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MASTER´S FINAL WORK

DISSERTATION

DETERMINANTS OF UNDERPRICING AND ABNORMAL RETURNS IN EUROPEAN IPOS

BRUNO MIGUEL PRATA DUARTE

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IPO – Initial Public Offering.

EMH – Efficient Market Hypothesis.

AR – Abnormal Return.

AAR – Average Abnormal Return.

CAR – Cumulative Abnormal Return.

CAAR – Cumulative Average Abnormal Return.

ABSTRACT, KEYWORDS AND JEL CODES

This investigation aims to analyse the impact of underpricing and short-term abnormal returns in a sample of IPOs from European Markets between 2014 and 2022. To fulfil the research objectives, an event study was conducted to measure the cumulative abnormal returns up to thirty days after the IPO, followed by four regression analyses to examine the effect of firm and issue-specific characteristics in the levels of underpricing and abnormal returns. The findings show a positive value for underpricing and some significant abnormal returns, mostly negative, in the days following the IPO. Furthermore, the regression analyses indicate no significant impact of the firm-specific characteristics on underpricing and abnormal returns in the current IPOs' sample. However, issue-specific attributes, like offer price and offer size, significantly impacted the levels of underpricing and abnormal returns. These results suggest that issue-specific characteristics seem to be a good risk indicator investors use to analyse investments. The current study contributes to theory and practice by updating the knowledge from previous research on underpricing and short-term abnormal returns on recent IPOs and providing insights into the role of firms and issue-related characteristics.

KEYWORDS: Underpricing, Abnormal Returns, Market efficiency, Event Study Analysis

JEL CODES: G12, G14, G15

TABLE OF CONTENTS

TABLE OF FIGURES

1.   INTRODUCTION

An Initial Public Offer (IPO) represents a critical point in a company seeking to transition from private to public for the first time. An IPO is when a firm offers its shares to the public, allowing external investors to become shareholders. Going public is strategic and linked to financial and non-financial reasons. The main financial reasons considered to be the most impactful are the desire to raise capital for the firm and create a public market that allows founders and other shareholders to convert their wealth into cash (Ritter and Welch, 2002). In an IPO, the issuing firm partners up with an underwriter who acts as a financial advisor and an intermediary in the IPO process. During the process, both intervenients set an offer price and the total number of shares to be issued, and the underwriter sells the securities through his distribution network (Lowry, Michaely and Volkova, 2017).

The IPO process is complex and has gathered significant attention from researchers. They have dedicated their attention to studying the returns generated by IPOs, which some academics labelled as the "New Issues Puzzle" or "IPO puzzle". The analysis of these returns by previous researchers has shown that IPOs, on average, tend to outperform the market, generating short-term returns higher than expected for those securities. The study of IPO returns has pointed to the existence of significant positive short-term returns in the initial days or weeks after the event. The returns recorded for the first day of trading compared to the final offer price have been one of the most focal points in the literature, known as "underpricing". The underpricing phenomenon consists of setting the offer price for the newly issued shares below its fair market value to generate positive returns for investors on the first day of trading.

Various researchers have verified the existence of underpricing and short-term abnormal returns in different markets across the world, some registering significantly higher values of underpricing of more than 50% (e.g., Chan, Wang and Wei, 2004; Ritter, 1984) while others much lower, about 10% or less (e.g., Borges, 2007; Brounen and Eichholtz, 2002).

This phenomenon is seen as a contradiction to the Efficient Market Hypothesis, which states that the stock price fully reflects all the available information, meaning that all securities constantly trade at their fair value. If this is the case, it would be impossible

for any investor to persistently earn excess returns from trading because there are no mispriced shares. However, the existence of evidence regarding short-term abnormal returns in IPOs might indicate the existence of some pre-market pricing inefficiencies (Fama, 1970).

The research literature on IPO is not restricted to short-term returns (e.g., Borges, 2007; Chan, Wang and Wei, 2004; Ritter, 1991). Most studies extended the analysis of returns up to five years after the IPO, recording the existence of significant underperformance in the long run. In other words, the IPO tends to register significant negative abnormal returns in the long run, meaning they perform below expectations. This situation not only diverges from the initial returns performance but also raises questions regarding market efficiency.

The vast literature on this topic presents many explanations regarding this phenomenon. Researchers have reached four broad categories with different theoretical backgrounds that comprise several possible explanations. The models based on the asymmetric information theory are among the most supported by academics. The explanations based on this theory consider that the issuer possesses more information than the buyer, generating a higher risk for the investors. Rock (1986) argues that the underpricing is a risk mitigation strategy used to incentivise investors with less information to participate in the IPO. Also, within this theoretical background, Baron (1982) advocates for the principal-agent problem, stating that the issuer and the underwriter might have different objectives for the operation, and that might influence the IPO pricing. Besides these models, it is possible to find explanations linked with other theoretical foundations, like those based on institutional reasons, control considerations, and behavioural approaches.

Researchers have deepened the research by analysing what factors can be used to explain the different levels of abnormal returns recorded. Nevertheless, the academic community remains divided on the causes behind underpricing and short-term abnormal returns in IPOs, as evidenced by many potential explanations. This renders it a particularly interesting area for further exploration.

This specific stream of research has investigated a broad number of determinants mainly linked with factors that can influence the risk levels perceived by investors or act

as signals for investors' confidence in the success of a specific IPO. The main categories are firm-specific characteristics, linked with the unique characteristics of each firm; issue-specific characteristics, linked with the unique characteristics of the IPO operations; and country-specific characteristics, linked with each country's institutional and legal framework.

The purpose of this study is to investigate the existence of underpricing and subsequent short-term abnormal returns in European IPOs and how these returns relate to the Efficient Market Hypothesis (EMH). Additionally, we examine how certain explanatory variables linked with specific characteristics of the firm and the issue might influence the underpricing and the short-term abnormal returns. To pursue these goals, this master thesis presents an event study on the IPOs of five European indexes from February 2014 to February 2022 to estimate the values of abnormal returns. Regression analyses were conducted to evaluate the impact of some firm-specific and issue-specific characteristics of the IPOs in the abnormal returns to examine the existence of factors that might help to predict this phenomenon. This research aims to contribute to the existing knowledge by providing insights into the dynamics of IPO pricing and performance in the context of European capital markets and highlighting the presence and persistence of market anomalies. Furthermore, understanding the factors influencing the pricing of IPOs and the subsequent short-term performance can offer valuable guidance to companies, financial services firms and investors involved or wanting to participate in IPOs. The driving factors behind this research are the fact that the majority of the studies on this topic are old and manly focused on American markets, leaving us space to explore the implications of this phenomenon on a more recent period of time and with particular empashis on European markets.

2. LITERATURE REVIEW

Market efficiency

In 1970, Eugene Fama published the first insights on the Efficient Market Hypothesis (EMH) (Fama, 1970). The hypothesis states that the price of a stock reflects all the available and relevant information, so it always trades at its fair value. Therefore, in an efficient market, an investor cannot profit from any trading strategy because there are no undervalued or overvalued stocks. Based on the analysis performed, Fama (1970) concluded that this market efficiency could exist in three forms (weak, semi-strong, and strong), depending on the nature of the available information. In the weak form, the EMH is limited to only one subset of public information regarding the historical information on the stock price. Fama (1970) argues that all the historical information on the stock price is reflected in the current price, so it is impossible to predict future prices and achieve excess returns. In a semi-strong form, the EMH incorporates the stock's historical information and assumes that the stock prices adjust quickly to any new public information. All the publicly available information is reflected in the stock price. Therefore, it is impossible to predict price changes based on that information and achieve excess returns from undervalued stocks. In the strong form, the most rigid of the three, the EMH incorporates all public and private information, stating that it is impossible to generate abnormal returns based on inside information as this information is already incorporated into the stock's price.

