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The Impact of Lead Underwriters on Underpricing for European IPOs

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Abstract:

The primary objective of this paper is to analyze if the increased number of average underwriters per IPO influences the level of underpricing for European IPOs. The level of underpricing determines the allocation of capital in an economy and therefore impacts the economic growth of a country. Consequently, policymakers and companies are interested in finding determinants of underpricing. This study performed an Ordinary Least Square (OLS) regression model to find a negative relationship between the average number of underwriters and the level of underpricing per IPO using a dataset of 539 European IPOs between 2010 and 2021. This negative correlation is primarily explained by an increase in the deal value of IPOs. The results are in line with previous work of Hu & Ritter (2007) and Jeon et al. (2015). The negative correlation implies that the expected profits of underwriters will decrease when it accepts to share a joint lead underwriting position.

Keywords: IPO, Underpricing, Lead Underwriters, Capital Requirements

Contents

1. Introduction

This paper analyzes the effect of the number of lead underwriters on the level of underpricing for European Initial Public Offerings (IPOs). On average, there is a significant discrepancy between the offer price of issued stock from IPOs and the share price on the first trading day. This is a fundamental reason for Investment Banks (IBs) to facilitate IPOs in the role of underwriter. Conversely, issuing firms are missing out on a significant sum of money due to underpricing. Besides interacting as an intermediary for selling the stock, underwriters provide service for issuing firms, for example by giving analyst coverage on topics as financial performance or industry trends. In recent years, there has been a discernible trend indicating an increased frequency of IPOs involving multiple lead underwriters. The objective of this study is to analyze if this pattern affects the average level of underpricing. Underpricing is relevant to the society on several different dimensions. If the level of underpricing is too high, the compensation for entrepreneurship is diminished, which can potentially harm investment and economic growth. Moreover, the level of underpricing determines the capital allocation in a country. These factors explain the plethora of literature regarding underpricing.

Researchers have examined determinants of underpricing extensively and it seems to be explained by several different factors, and in many cases, it is highly contextual. However limited research is done with respect to the structure of the underwriting syndicate and how that affects underpricing. Hu & Ritter (2007) found a negative relationship between the number of lead underwriters and the level of underpricing. They argued that the addition of extra lead underwriters increased the bargaining power of the issuing firm. Moreover, it was stated by Jeon et al. (2015) that the visibility of issuing firms increased due to an increase in lead underwriters. Subsequently, this increased visibility resulted in a reduced level of underpricing. Since these papers solely focus on IPOs from companies in the US, this study is the first to use a dataset with European IPOs between 2010 and 2021. The aim of the study is to find a similar relationship as for US IPOs. This leads to the research question of the paper; to what extent does the number of lead underwriters for IPOs in Europe affect the level of underpricing?

An OLS regression was utilized to examine the research question in the form of the initial hypothesis. The results outline that there is a significant negative relationship between the number of underwriters and the level of underpricing for European IPOs.
Subsequently, the objective of the study is to find determinants for the change in the average number of lead underwriters per IPO. This study proposes three main drivers behind the increase of multiple lead underwriter IPOs, which are tested in a Poisson regression model. The explanatory factors are the size of the deal value, whether a firm is buyout backed or not and the capital requirements imposed on IBs. IBs are faced with new financial regulations following several bankruptcies of financial institutions. These regulations will likely impede their investment options. Subsequently, IBs are obliged to reduce their spending on underwriting activities which will result in underwriters sharing the role of lead underwriter with other IBs to share the costs of buying the issued stock. This study is the first to examine if the change in capital requirements affects the average syndicate composition of IPOs.

The remainder of the paper is therefore structured as follows. Chapter 2 highlights the relevant current literature and discusses the connection with the objective of this paper. Thereafter, chapter 3 elaborates on the development of the hypotheses in the theoretical framework. Chapter 4 outlines the dataset and presents the descriptive statistics. Subsequently, chapter 5 consists of the empirical strategy and outlines the results and interpretation. Finally, chapter 6 concludes the findings of the study.

