has been done with the previous questions, the literature is used to formulate the hypothesis:

- $H_{1.2}$: There is a negative relationship between IPO long-run underperformance and underpricing on Euronext.

1 Literature review

1.1 Why do companies go public?

Going public is not a simple and straight-forward decision for a company (Pagano et al., 1998). Many reasons can be put forward to explain this choice and this phenomenon has been thoroughly theorized. This section aims at describing the main studies on that particular matter.

Firms seek multiple benefits from going public. Those benefits vary greatly depending on the type of firm, the ownership structure, the age, size and the regulatory environment in which this firm operates (Bancel & Mitoo, 2009).

At first glance, the intuition would be that raising equity capital is the most important determinant in the decision to go public. This intuition seems to be correct. Indeed, Ritter and Welch (2002) found that raising equity capital is one of the two most important benefits of going public. This view is supported by other studies (Kim & Weisbach, 2008; Pagano, Panetta, & Zingales, 1998). Nevertheless, the purpose of raising equity may vary across countries.

Zagales, Pagano and Panetta (1998) empirically studied Italian companies. The authors found that these firms did not go public in order to raise funds for growth but the motivation behind this decision was rather to use the equity to rebalance their accounts by paying back some debt of prior high investment periods. Similar findings have been observed in other European countries, namely Spain (Planell, 1995) and Sweden (Rydqvist & Högholm, 1995).

These findings are inconsistent with the study of Bancel & Mitoo (2009). The authors surveyed European CFOs concerning their decision to go public. A dominant share of CFOs stated that financing for growth is one of the key elements of the decision to go public along with raising raising equity capital. Over 70% of the CFO surveyed by the authors defined this benefit as being the most important.

Similar results are observed in the USA. Ritter & Welch (2002) state that the main reason

American companies go public is to raise equity for growth. It is supported by the fact that newly listed companies experience significant growth following their IPOs. Only older US firms are likely to adopt the same behavior as European firms and use equity to rebalance their accounts (Mikkelson et al., 1997).

The motivation behind the decision of listing may vary across countries. Another possibility is that it has simply evolved in European countries after 1998, which is why we observe different findings in Europe.

The second recurrent benefit documented in the literature can be described as the visibility, reputation and credibility that arise from going public (Merton,1987; Maksimovic & Pichler, 2001). Most CFOs in the EU find that it is among the most important benefits of going public (Bancel & Mitoo, 2009). This parameter marks a major difference between European and American firms, as non-financial reasons like increased visibility and reputation do not appear to play a major role in the IPO decision in the US (Ritter & Welch, 2002; Brau & Fawcett, 2006).

However, these non-financial reasons have indirect financial impacts. It is essential for a firm to increase its visibility and, consequently, its shareholder base because this will lower its cost of capital (Merton et al., 1987). It could be explained by the fact that going public increases the firm's bargaining power with bankers and financial creditors (Rajan, 1992).

As previously stated, Ritter & Welch (2002) found that raising equity capital is one of the two most important determinants of going public. The second one is the motivation of the initial owners to convert their investment into cash. The listing process enhances shares' liquidity (Amihud & Mendelson, 1986) which allows the initial owners to cash out their investment in an easier way. In addition to sell their investment, owners can also maintain their control because the listed shares could be dispersed among a higher number of investors. Empirical evidence supports this theory. In the three years following the IPO, the turnover of the controlling group is higher than normal, even when the initial shareholders keep their controlling block after the IPO (Pagano, Panetta, & Zingales, 1998). IPO could be an owner decision because it benefits him in various ways. It allows her/him to consume her/his investment and also to reinvest the equity capital acquired with the listing (Rust & Gupta, 2017).

Intrinsic characteristics of the firm also influence the decision of listing. For example, the size of the firm is correlated with the probability of going public. It is notably true for European companies where the average age of newly listed companies is 40 years old which is far much

older than what is observed in the US (Pagano, Panetta, & Zingales, 1998).

Rust & Gupta (2017) defined the perfect size to go public as the “Goldilocks size”. If the firm is too small, it will experience borrowing constraints and will not be able to pay for fixed and proportional IPO fees. Larger companies can afford the fees but do not always need IPO to achieve their optimal scale as they can use debt financing and the earnings that they kept by not going public.

There are two potential formal theories to explain the motivation behind the decision to go public.

Documented by Zingales in 1995, the life-cycle theory argues that being a potential target for a takeover deal is what a firm seeks in an IPO. This theory also claims that the value of the firm in the event of a takeover will be greater when the company is listed. It is consistent with the findings of Hsieh et al. (2011), who state that the decision to go public may be part of a merger and acquisition strategy.

The second theory is called market timing and was developed by Lucas & McDonald in 1990. Market-timing is an asymmetric information model which argues that a firm will not go public if there is a significant probability that it will be undervalued as it could be the case in a bear market scenario. The strategy will be to wait for a favorable market to go public and therefore benefit from a bull trend. This is consistent with the windows of opportunity theory developed by Jay R. Ritter in 2003. The author states that the owners use their superior information to choose the best timing to go public. By doing so, they will benefit from favorable market conditions.

These theories are difficult to test due to a lack of relevant data on private firms. Despite this obstacle, the large variation in the number of IPO per year seems to depend on market conditions.

1.2 Introduction method

As explained in the introduction, pricing and allocation are the backbones of the IPO process. Therefore, there is a significant probability that the choice of method plays a role in IPO underpricing. This section is divided into two parts. First, the primary pricing methods are explained. Then, the allocation mechanism related to the most common introduction method is documented.

1.2.1 Pricing

Due to the lack of historical market value data for companies, finding the right offer price is a tedious and risky process. If the price is too low, it will result in a significant amount of money left on the table. Conversely, if the price is perceived as too high by investors, it could prevent the IPO from succeeding.

There are three pricing methods studied in the literature: fixed price, auction and bookbuilding.

1.2.1.1 Fixed price

Regarding the fixed price method, the price is set with the help of an investment bank. The firm pre-announces the number of shares and offer price. The general public is then able to participate in the offering by specifying the number of shares it wants to acquire. If the demand is higher than the volume of shares offered, rationing occurs. Otherwise, offered shares that have not been purchased remain unsold (Van Hulle, Casselman, & Imam, 1993).

1.2.1.2 Auction

Van Hulle et al. (1993) define auction as a method that sets the price at the point where the demand meets the offer. Potential investors place bids above a predetermined minimum price. Then, investors' bids are ranked and the issuer sets the offer price with the investment bank accordingly (Azevedo, Guney, & Leng, 2018). When the price is set such that oversubscription remains, the tender is defined as dirty. Two versions of the auction method are used in Europe. The first one is the classical method, it consists of determining the number of shares and offer price a few days prior to the first day of trading. The second one is called the direct method, it consists in determining the offer price during the first day of trading (Van Hulle, Casselman, & Imam, 1993).

1.2.1.3 Bookbuilding

Ritter defines the bookrunner as a "lead underwriter responsible for negotiating an offer price with the issuer and allocating shares to investors" (Ritter J. R., Equilibrium in the IPO market, 2011).

In the US, the first step is to define the price range. The spread between the minimum and maximum of the price range is often around 2$. In the EU, the process is different, for example, in Germany, the price range is defined after the start of the bookbuilding and the difference between the minimum and maximum is usually higher than 2€ (Stomper, Aussenegg, & Pichler, 2004).

The firm can then consult several institutional investors and review the price range according to their expectations. In the US, the offer price is usually set minimum 20% below the initial price range and maximum 20% above while it is rarely above the maximum of the range in European countries (Ritter J. R., Differences between European and American IPO Markets, 2003).

The popularity of this method has grown bigger and bigger since 1990 and is now the prevailing practice worldwide.

1.2.2 Allocation

Fixed price and auction offerings are becoming less popular in Europe due to the increased interest in bookbuilding since 1990 (Ritter J. R., Differences between European and American IPO Markets, 2003).

The allocation mechanism of bookbuilding is of particular interest. Underwriters allocate IPOs' shares as they wish, they can thus allocate these to their most important clients. In the list of clients, we find institutional investors such as hedge funds (Ritter & Loughran, 2002).

Ritter (2003) develops three views on IPO allocation. The pitchbook theory argues that underwriters will choose to sell the shares to buy-and-hold investors. According to the academic view, an investor will have the shares if he truly reveals their estimated price value. Finally, the profit-sharing view asserts that the underwriter will allocate high potential IPOs to the client that provides them with commission business, namely soft dollars in exchange.

As argued by Ritter & Loughran (2002), there are two main incentives for underwriters to fix a lower price with the bookbuilding method. First, the cost for the underwriter will be lower if he sets a low offer price because he will not need to spend on huge marketing costs. Second, investors are willing to pay high fees to underwriters in order to be sure to have the shares.

1.3 IPO underpricing : definition

Ritter defines underpricing as :

> *"The percentage first-day return, measured from the offer price to the closing market price. In principle, for the issuer the underpricing of an IPO should be measured relative to the market price, rather than the offer price, but in practice it is measured from an investor's point of view, using the offer price as the base."*

First documented by Stoll & Curley in 1970, this phenomenon has persisted over time and has been pervasive around the world even though its amplitude varies across countries and markets (Chen et al., 2017).

IR stands for initial return and underpricing of the company i at time t is calculated as follows :

$$IR_{i,t} = \frac{P_{i,t} - OP_i}{OP_i} \tag{1.1}$$

where

- $P_{i,t}$ is the price of the stock at the end of the first day
- OP_i, is the offer price set by company i

Taking the abnormal component of the underpricing into account, initial return becomes :

$$AIR_{i,t} = IR_{i,t} - CMR_{i,t} = \frac{P_{i,t} - OP_i}{OP_i} - \frac{Index_{i,t} - Index_{i,0}}{Index_{i,0}} \tag{1.2}$$

where

- $CMR_{i,t}$ is the cumulative market return
- $P_{i,t}$ is the price of the stock at the end of the first day
- OP_i is the offer price set by company i
- $Index_{i,t}$ is the value of the index of reference i at time t
- $Index_{i,0}$ is the value of the index of reference i at start of the IPO day

Underpricing is adjusted for market return (CMR) by subtracting the variation of the reference index to CIR during the period.

There are two main views on the origin of the phenomenon.

On the one hand, rational theories state that issuers and investment banks purposely set the offer price below the fair value. The motivation could be to make the IPO attractive and encourage the investors' participation (Gao, 2010). Indeed, it is crucial to prevent investors from waiting because it could jeopardize the success of the operation. Moreover, the goal of underpricing may be to reward the investors for bearing the risk associated with the IPO (Ritter & Welch, 2002).

On the other hand, irrational theories are based on investors' sentiment and overconfidence towards IPOs. The offer price is set at fair value but soon as the trading starts, investors' irrational perceptions and overoptimism drive the stock price above its fair value (Gao, 2010; Manigart, 2003). Therefore, the closing price of the first day is not based on fair value anymore but has been moved up by investors' expectations. These theories find empirical supports in two observations. First of all, IPOs' long-run underperformance may be seen as proof that investors drive the price above fair value on the first day of trading (Van Hulle, Casselman, & Imam, 1993). Then, as documented by Purnanandam and Swaminathan in 2004 using a sample of 2000 US firms, offer prices are on average overvalued compared to the firm's intrinsic value calculated using multiple valuation technique. Hence the offer price appears to be set above fair value and there is still underpricing, these abnormal IPO initial returns might thus be due to irrational behaviours.

Following these theories, Manigart (2003) makes an interesting distinction between underpricing and overvaluation. The former is defined as the intentional setting of a price below the fair value of the firm. The latter represents the phenomenon during which a firm sets the offer price at fair value and investors drive the price up after the IPO.

This present contribution will consider the underpricing phenomenon in its broader definition that was introduced by Ritter and presented at the beginning of this section. However, it is important to keep in mind that this definition of underpricing encompasses the overvaluation phenomenon.

IPO underpricing will eventually result in money left on the table, defined as the hypothetical loss of revenue for the issuer. This amount of money can be determined using this formula:

$$MLOT_i = \ N \times \ (P_{i,t} \ - \ OP_i) \tag{1.3}$$

where

- $MLOT_i$ is the amount of money left on the table by company i
- N is the number of shares issued during the IPO of company i
- $P_{i,t}$ is the closing price of the IPO first trading day s
- OP_i is the offer price set by company i

1.4 Long-run performance

Jay R. Ritter identified in 1991 a new anomaly in IPO markets, namely the long run overpricing of initial public offerings. By analysing a sample of 1526 IPOs during the period 1975-1984, Ritter discovered that the three-year performances of firms following their IPO were remarkably lower than those of comparable companies in terms of size and industry. In fact, they had a 3-year average returns of 34,47% against 61,86% for comparable firms over the period. Moreover, over the period 1980-2017, US IPOS have shown an average 3-year average buy and hold return of 22,4% which represents -17,5% when returns are adjusted for the market (Ritter J. R., 2020).

Similar evidence has been found in other countries. In the UK, from 1980 to 1995, listed companies significantly underperformed over the three years following their IPOs (Levis, 1993; Espenlaub, Gregory, & Tonks, 2000; Rindermann, 2003). The same observation has been reported for France, Germany, Italy, the Netherlands, Spain, Sweden and Switzerland between 1988 and 1998. Listed firms of these countries underperformed by a minimum -12% to -42% (Schuster, 2003). As a conclusion, Weisbach et al. (2006) argued that IPO leads to future negative abnormal returns internationally.

As documented previously, IPOs' long-run underperformance supports the theory of overvaluation and overoptimism. Newly listed companies for which analysts and investors predict high growth tend to underperform their benchmarks in the long-run whereas the opposite observation can be made for firms with lower prospected growth. This reinforces the overoptimism argument (Rajan & Servaes, 1997). These findings lead to a logical statement; the main determinant of IPO long-run performance may be IPO underpricing. Indeed, if investors drive the price of the stock above its fair value, then when the market will adjust the price, the performance will be negative.

Several factors may influence the magnitude of long-run underperformance of IPOs. First of all, it seems that the size of the firm has a significant impact, as large IPO companies tend to have higher long-run performance than smaller ones. This fact may be due to lower profitability for small firms or high compliance costs (Signori, Ritter, & Vismara, 2013). The second recurrent determinant in the literature is earning. By studying 1032 IPOS, Yi (2001) came to the conclusion that firms who have negative earning prior to listing underperform significantly in the long run. According to the authors, this finding results from investors' overoptimism on growth perspective.

Finally, the dilution of initial ownership may influence the underperformance. When the initial shareholders sell a significant part of their shares during IPO, the long-run performance is lower (Goergen, Khurshed, & Mudambi, 2007).

1.5 Theoretical explanations of underpricing

Numerous explanations have been advanced for IPO underpricing and these explanations can be grouped into four categories as shown in FIGURE 1.1. Therefore, this section will be divided into four parts: Information asymmetry, institutional explanation, ownership and control and behavioural theories.