These conclusions suggest that investors cannot achieve abnormally high returns because the market always prices the stocks correctly according to the available information. So, in an efficient market, the expected value of abnormal returns is zero. Nonetheless, it is possible to earn abnormal returns through price anomalies. This indicates that abnormal returns can be seen as an anomaly to the EMH, meaning that it might be some inefficiency that causes some particular security to behave differently from what was expected (Latif *et al.*, 2011).

Regarding IPOs, the premises of an efficient market do not necessarily exclude the existence of underpricing, as the presence of abnormal returns in a single moment is not enough to question these hypotheses. Within an efficient market, we expect that it is possible to observe sporadic abnormal returns, but these returns need to be quickly

adjusted by the newly available information (Fama, 1970). These abnormal returns suggest that buying into an IPO could generate returns greater than the market average, and it is possible to find this type of phenomenon within an efficient market. What is expected is that the market quickly adjusts the stock price and, consequently, besides the abnormal returns caused by the underpricing, all the other returns should be zero or very close to it. As Fama (1970) acknowledges, this abnormal return might not be directly caused by inefficiencies in the market but rather caused by the fact that the shares are not traded before the IPO. So, these shares could not be priced efficiently, meaning that the market and the issuer have different perspectives on the valuation.

Based on previous studies (e.g., Isola, Teixeira and Ferreira, 2014; Ritter and Welch, 2002; Reilly, 1973), we anticipate a certain level of underpricing and subsequent positive abnormal returns attributed to the underpricing phenomenon. However, it is important to note that these findings are insufficient to challenge the Efficient Market Hypothesis (EMH).

Concepts of Underpricing and short-term overperformance

The underpricing phenomenon involves setting an IPO's issuing price below its fair market value. According to Ljungqvist (2007, p.381), underpricing is "estimated as the percentage difference between the price at which the IPO shares were sold to investors (the offer price) and the price at which the shares subsequently trade in the market". The existence of an initial positive performance in the aftermarket can suggest that the newly issued shares were underpriced (Ibbotson, 1975). The underpricing focuses exclusively on evaluating the return on the first day of trading to measure if the stock's issuing value was below the investors' expectations.

The underpricing phenomenon was first disclosed by Logue (1973) and Stoll et al. (1970) when assessing the returns achieved by investors from purchasing new stock issues. They found that investors could achieve higher returns in the short term, which could indicate that a large proportion of new issuers were listing their stock below the expected market value. Ibbotson (1975, p.250) assessed the same phenomenon and concluded that investors have "a far higher likelihood of an extremely large positive performance" in the short run. Within the same study, Ibbotson (1975) explored potential

reasons behind the underpricing phenomenon, primarily focusing on the role of underwriters. However, despite the investigation, no satisfactory explanation was identified.

Ritter (1984) analysed the initial returns of more than 1,000 IPOs during 1980 and 1981 in the US to further explore this unusual behaviour. From the analysis, he concluded that investors could achieve average returns of more than 48% on the first day of trading, naming this situation a "hot issue market". Several other authors performed similar studies reaching analogous conclusions (Borges, 2007; Westerholm, 2006; Chan, Wang, and Wei, 2004; Brounen and Eichholtz, 2002). In Nordic markets (Sweden and Norway), Westerholm (2006) determined an average underpricing of 17.1% in 458 IPOs between 1991 and 2002. Brounen and Eichholtz (2002) analysed a sample of 54 IPOs in France, Sweden, and the UK and determined an excess return of 2.55% on the first trading day. Evaluating the initial returns in a sample of 609 IPOs from the Chinese stock market, Chan, Wang, and Wei (2004) found an average underpricing of 178% in A-shares IPOs (shares not readily available to foreign investors) and 11.6% on B-shares IPOs (shares readily available to foreign investors). Especially addressing the Portuguese stock market, Borges (2007) analysed 41 IPOs from 1988 to 2004 and found an average underpricing of 11.1%.

The majority of the above-cited studies extended the analysis of the abnormal returns up to 5 years, intending to prove that the stocks overperform (have significantly positive returns, higher than the market average) right after the IPO, and this performance diminishes over time. Westerholm's (2006) results suggest that the average long-run return over five years was minus 12.6% per year, Brounen and Eichholtz (2002) recorded a twelve-month average return of minus 1.29%, and Ritter (1991) reported a 3-year average return of minus 29,13%. Despite this tendency, in some cases, like Borges (2007), it is also possible to find no signs of long-run underperformance. The initial overperformance can be primarily explained by underpricing. If the stock is offered at a lower value than expected, the first investors can achieve higher returns until the market adjusts to the fair price, recording an occasional inefficiency.

More recently, some authors have discussed the effect of firm-specific characteristics on the levels of underpricing and the initial performance of the shares. The

findings suggest that the industry/sector, ownership structure, board characteristics, firm size, and characteristics related to the cost and the number of shares issued may impact underpricing (Wang *et al.*, 2023; Ljungqvist and Wilhelm, 2003). Other studies focused on the effect of underwriters' specific characteristics, like size and reputation. They concluded that IPOs linked with high-reputation underwriters generally have less risk and low underpricing levels (Carter, Dark, and Singh, 1998).

Most literature regarding IPOs market performance has found evidence of an average underpricing within the analysed samples. Nonetheless, within this sample, it is also possible to find records of overpriced IPOs, meaning that the close price for the first day of trading is below the final offer price, resulting in negative returns for investors. From the results of previous research, we might assume that overpricing is less common than underpricing or, when it happens, tends to register lower levels, which explains that the average results point to underpricing.

Underpricing explanations

The underpricing phenomenon has been a prolific research topic in Finance, so it is possible to find various attempts to explain it. Ljungqvist (2007) presents a comprehensive review of the most important theories introduced to date. He grouped them under four broad categories: asymmetric information, institutional reasons, control considerations, and behavioural approaches.

The asymmetric information models are based on the idea that one of the parties involved in the IPO has more information than the others. The underpricing can result from the information asymmetry between the issuer, the underwriter, and the investors (Rock, 1986). The institutional theories focus on the effect of three features of the marketplace: litigation, bank price stabilising activities, and taxes (Ibbotson, 1975; Logue, 1973). On the other hand, control theories propose that underpricing moulds the shareholder composition and minimises external investor intervention once the company goes public (Stoughton and Zechner, 1998; Brennan and Franks, 1997). Lastly, behavioural theories suggest the existence of irrational investors who bid up the price of the IPO shares beyond their true value (Ljungqvist *et al.*, 2018).

Ljungqvist (2007) claims that the information asymmetry models are the most supported by empirical evidence, while the support for the institutional theories is mixed. Both control and behavioural theories have yet to reach their full development stages and are still under active research. This indication is supported by many studies (Ritter and Welch, 2002; Rock, 1986) pointing out asymmetric information models as the basis for the underpricing phenomenon.

In the following sections, we explore the asymmetry models since they are the most supported by empirical evidence, and some of the fundamental ideas behind the behavioural theories are presented.