2. Literature Review

2.1 IPOs and Underpricing

IPOs represent the process of companies going public. By selling their shares to a diversified group of investors, the issuing firm increases its liquidity through raising additional capital. It is seen as a necessary step for firms pursuing further growth (Ibbotson & Ritter, 1995)
Going public is a costly process and several different actors are involved. The issuing firm needs an investment bank, also named an underwriter, which will buy the initial shares before they are sold to potential investors. Normally, the lead underwriter works together with other co-underwriters in a syndicate. A bookrunner is the investment bank that takes the most initiative, decides upon the offer price to the issuing firm, and as a result receives the highest commission on the deal. In practice, there is not a big difference between the role of a lead underwriter and a bookrunner, hence, in this paper these are used interchangeably. The lead underwriter is also responsible for creating awareness of the new stock, by going on a roadshow to several potential investors. The commission received by the underwriters is 7% of the total deal value in most cases in the US and a bit less for European IPOs. (Jenkinson & Jones, 2009) Besides this commission, underwriters can earn money by buying the shares for a lower price than what they are sold on the market on the first trading day. Commonly, there is a significant difference between the share price of the issuing firms when sold to the investment banks (offer price) and the price for which they were sold on the first day of the market. This phenomenon is called underpricing. The level of underpricing, sometimes also referred to as money left on the table, fluctuates significantly. According to Ljungqvist (2007), the average level of underpricing was 21% in the 1960s, 12% in the 1970s, 16% in the 1980s, 21% in the 1990s, and 40% in the four years since 2000.

There is an extensive amount of literature available regarding underpricing of IPOs. Rock (1986) wrote one of the most influential papers on underpricing of IPOs. He created a model based on asymmetric information to indicate determinants for underpricing. The paper identified two main factors for companies going public. Firstly, the owners might want to refinance the firm. Investors have put in a substantial amount of their wealth into their company and they can reach a point at which they want to diversify their investment. Secondly, going public is one of the most efficient methods for raising new funds to foster growth. Another well documented reason for firms engaging in IPOs is to increase the visibility of the firm. Bancel & Mittoo (2009) surveyed 12 CFOs of different European countries. The majority indicated that increasing visibility is the main driver behind firms going public.

Ljungqvist (2007) presents an overview of the existing literature regarding determinants for underpricing of IPOs. The arguments can be classified in four main categories: asymmetric information, institutional reasons, control considerations, and behavioral approaches. For brevity purposes, this paper will only discuss the most well studied theories. Rock (1986) created one of the most famous asymmetric information models related to underpricing. Rock identified that there is a small group of investors which have more information about the true value of the stock of a company. This group of informed investors will only buy favourably priced stock. Meaning that the big group of averagely informed investors will bid in unattractive offers or they will share the supply of stocks for attractive offerings with the informed investors. To ensure that there is enough demand to buy the shares on offer, it is necessary that uninformed investors are also buying shares. This requires a positive expected return for uninformed investors, which is settled by the underpricing commission.

A second well researched argument for underpricing is that the commission pays for the analyst coverage that the investment banks provide to the issuing firm. Cliff &Denis (2004) found proof for their hypothesis that underpricing is a compensation for IPO analyst coverage during and after the deal. Furthermore, they founded that if the analyst coverage is lacking, the issuing firm is more inclined to switch from underwriter if they sell shares in a follow up Seasoned Equity Offering (SEO). Equity research is costly and according to Loughran & Ritter (2004), during the dotcom bubble the larger brokerage firms spent one billion USD each on analyst coverage. Issuing firms often do not have the capacity to gain quality equity research, hence, it makes sense to acquire this from an external party, in this case the underwriting firms. The underpricing commission is often used for compensating for the analyst coverage.

There are multiple determinants that influence the level of underpricing, but the lack of transparency, which is captured by Rock (1986) in his asymmetric information model forms the basis of the discrepancy between the offer price and the share price on the first trading day. In addition, issuing firms are content to pay for the analyst coverage provided by investment banks, if the information is of a sufficient level. Since it is difficult to measure the intrinsic value of shares, underpricing will remain an interesting game between the issuing firms and investors. However, the importance of finding determinants for society are clear, which explains the size of newly published literature regarding IPOs and underpricing.