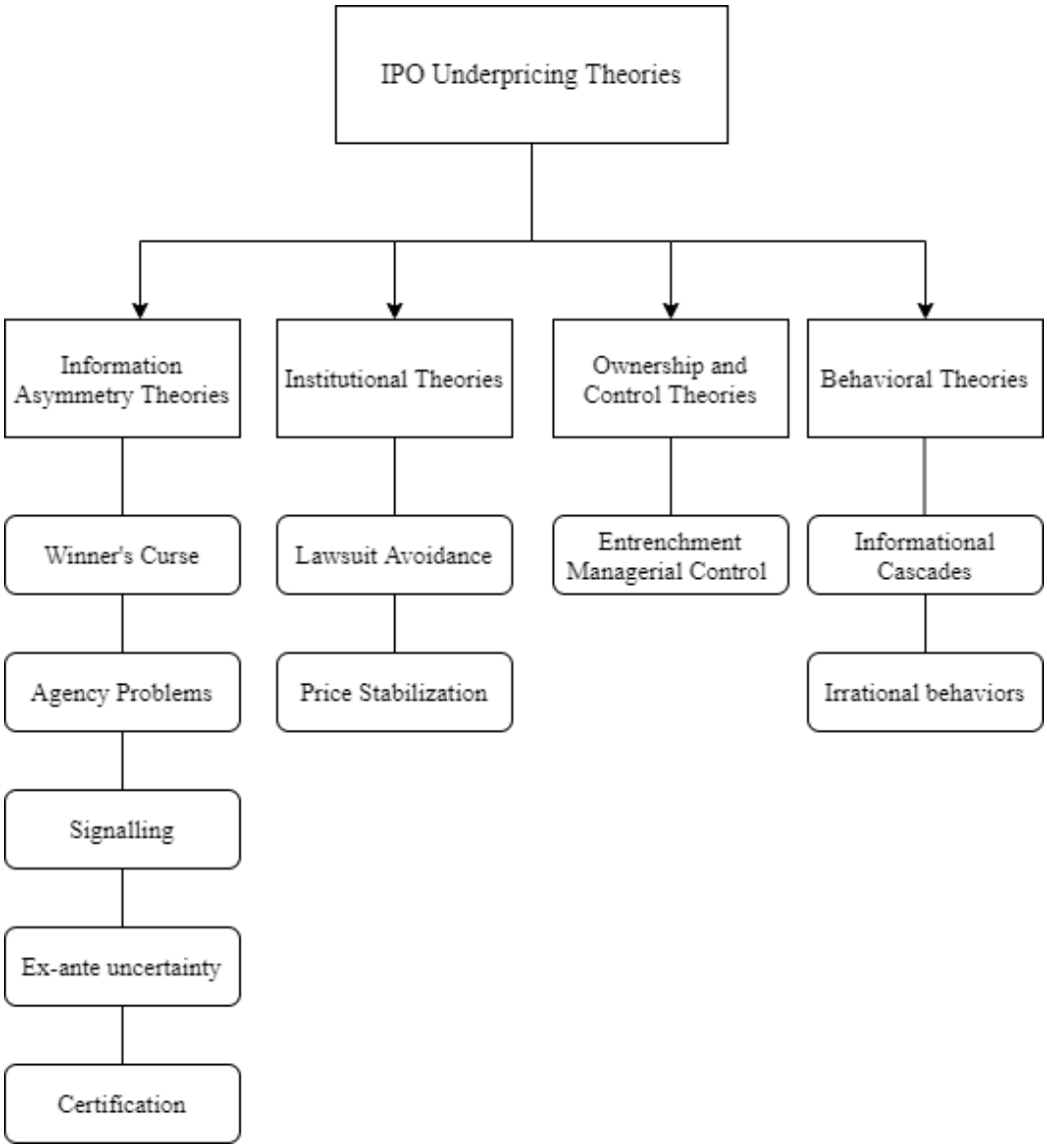

FIGURE 1.1: Underpricing theories taxonomy

1.5.1 Information Asymmetry Theories

There are various types of agents, presented in FIGURE 1.2. Several theories have been developed based on the asymmetric information between these agents. This section will focus on the five prevailing asymmetric information theories in the literature.

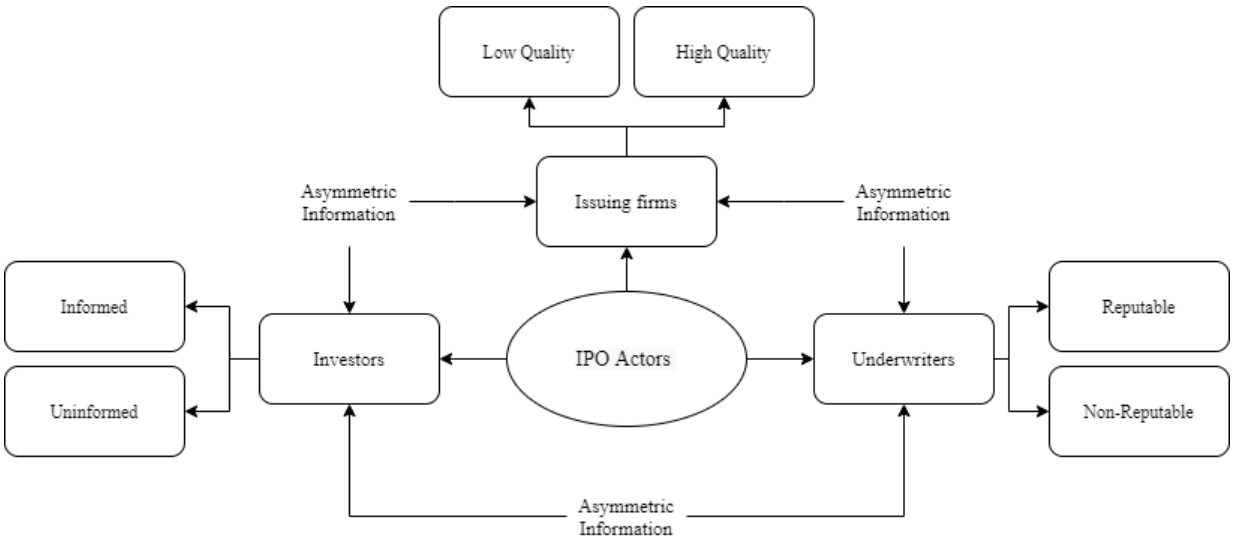

FIGURE 1.2: IPO Key actors (Adapted from Jamaani & Alidarous, 2019)

1.5.1.1 Winner's curse

This theory was first developed by Rock (1986) and has been widely used in the literature to explain IPOs underpricing. As shown in FIGURE 1.3, the framework relies on the existence of two types of investors: informed and uninformed.

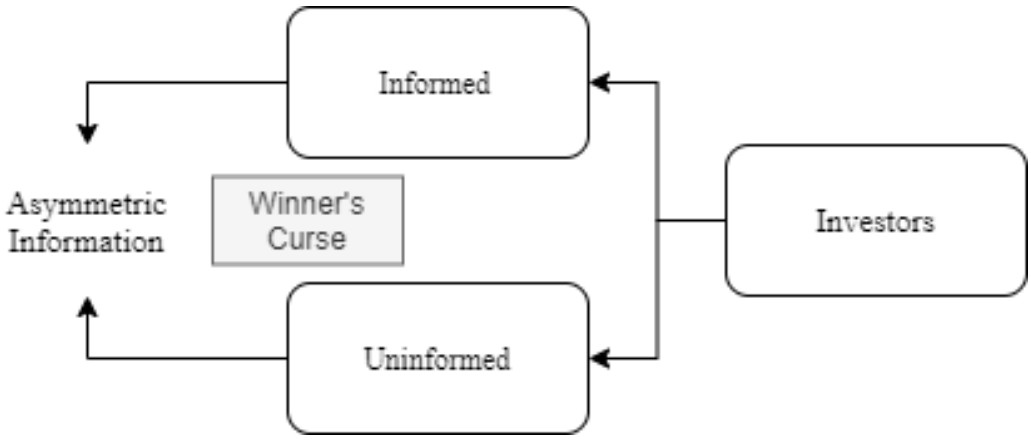

FIGURE 1.3: Winner's curse (Adapted from Jamaani & Alidarous, 2019)

During an IPO, a fixed number of shares is sold to investors. Rationing frequently occurs because IPOs are usually oversubscribed (Ritter & Loughran, 2002) and there is not enough shares for all investors. As explained by Ibbotson et al. (1994), the winner's curse states that the market knowledge of informed investors allows them to determine the fair value of a company. Therefore, they only participate in underpriced IPOs. Comparatively, uninformed investors cannot determine if an offering is underpriced. Consequently, these investors randomly choose the issue to which they will subscribe (Rock, 1986). This situation obviously results in lower profits for the uninformed investors than for the informed ones.

The uninformed investors face a winner's curse because when they receive all the shares that they asked for, it often means that informed investors do not want to participate in this particular listing and thus that this IPO is less likely to be underpriced (Ibbotson, Sindelar, & Ritter, 1994). In this case, getting the shares is not good news because there is a significant probability that the investors won for the wrong reasons (Van Hulle, Casselman, & Imam, 1993).

Rock (1986) documented that the market needs the participation of uninformed investors because informed investors cannot "absorb" all the offer. Therefore, in order to ensure that uninformed investors subscribe to the IPO, the issuer has to discount its offer price. The disadvantaged participant needs to be compensated for the adverse selection he is facing and it is done through underpricing (Ritter J. R., Equilibrium in the IPO market, 2011).

In the winner's curse model, the underwriter does not play a major role because he and the issuing firms cannot determine the fair value of the company, only some investors can (Rock, 1986).

1.5.1.2 Agency Problems

During the early stages of the IPO process, the underwriter will acquire private information on the issuer and he will then be able to allocate the shares to investors. This situation creates agency problems, as displayed in FIGURE 1.4. Baron & Holmström (1980) argued that following this gathering of information, the underwriter will be better informed than the issuer. Agency problems arise from the fact that investment banks are tempted to underprice the offer price significantly in order to decrease the cost of selling the IPO. Indeed, if the price is relatively low, the underwriter will not need to engage huge marketing costs to promote the listing.

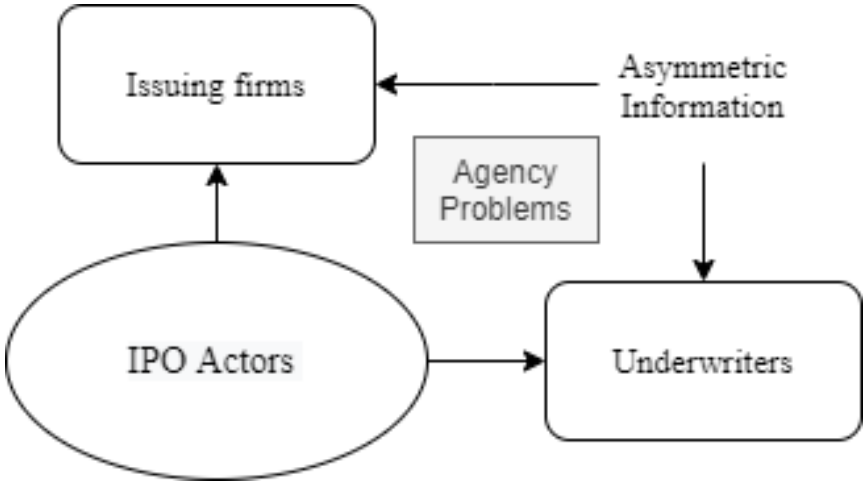

FIGURE 1.4: Agency Problems (Adapted from Jamaani & Alidarous, 2019)

If the investment bank in charge of fixing the offer price of the IPO discovers private information on the issuer that should increase its value, it may be inclined not to disclose it (Benveniste & Spindt, 1989). By avoiding this underprice reduction, the bank does not act in the best interest of its client, namely the issuer.

Regarding the emergence of new public information that could increase the offer price, Hof documented (1999) that underwriters only adjust partially the price comparing to the importance of the news. The principal reason may be that a substantial offer price increase would decrease the subscription of investors, even if the price variation is proportional (Hof & Saveri, 1999).

Ritter (2009) found evidence of agency problems in the practice of IPO spinning. Liu and Ritter (2009) define this practice as "the allocation by underwriters of the shares of hot initial public offerings (IPOs) to company executives in order to influence their decisions in the hiring of investment bankers and/or the pricing of their own company's IPO."

Investment banks tend to underprice IPOs in order to provide returns to third party businesses. By doing so, underwriters expect to influence corporate decisions and receive commissions from these businesses in the future. The word "spinning" refers to the fact that the given shares can be instantly sold (Ritter J. R., Equilibrium in the IPO market, 2011).

Using a sample of 56 listings associated with spinning from 1996-2000, Liu and Ritter (2009) determined that the first-day return of these companies is on average 23% higher than for IPOs with no spinning. It might be evidence that this practice induces the underwriter not to act in the best interest of the issuer.

The authors conclude that spinning not only influences underpricing but also corporate decisions of shares recipient. Ritter (2010) later included spinning into what he calls CLAS practices.

1. Payment of excessive Commission
2. Laddering
3. Biased Analyst recommendations
4. Spinning

The first point defines the deliberate allocation of IPOs' shares by underwriters to investors in return for commissions on other future trades, namely, soft dollars. Regarding laddering, it is the allocation of shares to investors who then have an obligation to acquire additional stocks in the immediate aftermarket. Finally, sell-side analysts tend to give easily "buy" recommendations to underwriting clients (Fang & Yasuda, 2009). The conflict of interest arises from the fact that analysts earn significant revenues from investment banks.

Ritter describes these practices as "both a cause and a consequence" of IPO underpricing.

1.5.1.3 Signaling

As shown in FIGURE 1.5, signaling models rely on asymmetric information between underwriters and investors (Van Hulle, Casselman, & Imam, 1993). These models define underpricing as a signal for the true quality of a firm. It implies that if a company has better growth perspectives, she will set a lower offer price.

Classic signaling models are organised around three distinctive phases (Welch, 1988; Allen & Faulhaber, 1989). In the first phase, the company offers its shares through an IPO, the issuer can have either good or bad growth perspective and knows its category[1]. Nevertheless, investors do not have this information which means that the firm needs to send a signal to the public to communicate its quality. In the second phase, the signal on quality is spread to the markets. Finally, the third phase consists in an offering by the firm of additional shares through an SEO.

Newly listed companies that have good growth prospects set a below-fair value offer price to send a good quality signal to the market and this can explain underpricing (Van Hulle, Casselman, & Imam, 1993).

[1] Between the good prospect and bad prospect categories

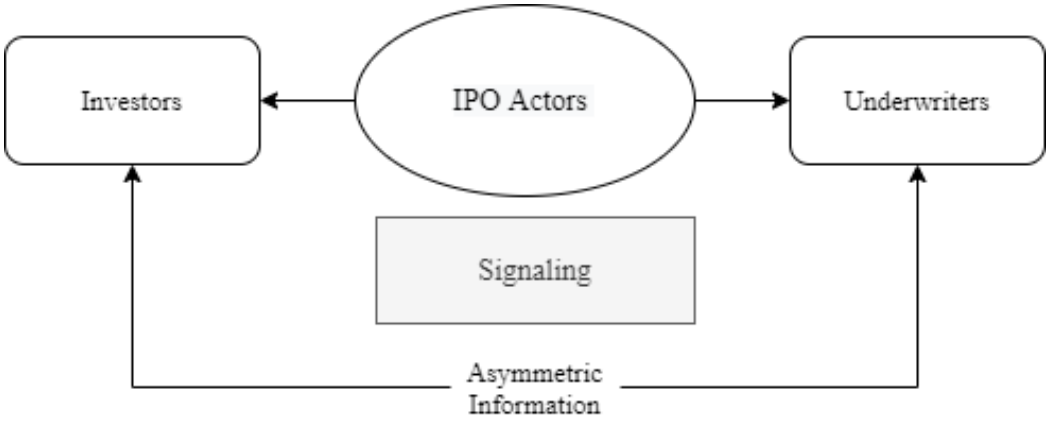

FIGURE 1.5: Signaling (Adapted from Jamaani & Alidarous, 2019)

Several studies have investigated the implications of these theories. Grinblatt & Hwang (1989) empirically proved that a firm's fair value is positively correlated with the magnitude of initial returns, which is consistent with the signaling models. A few years later, Jegadeesh et al. (1993) documented the third phase on seasoned offering. The authors tested the assumption that companies set lower offer prices in order to benefit more during SEO. They have empirically approved this assumption, which supports signaling models.

1.5.1.4 Ex-ante uncertainty

Beatty & Ritter (1986) developed the explanation that an increase in ex-ante uncertainty related to the issuer would be likely to increase underpricing. The authors described IPO deal size as a proxy for the theory.