Information asymmetry models

The information asymmetry theory, originally presented by Akerlof (1970), states that in any transaction, one of the parts possesses more information, securing an advantage over its counterpart. This author uses as an example the car market. The car salesman has more information about the car than the possible buyer; therefore, he can offer a car with worse quality at higher prices. At the same time, the lack of information on the buyers' side makes him incapable of differentiating good cars from bad, and the salesman may be unable to sell the cars for their fair value. This information asymmetry increases the risk of one of the parties getting a bad deal, so it is necessary to find strategies to diminish the various parties' uncertainty and risk.

Using the information asymmetry theory as the theoretical background, it is possible to find several models aiming to explain the underpricing phenomenon. In the specific case of IPOs, we can consider that the owners and the underwriters possess more information about the company than the potential subscribers. For that reason, we have an information asymmetry scenario that generates a problem that needs to be solved. Considering that the investors are aware of this problem, they might require more information or a price reduction on the stock to compensate for the risk they face. By reducing the stock price and committing to underprice, the issuer might want to stimulate the demand and guarantee a successful IPO (Rock, 1986). Karlis and Stumph (2000) also support this idea, stating that information asymmetry is a cause for uncertainty, resulting in underpricing. The authors argue that the IPO shares "are either discounted as a means

of providing incentives to overcome asymmetrical information or increased in value as investors pay a premium for shares signalled to be of high value." (Karlis and Stumph, 2000, p.21). The information asymmetry problem attracted considerable attention from academics, especially regarding the effect of this asymmetry on the relationship between managers and investors. As seen previously, the idea that managers have more information and can understand that information better than the market is seen as a cause for uncertainty, which causes an imbalance of power in a transaction. In equity markets, higher levels of uncertainty will result in price drops and lower levels of stock traded as a response from the market to the risk incurred by the lack of information. The existence of these asymmetries can also influence supply and demand and ultimately result in the existence of market failures (Welker, 1995). The effects of this information asymmetry have been widely analysed in other topics, like dividend policy, capital structure, and corporate governance.

Following this idea, the uncertainty related to the existence of investors better informed than others will also affect participation in the IPO. In cases of high demand, if uninformed investors are affected by adverse selection, they might be awarded overpriced shares. This allocation might cause heavy losses to these investors because they will have to trade their shares at a lower price in the aftermarket, a phenomenon termed the "Winner's Curse". This condition could dissuade them from further investments, reducing the future IPO's success (Rock, 1986). The lower issuing price could work as an incentive to uninformed investors.

The assumptions related to the role of the underwriters in underpricing also represent an important line of explanation regarding this phenomenon within the information asymmetry models. Focusing on the agency problems, according to Arikawa and Imad'eddine (2010) and Baron (1982), the principal-agent problem is the leading cause of underpricing concerning the relationship between the underwriter and the issuer. In this context, interests can be misaligned between the underwriter and the issuer. This may lead the issuer to act in their own self-interest by offering shares at a lower price to ensure a more successful IPO.

Karlis and Stumph (2000) advocate for the signalling theory to explain the underpricing regarding the relationship between the underwriter and the investor. The

authors state that due to the investors' uncertainty, the underwriter can set a lower price for the shares to captivate the investors, guaranteeing a successful IPO and maintaining good reputation levels. Ibbotson (1975, p.264), in a similar line of thought, states that underpricing can be used to "leave a good taste in investors' mouths" and captivate investors for future issues.

Within the information asymmetry topic, we explore the specific case of the overvaluation and undervaluation of IPOs. Booth and Smith (1986) explored the importance of the certification of IPOs by an underwriter. They state that issuing equity has a potential risk linked with the opportunism of the insiders who have more information and can exploit situations where "outsiders have over-estimated the future cashflows to be received by investors" (Booth and Smith, 1986, p.264). Considering that an IPO consists of a wealth transition between two parties, it is expected that the selling party aims to achieve the highest return possible. Therefore, there is a higher probability of finding overvalued firms in IPOs. However, the authors consider that the investors are aware of this situation and because of that, the announcement of the intent to raise equity acts as a warning sign that the company might be overvalued. The investors react to this warning sign, and the issuing price will need to drop to the new perceived price after the announcement to guarantee a successful IPO because the perceived overvaluation could affect the interest of new investors resulting in lower demand and consequently affect the IPO performance.

This perspective about the possible overvaluation of IPOs is directly linked with the information asymmetry problem and market efficiency. More recently, Purnanandam and Swaminathan (2005) presented an alternative approach related to behavioural theories. In their approach, they argue that the perception of overvalued firms is unclear, and it is possible to find underpriced IPOs despite being overvalued by their peers. In their study, Purnanandam and Swaminathan (2005) discovered that it is possible to find IPOs that present excess returns on the first day of trading despite having a pre-market valuation above the expected based on their peer firms. The same researchers analysed a sample of more than 2000 IPOs and found that 50% were overvalued when compared to their industry peers. Additionally, in the short run, their results suggest that the excess returns achieved by overvalued IPOs are between 5% and 7% higher than the ones achieved by undervalued IPOs. The cause for this phenomenon is said to be directly

linked with the over-optimism from potential investors willing to, irrationally, pay a price far superior compared to the stock's fair price. These studies provide the foundations for new explanations for the underpricing and could offer a better comprehension of this phenomenon.

Determinants of IPO Underpricing

To better understand the underpricing phenomenon, some researchers focused on the determinants that could explain the existence and the different levels of underpricing in IPOs. These determinants can be divided into three broad categories: firm-specific characteristics, issue-specific characteristics, and country-specific characteristics.

The first group of determinants aims to establish how specific variables, different from firm to firm, can affect underpricing. This group includes age, size, and financial situation, like leverage or other financial ratios.

Table 1 provides an overview of studies addressing firm-specific characteristics, types of measurement, and key findings.

Table 1 - List of firm-specific determinants

Variable	Measure	Key Findings	Reference
Age	Number of years between the founding and the year of the IPO	Younger firms have higher average initial returns. Older firms have a smaller amount of underpricing.	(Ritter, 1991) (Ritter and Loughran, 2004) (Habib and Ljungqvist, 2001)
Size	Natural logarithm of total assets	Bigger firms have a smaller amount of underpricing.	(Chen, Firth, and Kim, 2004) (Ritter and Loughran, 2004)
	Natural logarithm of net sales	Bigger firms have a smaller amount of underpricing.	(Habib and Ljungqvist, 2001)
Leverage	Total leverage divided by total assets	The level of leverage has a positive effect on the level of underpricing.	(Chen, Firth, and Kim, 2004)
	Total leverage divided by the total assets	The level of leverage has a negative effect on the level of underpricing.	(Habib and Ljungqvist, 2001)
Returns on Assets	Net income divided by the average total assets	A Higher return on assets is linked to a higher level of underpricing.	(Chen, Firth, and Kim, 2004)
Industry	Tech Firms vs. Non-Tech Firms	There is no evidence of differences in the level of underpricing between Tech and Non-Tech.	(Beck, 2017)
	Tech Firms vs. Non-Tech Firms	Tech firms have higher levels of underpricing.	(Ritter and Loughran, 2004)
	Comparison between different industries	The level of underpricing can vary significantly between industries.	(Saro and Chenine, 2007)
Board	Board reputation, experience, and independence	A higher reputation and experience reduce the level of underpricing. Inconclusive results regarding independence.	(Wang *et al.*, 2023)

The second group of determinants addresses how variables associated explicitly with the issuing operation might influence the level of underpricing. This group contains factors like the number of IPO shares or the underwriter's reputation. Table 2 shows an overview of issue-specific characteristics already documented in the literature, including the type of measurement and the findings.