2.2 Role of Lead Underwriters in Underpricing

Now that the relevancy of underpricing has been confirmed, this paper aims to do more research into the role of underwriters in the level of underpricing. Several researchers have discussed this topic and there is a consensus that the choice between one or multiple underwriters influences the level of underpricing, although the exact effect remains point of discussion.
Flagg & Margetis (2008) performed research in which they tested how the underwriter influences the level of underpricing. They drew the following conclusion: the reputation of the underwriter is one of the explanatory variables for underpricing. However, the explanatory power increased substantially when deal flow and the size of the underwriter as a control variable. In other words, picking the right underwriter(s) will have an impact on the level of underpricing, which showcases the importance of issuing firms. However, there is no guarantee that picking a specific underwriter will lead to the same result on different occasions.

Thus far this paper primarily discussed classic underpricing theories. However, as with many corporate finance topics, the way IPOs are executed is constantly changing. The characteristics of issuing firms and the state of the economy transformed over the years. As a result of these changes, new trends in IPOs become visible thus leading to new research. One trend that became visible in recent years is the increased average number of lead underwriters per IPO deal. Hu & Ritter (2007) were amongst the first to recognize that the number of average underwriters per deal has increased severely across the last decades. The dataset used in their paper consists of IPO deals within the US. Until the start of the century, nearly all IPO deals were executed by a single bookrunner. In recent years, the fraction of IPO deals with multiple bookrunners has increased to 90%. Subsequently, the average number of leading underwriters has also doubled in the same period. This rather steep increase in leading underwriters, and especially bookrunners, has raised further questions about their impact on the level of underpricing. The paper found that the increased demand for multiple bookrunners resulted in a lower level of underpricing. Issuing firms increased their bargaining power and this led to negotiating a better offer price. The addition of one extra bookrunner for IPO results in a higher offer price (1%), due to the increased bargaining power of the issuing firm.

Moreover, the article concluded that the willingness of companies to be a joint bookrunner, rather than a single bookrunner, can be explained by the state of the economy and the issue size of the deal. If companies share the position of bookrunner, then they also share the profits from being a bookrunner. During economic booms, banks are focused on making profits and they are in the position to negotiate hard, since the supply of IPO deals and the supply of investors willing to buy the allocated shares is high. However, during economic recessions, the priority of banks shifts towards staying in business and keeping employees with valuable knowledge at the company. To survive, banks are forced to perform IPO deals as a joint bookrunner, which diminishes the possible returns of the deal. Subsequently, banks are willing to be joint bookrunner if the issue size of the deal exceeds a certain threshold. The paper does an excellent job into linking economic trends with classic underpricing theories and it is amongst the first papers to propose factors determining the rise in average number of bookrunners per IPO deal.

Jeon et al. (2015) investigated if adding multiple lead underwriters (MLUs) to an IPO deal increases the visibility of the issuing firm and if this affects the level of underpricing. Companies are interested in increasing their visibility, because it will attract more potential investors and in general, it becomes easier and thus more profitable to sell their stock. The paper used a sample of 809 US IPOs between 2001 and 2010. After constructing proxies for IPO visibility, they compared the visibility of MLU-IPOs with single lead underwriter-IPOs (SLU-IPOs). One of the most relevant findings of the paper is that the media visibility of the pre-IPO phase was bigger for MLUs than for SLUs. Moreover, a relatively greater number of shares of MLU-IPO firms, compared to SLU-IPOs firms, were sold to institutional investors. The paper continues by investigating whether the increased visibility comes at a cost for the issuing firm in the form of increased underpricing. The results show that such a trade-off does not exist. The results indicate an overall negative relationship between the increased visibility of the issuing firm and the level of underpricing, which is in line with the paper of Hu & Ritter (2007).

Even though there is a dearth of literature regarding the effect of multiple bookrunners in IPOs on underpricing, the available literature suggest that there is a negative relationship between the number of bookrunners and the level of underpricing. However, both papers of Jeon et al. (2015) and Hu & Ritter (2007) use a sample of US IPOs. Since there is a difference between IPOs worldwide, the first goal of the paper is to find if there is a similar relationship between the number of lead underwriters and underpricing for European IPOs. The next part highlights the differences and similarities of European and US IPOs. Thereafter, the paper continues to discuss known determinants for the change in lead underwriters. Additionally, the paper proposes a new line of arguments, based on the changing financial regulations for banks following the global financial crisis (GFC).