Nevertheless, ex-ante uncertainty can encompass several characteristics of the issuing firm. On the one hand, Rock (1986) argues that the level of ex-ante uncertainty is a decreasing function of the company's age. Engelen and van Essen (2010) document that the decreasing function between the two variables is due to the higher ex-ante uncertainty of younger firms which causes the investors to ask a stronger underpricing.

On the other hand, Jenkinson & Ljungqvist (2001) describe that ex-ante uncertainty depends on four factors: age, size, use of proceeds and company type.

While this theory has been empirically proven by several authors (Michaely & Shaw, 1994; Brau & Fawcett, 2006), according to Ritter & Loughran (2002), it does not explain underpricing in several developing markets.

1.5.1.5 Certification

Book and Smith (1986) developed an asymmetric model between issuing firms and investors. Similar to the signaling model, the issuer knows the quality of its firm while uninformed investors do not have that information. Therefore, the issuer sends the signal of quality by employing a reputable owner. As a result, the underwriter's reputation is negatively correlated with underpricing (Carter & Manaster, 1990).

High reputation underwriters can therefore certify the "fair valuation of the offer price" (Jamaani & Alidarous, 2019). Chishty et al. (1996) have empirically proven the existence of the negative relationship between underpricing and underwriter's reputation. The authors found that the latter impact negatively the former which supports certification theory.

Lee and Wahal (2004) argue that the certification hypothesis might exist for every adviser: underwriters, venture capital firms, auditors. Indeed, Hamao et al. (2000) found empirical evidence of certification theory for venture capitalists in Japan.

1.5.2 Behavioral theories

Evidence supporting asymmetric information theories has been found but these models are not always appropriate. For example, they cannot explain extreme abnormal initial returns that occurred during the internet bubble, as evidenced by Ritter & Welch (2002). According to these authors, agents' irrational behaviors could be an explanation for underpricing in these kinds of situations.

1.5.2.1 Informational cascades

An informational cascade is a theory in which agents' beliefs converge in a specific time frame.

Welch (1992) developed a model highlighting the influence of the theory of informational cascades on both investors' behaviour and IPO underpricing. The fact that IPO sales are sequential allows investors to acquire information on previous transactions. The model describes the IPO investor's decision as depending on bids made by earlier investors. Eventually, it can result in investors imitating previous decisions without considering the private information they have.

Welch (1992) argues that due to information cascades, IPOs are either heavily oversubscribed or barely subscribed and several authors support this statement (Pollock, Rindova, & Maggitti, 2008). Investors will only participate in the IPO if the issue is hot because they suppose that earlier investors have superior information (Welch, Sequential Sales, Learning, and cascades, 1992).

The significant probability of cascade forces the issuer to underprice in order to ensure the participation of investors.

This theory diverges from Rock's winner's curse (1986) because the latter suggests that investors have no information on previous investors. Welch (1992) criticizes that statement with two arguments. First of all, best efforts offerings are a fast process and investors rapidly know if they will be rationed. Then, investors have easy access to information on how an issue is selling through brokers. Regarding this last fact, it is even more true today because IPOs' information is more accessible thanks to the internet.

Alevy et al. (2007) analysed 1500 individual decisions from market professionals and students. They found evidence that non-professionals investors are more inclined to be influenced by informational cascade than professionals.

1.5.2.2 Irrational investors

As already discussed in previous sections, investors' behaviours influence underpricing.

Ljungqvivt et al. (2006) introduced a new type of investors called "irrationally exuberant". The authors argue that these investors tend to overestimate the prospects of certain IPOs. Moreover, they suggest that issuers should try to profit from the presence of this kind of investor. According to the authors, there are two steps to follow in order to take advantage of irrational investors. Firstly, the issuer limits the supply of shares with the aim of avoiding price depression. Secondly, the issuer delegates the task of holding supplementary shares to institutional investors. These investment firms then gradually sell these shares to sentiment investors after the IPO. By doing so, issuers maximize the price of their company.

Cornelli et al. (2006) support irrational investor theory by proving that overoptimism leads to higher IPO initial returns. Moreover, the authors document the lower long-run performance of IPOs from these periods of overoptimism.

1.5.3 Institutional explanations

There are two dominant institutional-based theories. These theories emphasise the influence of litigation risks and underwriters' price support on underpricing.

1.5.3.1 Lawsuit avoidance

Litigation risks were first documented by Logue (1973) and Ibbotson (1975). These authors argued that issuers purposely set the offer price under the fair value to prevent from being sued by disappointed investors in case of underperformance. Jenkinson and Ljundqvist (2001) later stated that litigation inflicts direct financial damages to the issuer but also indirect damages through a potential loss of reputation and increased costs for raising capital in the future.

Proof of litigation risks was provided by Lowry & Shu in 2002. The authors observed that in the US for the period 1988-1995, 6% of newly listed firms were charged by investors and paid on average 13.3% of the IPOs' proceeds.

Nevertheless, this theory will probably not explain underpricing in Europe because it is mainly an American centric model, as argued by several authors (Jenkinson, 1990; Loughran, Ritter and Rydqvist 1994; Lee, Taylor and Walter 1996). Regarding Europe, the most reliable explanation for the lack of economic significance of litigation seems to be class-action lawsuit. While it is a common practice in the US, it is very infrequent in Europe (Ritter J. R, 2003). This observation implies that EU investors will rarely sue newly listed companies even in the event of poor IPOs' performances.

1.5.3.2 Price stablization

Formalized by Benveniste et al. (1996), the price stabilization theory states that underpricing may be due to the price support service offered by the underwriters to the issuers. This service consists in a commitment of the investment bank to support the IPOs' price against value drops for a specific period following the listing. Price stabilization can result in high costs for the underwriter in the event of a significant share price decrease in the days succeeding the IPO. The investment bank thus set the price below fair value to ensure against potential shares price drops.

Clear empirical evidence has not been found in the literature because there is no unanimity on that matter. On the one hand, Asquith et al. (1998) have not found empirical evidence of the influence

of price support on IPOs' initial returns on a sample of 560 US IPOS from 1982 and 1983. On the other hand, Ellis et al. (2000) found proof of the relationship between the two factors for 559 US IPOs between 1996 and 1997. Jenkinson & Ljungqvist (2001) advance a reliable explanation for these different observations; there is a lack of available data on price support and its magnitude.

1.5.4 Ownership and control reasons

This research has already discussed the existence of an agency problem between underwriters and issuers but this issue also exists between managing and non-managing shareholders. It results from misaligned incentives that could lead the managers to focus on maximising their private benefits without considering outside shareholders (Jensen and Meckling, 1976).

1.5.4.1 Entrenchment managerial control

Shleifer and Vishny (1989) first documented the entrenchment of managerial control. The authors define it as being the use of underpricing by the IPO firm for the purpose of spreading out the ownership. The firm sets a price lower than fair value which attracts a relatively high number of investors. As argued in the previous sections, when the demand is high, rationing occurs, ensuring that the firm keeps its control block.

Pagano et al. (1998) have provided empirical evidence on the influence of this specific agency problem on underpricing. Nevertheless, Engelen and Van Essen (2010) argued that while the phenomenon might be proven for U.S. and U.K., there is no evidence for developing and other European countries because companies' initial shareholders of these countries usually issue a smaller percentage of them shares.

1.5.5 Conclusion of the theorical aspects of underpricing

The theories that have been presented clearly depend on the actors of the market, namely the underwriters, issuers and investors. It is difficult to draw a global conclusion on which theory is the most reliable because each country has actors with specific characteristics. For example, as it will be discussed in the following section, American underwriters tend to charge higher fees or China's government influences the offer price.

Therefore, it is essential to test these theories with the appropriate variables and it will be the aim of the second part of this study.

1.6 IPO underpricing around the world

As previously noticed, IPO underpricing is a common phenomenon around the world. Nevertheless, its magnitude varies from one country to another. This section summarizes the particularities of three specific places. First of all, the United States will be studied as it is the reference country for most research around the world (Ritter J. R., 2003; Gao, 2010). Then, a general description of the Europe IPOs market will be provided to have a comprehensive understanding of the place on which Euronext is installed. Finally, China's specificities are going to be documented in order to try to explain why the country has showed the highest initial returns these past years.

The structure will be the following for every country, firstly, a presentation of figures on IPOs volumes and initial returns will be displayed. Then, there will be a dedicated section to pricing and allocation mechanism which helps in understanding which method is the most popular and what are the implications on underpricing. Finally, the last section will document regulation specificities of the studied area. After the countries presentation, an highlight of the main differences will be presented.

1.6.1 USA

1.6.1.1 Figures

Ritter provided and analysed a vast number of data on US IPOs. As shown in FIGURE 1.6, the volume of listings peaked in 1996 during the technological boom. Evidence on the volume variation of IPOs supports the windows of opportunity theory mentioned in SECTION 1.1. Firms tend to rush into the market to benefit from a potential momentum (Ritter J. R., Differences between European and American IPO Markets, 2003).

1.6.1.2 Regulations

Several arguments have been advanced in the literature to explain this decrease of new IPOs in the US. One of the main arguments focuses on new regulations, in particular on the Sarbanes-Oxley Act (SOX) created the 30th July in 2002. SOX imposes new requirements for firms that are already public or want to go public such as stricter financial controls and monitoring. Overall, it has increased the cost of listing with the addition of new compliance requirements (Signori, Ritter, & Vismara, 2013).

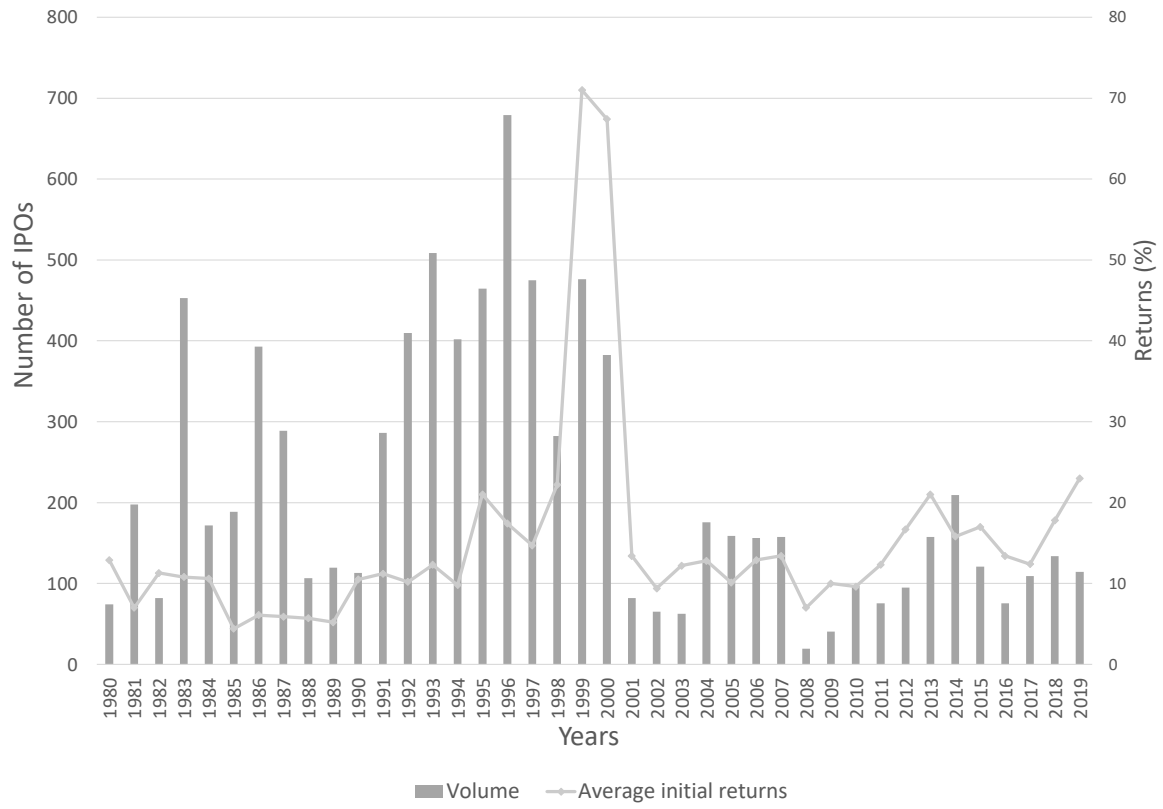

FIGURE 1.6: Number of U.S. offerings and average percentage first day return (Adapted from Ritter J. R., 2020)

As a result, the Sarbanes-Oxley Act has altered both underpricing and aftermarket performances of IPOs such that it may decrease the former and increase the latter (Johnston & Madura, 2009).

Johnston and Madura (2009) observed several implications of the act. Regarding initial returns, US figures have been lower since the implementation of the SOX and the fact that initial returns have remained constant in Canada over the period supports the fact that the regulation influences underpricing. Moreover, the authors make a similar statement regarding aftermarket performance, the Sarbanes-Oxley act increases it. SOX may improve the effectiveness of IPOs' process by providing higher quality information to investors and underwriters.

1.6.1.3 Pricing/Allocation mechanism

Bookbuilding is the most popular mechanism in the US (Azevedo, Guney, & Leng, 2018). There are very few auctions, only 20 since 1999 and it is decreasing to 0 auction for the last 5 years (Ritter J. R., Initial Public Offerings: Underwriting Statistics Through 2019, 2020). Our study recorded no use of fixed price method.

1.6.2 Europe

1.6.2.1 Figures

As illustrated by FIGURE 1.7, the volume peaked in 2000 the year prior to the tech bubble burst. It sharply decreased in 2001. From 2004-2007, the numbers of IPOs were back at a high level but fell again from 2007 to 2008 due to the beginning of the financial crisis. The volume did not exceed 200 IPOs since then. From 1995 to 2011, average IPOs' underpricing was 15,98% for a total of 3948 European companies .

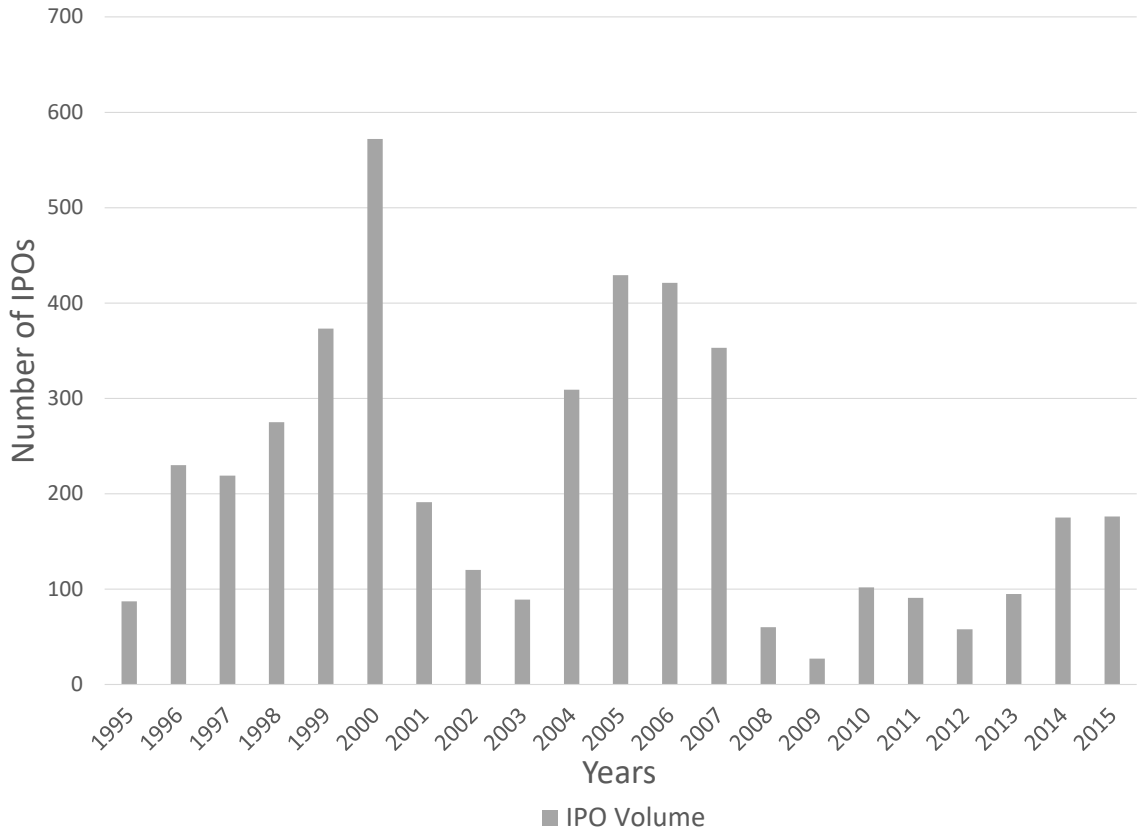

FIGURE 1.7: Volume of European IPO markets (adapted from Ritter et al. (2013))

1.6.2.2 Regulations

The Sarbanes-Oxley act influenced European regulation. Following the SOX, European commission issued the Report of the High Level Group of Company Law Experts on a Modern Regulatory Framework for Company Law in Europe (Signori, Ritter, & Vismara, 2013). Based on this framework, member states revised existing or created new requirements.