Table 2 - List of issue-specific determinants

Variable	Measure	Key Findings	Reference
Underwriter	Ranked reputation of the underwriter	Underwriters with higher reputation tend to underprice more.	(Ljungqvist and Wilhelm, 2003)
	The size of the underwriter measured by the number of offers lead	Bigger underwriters tend to underprice more.	(Saro and Chenine, 2007)
Size	Number of offered shares	The number of offered shares has a negative influence on the underpricing level.	(Aggarwal and Prabhala, 2002)
Market performance	Cumulative daily returns for the market index	Higher markets return will positively influence the level of underpricing.	(Lowry and Murphy, 2007)
Trading Volume	The volume of trading for the first day divided by the number of shares offered	Higher trading volumes could indicate higher levels of underpricing and higher short-term returns.	(Saro and Chenine, 2007) (Zheng and Li, 2008)

The third group focuses on country-specific differences to explain different levels of underpricing. According to Engelen and van Essen (2010), the country-specific characteristics mainly address the institutional framework of each country. This framework can be divided into two categories: formal institutions, like laws and regulations, and informal institutions, like norms and culture.

The study of formal institutions, the most developed field, analyses how factors linked with laws and regulations might reduce the uncertainty regarding the IPO. The quality of the legal system, the legal protection of investors, and their willingness to accept risks are broadly documented and verified in the financial literature (Chiou, Lee, and Lee, 2010).

In the case of country-specific characteristics, the focus is not directly linked with the level of underpricing but with the *ex-ante* uncertainty generated by the institutional framework of each country. Higher levels of uncertainty when a firm is going public will generate a higher risk that will need to be compensated for with a higher level of underpricing. Table 3 shows an overview of country-specific characteristics already documented in the literature, including the type of measurement and the findings.

Table 3 - List of country-specific determinants

Variable	Measure	Key Findings	Reference
Legal Framework	Protection of intellectual property right	Lower levels of protection generate lower firm growth and firm value. More uncertainty regarding post-IPO strategies. Higher perceived risk	(Claessens and Laeven, 2003)
	Control of transfers of assets and profits from managers and controlling shareholders.	Lower levels of control generate higher uncertainty for future shareholders.	(Johnson *et al.*, 2000)
	Protection for investors	Lower levels of protection generate more uncertainty about realising a return on investment. Increases the uncertainty about the value of the investment	(Engelen and van Essen, 2010)

3. METHODOLOGY

In order to fulfil the proposed research objectives, the methodology of this master thesis is divided into three parts. The first part aims to determine the existence and the level of underpricing in the sampled IPOs. The second consists of an event study with which we aim to measure the abnormal returns for the IPOs in the sample. Finally, in the third part, the analysis of the underpricing phenomenon determinants is conducted through a multiple regression.

Models, formulas, and variables
Underpricing

The underpricing of a new issue can be calculated as the return of the first day of trading in comparison to the offer price:

$$(1) \quad Under\ or\ Overpricing = \frac{P_1}{P_0} - 1$$

where P_0 corresponds to the IPO issuing price and P_1 to the closing price of the shares on the first day of trading. Considering the models presented by previous similar studies (Molin and Landelius, 2021), the calculation of the under or overpricing will be adjusted for market movements, as seen in the following equation:

$$(2) \quad Adjusted\ Under\ or\ Overpricing = \frac{P_1}{P_0} - r_{M1}$$

Where r_{m1} is the market return of the first day of trading, which is given by the specific index return for that day.

Event Studies

The event studies methodology, as used by Fama *et al.* (1969), focuses on evaluating the impact of a specific event on share prices by measuring the existence of abnormal changes.

The first step to proceed with the analysis is determining the time window and the estimation period. The time window refers to the duration during which the share price will be assessed and the abnormal return will be calculated.

The estimation period allows measuring the expected returns, in other words, to estimate the normal returns if the event had not occurred. We can measure the abnormal returns by comparing this estimation to the real returns in the event period.

There are numerous different models used to measure the expected returns. Based on analyses of these various models, we decided to employ the "market model" presented by Fama *et al.* (1969), which is considered to be "the most widely used in the field" (El Ghoul *et al.*, 2022, p.351) and was also the base of studies similar to ours. The following equation will be used for the computation of the expected returns:

$$(3) \quad E[r_{it}|\Omega_t] = \alpha_i + \beta_{iM}r_{Mt}$$

α_i – Share excess return

β_{Im} – Share volatility relative to the market

r_{Mt} – Market return for period t

In this case, the event of interest is an IPO, meaning there is no historical information on the share price. Therefore, it is impossible to determine the expected returns using this model. To overcome this limitation, we will need to make use of the "market-adjusted model", as presented in the following equation:

$$(4) \quad E[r_{it}|\Omega_t] = r_{Mt}$$

The market return will correspond to the index's return where the IPO is listed, so the expected return will coincide with the market return for that specific date.

To compute the abnormal returns, we compare the real returns with the expected returns calculated from the mark-adjusted model, as shown by the following equations:

$$(5) \quad AR_{it} = r_{it} - E[r_{it}|\Omega_t]$$

$$(6) \quad AR_{it} = r_{it} - r_{Mt}$$

AR_{it} – Abnormal return of share i for period t

To further analyse the abnormal returns and their inference to the event, it is possible to choose from two different methods: Cumulative Abnormal Returns (CAR) and Buy-and-Hold Returns (BHAR).

The first one (CAR) is a simplified version mainly focused on short-term analysis and allowing the evaluation of several IPOs over multiple periods. The second (BHAR) is considered more complex and more suitable for long-term analysis (El Ghoul *et al.*, 2022). Considering that we aim to evaluate the returns on the first 30 days of trading, we will employ the Cumulative Abnormal Return (CAR) method.

The Cumulative Abnormal Return consists of the sum of the individual abnormal returns of each IPO for a certain period between two dates. The following equation gives the sum of the different individual returns for each IPO:

$$(7) \quad CAR_T = \sum_{t=t_1}^{t_2} AR_{it}$$

CAR_T – Cumulative abnormal returns for stock i from time t_1 to t_2

In the next step, we aggregate the Cumulative Abnormal Returns and obtain the average abnormal returns for each period for all the sampled IPOs and the respective variance. The following equations give the Cumulative Average Abnormal Returns and the variance:

$$(8) \quad CAAR_T = \frac{1}{N}\sum_{i=1}^{N} CAR_T$$

$$(9) \quad VAR(CAAR_T) = \sigma_T^2 = \frac{1}{N^2}\sum_{i=1}^{N}(CAR_T - CAAR_T)^2$$

T – Time between the event day and up until a maximum of 30 days

$CAAR_T$ – Cumulative average abnormal returns for stock i from time t_1 to t_2

N – Number of IPO observations

According to Campbell, Lo and MacKinlay (1997, pp.162–163), we expect the abnormal returns to be zero, so we test the hypotheses that abnormal returns exist and differ from zero. For the specific case of event studies, we assume a normal distribution:

$$(10) \quad CAAR_T \sim N(0, \sigma_T^2)$$

Following the normal distribution, a *t*-test will be conducted to examine the statistical significance of the cumulative average abnormal returns obtained, as follows:

$$(11) \quad t = \frac{CAAR_T}{\sqrt{VAR(CAAR_T)}} \sim N(0,1)$$

Regression

Lastly, we will conduct a multivariate regression to observe the influence of some specific determinants on the level of underpricing and the short-term abnormal returns. In the literature review, we presented some variables previously tested by other authors, some of which we will also employ in this study.