2.3 Difference and Similarities between US & European IPOs

A difference between US and European IPOs is that the level of gross spreads is significantly lower in Europe than in the US (Torstila, 2001) One of the main determinants behind this reasoning is that privatization IPOs tend to have lower gross spreads, due to the high bargaining power of the governments. Since many European countries experienced fewer privatizations in recent years, the gross spread was expected to increase a bit and come closer to the average gross spread in the US. Moreover, Akyol et al. (2014) researched the effect of governance codes within EU countries and found that the level of underpricing decreases when applying extra governance codes. The Sarbanes-Oxley (SOX) act was initiated in 2002 in the US to help protect investors from financial fraudulent reporting, and it helps to restore investor confidence and transparency. It has a significant negative effect on underpricing. Recently, EU members have implemented new governance codes compliant to the existing rules in the US. According

to Abrahamson et al. (2011), both US firms and European firms have a high propensity to hire bookrunners from the same continent. Local bookrunners were dominant and appeared in 80 to 90% of the deals. But the number of US bookrunners in European IPO deals and vice versa has increased in the period of their sample. US bookrunners are especially popular in European IPOs. For large offerings, nearly all European firms involve a US bookrunner. This is mainly explained by the global character of the issuing firms and the benefits a US investment bank brings with its reach. Since there seems to be less of a separation between the origin of the underwriters, this reduces differences between US and European IPO markets.

Concluding, this paper examines if there is a relationship between the average number of lead underwriters per IPO deal and underpricing for European IPOs. The abovementioned arguments indicate that the IPO market in Europe and the US have become increasingly similar, hence it is plausible that European IPOs followed a similar pattern as US IPOs as established by the literature.

2.4 Determinants for Increased Number of Lead Underwriters per IPO

When analyzing determinants for the increase in average lead underwriters, limited research is available. The most discussed determinants are the size of the deal value and the share structure of the issuing firm. In their empirical tests, Hu & Ritter (2007) suggested using the deal value as the explanatory variable, which yielded significant findings. If the deal value reached a certain level, IBs are more likely to accept being joint bookrunners. Investment banks estimate the expected costs and benefits of being a bookrunner. Below a certain threshold it is not worthwhile for investment banks to share the position of bookrunner. Jeon et al. (2015) analysed 809 US IPOs between 2001 and 2010 and found a similar outcome, however, their line of reasoning was different. They found that an increasing issue size puts more pressure and more risk on the IPO from the perspective of underwriters. Hence, IBs were persuaded into sharing these risks by becoming joint bookrunner.

Another possible explanation for the preference of multiple bookrunners in recent years is the share structure of the issuing firm. The number of Venture Capital (VC) or Private Equity (PE)-backed IPO deals has increased. The direct impact of this increase on the number of underwriters is not set in stone. According to Hu & Ritter (2007), buyout-backed firms are more likely to use multiple bookrunners than non-buyout-backed firms. The main rationale behind this relation is reciprocity. PE firms often maintain close relationships with specific banks, because of the frequent business they have together. Issuing firms are commonly backed by several different PE firms. Each PE firm aims to get their preferred investment bank involved as an underwriter, hence there is pressure on investment banks to share the underwriting role with fellow banks. In contrary, Flagg & Margetis (2008) state that PE-backed IPOs exhibit lower underpricing than non-PE-backed IPOs. This is mainly due to decreased uncertainty. Investors believe that the chance of purchasing successful stock is higher when the issuing firm is backed by PE. PE-backed firms tend to raise more capital when the stock is traded publicly, this is also called certification theory. This theory originates from Megginson & Weis (1991). They found that if VCs are involved, the information asymmetry reduces, which leads to a lower underpricing.

2.5 Effects of New Financial Regulations on Underwriting

Due to excessive risk-taking behavior of banks leading up to the GFC, stricter financial regulations were imposed. This meant that banks were forced to set more capital aside to protect themselves from going bankrupt during tough economic times. This changed the capital structure of investment banks and possibly limited investment opportunities. If the regulations

affected the investment opportunities for IBs, then it seems plausible that it also affected investment in the form of underwriting IPOs. The following part explains the effect of several new regulations on the capital requirements for investment banks. Thereafter, it argues why this could impact the average lead underwriters per IPO deal.