These regulations are not homogeneous across countries but they follow the EU guidelines which aim at promoting transparency and better internal control (Akyol et al., 2014).

Using a sample of 3,677 European IPOs listed from 1998 to 2012, Akyol et al. (2014) found that IPO underpricing decreased with the implementation of "SOX-like" new regulations by member states of the EU.

1.6.2.3 Pricing/Allocation mechanism

As already mentioned in previous sections, Ritter already documented in 2003 that the use of fixed price and auction methods have declined since 1990 in favour of the growth of bookbuilding.

1.6.3 China

1.6.3.1 Figures

Between 1990 and 2015, 2556 firms were listed on China stock exchanges. The average IPO underpricing has been approximatively 169,5% in China over this period. (Ritter J. R., Initial Public Offerings: Updated Statistics, 2020). Abnormal first day return has diminished these past years, indeed, between 1990 to 2000, this figure was 256,9% (Azevedo, Guney, & Leng, 2018).

As shown in FIGURE 1.8, the number of listings peaked in 2010 and 2011 with respectively 350 and 280 IPOs and a relatively high activity was observed in 1996, 1997 and 2000.

1.6.3.2 Pricing/Allocation mechanism

As shown in FIGURES 1.9 and 1.10[2], pricing methods completely changed over 20 years. The use of auction fully disappeared while bookbuilding became the most popular practice. In 2010, only four fixed price offers were made. This evolution has direct effects on underpricing. Indeed, the magnitude of the phenomenon varies from one method to another (Ma & Faff, 2007). For example, abnormal first-day returns are on average 51,5% for bookbuilding and 230% for auction.

[2]Both adapted from Azevedo et al. (2018)

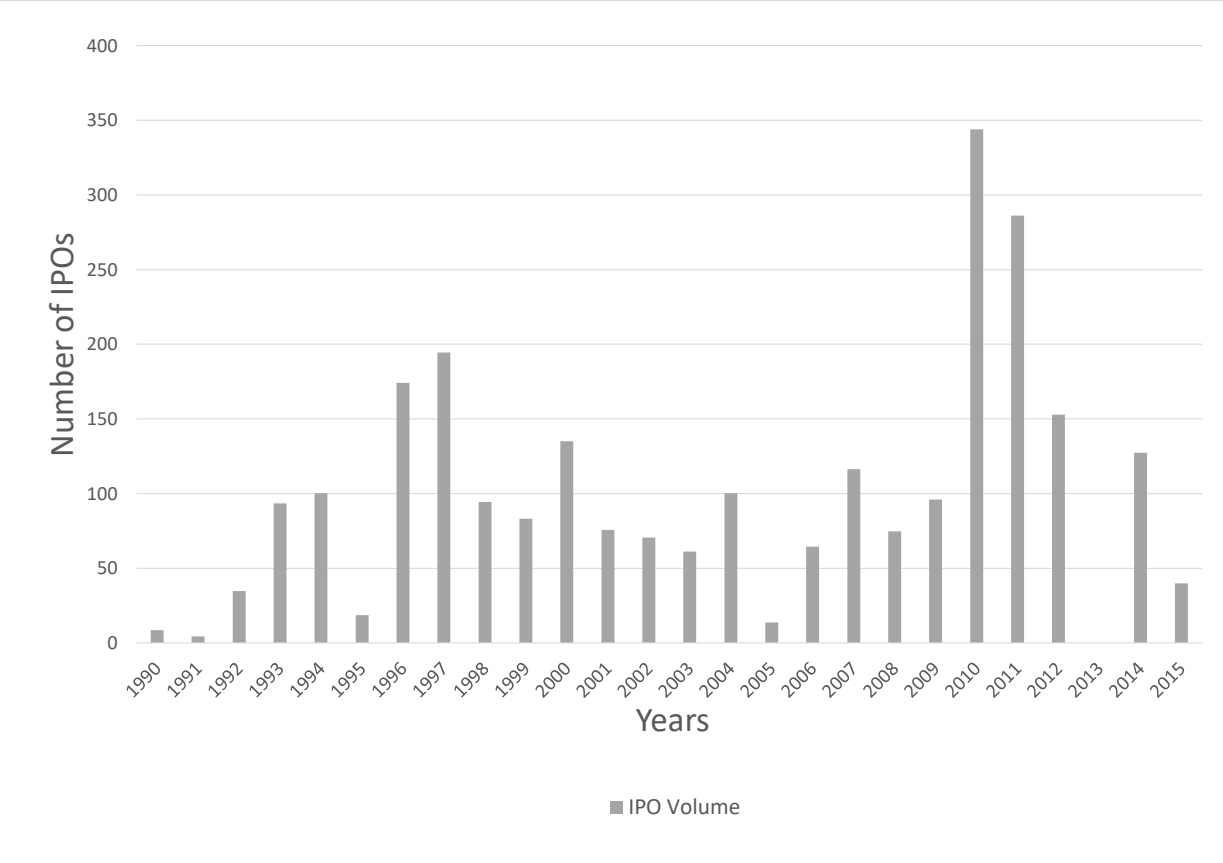

FIGURE 1.8: IPO volume in China (adapted from Azevedo et al. (2018))

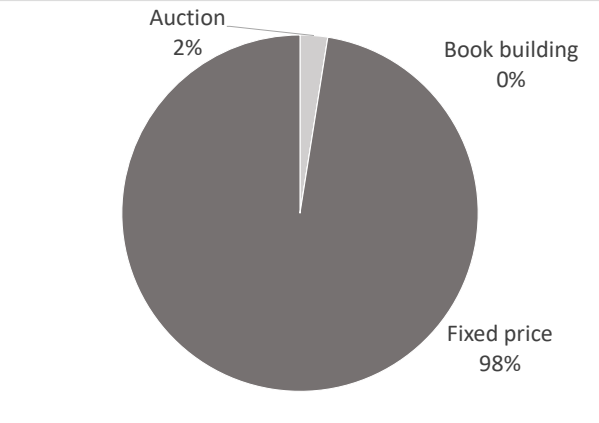

FIGURE 1.9: Popularity of IPO allocation mechanism (1997)

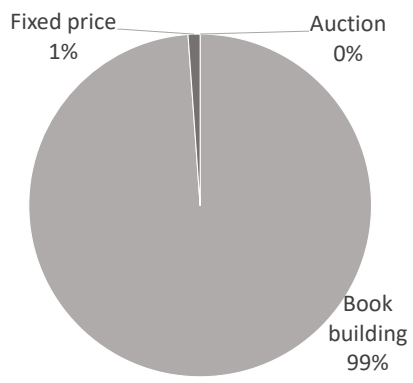

FIGURE 1.10: Popularity of IPO allocation mechanism (2010)

1.6.3.3 Ownership structure

China's corporate governance has always been very particular because of this odd combination of minority shareholders and state shareholders. Litterature has investigated a potential agency problem resulting from this governance. The state shareholders do not always have a strategy of value maximization, which can cause IPOs' long-run underperformance and eventually underpricing (Chen et al., 2013). There is a positive correlation between the proportion of state ownership in a particular firm and its IPO underpricing.

1.6.3.4 Political connections

Political influence on IPOs is strong in China. Central and local governments have an impact on which companies are going to go public and on the timing of their listings (Azevedo, Guney, & Leng, 2018). Nevertheless, a company may not benefit from having a CEO with good political connections, these firms even tend to underperform those with no political links (Azevedo, Guney, & Leng, 2018).

1.6.4 Main differences

1.6.4.1 Volume

Volumes were relatively high during the tech boom in the three countries. IPOs peaked in 1996 and 2000 respectively for US and Europe. In China, highest volume was recorded in 2010, the country had a GDP growth rate of 10.64% this particular year.

After the tech bubble burst, numbers of listing have been low for 3-5 years depending on the country. Overall, the number of new listing have significantly decreased since 2000.

1.6.4.2 Underpricing

As shown in TABLE 1.1, the magnitude of the phenomenon is significantly higher in China than in Europe and the US. It is important to keep in mind that the magnitude varies across countries in Europe, as documented by Loughran et al. (2020).

Region	**USA** (1990-2018)	**Europe** (1995-2011)	**China** (1990-2015)
Average initial IPO returns	21,3%	15,98%	169,5%

TABLE 1.1: IPO underpricing summary

1.6.4.3 Pricing/allocation method

There is a common trend regarding the choice of listing method, bookbuilding is becoming the dominant practice worldwide. As mentioned in this section, the choice of method influences underpricing and long term performance. The popularity of bookbuilding could be positive for the IPO process because it might increase its effectiveness (Chiou et al., 2010).

1.6.4.4 Regulations

As previously said, literature largely documented the impact of regulators on IPO volume and underpricing. The impact of government is particularly marked in China, where the state controls the offer price, the timing of IPO and most importantly, which firms that are going to be listed. It is different in the US and in the EU, the influence of the regulators is made through the implementation of new control, reporting and compliance requirements.

1.6.4.5 Agency problems

The agency problems in China are completely different than what is observed in the US and in Europe. In China, the misaligned incentives take place between the private and state owner, while worldwide, the phenomenon is often described as involving the private issuer and underwriter. Despite the common characteristics of agency in the EU and US, differences arise from the specificity of American underwriters. They tend to charge higher fees and are more inclined to make a revision of the offer price than European investment banks (Ljungqvist, Jenkinson, & Wilhelm Jr, 2003).

2 Dataset, variables selection and regression model

This section is divided into five parts. The first part consists in presenting the initial database and the transformations that led to the final research sample. In the second part, the variables used in the linear regression are explained. Then, the third part provides a theorethical background on the regression model that is used in this study. Finally, the variables are tested which leads to the presentation of the three final models.

2.1 Dataset

Most of the data on prices, returns and company's characteristics come from Bloomberg. According to Euronext 's website, the first listings started in March 2003. However, to work with entire years only, the data were retrieved starting from 2004. For the same reason, IPOs from 2020 are not included in the database.Therefore, this study focuses on IPOs from the period 2004-2019.

The database is obtained using the IPO function of Bloomberg and the studied markets are selected with the filter menu. The sample initially contained 522 IPOS distributed over four countries, as shown in TABLE 2.1.

	Amsterdam	**Belgium**	**Paris**	**Lisbon**
Number of IPOs	56	65	385	16
Repartition	10.7%	12.5%	73.8%	3.1%

TABLE 2.1: Repartition of IPOs between countries

The database does not include data from Euronext Dublin but includes IPOs from Euronext, Euronext Growth and Euronext Access. Moreover, it contains only IPOs of companies that are still listed which is not an issue since it is often the case in the literature (Ritter J. R., Equilibrium in the IPO market, 2011). Bloomberg initially included IPOs for the period prior to the creation of Euronext. When keeping only Euronext's IPOs, the "market" sample consists of 245 IPOs.

There are common filters in the literature. The first one is recurrent and consists in dropping IPOs with lower offer prices (Butler et al. 2014, Lowry & Schwert 2004, Michaely & Shaw 1994). All listings below 3€ per share are dropped, which represents 8 IPOs in the sample. International researches then focus on having only dollar-denominated values. This is not required in this case as data on Euronext are uniformly denominated in Euro.

The last filter is necessary because this research focuses on determining the impact of specific variables on IPO underpricing. Consequently, IPOs for which available data on these variables are not available are also removed from the sample.

At the end of the day, the final database is therefore constituted of 150 IPOs split between four different countries, as shown in TABLE 2.1.

	Amsterdam	**Belgium**	**Paris**	**Lisbon**
Number of IPOs	10	18	120	2
Repartition	6.7%	12.0%	80.0%	1.3%

TABLE 2.2: Repartition final sample

In addition to the database retrieved from Bloomberg, other data sources are taken into account which is necessary because information on specific variables are not always available on Bloomberg.

This paper studies the impact of the underwriter reputation on underpricing. For this purpose, the document “ranking underwriters in Europe” written by Migliorati & Vismara in 2014 is used. This choice is relevant for three reasons:

1. It is the most recent ranking.
2. It is focused on European markets only which is not the case for other previous studies.
3. It covers a large portion of the IPOs market by integrating 260 underwriters and 3776 IPOs.

Bloomberg provides information on the adviser/underwriter for each IPO but the platform uses its own abbreviations, which makes it challenging to identify which underwriter is mentioned. To figure this out, some information on the underwriter has to be retrieved from IPOs prospectus found on the Euronext website. For some of the underwriters, it is observed that the ownership of the investment bank can change over the years. Thus, for those specific cases, the following decision was taken: If an underwriter was acquired by another group, the former takes the reputation score of the later. For example, the adviser Gilbert Dupont whose abbreviation is

GDUPN on Bloomberg, was a subsidiary of the bank Crédit du Nord and had been underwriting IPOs in the name of Société Générale since February 2018 (Société Générale, 2018). Therefore, its reputation rank was set to Société Générale's one for IPOs posterior to February 2018.

Two other distinct types of information are also retrieved from the Euronext website. Firstly, information on the placement method used for each IPO is taken from the website and IPO prospectus. Secondly, Euronext pages are used to calculate the long-run performance of the listings because Bloomberg only provides up to 1-year performances. In both cases, data has been collected manually.

2.2 Variables selection

This section aims at discussing and justifying the selection of variables for the linear regression model implemented to explain the underpricing phenomenon. The independent variables were chosen based on the literature. This study focuses its empirical research on evaluating the importance of information asymmetry based theory on Euronext.

2.2.1 Dependent variables

2.2.1.1 Underpricing

Initial returns of the IPO's first day is the measure that is selected for this study. The formula is also presented in EQUATION 1.1. It consists in the difference between the first-day closing price and the offer price. Ljungqvist (2007) argued that underpricing is immediate in well-developed countries and that, as a consequence, the undervalued offer price will rapidly adjust to its fair value. Thus, the measure of first-day return is sufficient for the studied markets and there is no need to use first-week performance as a dependent variable.

2.2.2 Independent variables

The literature review helps in highlighting the most important and influential theories. Several authors documented the variables that can act as proxies to verify the validity of these theories empirically. This study uses valuable previous findings and aims at testing new variables based on which information is available in our database.

2.2.2.1 Underwriter reputation

The negative relation between underpricing and underwriter's reputation has been largely documented (Carter and Manaster, 1990; Booth and Smith, 1980; Titman and Trueman, 1986). As argued by Van Hulle et al. (1993), the reputation of the underwriter may reduce the underpricing. Firstly, as described by the authors, some specific investment banks have the reputation of pricing only "sure thing – IPOs" . Investors are aware of this characteristic and therefore assume that the bank sets a price close to fair value. Every actor is then fully informed and there is no winner's curse anymore. Secondly, underwriters may have a reputation for knowing the quality of the company. Again, investors know this characteristic and conclude that there is no need for a good firm to signal its value through underpricing as the signaling models assume.