In this analysis, we will attempt to test the effect of 11 determinants related to firm-specific and issue-specific characteristics. Table 4 specifies the variables' names and the measures used to obtain their values.

Table 4 - List of independent variables and respective measures

Variable	Measure
Age	$IPO\ year - Incorporation\ year$
Size	$\ln(Total\ Assets)$
Leverage	$\dfrac{Total\ Leverage}{Total\ Assets}$
Offer Size	$\ln(Shares\ offerred \times Issuing\ price)$
Trading Volume	$\dfrac{First\ day\ trading\ volume}{Shares\ offerred}$
Ownership Concentration	The sum of the ownership % of the two biggest shareholders prior to the operation
Board Size	Number of members that compose the firm's board prior to the operation
Board Women's	$\dfrac{Number\ of\ womens\ in\ the\ board}{Size\ of\ the\ board}$
Offer Price	The final offer price of the IPO
Covid	Dummy Variable for IPOs that occurred during the Covid-19 pandemic (2020 and 2021)
Industry	Dummy Variable for the industries with the most observations. "Basic Materials", "Consumer Discretionary", "Financials", "Health Care", "Industrials" and "Telecommunications"
Market	Dummy Variable for the markets with the most observations. "Amsterdam", "Brussels", "Milan", and "Paris"

The equation for the regression is as follows:

$$Dependent\ Variable = \beta_1 Age + \beta_2 Size + \beta_3 Leverage + \beta_4 OfferSize +$$
$$\beta_5 TradingVolume + \beta_6 OwnershipConcentration + \beta_7 BoardSize +$$
$$\beta_8 BoardWomen + \beta_9 IssuingPrice + \beta_{10} Covid + \beta_{11} Sector + \beta_{12} Country$$

For the presented variables, we expect to find a negative sign on the coefficient of the Age and Size variables, meaning that older and bigger firms should present lower levels of underpricing. The same is expected for the board characteristics, meaning that bigger boards with a higher presence of women should be a proxy for higher assertiveness and transparency, resulting in less risk and, consequently, less underpricing. Lastly, we also expect to find a negative sign on the coefficient of the Offer Size and Offer Price variables, meaning that bigger offers and offers with a higher final offer price should suffer lower levels of underpricing.

On the contrary, we expect to find a positive sign on the coefficient of three variables: Ownership Concentration, Trading Volume and Leverage. For the first one, we assume that a higher concentration of capital should raise bigger questions regarding information asymmetry, carrying more risk and possibly being subjected to higher levels of underpricing. The same can be said about the variable Leverage since higher levels of debt could indicate higher levels of business risk, resulting in higher levels of underpricing. Lastly, we also expect a negative coefficient for the variable Trading Volume, meaning that shares with higher trading volume on the first day of trading could be the ones of more interest to investors, causing higher price fluctuations and, consequently, higher levels of underpricing.

The event window will be divided into different fractions of time to analyse the determinants. The first window includes the event day plus five days after. The second will address the event day plus fifteen days after. The third and last window corresponds to the event day plus thirty days after. This way, this study will present five different regressions. For each one of the regressions, the independent variables will be identical, and only the dependent variable will change. In the first regression, the dependent variable will be "underpricing". In the following regressions, the dependent variable will correspond to the cumulative average abnormal returns for each period under analysis,

between 0-5 days, 0-15 days, and 0-30 days after the IPO. The coefficients obtained for each variable will allow us to estimate the effect of each determinant on the price behaviour of IPOs. A descriptive statistics summary of the variables used can be found in Table 10 in the Appendix

Sampling process and sample characteristics

The data set for this analysis comprises 139 IPOs registered in Euronext markets between February 2014 and February 2022. This broad period of 8 years intersects distinct stages of market performance and economic environment and, as such, may offer insights into interesting behaviours throughout different scenarios.

The list of IPOs included in the sample was obtained from the Euronext website. This website lists all the IPOs on Euronext markets, including other important information, like IPO date and issuing price. Share price and index performance data were obtained from the Refinitiv Eikon database. Other firm-specific information regarding the IPO operation was collected from the documents available to potential investors. The sample only included IPOs in the leading market, "Euronext", excluding IPOs in secondary markets, like "Euronext Growth" or "Euronext Access". Some IPOs listed on the first market were excluded because they had a few days with significant trading volume or lacked reliable information about the operation. The final sample list only comprises public IPOs, thus excluding private placements. Some of the analysed IPOs were already delisted at the moment of this study.

The sampled IPOs are all listed in five European markets (Amsterdam, Brussels, Lisbon, Milan, and Paris). The corresponding indexes used were "AEX" for the Netherlands, "PSI" for Portugal, "CAC" for France, "FTSE Italia" for Italy, and "BEL" for Belgium. Table 5 presents the number of IPOs per year in each cited market.

Table 5 - Number of IPOs per year per country

	2022	2021	2020	2019	2018	2017	2016	2015	2014	Total
Amsterdam	-	8	1	1	4	2	4	8	5	33
Brussels	-	3	3	1	2	1	1	4	2	17
Lisbon	-	-	-	-	-	-	-	-	1	1
Paris	1	9	1	3	7	9	6	12	13	61
Milan	-	-	-	-	4	7	3	8	5	27
Total	1	20	5	5	17	19	14	32	26	139

The market with the highest number of IPOs is Paris, representing almost half of the total number of IPOs. The least represented is the Lisbon stock exchange, with only one observation. Regarding the years, the observations are generally balanced, except for 2019 and 2020, probably due to the COVID-19 pandemic and 2022, as only IPOs until February were considered.

The sampled IPOs spanned various industries. Table 6 presents the number of IPOs per industry and year.

Table 6 - Number of IPOs per industry per year

	2022	2021	2020	2019	2018	2017	2016	2015	2014	Total
Basic Materials	-	1	-	-	-	1	-	1	2	5
Consumer Discretionary	-	3	1	1	3	5	5	5	2	25
Consumer Staples	-	-	1	-	-	-	1	2	1	5
Energy	-	1	-	1	1	-	1	1	1	6
Financials	-	6	-	-	3	2	2	7	7	27
Health Care	1	3	2	1	3	4	3	11	6	34
Industrials	-	3	-	2	4	6	2	3	4	24
Real Estate	-	-	1	-	1	-	-	1	-	3
Technology	-	2	-	-	2	1	-	-	1	6
Telecommunications	-	-	-	-	-	-	-	1	2	3
Utilities	-	1	-	-	-	-	-	-	-	1

The Health Care industry has the highest number of companies going public, followed by companies in the Financial area and the Consumer Discretionary industries. These three industries represent more than half of the sampled IPOs. This proportion could be related to these companies operating in industries with higher capital demand, which raises the necessity of issuing new equity.

4. RESULTS

Event Studies – Underpricing and Cumulative Abnormal Returns

To start the analysis, we overlook the underpricing phenomenon across the different markets in our sample. Table 7 presents a summary of the results regarding the underpricing analysis.