As described in SECTION 2.1, three sources were combined to come up with this underwriter reputation variable: the list of advisers provided by Bloomberg, the Euronext website to know which adviser is the underwriter and the ranking from Migliorati & Vismara (2014). More practically, this study first tested the variable using directly the rank provided by Migliorati and Vismara, which is a figure between 0 and 1. However, it did not lead to interpretable results. Therefore, as already done in previous studies (Logue, 1973; Walker, 2008), a dummy variable is used to represent the influence of the underwriter reputation on underpricing. The value of this variable is 1 if the lead underwriter is among the five most prestigious advisers in the sample according to the study of reference (Migliorati & Vismara, 2014) and 0 otherwise.

2.2.2.2 Venture Capital backed IPOs

As argued by Bessler & Martin (2012), venture capitalists (VC) influence the performances of the EU IPOs they back. The authors reported that the abnormal performances of newly listed companies were higher for venture-backed IPOs. This is true for both short and long term returns.

There are two main reasons advanced by the literature for this implication. Firstly, venture capital firms have a positive impact on the growth of companies because they offer valuable financial resources in addition to strategic and operational advice (Haltiwanger, Jarmin, & Miranda, 2013). It leads to higher returns because investors integrate VC backing as a positive signal. Secondly, VC uses the listing of the ventures in a way to sell their shares and reinvest the proceeds in other high growth potential companies (Bessler & Martin, 2012). In our model, `VC_Backed` is a

dummy variable that takes the value 1 if the IPO is backed by a venture capitalist and 0 otherwise. The coefficient for this variable is expected to be positive, and therefore that the venture capitalist backing increases the underpricing of the specific IPOs.

2.2.2.3 Greenshoe exercised

Greenshoe option, or over-allotment option, is the process that allows the underwriter to borrow shares from initial shareholders in order to increase the number of shares offered. The goal is to be able to meet excessive demand in case the IPO would be heavily oversubscribed. The Over-Allotment arrangement (OOA) unfolds as the following. If there is an oversubscription, the underwriter borrows the shares from the issuers and then, after the offering, repurchase these at market price to return the shares to the shareholders (Franzke & Schlag, 2003).

OOAs decreases the underpricing, investment banks will not set a low offer price because if the option is exercised, they are going to need to buy back the shares at the market price. Therefore, they must ensure that the issue is not underpriced.

2.2.2.4 Average daily returns of the market index during the 30 days before the offering

The impacts of market conditions on underpricing are discussed in the literature review. As a reminder, Lourghran & Ritter (2002) argued that during bull markets, the level of initial returns is significantly higher. This variable that consists in the average daily return of the reference index 30 days before the IPO could help in measuring the influence of favorable or unfavorable market timings on IPOs' initial returns. TABLE 2.3 displays the reference indexes that are in use. This study assumes that the average daily return might be an indicator of agency problems and, more particularly of the partial price adjustment consequential to the emergence of new public information. Therefore, a positive coefficient for this variable is expected.

Market	**Reference index**
Euronext Brussels	BEL20
Euronext Paris	CAC40
Euronext Lisbon	PSI20
Euronext Amsterdam	AEX

TABLE 2.3: Reference indexes

2.2.2.5 Standard deviation of daily market index returns during the 30 days before the offering

According to Lowry et al. (2010), a "hot" IPO market characterized by huge volatility in index returns influences both the underpricing and also the volatility in IPOs' initial returns. The authors advanced that high volatility markets imply difficulties for underwriters to price IPOs correctly which eventually leads to higher underpricing. These difficulties are partly due to the uncertainty surrounding the demand for the IPOs. Investment banks therefore underprice to ensure that investors subscribe. The reference indexes displayed in TABLE 2.3 are used. In conclusion, the expected sign for the coefficient of the variable is positive.

2.2.2.6 Company's Age

This variable is used as a proxy to calculate the influence of ex-ante uncertainty on underpricing. As argued by Rock (1986) and Ritter J. R. (1984), IPO ex-ante uncertainties are negatively correlated with the age of the firm that is going public. Investors will ask for a significant initial return in exchange for bearing the higher risk that smaller companies represent. Therefore, age is expected to have a negative impact on underpricing. The variable is measured in a number of years and calculated from the creation of the firm to the announcement date of the IPO.

2.2.2.7 IPO Deal size

IPO proceeds constitute another way of measuring ex-ante uncertainty's influence on IPOs underpricing. It is linked with the age variable that was developed previously. Regarding IPO uncertainty, Beatty & Ritter (1986) distinguish two types of firms: established firms that issue large proceeds and speculative ones that issue a smaller amount.

Empirical evidence on the negative correlation between deal size and underpricing was demonstrated for several markets (Jamaani & Alidarous, 2019). This variable is measured in millions of euros and is expected to have a negative coefficient in the regression.

2.2.2.8 Average first-day returns of the 10 prior IPOs on the market

Ibbotson & Jaffe (1975) developed a theory on "Hot issue" markets. The authors define it as periods in which the average first-day returns of IPOs is abnormally inflated. They conclude that past IPOs' initial returns might predict future listings' initial performance. The first day returns of these past IPOs are computed using EQUATION 1.1 and arithmetic mean is performed on these figures, as shown in EQUATION 2.1.

$$\text{Avg\_10\_prior}_j = \sum_{i=1}^{10} \frac{IR_{j-i}}{10} \tag{2.1}$$

where

- IR_{j-i} is the initial return of the IPO_{j-i} on Euronext.

This variable is used as a proxy for market timing theories and this study expects a positive relationship between the average initial return of the 10 prior IPOs and the underpricing.

2.2.2.9 Lockup days

The Lockup period (LP) is defined as the number of days during which investors cannot sell the IPOs' shares. As argued by Arthurs et al. (2009), the existence of a lockup period reduces the information asymmetries that investors are facing. The authors state that the issuer can use LP mechanisms as a signal for the quality of the firm and its long term growth potential. The model tests the lockup period as a dummy which takes the value 1 if there is a lockup date and 0 otherwise.

Independent Variables	**Description**	**Theoretical explanation**	**Expected signs**
UW_Reputation	Underwriter reputation	Certification	(-)
VC_Backed	Venture Capital backed IPOs	Certification	(+)
Greenshoe _exercised	The number of shares that are borrowed from the issuer by the underwriter	Signaling	(-)
AvgRet_30_Days	Average daily return of the market index during the 30 days before the offering	Market condition Agency Problems	(+)
Stdv_30_days	Standard deviation of daily market index returns during the 30 days before the offering	Market condition Agency Problems	(+)
Company_Age	Age of the company going public	Ex-ante uncertainty	(-)
Deal_size	Amount of proceeds	Ex-ante uncertainty	(-)
Avg_10_prior	Average first-day returns of the 10 prior IPOS	Market conditions	(+)
LP_days	Lockup period	Signaling	(-)

TABLE 2.4: Presentation of the independent variables

2.3 Multivariate linear regression model

In order to test the theoretical explanations of underpricing documented in the literature review, an empirical study of several variables' impact is performed through a linear model (Hair et al., 1998).

2.3.1 Context

This model is defined as "a multivariate statistical technique used to examine the relationship between a single dependent variable and a set of independent variables" (Hair et al., 1998). The sample is composed of the value of the independent variables, and the multilinear regression aims at explaining how those variables influence the explained variable. Regarding this present study, this statistical tool tries helping to determine which factor significantly affects underpricing.

The model is defined as the following equation :

$$Y = \alpha + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_i x_i + \epsilon \tag{2.2}$$

where

- Y is the dependent variable
- α is the intercept, the value where the line crosses the y-axis
- β_i are the regression coefficient that represents the change in the dependent variable for a one-unit change in the corresponding independent variable
- x_i are the independent variables
- ϵ is the error term

There are two different types of assumptions to verify in order to assess the explanatory power of the model. First, the general significance of the model is tested with a Fisher test.

Second, the significance of each variable is tested with a student test which evaluates the hypotheses presented in EQUATION 2.3. It is essential to distinguish these hypotheses from our research hypotheses presented in the introduction. If β_i is statistically significant, the student test indicates that H_0 can be rejected. Therefore, it will be possible to state that the proxy variable i influences the studied phenomenon. This study will use the results of these tests to confirm or reprobate the hypothesis $H_{1.1}$.

$$\begin{aligned} H_0 &: \beta_i = 0 \\ H_A &: \beta_i \neq 0 \end{aligned} \tag{2.3}$$

2.3.2 Regression optimization

The regression method used in this present work will be the ordinary least squares (OLS) and all regressions are performed using STATA.

In order to ensure that the OLS estimators are efficient, several tests and transformations are performed. Standardization and the outliers finding are done using Python. The code is displayed and explained with commentaries in APPENDIX 1.

2.3.2.1 Outliers

Removing the extreme values of the sample ensures that these values do not influence the model more than they should. This transformation has been done with the Local Outlier Factor (LOF) algorithm from Python. This method focuses on the X variables and deletes the outliers from a dataset by measuring the local density of every observation. An observation is then considered an outlier when it presents a lower density than its neighbor observations (Sklearn, 2019). The algorithm identified 15 outliers in the study sample.

2.3.2.2 Standardization

Regression models provide more reliable results when the data are scaled. If it is not the case, the model's coefficients are sensitive to the scale of the data and will tend to over-evaluate huge numbers. Python function "Standardscaler" is used to standardize the values of the model variables. This method relies on setting the values of the individual features such as the mean is 0 and the variance is 1. Every independent variable of our model has been standardized in order to interpret and draw a statistically significant conclusion from the coefficient of the model.
The formula used for standardization is described in the following equation.

$$Z = \frac{x - mean}{std.dev} \tag{2.4}$$

where

- Z is the value after standardization
- X is the initial value of the variable which is standardized.
- $mean$ is the mean of the variable across the sample.
- $std.dev$ is the standard deviation across the sample.

It is important to note that X-Standardization has been used on the data. It consists of standardizing only the X variables. For the purpose of better interpretation, dummy variables are not standardized (Kim & Ferree, 1981).

2.4 Variables testing

The main goal of this study is to have the best possible regression based on the available data. In order to achieve this goal, several transformations are to be applied to our sample. First, it is needed to delete the outliers of the dataset. Then, data of our sample have to be standardized and independent variables are selected. Finally, a correlation test is performed before performing robust regression.

The regression model aims at measuring the linear relationship between a dependent variable and independent variables. Extreme values tend to weaken the model and should be withdrawn from the observations. Therefore, the sample was initially composed of 150 IPOs and it decreased to 135 by deleting the outliers.

The forward selection approach is used to reach the best possible model. It consists in integrating all variables one by one into the model and perform tests at each steps. Every tried variable are displayed in APPENDIX 2.

The first statistical indicator is R-squared. This measurement represents the way variables of the model explain underpricing. For example, an R-square of 0.80 implies that the variables explain 80% of the phenomenon. However, R-squared does not provide information on the quality of the model. As shown in FIGURE 2.1, no matter what variable you add to your model, the R-squared will always increase. Adjusted R-square is more relevant than the simple one because it takes into account the model's predictive capacity. As graphically shown in FIGURE 2.1, there is an inflection point where one additional variable not only does not improve the adjusted R-square anymore but also decreases the model quality. The first objective will be to find the number of variables at the inflection point for our model.

The selection process leads to the nine variables that have been described in SECTION 2.2.2. In order to verify if there is an issue of multicollinearity of the model, it is necessary to compute the correlation between the independent variables. The variables on deal size and greenshoe are highly correlated, as FIGURE 2.2 displays. A correlation of 0.8788 means that it could make the model unstable. Since ex-ante uncertainty is already tested with the Age variable and that Deal Size showed a weak significance when tested in different models, the variable Deal Size is dropped from the regression.

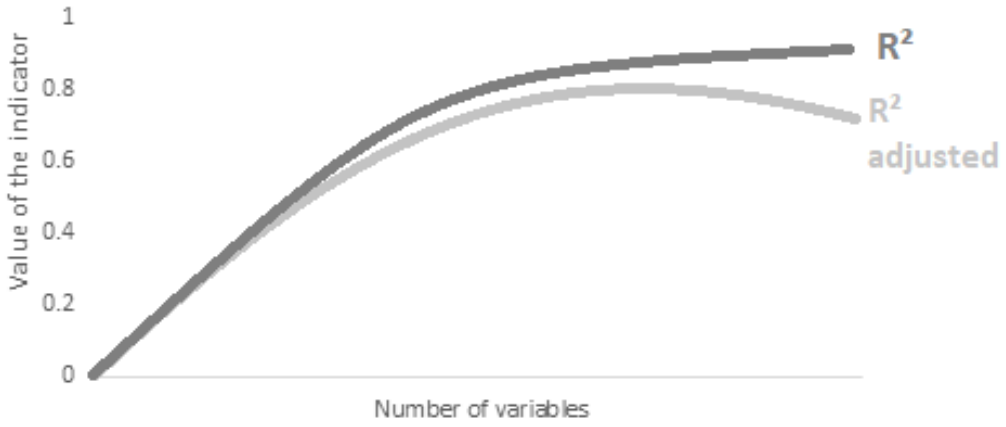

FIGURE 2.1: R-squared and adjusted R-squared values depending on the number of variables [1]

	UW_Rep~n	VC_Bac~d	Greens~d	AvgRet~s	Stdv_3~s	Age	Deal_s~e	Avg_10_prior	LP_days
UW_Reputat~n	1.0000								
VC_Backed	-0.0041	1.0000							
Greenshoe_~d	0.3465	-0.0583	1.0000						
AvgRet_30_~s	0.0008	-0.1182	0.0073	1.0000					
Stdv_30_days	-0.1360	0.0138	-0.0142	-0.2956	1.0000				
Age	0.0559	-0.0651	0.1861	0.1143	0.0680	1.0000			
Deal_size	0.4162	-0.0886	0.8792	0.0201	0.0120	0.1529	1.0000		
Avg_10_prior	0.0720	-0.2934	0.0587	-0.0590	-0.2227	-0.0035	0.1029	1.0000	
LP_days	0.3129	0.1688	0.2056	0.0161	0.0052	0.1381	0.1865	-0.3794	1.0000

FIGURE 2.2: Correlation matrix study sample

Since other variables have a higher correlation than 0.30, a multicollinearity check is performed. The collin command of STATA is used. If the condition number displayed by the command is higher than 10, it means that the regression coefficient is globally unstable and it is necessary to delete variable(s) (Utah, 2020). As FIGURE 2.3 shows, the regression model presented in EQUATION 2.5 is stable and does not appear to suffer from any multicollinearity.

Nevertheless, the correlation between Lockup days and the average initial returns of the ten prior IPOs catches the attention because there is a negative correlation of -0.3794. This result was not expected. Indeed, there is no evidence of the existence of a link between these variables in the literature. Moreover, there is no logical implication that can explain it. In order to test if this correlation has an impact on the stability of the model, regressions have been performed on three different models :

- A complete model with eight independent variables (M1)
- A first alternative excluding the Lockup days variable (M2)
- A second alternative model excluding the Average IR of the 10 prior IPOs variable (M3)

[1] Note that this graphic is for informational purposes only and does not represent real data.

	Eigenval	Cond Index
1	2.5025	1.0000
2	1.4797	1.3005
3	1.2119	1.4370
4	1.1484	1.4762
5	0.8149	1.7524
6	0.7395	1.8395
7	0.5254	2.1825
8	0.3472	2.6845
9	0.2305	3.2951
Condition Number		3.2951

FIGURE 2.3: Collin test STATA

A comparison between the p-value of the coefficient for each model is also made. The goal is to figure out if the correlation between these variables alters the coefficients. As described in FIGURE 2.4, the variables `Avg_10_prior` and `LP_days` are non-significant when they are in the same model while they are respectively significant at a level of 5% in the alternative models. The coefficient and p-values of the other variables seem to be constant across models. Therefore, the two variables do not seem to jeopardize the stability of the model except for the two factors' coefficient. The three models are discussed more precisely in CHAPTER 3.