Table 7 - Results for underpricing tests for each market

	Adjusted Under/Overpricing	t-statistic	Median	Maximum	Minimum
Amsterdam	8,98%	2,181**	2,49%	89,58%	-40,19%
Brussels	-1,90%	-0,867	-3,12%	15,32%	-18,83%
Lisbon	-1,45%	-	-	-1,45%	-1,45%
Milan	1,94%	0,604	4,33%	32,45%	-67,06%
Paris	-0,14%	-0,061	0,18%	102,7%	-54,85%

*, **, *** denotes significance at the 0.1, 0.05, and 0.01 level

As expected, it is possible to find an abnormal return for the first trading day compared with the offering price. Nonetheless, it is only possible to find evidence of underpricing in two of the five markets in the sample, namely, Amsterdam and Milan. In the other three markets, we obtained a negative value for the abnormal returns, which suggests the existence of overpricing, meaning that the final IPO offer price is above the first-day trading price, generating a negative return for the investors. These results provide evidence that IPOs can be either overvalued or undervalued despite the average results for the whole sample, revealing some undervaluation.

Among all the markets, the French index, despite some degree of overpricing, is the one where the abnormal returns are close to zero, possibly indicating high levels of efficiency regarding IPO pricing. Nonetheless, the French index registered the biggest underpriced IPO among all (maximum value). The Dutch index presents an underpricing of nearly nine per cent, which is a significant value compared to the other indexes. Seemingly, the IPOs in this index appear to have significant levels of underpricing, suggesting that investors can achieve excess returns by simply participating in the IPO. This is consistent with the fact that this is the only market where the abnormal returns are statistically significant, which could indicate the occurrence of an anomaly regarding IPO

pricing in the Dutch market. Despite this, the existence of these abnormal returns only on the first day of trading can not be seen as an undoubtful proof of some sort of market inefficiency.

As stated in the methodology, we complemented the analysis of the short-term abnormal returns of IPOs by conducting an event study. Results are shown in Table 8:

Table 8 - Results for AAR and CAAR for a 30-day window

Day	AAR (%)	t-statistic	CAAR (%)	t-statistic
0	2,2157%	1,3913	2,2157%	1,3913
1	0,2117%	0,4200	2,4275%	1,4405
2	-0,2647%	-0,9582	2,1628%	1,2437
3	-0,2014%	-0,6830	1,9614%	1,1486
4	-0,1250%	-0,7063	1,8364%	1,0625
5	-0,4700%	-2,5940***	1,3663%	0,7887
6	-0,4354%	-2,2394**	0,9309%	0,5296
7	0,2544%	1,1296	1,1853%	0,6559
8	-0,3782%	-1,7517*	0,8072%	0,4444
9	-0,3351%	-1,8688*	0,4720%	0,2593
10	-0,0008%	-0,0035	0,4713%	0,2578
11	-0,1366%	-0,8851	0,3347%	0,1827
12	-0,3304%	-2,4293**	0,0042%	0,0023
13	-0,1832%	-0,9619	-0,1790%	-0,0972
14	-0,1671%	-1,2247	-0,3461%	-0,1861
15	-0,4808%	-2,8968***	-0,8268%	-0,4389
16	-0,0399%	-0,2054	-0,8667%	-0,4582
17	-0,1805%	-1,2545	-1,0472%	-0,5502
18	-0,2363%	-1,3498	-1,2835%	-0,6715
19	-0,3021%	-1,5335	-1,5856%	-0,8147
20	0,1281%	0,6611	-1,4575%	-0,7378
21	-0,1367%	-0,7203	-1,5942%	-0,7845
22	0,0178%	0,0981	-1,5764%	-0,7866
23	-0,4322%	-2,4630**	-2,0086%	-0,9968
24	-0,1821%	-1,0039	-2,1907%	-1,0750
25	-0,2472%	-1,6403*	-2,4379%	-1,2125
26	-0,0270%	-0,0973	-2,4649%	-1,1873
27	-0,2421%	-1,2857	-2,7070%	-1,2877
28	-0,0272%	-0,0997	-2,7341%	-1,2658
29	-0,2523%	-1,2227	-2,9864%	-1,3694
30	-0,1334%	-0,7162	-3,1198%	-1,4244

*, **, *** denotes significance at the 0.1, 0.05, and 0.01 level

The Average Abnormal Return (AAR) measures the average abnormal return for each day of the post-event window. For day 0 of our time window, which corresponds to

the return between the issuing price and the close price of the first day of trading, the results show a positive abnormal return of 2,21%, which we previously defined as underpricing. These results suggest that, on average, IPOs in our sample experience some degree of underpricing. An investor that participates in an IPO in these markets can achieve, on average, a positive abnormal return of 2,21% if they wait and sell their shares at the first-day closing price. This positive result for underpricing is consistent with previous studies.

Nonetheless, the value for these European markets is lower than what other authors have obtained for other international markets (Ritter (1984) recorded 48% for IPOs in American markets; Ritter (1991) recorded 14% for IPOs in American markets; Chan, Wang and Wei (2004) recorded 178% and 11,6% for two different types of IPOs in Chinese Markets). Despite this, for a confidence level of 95%, the results show no statistical significance for the underpricing recorded, meaning that we cannot conclude that these results are significantly different from zero. This lack of statistical significance can indicate that there are no signs of market inefficiency regarding the IPO market within these European indexes. In the following thirty days, we only obtained three days of positive abnormal returns, but again, none of them showed statistical significance. The decrease in the value of the abnormal returns, even reaching values much lower than the return for the initial day of trading, could indicate that the market is adjusting to the underpricing recorded on the first day and eliminating the excess return that arises from the operation.

As previously discussed, based on the EMH, the expectation is that the abnormal returns in an efficient market should not be significantly different from zero. Thus, we should expect that, after the adjustment, the abnormal returns should respect this premise. Most of the registered abnormal returns are negative, meaning that, on average, these securities are performing below the market. Additionally, out of the thirty days, eight experienced abnormal returns statistically significant at a confidence level of 90%, implying that they are significantly different from zero. These eight days represent about twenty-five per cent of our time window, so despite being unable to find any evidence of market inefficiency regarding the IPO underpricing, we might pose some questions regarding the post-event short-term returns. Nonetheless, these returns might not be directly linked to the underpricing but can result from other events that occur during the

time window. As we extend the time window of analysis, we need to consider that the abnormal returns observed could be the result of other events besides the IPO operation itself.

Concerning the CAAR, the results show no statistical significance for any day in the event window. Until day twelve, the CAAR was positive but slowly decreasing due to the negative abnormal returns registered. We could assume that the IPOs are overperforming the market during this period. However, looking at both the CAAR and the AAR, it is possible to notice that the positive value of the CAAR for the first 12 days of the event window is boosted by the positive return registered for the underpricing. Days twelve and thirteen are the turning point for the CAAR. Beyond this point, once again, the negative abnormal returns implicate a negative result for the CAAR that will remain until the end of the time window and reach a negative value of 3,11% on the thirtieth day after the IPO. If the underpricing effect were removed, we would start seeing negative values for CAAR from day two onwards. During this event window, excluding the underpricing positive returns, the total returns would be about -5,33%. Regardless of this, we cannot conclude that these cumulative values are statistically different from zero, which suggests that across all the sampled companies, we cannot conclude the existence of an abnormal performance, positive or negative, in the short term following the IPO event.

Regression – Determinants analysis

Table 9 presents the results of the regression analysis. The regression coefficients were obtained by testing the effect of the explanatory variables in the underpricing and the cumulative average abnormal return.