UW_Reputation	0.030	0.007	0.042
VC_Backed	0.068	0.085	0.113
Greenshoe_exerciced	0.000	0.000	0.000
AvgRet_30_Days	0.043	0.039	0.064
Stdv_30_days	0.107	0.130	0.048
Age	0.750	0.894	0.700
Avg_10_prior	0.255	0.063	
LP_days	0.148		0.039

FIGURE 2.4: P-values of the three models (left to right: M1, M2, M3)

2.5 Model implementation

As previously explained, our empirical analysis is based on one main regression model and two sub-models. The three following models incorporate our variables into the multivariate equation described in EQUATION 2.2 and will be tested with the robust regression function from STATA. The main model encompasses the eight variables described in TABLE 2.4.

- Main regression model M1:

$$\begin{aligned} First\_Day\_Return = \ & \alpha + \beta_1 \texttt{UW\_Reputation} + \ \beta_2 \texttt{VC\_Backed} \\ & + \beta_3 \texttt{Greenshoe\_Exercised} + \beta_4 \texttt{AvgRet\_30\_Days} \\ & + \beta_5 \texttt{Stdv\_30\_days} + \beta_6 \texttt{Company\_Age} \\ & + \beta_7 \texttt{Avg\_10\_prior} + \beta_8 \texttt{LP\_days} + \epsilon \end{aligned} \tag{2.5}$$

- Regression model M2:

$$\begin{aligned} First\_Day\_Return = \ & \alpha + \beta_1 \texttt{UW\_Reputation} + \ \beta_2 \texttt{VC\_Backed} \\ & + \beta_3 \texttt{Greenshoe\_Exercised} + \beta_4 \texttt{AvgRet\_30\_Days} \\ & + \beta_5 \texttt{Stdv\_30\_days} + \beta_6 \texttt{Company\_Age} \\ & + \beta_7 \texttt{Avg\_10\_prior} + \epsilon \end{aligned} \tag{2.6}$$

- Regression model M3:

$$\begin{aligned} First\_Day\_Return = \ & \alpha + \beta_1 \texttt{UW\_Reputation} + \ \beta_2 \texttt{VC\_Backed} \\ & + \beta_3 \texttt{Greenshoe\_Exercised} + \beta_4 \texttt{AvgRet\_30\_Days} \\ & + \beta_5 \texttt{Stdv\_30\_days} + \beta_6 \texttt{Company\_Age} \\ & \beta_7 \texttt{LP\_days} + \epsilon \end{aligned} \tag{2.7}$$

3 Research results and discussions

This chapter is divided into two parts. The first one describes the phenomenon of underpricing on the Euronext market and the second one displays the regression results.

3.1 Measures of underprincing

3.1.1 Volumes

For this section, the sample is divided into two parts, i.e. Euronext main and Euronext Growth/Access. Euronext Growth and Access are regrouped because there are only five IPOs from Access in the sample. As a reminder, this paper refers to underpricing and initial returns interchangeably.

This section focuses on the sample before the suppression of IPOs for which we do not have data for specific variables. The purpose is to better suit the reality in terms of volumes and proceeds. As shown in FIGURE 3.1, the highest number of IPOs was observed in 2006, just before the financial crisis. Our sample shows a significant decrease in volume from 2008 to 2013. The number of listing then increases but does not go back to the same level as 2006.

Regarding deal sizes, the graphic representation shows that there is no strict correlation between the number of IPOs and the number of proceeds. For example, 2006 and 2015 were the years with the greatest volumes. However, both years show lower proceeds than the prior one. There is a potential explanation in the repartition of IPOs. Indeed, 2006 has been the year with the highest numbers of IPOs, but the share of listing from Euronext Growth/Access was significant. This market is focused on small and medium-sized firms which therefore imply lower proceeds. Nevertheless, this observation does not explain the low proceeds in 2015.

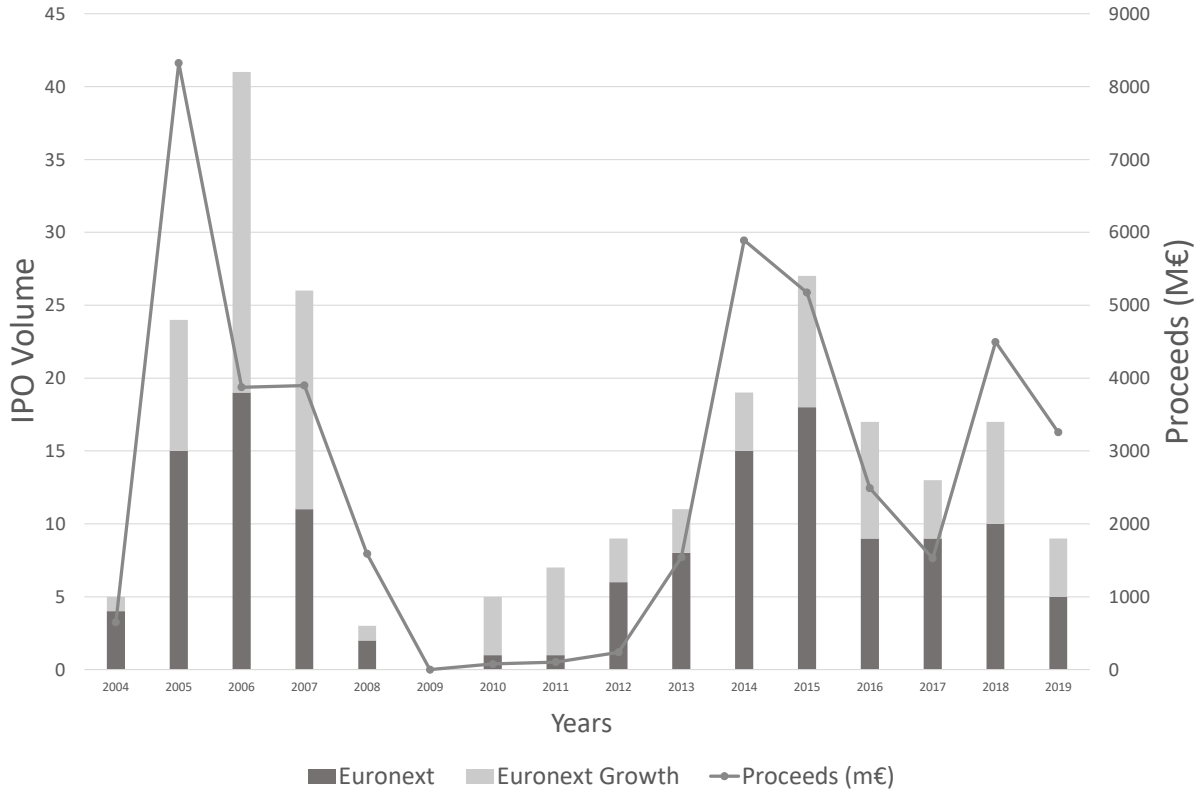

FIGURE 3.1: Volume of IPOs on Euronext and Euronext Growth (Bars) / Proceeds (line)

Over the period, there have been 133 IPOs on Euronext and 100 on Euronext Growth/Access. The period of high volumes has been similar between the two markets. Nevertheless, the number of listing decrease significantly for Euronext Growth and Access. The comparison of the period 2004-2011 and 2012-2019 shows that the number of IPOs decreased by 25% for Euronext Growth/Access while it increased by 35% on Euronext.

These results are consistent with what Ritter (2013) observed. The author states that there is a global decrease in the number of small companies listings and advance two possible explanations. The first one concerns the low profitability of small firms in the three years following the IPOs, which obviously diminish the attractiveness of going public.

The second explanation consists in explaining the low volume by the market conditions. This second argument is consistent with the graphic of FIGURE 3.1 which seems to highlight that the highest volume levels may correspond with high growth periods and that it is true no matter the market. For the purpose of identifying any visual evidence of the influence of growth on the decision to go public, GDP growth rates in the Eurozone are added to the volumes in FIGURE 3.2. Before 2015, an obvious correlation between the two factors can be observed in the graphic.

In addition to this graphical evidence, a Pearson coefficient is computed for both markets and both variables in order to determine the correlation. The result is a positive correlation of 0.58 statistically significant at 2%. This finding might be evidence of the market timing theory presented in the literature review. It states that issuers wait for favorable market conditions to go public (Lucas & McDonald, 1990). Years showing high GDP growth are the best timing to go public and benefit from an economic momentum. It is why high volume is observed when the growth rate is high and conversely, there are fewer IPOs when the GDP is lower.

The theory on market timing seems to be verified for both Euronext and Euronext Growth. Still, as suggested by Ritter (1993), unfavorable market conditions might have a higher impact on the listing for small companies compared to larger ones. Moreover, as indicated by Vismara et al. (2012), second markets like Euronext Growth largely benefit from hot periods and often suffer from cold periods.

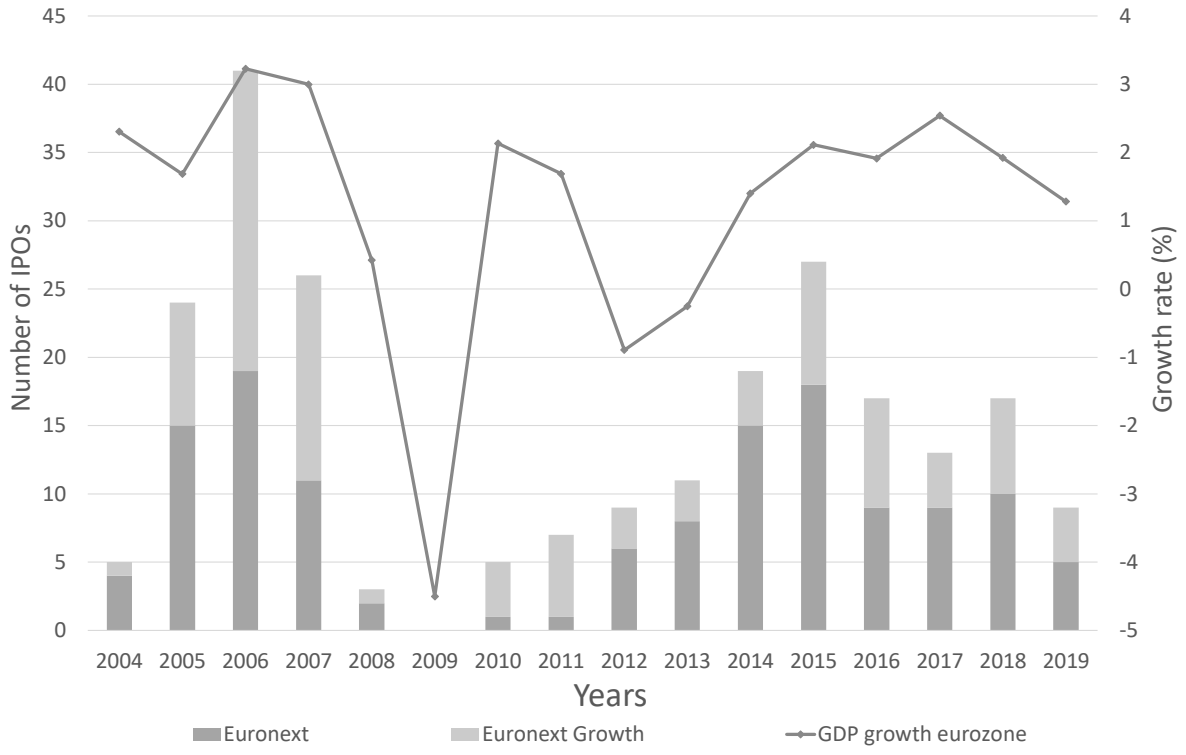

FIGURE 3.2: IPOs volume and GDP growth

3.1.2 First-day and first-week returns

At this point, the first research question RQ1 can be addressed:

RQ_1 :	*Is there evidence of IPO underpricing on Euronext?*

Hypothesis H_1 can be asserted. IPO underpricing exists on Euronext and initial returns are on average 6.28% [1]. TABLE 3.1 summarizes basic information on the phenomenon.

As evidenced by Ljunkvidt (2007), in some countries, it takes more than one day for the investors to adjust the price to its fair value. It is therefore interesting to study the returns after one week. The author states that it adjusts rapidly in well-developed countries. Thus, first-day initial returns should be enough for Euronext. As shown in TABLE 3.1, the mean of the returns is higher after one week than after one day and similar observations can be made for standard deviation[2]. This finding suggests that the underpricing phenomenon probably takes more time to appear on Euronext and Euronext growth.

Variable	**Obs**	**Mean**	**Std.dev.**	**Min**	**Max**
First day initial returns	233	0.062822	0.155484	-0.25798	1.361842
First week initial returns	233	0.073148	0.190951	-0.35402	1.394737

TABLE 3.1: Average initial returns on the entire Euronext market

The difference of initial returns between the first week and first day is bigger on Euronext that on Euronext Growth. More importantly, underpricing is higher for Euronext growth. The results presented in TABLE 3.2 are not surprising. Euronext Growth is composed of smaller companies. As Switzer & Zhai (2019) documented for the US and Canadian markets, smaller companies tend to show higher underpricing than their larger counterparts.

Markets	**Obs**	**First-day init. ret.**	**First-week init. ret.**
Euronext MAIN	133	0.0446611	0.0605487
Euronext Growth/Access	100	0.0869764	0.0899046

TABLE 3.2: Repartition of Underpricing between markets

[1] As shown in Appendix 8, the average first day return is different from 0 at a statistical significance level of 0.01.

[2] As shown in Appendix 9, the average First week initial returns is higher than the First day initial returns at a statistical significance level of 0.10.

The low profitability of small companies after their IPOs has been largely documented but it does not seem to have a direct impact on the pricing of these IPOs by the market. However, it can have an indirect effect through risk. Indeed, smaller companies represent a higher risk and it has been proven that riskier IPOs are on average relatively more underpriced than less risky listings (Manigart, 2003). The goal behind setting a relatively low offer price might be to compensate investors for the risk they are taking.

Initial returns cannot be analyzed as an absolute number. It is essential to analyze how the figure has evolved over the period. FIGURE 3.3 represents the volume and underpricing for listing on Euronext and Euronext Growth between 2004-2019. Unfortunately, it is impossible to draw a conclusion from it because the abnormally low IPO volume from the period following the crisis makes any analysis non-significant. In order to solve this issue, this period must be withdrawn from the scope of observation and the results are exhibited in FIGURE 3.4. The Pearson coefficient is used to highlight any potential correlation between volume and underpricing. The result is a positive correlation between the number of IPOs and IPO initial returns per year of 0.48 statistically significant at only 15% which does not allow us to conclude anything.

Euronext Growth aims at attracting smaller companies raising smaller amounts than on Euronext. Indeed, these firms raise average proceeds of approximately 14 million euros against more than 300 million euros on average on Euronext. As documented by Vismara et al. (2013), companies listed on secondary markets like Growth, have on average poor long-run performance.

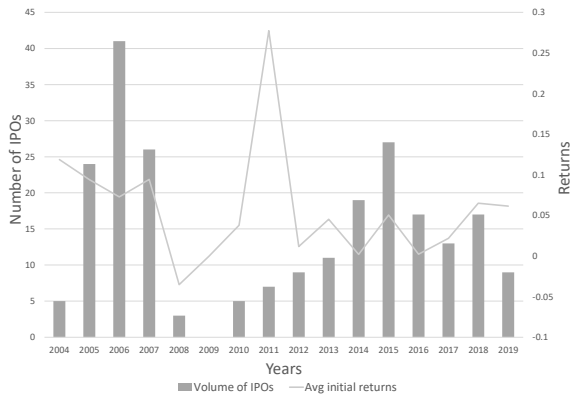

FIGURE 3.3: Volume and underpricing whole period

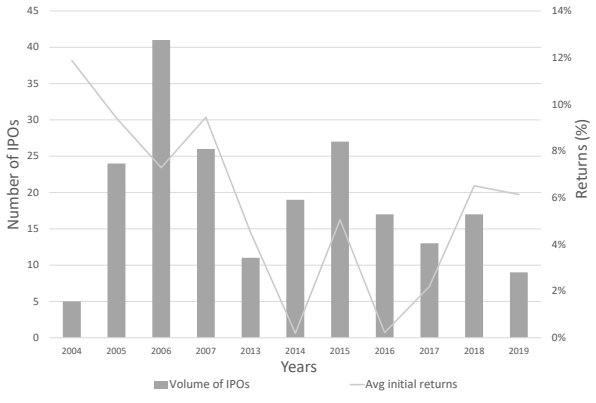

FIGURE 3.4: Volume and underpricing without 2008-2012

3.1.3 Comparison with longer time frames

Country	Sample Size	Time Period	Avg. Initial Return
Belgium	154	1984-2017	11.0%
France	834	1983-2017	9.7%
Portugal	33	1992-2017	11.5%
Netherlands	212	1983-2017	13.3%

TABLE 3.3: Average Initial Returns in Euronext countries (adapted from Ritter (2020)

Based on TABLE 3.3, it is possible to conclude that initial returns have decreased over time. The most logical explanation of this phenomenon is that the periods of comparison include the internet bubble IPOs. As documented in SECTION 1.6, initial returns have peaked in the US and EU before the bubble burst; therefore, these extreme values influence the average initial returns presented in TABLE 3.3.

Moreover, as suggested in SECTION 1.6, the implementation of SOX-like requirements might contribute to this lower underpricing.

3.1.4 Underpricing by industry

Euronext			**Euronext Main**			**Euronext Growth/Access**		
Main Industries	***IPOs***	***IR***	***Main Industries***	***IPOs***	***IR***	***Main Industries***	***IPOs***	***IR***
Biotech	33	4.78%	**Biotech**	25	2.6%	**Biotech**	8	7.10%
Appli. software	12	5.39%	**Specialty pharma**	11	3.79%	**Advertising Marketing**	7	12.25%
Speciality pharma	12	5.59%	**Real estate**	6	5.51%	**Appli. software**	7	8.48%

TABLE 3.4: Underpricing by industry on Euronext

There are 92 different sectors in our sample. The complete list is in APPENDIX 4. There is a wide range of industries in both sub-sample; 48 distinct sectors have been recorded on Euronext GA and 65 on Euronext main. According to the sample described in TABLE 3.4, Biotechnology is the main industry on Euronext in terms of IPOs. The underpricing difference between markets is even sharper when grouping by top sectors. Indeed, the aggregate weighted average initial returns of the top 3 sectors in Euronext Growth/Access is 9.17% against 3.32% on Euronext main. The

classification of Bloomberg displayed in our sample is the “First Level Microsector" therefore, it is very specific. It is possible to have a more general classification by taking a Macro sector categorization. The general classification is made following the Global Industry Classification Standard (GICS) developed by Standard & Poor’s and MSCI (S&P & MSCI, 2018).

	Euronext		**Euronext Main**		**Euronext Growth/Access**	
Industry	***IPOs***	***IR***	***IPOs***	***IR***	***IPOs***	***IR***
Healthcare	64	6.79%	43	3.03%	21	14.48%
Information Technology	38	6.59%	15	4.91%	23	8.28%
Consumer Discretionary	29	9.39%	13	3.14%	16	5.96%
Industrials	28	5.34%	13	5.40%	15	5.30%
Communication Services	14	6.31%	6	3.35%	8	8.53%
Materials	14	5.94%	7	7.03%	7	4.86%
Real Estate	14	6.14%	13	6.39%	1	2.94%
Financials	12	5.43%	12	5.43%	0	/
Utilities	11	8.22%	7	7.70%	4	9.13%
Consumer Staples	8	8.87%	3	4.09%	5	11.72%
Energy	1	-4.44%	1	-4.44%	0	/
TOTAL	233		133		100	

TABLE 3.5: Main industries on Euronext based on GICS

There are 11 categories in this classification. The main industries on Euronext according to GCIS are described in TABLE 3.5. First of all, it is relevant to highlight that 75% of IPOs on Euronext are concentrated in five distinct industries: Healthcare, Information Technology, Consumer Discretionary, Industrials and Communication Services.

Second of all, health care is the main industry on Euronext which is consistent with the classification of Bloomberg displayed on TABLE 3.4. It is logical since this category encompasses Biotech. The interest in using a general classification like GICS can show underpricing differences between sectors and markets. TABLE 3.5 highlights a significant difference in initial returns for the same industries depending on the markets. For example, IPOs of companies in the healthcare industry show a underpricing of 3.03% on Euronext main against 14.48% on Euronext Growth/Access.

This particularity implies that the differences in the type of companies that list on these markets imply variation in initial returns. If the underpricing were equivalent between IPOs from different markets and matching sectors, it would mean that abnormal initial returns are potentially due to different sectors’ composition on these markets.

3.1.5 Introduction methods on Euronext

In the literature review, the three primary placement methods are presented :

- Fixed price: the price is pre-determined by the issuer and the underwriter
- Bookbuilding: the price is defined following the consultation of institutional investors
- Auction: the price is set according to the demand of investors

As explained in the previous sections, bookbuild became the predominant IPO placement mechanism while firms have rarely used auction these past years. In addition to these traditional methods, several hybrid mechanisms have been adopted worldwide. As an example, as documented by Kerins et al. (2007), the most popular practice in Japan was a hybrid of auction and fixed price. As shown in FIGURE 3.5, the most predominant IPO placement on Euronext is hybrid. This hybrid method is a combination of bookbuilding and an open price offer. According to Jagannathan et al. (2010), the latter can be considered a fixed price method. It consists of 2 simultaneous phases. Firstly, a private placement which aims at setting the price and shares allocation to institutional investors. Secondly, an open price offer during which retail investors can place orders specifying the quantity and price they desire. These two phases unfold at the same moment and the price is not pre-determined in both cases. The offer price will indeed be fixed at the last moment (Jagannathan, Jirnyi, & Sherman, 2010).

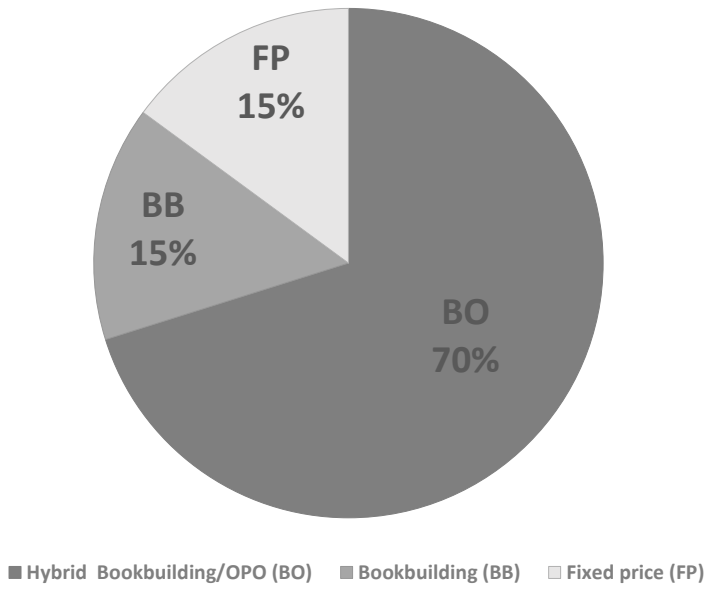

FIGURE 3.5: Volume by IPO method on Euronext (2004-2019)

The two graphics in FIGURES 3.6 and 3.7 highlight that there is no trend in terms of methods between the periods: 2004-2011 and 2012-2019. There is a slight decrease in the use of the hybrid method while the use of fixed-price method increases. Nevertheless, the small number of observations does not allow us to draw robust conclusions.

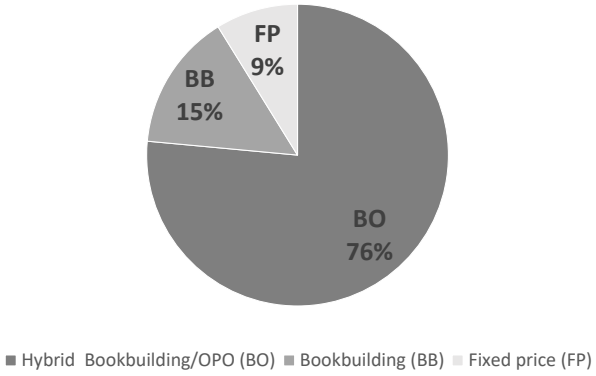

FIGURE 3.6: Popularity of IPO allocation mechanism (1997)

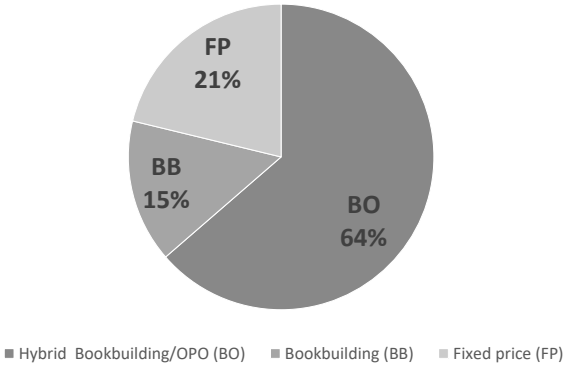

FIGURE 3.7: Popularity of IPO allocation mechanism (2010)

There are several potential explanations for the abandonment of auction developed in the literature. In France, auctions disappeared with the authorization for simultaneous hybrid bookbuilding. Before this event, a sequential hybrid of "Placement Garanti" and fixed price offer was used. Still, this method was not optimal due to long-term delays (Jagannathan et al., 2010). Therefore, we might assume that auction was abandoned for a more effective method, namely, hybrid bookbuilding.

3.2 Regression results

3.2.1 Main model

3.2.1.1 Results analysis

The regression results are displayed in TABLE 3.6. Based on our sample that contains 135 IPOs, a multivariate regression is performed and coefficients of each variables are computed. The model has a relatively small explanatory capacity with an R-squared of 21.84%. This figure implies that the model can explain 21.84% of the dependent variable, namely, first-day initial returns of the sample's IPOs. Despite this weak prediction, this R-squared is comparable to the study of Van Hulle et al. (1993) on underpricing which displayed an r-squared of approximatively 20%. Moreover, the model allows us to draw several relevant conclusions.

Independent Variables	**Coefficient**	**P-value**
Constant	0.0611	0.000
`Avg_10_prior`	0.0081	0.215
`AvgRet_30_Days`	0.0131**	0.033
`Stdv_30_days`	-0.0106*	0.060
`Greenshoe_exercised`	0.0253**	0.000
`Company_Age`	0.0019	0.531
`LP_days`	- 0.0204	0.138
`UW_Reputation`	- 0.0305**	0.020
`VC_Backed`	0.0379	0.101
Observations	135	
R-squared	0.2184	

TABLE 3.6: Multivariate regression results, independent variables coefficients for underpricing[3]

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[3]The OLS regression is estimated using Eicker-White's robust variance method which ensures heteroskedasticity-consistent standard errors. The regression calculated is EQUATION 2.5. P-values are presented: ** indicates a statistical significance at 5%, * indicates a statistical significance at 10%. Note that robust regression does not compute an adjusted R-square.

When we incorporate the coefficients into EQUATION 3.1 , the model becomes:

$$\begin{aligned}\texttt{First\_Day\_Return} &= 0.0611 + 0.0081\,\texttt{Avg\_10\_prior} + 0.0131\,\texttt{AvgRet\_30\_Days} \\ &\quad -0.0106\,\texttt{Stdv\_30\_days} + 0.0253\,\texttt{Greenshoe\_exercised} \\ &\quad +0.0019\,\texttt{Company\_Age} - 0.0204\,\texttt{LP\_days} - 0.0305\,\texttt{UW\_Reputation} \\ &\quad +0.0379\,\texttt{VC\_Backed}\end{aligned} \tag{3.1}$$

The first analysis concerns the expected sign detailed in TABLE 2.4. The "direction" of the relation between the independent variables and the dependent variable is first guessed based on the literature. With the computed regression, it is possible to compare expected and effective signs. Among the eight variables, the prediction is correct for five and incorrect for three. The inaccurate suppositions are highlighted in grey in TABLE 3.7.

Independent Variables	**Expected sign**	**Regression sign**
Avg_10_prior	(+)	(+)
AvgRet_30_Days	(+)	(+)
Stdv_30_days	(+)	(-)
Greenshoe_exerciced	(-)	(+)
Company_Age	(-)	(+)
LP_days	(-)	(-)
UW_Reputation	(-)	(-)
VC_Backed	(+)	(+)

TABLE 3.7: Multivariate regression for underpricing on Euronext

These coefficients are not always statistically significant which implies that we cannot systematically establish their influence on underpricing. TABLE 3.6 shows that there are three independent variables statistically significant at 5% and one variable at 10%. The interpretation of the coefficient is different when the variables are standardised, the value of the coefficient indicates the average variation in the dependent variable for a 1 standard deviation increase in the independent variable. The descriptive statistics of the sample with the standard deviation measures are displayed in APPENDIX 10.

The independent variables significant at a 95% confidence level are the following:

1. The average return of the reference index for 30 days prior to the IPO have an influence significant influence on underpricing. Indeed, if AvgRet_30_Days soars by 0.00188, the underpricing increase on average by 0.0131

2. The underwriter reputation has a negative impact on underpricing. Indeed, IPO which underwriters are among the top 5 in terms of reputation on Euronext has a lower average underpricing by 0.0305
3. `Greenshoe-exercised` has also a significant effect. If the over-allotment increases by 2642320, the initial returns grow on average by 0.0253.

Finally, the standard deviation return of the reference index for 30 days prior to the IPO has a significant impact at a 90% confidence level. An increase of 0.0038 of the independent variable implies an average drop of the IPO initial returns of 0.0106.

3.2.1.2 Determinants of underpricing on Euronext

This section aims at explaining what the concrete implications of the model's results on underpricing are. As described in SECTION 2.2.2, independent variables of the regression equation act as proxies in order to test the validity of several theories. This section is divided into four parts according to the four significant independent variables presented previously: `UW_Reputation`, `Greenshoe_exerciced`, `AvgRet_30_Days`, `Stdv_30_days`.

Underwriter reputation As expected, there is a negative relation between underpricing and the underwriter's reputation, according to our model. The first link between our result and the theory is related to the certification theory. This information asymmetry theory based states that the issuer's choice of a reputable underwriter sends a signal of a fairly valued IPO.

An extensive development of this observation might be that the investors active on the Euronext market faced an information asymmetry compared to the issuers. On the one hand, the companies going public on the studied market know if the IPO is underpriced or not. On the other hand, investors do not have this information. Therefore, if the underwriter is among the five most reputational of Euronext, it sends the signal that the offer price is set at fair value. Hence, investors interpret the signal and do not drive the price significantly higher than the offer price which results in a lower underpricing.

Greenshoe exercised This variable represents the amount of shares borrowed to the issuer by the underwriter to meet excess demand. A negative relationship between the amount of over-allotment and IPO initial returns is expected for two reasons.

Firstly, given the fact that OOA is costly for the underwriter in the event of a significant underpricing, it sends a signal to investors that the offer price is probably set at fair value by the underwriter.