Table 9 – Regression Analysis Results

Variable	Underpricing	CAR 0-5	CAR 0-15	CAR 0-30	ES
Age (Age)	.000396	.0003521	.0003242	.0003983	-
	(0.304)	(0.416)	(0.487)	(0.462)	
Size (Size)	.0113641	.0140601	.0124292	.0124305	-
	(0.074)	***(0.050)	(0.106)	(0.163)	
Leverage (LV)	.0123242	.0194319	.0089524	.001486	+
	(0.388)	(0.228)	(0.605)	(0.941)	
Offer Size (OS)	-.0442617	-.0518408	-.0538628	-.0612189	-
	***(0.009)	***(0.007)	***(0.009)	***(0.011)	
Trading Volume (TV)	-.0165536	-.0189421	-.0183953	-.022107	+
	***(0.027)	***(0.024)	***(0.042)	***(0.035)	
Ownership Concentration (OC)	.0510874	.0539733	.0864536	.0596259	+
	(0.483)	(0.510)	(0.328)	(0.561)	
Board Size (BS)	.0028724	.003251	.0068952	.0065464	-
	(0.588)	(0.586)	(0.284)	(0.380)	
Board Women (BW)	-.0729017	-.1062779	.00140116	-.0406094	-
	(0.549)	(0.438)	(0.924)	(0.812)	
Offer Price (OP)	.0029105	.0023702	.0032555	.0036636	-
	***(0.000)	***(0.004)	***(0.000)	***(0.000)	
Covid (COVID)	Yes	Yes	Yes	Yes	
Dummy Country (CNT)	Yes	Yes	Yes	Yes	
Dummy Industry (IND)	Yes	Yes	Yes	Yes	
CONSTANT	.4871884	.347501	.4965421	.8059356	
	(0.117)	(0.109)	(0.187)	(0.066)	
Number of IPOs	138	138	138	138	

*, **, *** denotes significance at the 0.1, 0.05, and 0.01 level
Notes: The values inside parentheses represent each variable p-value. ES stands for the expected sign.

The Offer Size variable showed significant results among the sample. We registered a negative coefficient, meaning that bigger offers tend to register lower levels of underpricing. These results are consistent with previous literature that argues that this phenomenon can result from lower post-IPO uncertainty. Smaller IPOs might entail higher risk and become more alluring, considering the possibility of generating higher returns on the first day of trading (Gauvin and Power, 2019).

Looking at the first regression, it is also noteworthy that the Offer Price has the highest explanatory power with a statistically significant positive coefficient. This result means that IPOs linked with higher offer prices tend to be subject to higher levels of underpricing. The expectation would be that a higher offer price can cause lower demand or diminish the accessibility to the IPO, reducing the levels of underpricing, but that does not seem to be the case. The explanation for this might be presented by Ritter (1998) in a phenomenon the author nominated as the "bandwagon effect". This phenomenon presents the idea that an investor not only pays attention to the available information about the firm and the IPO but also to whether other investors are participating in the IPO. Considering that the offer price can be adjusted upwards if regular investors, like institutional investors, send positive feedback to the market, this might rush the demand from other investors. This high demand can spread to the aftermarket, resulting in the stock price rise on the first day of trading, meaning higher values of underpricing.

Lastly, the Trading Volume for the first day was also significant and negative. The results are interesting in this particular case since we were expected to find a positive relation between these two variables. High trading volumes to the number of offered shares could mean additional interest from investors and higher price fluctuation during the first day of trading, resulting in higher returns. Nonetheless, this could also mean that, in the analysed markets, IPOs that attract considerable interest from investors are more efficiently priced, resulting in less underpricing and abnormal returns. Additionally, we can argue that less underpricing results from lower levels of risk perception and uncertainty regarding the firm, which can result in higher demand (İlbasmış, 2023).

The Telecommunications industry dummy variable is the only significant in the model, showing that companies in this industry tend to experience higher levels of underpricing. The same effect could be deducted from the Industrials, Financials, and Basic Materials industries, but the results have not shown statistical significance for these cases. On the other hand, Health Care and Consumer Discretionary have a negative coefficient. However, once again, it lacks explanatory power. The same conclusion can be drawn for the market dummies, where no particular market appears to be a significant explanatory variable. We also tested the possible effects of covid on the price performance of the IPOs. The expectation was that the constraints caused by the pandemic

might suggest that going public during this period could be seen as a risk move by investors, that could be unsure about the future and experiencing high levels of information uncertainty. This could mean that fims going public during the pandemic should present higher levels of underpricing. The results showed a positive coefficient for this variable, what is consistent with our expectation, nonetheless the results showed no statistical significance what prevent us from taking any conclusion regarding the covid effect. This lack of significance might be cause by the low number of IPOs that occurred during the covid period when compared with other periods of time.

Neither one of the board characteristics has a significant effect on the model. Despite the coefficients being in line with the expectation, it is impossible to draw any conclusion regarding their effect. One possible explanation for this could be the reduced number of IPOs in the sample, which could limit the conclusion regarding the effect of some variables. Also, despite not being significant, the ownership concentration variable presents a positive coefficient in line with the idea that a higher percentage of ownership concentration can raise issues related to information asymmetry between the issuer and the investors, resulting in a higher perceived risk. The same happened to some firm-specific characteristics tested in the regression. Neither Age, Size, or Leverage seems to significantly influence the level of underpricing or the subsequent abnormal returns registered. The effect of Age and Size has been widely studied in previous literature, showing significant results. However, this hypothesis is something that is not possible to confirm by our model.

Additionally, we have decided to test another variable that could work as a risk proxy: the auditor firm. The expectation was that a reputed auditor could reduce the uncertainty generated by the information asymmetry problem. The reputation metric was whether the auditing company was a Big4[1], but the results showed no significant relationship. After initial tests, we decided to exclude this variable because it was not statistically significant and worsened the regression results. Concerning the auditor analysis, the results might arise from the fact that more than ninety per cent of the sampled IPOs have a Big4 as an auditor, showing little variability in this variable.

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[1] Term used to refer to the four largest international accounting and professional services firms: Deloitte, PricewaterhouseCoopers (PWC), Ernst & Young (EY) and KPMG.

In summary, the results seem to be consistent among the four regressions since the three significant variables from the first regression are the ones that best explain the returns recorded in the different periods leading to the first thirty days of trading. Some interesting results relate to the industry variable. While in the first regression, only the Telecommunications industry is significant, in the second one, the Financials industry is also significant with a positive coefficient, meaning that firms in this industry have a positive effect on CAAR registering higher cumulative abnormal returns. Adding to both Financials and Telecommunications, in the third regression, we have significant results for the Industrial sector. Finally, in the last regression, the same happened with the Basic Materials, in all cases with positive coefficients. These results suggest that, despite the average cumulative abnormal returns being negative for these moments in the time window, the IPOs from these industries seem to have a positive effect, recording higher cumulative returns than the average. This might indicate that IPOs in these industries might be experiencing more positive cumulative or lower negative cumulative returns than the IPOs in other industries.

In conclusion, the results from these regressions show that it is hard to predict the market behaviour and the respective response to the IPO. Despite finding some variables that can be used to explain this market behaviour, the majority of variables, specifically those linked with firm-specific characteristics, cannot explain the market reaction. These conclusions might suggest that some publicly available information does not seem to affect investors' perspectives about the firms and the IPO operation. On the contrary, the specific characteristics of each IPO appear to have a significant impact on the investors and affect the market behaviour of the IPOs.