Indeed, the underwriter must ensure that the price is not too high when he will need to buy the borrowed shares back. Secondly, as shown in FIGURE 3.8, all other things being equal, an increase in the number of shares offered following the exercise of an OOA decreases the after IPO price.

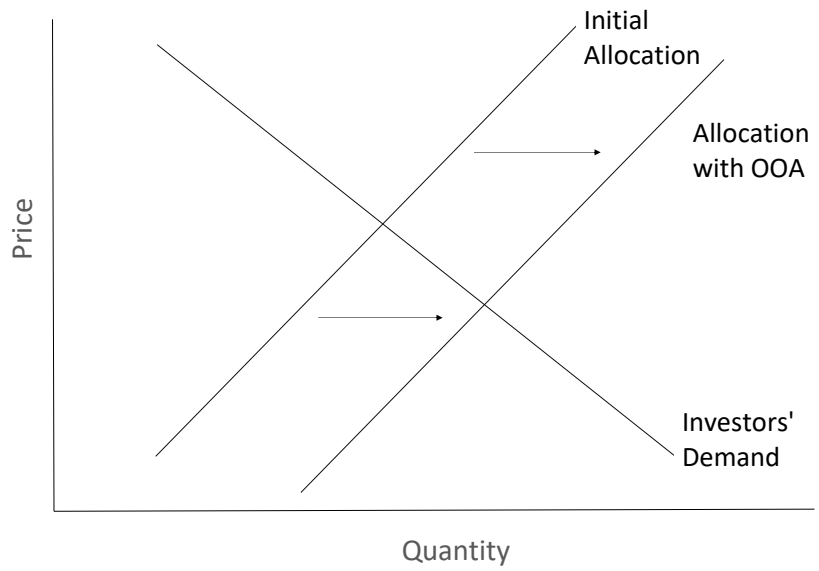

FIGURE 3.8: Change in price with OOA ceteris paribus [4]

This study advances a potential explanation for the difference between the expected sign and the effective relation highlighted by the regression model. As Ritter & Welch (2002) argued, information asymmetry models cannot always explain abnormal initial returns because some of these are due to behavioral components. Based on this finding, one can assume that the excessive demand might indicate that investors are overoptimistic toward the IPO and therefore overvalue its price. This assumption is tested in SECTION 3.3 by measuring the 3-year buy-and-hold performances of these IPOs. Indeed, if the investors' comportments drive the price above its fair value on the first day of listing, this price will adjust and thus decreases in the long term.

[4]Note that this graphic is for informational purposes only and does not represent real data.

Average daily returns of the market index during the 30 days before the offering. A positive influence of this variable on underpricing is expected based on the literature. The regression model is consistent with expectations and shows a significant positive impact of `AvgRet_30_Days` on IPO initial returns. This result is consistent with the market timing framework. This framework highlights a higher level of underpricing during favorable market conditions. The relation between these variables can be explained by the partial adjustment of the price to public information (Ritter & Loughran, 2002; Hof & Saveri, 1999). Indeed, a variation in the average returns of the stock in a specific market constitutes new public information. In theory, the underwriter must adjust the offer price consequently in order to avoid underpricing. Evidence of the Euronext market shows that the underwriter does not adapt the offer price fairly and it is why there is on average a significant positive impact of the variable `AvgRet_30_Days` on IPO initial returns.

Standard deviation of daily market index returns during the 30 days before the offering The variable has a negative coefficient in the model which is inconsistent with the expectation previously presented. This research has not found support for this result in the literature. One potential explanation is advanced by this study. As empirically proven by Arnold & Vrugt (2008), high volatility of the stock market increases the fundamental uncertainty. The following assumption can thus be formulated, an increase in standard deviation of daily market returns increases the uncertainty surrounding an initial public offering. Therefore, the investors integrate this information and tend to be less optimistic about the prospect of the company going public. If this assumption is verified, that would mean that the underwriter must adjust the offer price downward if there is high volatility prior to the IPO.

3.2.2 Sub-models

The results of the two alternative models are displayed in TABLE 3.8. Both regressions have a slightly lower R-squared than the main model which is normal because deleting a variable always decreases the R^2. The coefficient and p-value are very close to what is observed in the main model for the following variables: `AvgRet_30_Days`, `Stdv_30_days`, `Greenshoe_exerciced`, `Greenshoe_exerciced`, `UW_Reputation`, `VC_Backed`. The interest of these two models highlights that when the variables `Avg_10_prior` and `LP_days` are in the same model, they are not statistically significant. Nevertheless, when separated from each other in the two

similar models, the variables' coefficients have a p-value below 0.05. It means that the average return of the 10 prior IPOs and the existence of a lock-up period have a significant impact on underpricing at a confidence level of 95%. This difference between main and sub-models arises from the negative correlation between the two variables.

	Lock-up regression (M2)		**Avg 10 prior regression (M3)**	
Independent Variables	**Coefficient**	**P-value**	**Coefficient**	**P-value**
Constant	0.0541	0.000	.0639	0.000
`Avg_10_prior`	/	/	0.0122**	0.046
`LP_days`	-0.0268**	0.036	/	/
`AvgRet_30_Days`	0.0133**	0.027	0.0117*	0.055
`Stdv_30_days`	-0.0099*	0.083	-0.0126**	0.020
`Greenshoe_exerciced`	0.0243	0.000	0.0259**	0.000
`Company_Age`	0.0008	0.780	0.0023	0.499
`UW_Reputation`	-0.0365**	0.020	-0.0281**	0.023
`VC_Backed`	0.0358**	0.002	0.0317	0.156
Observations	135			
R-squared	0.2053		0.2103	

TABLE 3.8: Multivariate regression for models M2 and M3[5]

On the one hand, it is not possible to state that the average return of the 10 prior IPOs and the existence of a lock-up period influence IPO initial returns on Euronext. The simple reason is that it might be misleading because the main model does not verify this relation.

On the other hand, the negative correlation between the two factors seemingly causes an impossibility to interpret the coefficient correctly in the main model. This study interprets the variable `Avg_10_prior` and `LP_days` but it is important to keep in mind that these results cannot be generalized.

[5]The OLS regression is estimated using Eicker-White's robust variance method which ensures heteroskedasticity-consistent standard errors. The regressions calculated are EQUATIONS 2.6 and 2.7. P-values are presented: ** indicates a statistical significance at 5%, * indicates a statistical significance at 10%. Note that robust regression does not compute an adjusted R-square.

Average first-day returns of the 10 prior IPOs on the market Based on the literature, a positive influence of the variable on underpricing was expected. The corresponding coefficient is indeed positive and significant at a confidence level of 95%. The Beta indicates that an increase of 0.0299 in the independent variable produces on average an increase of 0.0122 in IPO initial returns. The interpretation is similar than the `AvgRet_30_Days` variable. The fact that the returns of the 10 prior IPOs increase underpricing supports market conditions theory. Consequently, underwriters should change the offer price according to this new public information. Evidence on the Euronext market shows that they do not adapt the price which reveals agency problems.

Lockup days As expected, the coefficient of this variable is negative. The existence of a lockup period decreases on average the underpricing by 0.0268. Arthurs et al. (2009) argued that lockup periods improve the information symmetry on markets because it shows that the issuer is confident in the long term growth of its company.

This study advances another potential explanation. Investors know that underpricing usually occurs. Therefore, they subscribe to IPOs in order to benefit from the first day initial returns. When a lockup period is implemented, investors cannot benefit from underpricing which might imply a lower overoptimism for these listings.

3.3 Long-run performance

As explained in the literature review, there is evidence of long-run underperformance of IPO. The buy-and-hold performance described in EQUATION 3.2 is the proxy for long-run performance, as done by Ritter (1991).

$$BHR3_i = \frac{P_{i,t+3} - OP_i}{OP_i} \tag{3.2}$$

where

- $P_{i,t+3}$ is the price 3 years after the IPO i
- OP_i is the offer price of the IPO i

The IPOs that occurred less than three years ago are removed from the sample. Moreover, companies that have their 3-year performance within the "Coronavirus" crisis are also withdrawn. The sample of study for this section is therefore composed of 109 IPOs.

The first piece of evidence comes from the average long-run performance of the sample which is -5.85%, while the average IPO initial returns is 4.34%.

Besides, the relation between the IPO long-run performance and underpricing will be tested with the following simple linear model :

$$BHR3 = \alpha + \beta_1 \texttt{First\_Day\_Return} + \epsilon \tag{3.3}$$

where

- α is the intercept
- β_1 is the coefficient of IPO first-day return
- ϵ is the error term

As shown in TABLE 3.9, the independent variable `First_Day_Return` has a negative impact on the dependent variable. The coefficient is statistically significant at a confidence level of 90% and indicates that an increase of 0.01 in the IPO initial returns decreases the 3-year Buy-and-Hold return by 0.0215 on average.

Independent Variable	Coefficient	P-value
Constant	0.0921	0.496
First_Day_Return	-2.1504*	0.053
Observations	109	
R-squared	0.0252	

TABLE 3.9: Multivariate regression for underpricing on Euronext[6]

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As previously stated, the exercise of a greenshoe option increases underpricing. In order to test if this finding might be due to behavioral comportments, the link between the variables greenshoe_exercised and IPO long-run performance must be assessed.

There are 54 IPOs in the sample for which a greenshoe option has been activated. The average long-run performance of these IPOs is -8.09% against -3.65% for the IPOs which have not been overallocated. Unfortunately, this finding is not statistically significant otherwise, it would support the statement that the behavioral theories might explain the influence of greenshoe options on underpricing.

[6]The OLS regression is estimated using Eicker-White's robust variance method which ensures heteroskedasticity-consistent standard errors. The regression calculated is EQUATION 3.3. P-values are presented: ** indicates a statistical significance at 5%, * indicates a statistical significance at 10%. Note that robust regression does not compute an adjusted R-square.

3.4 Discussion of the results

The empirical part of this study aims at responding to the three research questions presented in the introduction. Therefore, this present chapter will be divided into three parts.

The first research question was :

RQ_1 :	*Is there evidence of IPO underpricing for companies listed on Euronext?*

SECTION 3.1.2 provides the following answer: underpricing exists and IPO initial returns are on average 6.28% on Euronext. Hypothesis H_1 is asserted.

After evaluating the existence of the phenomenon, this study focused on determining the causes of these abnormal initial returns. Therefore the following question is addressed :

$RQ_{1.1}$:	*Which theories explain IPO underpricing on Euronext?*

The regression model is mostly based on testing information-based theories. Strong evidence has been found on the influence of information asymmetry on underpricing. First of all, the positive impact of the average market index returns prior to the IPOs on the dependent variable shows that underwriters do not adjust the offer price based on the emergence of new public information. It is symptomatic of the existence of agency problems on Euronext. Indeed, by not adjusting the price, the underwriter does not act in the best interest of the issuer because it leads to a significant amount of money left on the table. Second of all, underwriters' reputation also has a statistically significant impact on underpricing. This variable tends to decrease IPO initial returns and it supports information asymmetry based theory. Indeed, the issuer who does not choose a reputable underwriter does not decrease this asymmetry which results in a higher underpricing.

Based on these findings, this study considers that hypothesis $H_{1.1}$ is verified. Nevertheless, giving the weak explanatory power of the model, this research states that other theories might also explain underpricing.

This study also aims at testing behavioral theories' influence on the phenomenon. This test is partly performed with the last research question :

$RQ_{1.2}$:	*What is the relationship between IPO long-run underperformance and underpricing on Euronext?*

As previously documented, IPO initial returns have a negative impact on the average long-run performance of IPOs on Euronext which verifies hypothesis $H_{1.2}$.

Two main categories of explanation on pricing have been presented in SECTION 1.3: rational and irrational theories.

On the one hand, rational postulation describes the abnormal IPO initial returns as being caused by deliberate actions from markets' actors. Issuers and underwriters purposely set the offer price below fair value for several rational reasons. Information asymmetry theories fall into this category.

On the other hand, irrational theories state that issuers and underwriters set the offer price at fair value and investors' comportments make the price soar on the first day of trading. In order to test the importance of the behavioral explanation, the following statement was implied: if the price is pushed above fair value by investors, it should adjust in the long term eventually causing long-run underperformance. Therefore, this study considers long-run underperformance of IPOs on Euronext as evidence in favour of behavioral theories.

4 Limits and recommendations

With this research, two main limits are identified. Those limits alter both the model's predictive capacity and the range of tested theories.

The first limit arises from the database. As mentioned in SECTION 2.1, a significant number of IPOs have been withdrawn from the sample due to missing values. This fact has undoubtedly reduced the quality of the model's prediction. Another limit related to the database is the absence of relevant variables that would have been otherwise tested and maybe incorporated to the model. Therefore, other sources, proxies and suppositions have sometimes to be used. The limited access to other database contributes to this difficulty, Bloomberg being logically limited in the information.

Concerning the method, after analysis, the doubt is formulated that a regression is able to explain and capture a complex phenomenon such as underpricing. Despite the optimisation applied on the model, it leads to a relatively low prediction capacity with a R-square inferior to 20%.

The implications of these two limitations are important. Every analysis and observation of this study is primarily valid for our sample. This research aims to generalise the findings to Euronext but it is essential to keep in mind that results must always be nuanced.

The recommendations formulated by this study focus on two points : dataset and modelling. Regarding the data, gathering information from different sources is critical. It provides new variables and also allows to compare information from different data providers. Indeed, inaccurate data have been observed in the initial sample which inevitably made the information impossible to use and interpret. Therefore, bringing together different sources ensures that most of IPOs of the market are in the research sample. It is crucial because the model relies on the quality and quantity of information, no matter the type of prediction tool used.

As highlighted before, this study made the statement that multivariate linear regression might not be the best model to predict underpricing. Indeed, there are other modelling approaches which

have a higher capability to handle complex datasets than linear regression. These models probably fit more accurately this kind of IPOs study sample. For example, testing other regression models such as polynomial regression could be relevant. This method is appreciated for its ability to fit greater range of data (Sklearn, 2019). Two other modelling approaches are also identified: Neural network models and Nearest neighbors. These approaches are stemmed from the machine learning field.

This study recommend the following methodology for further researches on IPO underpricing:

1. Ensure that the study sample is as complete as possible by gathering information from different sources
2. Test different modelling methods with a wide range of parameters. Hence, complex regressions and machine learning approaches in order to choose the most relevant one.

5 General conclusion

The purpose of this study is to determine the existence of underpricing on the Euronext market and the determinants of the phenomenon.

This study starts with the presentation of a theoretical background on underpricing. It summarizes the motivation behind the decision to go public and highlights the multivariate characteristic of this choice. Then, the description of the different methods of introduction helps understanding the mechanism at the core of the pricing of IPOs which plays a predominant role in underpricing.

Finally, SECTION 1.3 presents the definition of the phenomenon and the difference view related to the offer price determination. An anomaly that is often linked with underpricing in the literature is introduced, IPO long-run underperformance. The major chapter of the literature review is undoubtedly theoretical explanations of underpricing because it is a relevant summary of theories on IPO initial returns and it contributed to the development of the regression model. Finally, the presentation of three key regions and their figure on listings and initial returns provides the tools to understand how the market structure can influence the phenomenon.

For the practical research, a sample of 233 IPOs is used to measures the number of IPOs depending on certain filters and more importantly the magnitude of IPO underpricing on Euronext. At this point, the statistical tests allows to confirm hypothesis H_1. In the second part of the results, the sub-questions 1 and 2 are addressed with a regression model. It led to the identification of several theories which might explain underpricing on Euronext. Evidence is found for two main approaches : information asymmetry based and behavioral theories.

At the end of this dissertation, it is stated that underpricing exists on the Euronext market. As highlighted by the literature review, the phenomenon varies across markets. Therefore, there is a significant probability that Euronext's market structure and condition influence underpricing. The modelling section and the corresponding results respond to the three research questions defined in the introduction and find support for several explanation theories.

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