5. CONCLUSIONS

The purpose of this study was to investigate the price behaviour of IPOs in European markets by analysing the existence of underpricing and possible short-term abnormal returns following the IPO event. Furthermore, it also aims to explore the relationship between these returns and the Efficient Market Hypothesis (EMH).

Our research comprises a sample of 139 IPOs from 2014 to 2022, spread across five different European markets, and we obtained an average adjusted return for the first day of 2,21%. This value suggests that IPOs in European markets recorded a relative level of underpricing. Nonetheless, we concluded that this value is not statistically different from zero. This result leads us to conclude that there does not seem to be any degree of market inefficiency concerning IPO pricing in these European indexes.

An individual look at the underpricing phenomenon in each of the analysed markets shows that only in two of the five indexes is it possible to find positive returns for the first day, meaning there is a record of underpricing in only two markets. Within these two markets, only in the Dutch index, the recorded underpricing of about 9% is statistically significant, suggesting that in this market, investors might be able to guarantee abnormal returns by just participating in the IPO. Despite recording some degree of overpricing in the other three markets, these values do not appear to be significantly different from zero.

Furthermore, the results from the event study performed showed the existence of negative abnormal returns in the majority of the days following the IPO. Based on that, we can conclude that after the positive returns registered on the first day, the following returns for these securities are much lower and tend to perform below the market average. These results could also imply that the market quickly adjusts to the excess returns linked with the IPO. Moreover, in the post-event window, the abnormal returns were negative and statistically significant in eight of the thirty days analysed, possibly indicating some occasional inefficiency in the post-IPO returns.

Regarding the cumulative average abnormal returns results, we start with a positive value corresponding to the underpricing value and finish with a negative value of 3,11%. The initial positive value of CAAR is sustained by the positive abnormal returns recorded on the first day and is heavily affected by the negative returns in the

following days. Nonetheless, on none of the post-event days the CAAR was shown to be significantly different from zero, so we might conclude that we are in an efficient market.

Through a regression analysis, we investigated several potential determinants that could help explain the occurrence of underpricing and subsequent abnormal returns during the early trading days. We tested two groups of determinants, one group linked with firm-specific characteristics and the other with issue-specific characteristics. The empirical findings reveal both expected and unexpected relationships between the identified variables and the abnormal returns. The three issue-specific characteristics (Offer Size, Offer Price, and Trading Volume) were statistically significant for all the regressions. The Offer Size variable presented a negative effect, meaning that larger IPOs tend to have less underpricing, which goes along with previous literature. The Offer Price variable presented a positive coefficient that contrasts previous research. This could come not as intended underpricing by the issuing firm but as a result of high market expectations and confidence from investors regarding more expensive IPOs. The Trading Volume variable also showed interesting results, presenting a negative coefficient. From this relation, and despite the idea that IPOs with higher trading volume should experience higher levels of underpricing, we are tempted to conclude that highly anticipated IPOs are better priced.

The first firm-specific variable (Age, Size and Leverage) exhibited insignificance in explaining underpricing levels or subsequent abnormal returns. These results stand in contrast to prior literature, which often posited that larger and older firms might be perceived as more stable, leading to lower levels of underpricing. The same relation can be found concerning debt levels, where higher leverage can result in higher risk and, subsequently, higher levels of underpricing that will later influence abnormal returns. The observed discrepancy leads us to conclude that this may signal the need to further explore firm-specific characteristics in predicting underpricing and abnormal returns.

The other firm-specific variables (Board Size, Board Women, and Ownership Concentration) also showed interesting results, but none were statistically significant to the model. The same happened to other firm-specific variables that did not present statistically significant results and were eventually removed from the model.

The results regarding the Market where the firms went public dummy variable also present no statistically significant results, leading us to conclude that no particular index seems to have a higher tendency to record underpriced IPOs. The dummy variable for the Industry emphasises some differences in the levels of underpricing across the different industries in the study. We concluded that only the Telecommunications industry consistently records higher levels of underpricing and abnormal returns than the remaining sampled industries. Contrarily to the market dummies, this result led us to conclude that the industry where the IPO firm operates seems to influence the level of underpricing and the abnormal returns registered.

In conclusion, from an investor perspective, achieving higher returns from firms in some specific industries seems possible due to the underpricing. The same cannot be said about the market where the IPO occurs since we did not find significant evidence that some indexes positively affect these returns. Furthermore, the firm-specific characteristics tested also showed an inability to accurately predict the returns to be achieved in an IPO. The most effective predictors seem to be among the issue-specific characteristics, which should be the ones of utmost interest for investors when analysing any IPO market.

6.   LIMITATIONS AND FUTURE RESEARCH PROPOSALS

Every study has limitations, and this one is no exception. One limitation relates to the reduced size of the sample. Similar studies focusing on underpricing and the initial returns have used bigger samples. Introducing more firms could generate a better balance across industries, which might help reinforce the current conclusions and draw new ones. Nonetheless, to extend the data sample within the boundaries defined in this study, we would need either to extend the analysis period or include other types of IPOs, like private placements, which could significantly impact the results. This limitation represents an important research opportunity for future research since we believe that using a bigger sample that includes other European markets outside of Euronext could be interesting to shed light on the extent of this phenomenon within these markets and facilitate comparisons with other international markets.

As this study focused on short-term returns, we only gathered data for a small period after the IPO. Future research could also extend the time window of the event beyond thirty days to verify other propositions like the long-term underperformance of IPOs.

Regarding the method, the event study choice can also have imposed limitations. As stated before, the inexistence of previous data on the stock prices (because this information only exists after the IPO) makes it necessary to adjust the calculations regarding the expected returns. To overcome this issue, we used an adjusted market model to calculate the expected returns, setting the alpha value to one and the beta value to zero, equalling the expected returns to the market returns. By committing to this model, we assume that all firms have the same values for alpha and beta. Considering that the sampled data contains firms from different sizes and industries, it is plausible to argue that we would find different values for alpha and beta across all companies. For example, it is unlikely that all firms have the same level of risk. To overcome this limitation, one option could be finding a proxy that could work as an estimator for each firm's alpha and beta, available before the IPO. Using this solution would significantly increase the complexity of this work but could generate more accurate results, which is an option for future research.

The effect of firm-specific characteristics on the level of underpricing and abnormal returns was an important goal of this research to assess if public information about the firms, regarding their financial performance, organisational structure, and ownership, among others, could influence the level of risk perceived by investors and consequently influence the IPO and the post-event market behaviour. The limitation found is that not all companies disclose this information. We were restricted to the information made available by the firms, mostly in their prospectus, and the disclosed information was always not completely comparable. For future research, it would be important to find additional sources of information and collect information on additional variables related to each firm that can better explain how investors perceive their investments' value, for example, supplementary data on board characteristics, corporate governance, or sustainability policies.

Lastly, one interesting topic to be explored in future research about this phenomenon is testing alternative explanations, particularly regarding the propositions made by the advocates of behavioural theories. Examining these explanatory theories could be important to advance knowledge about the IPO market.

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8. APPENDIX

Table 10 – Descriptive Statistics of Model Variables

Variable	Median	Maximum	Minimum
Age	18,01	440	1
Size	18,99	26,68	4,61
Leverage	0,93	9,59	0,01
Offer Size	18,80	21,84	14,73
Trading Volume	0,34	0,70	0,002
Ownership Concentration	73%	100%	21%
Board Size	8,86	19	3
Womens in Board	19%	63%	0%
Issuing Price	15,58€	240€	0,78€