Many new regulations to prevent banks from going bankrupt are part of the Basel regulations. Basel I, which was implemented in 1988, was originally formed to 'maintain a harmonization of regulatory capital adequacy standards within the member states of the Basel committee' (Balin, 2008) International banks were involved in a race to the bottom of having operations in countries with the least number of regulations. This led to severe risk-taking behavior of banks and several undesirable bailouts. Several years after Basel I, Basel II was introduced. The most important addition of Basel II is that it created a new framework that revolved around three pillars: Capital requirements, the supervisory review process, and market discipline. (King & Tarbert, 2011) Especially the first pillar entailed regulations that required banks to introduce substantial reforms. The committee agreed that besides credit risk, operational risk and market risk should also be accounted for. In practice, this meant that banks again were forced to hold more capital against their risk weighted assets (RWA). Basel III followed straight after the global financial crisis in 2008 and altered several new requirements to improve the flaws of Basel I & II. Nearly all international banks follow the Basel regulations, however, enforcement differs per country. The new capital requirements are packed into several different complex forms of regulation. To keep it simple, this paper reviews the impact of the total package of capital requirements regulation.

The direct impact of the extra capital requirements on the economic activities of financial institutions is unclear. Admati et al. (2014) argue that the increased capital requirements have a limited impact on lending behavior and other economic activity, such as facilitating IPO deals. They argued that banks are forced to raise more equity following higher capital requirements, but the cost of equity will go down. This means that the economic activity of banks will stay unharmed. Begeneau (2020) proposes a model which claims that increased capital requirements can increase the credit supply. An increase in the capital requirements, reduces the supply of desired deposits, which increases the willingness of households to hold deposits at a lower interest rate. Therefore, the increased capital requirements can reduce funding costs which increases bank lending and stimulates the economy. However, she also acknowledges the more traditional theory that an increase in capital requirements increase funding costs of banks, which decreases credit supply. Fraisse & Thesmar (2020) researched the effects of increased capital requirements on banks and corporate finance. One of the main findings of their paper is that a 1 percentage point increase in capital requirements reduces lending by 2.3%–4.5%. The literature is ambiguous when trying to explain whether increased capital requirements will affect the investment pool of banks. However, even if total investment does not change, the Basel regulations are implemented to make banks more risk averse. If this is truly the case, then banks would be interested in sharing the risks of being an underwriter for an IPO, which would increase the fraction of multiple bookrunners per IPO. Support for this theory can be found when researching what happened after several crises in the last decades. The data from Hu & Ritter (2007) identifies that after the dotcom crisis, the GFC, and the European debt crisis, the number of IPOs decreased significantly. Simultaneously, the number of average underwriters increased substantially. This is in line with previous arguments that fewer IPOs increase the number of underwriters. Moreover, it supports the theory that a decrease in investment budget for banks increased the average number of bookrunners per IPO.

The COVID-19 crisis seems to follow a slightly different pattern. The number of IPOs remained stable, and the number of average underwriters did not change as well. In general, crises are difficult to compare with each other. Especially since it is not possible to analyze the middle and long-term effects of the COVID-19 crisis yet. However, the discrepancy between the COVID-19 crises and the other crises could be explained by a revised rule in Basel III.
One of the changes in Basel III, compared to Basel II is that the regulators allowed for a temporary capital requirement reduction, to minimize economic damage following the crisis. (Shin, 2011; Lall, 2009) Several Basel II regulations prolonged the GFC even further. Investment banks were forced to maintain high capital requirement standards during the crisis. Instead of using this capital to save themselves and other financial institutions in difficulty, banks were obliged to maintain the capital inhouse. Basel III allows for a temporary lift in capital requirements during a crisis, so that investment banks can use the money to keep business going and lend to institutions in need. This partially explains why during the COVID-19 crisis the IPO numbers did not drop. However, this needs further research.

3. Theoretical Framework

There has been a change in the number of average lead underwriters per European IPO in recent years. The first aim of this paper is to analyze if this change impacted the level of underpricing for IPOs. If this relationship can be validated, it adds a new insight into the existing literature regarding underpricing. Thereafter, the objective is to identify drivers behind the change in average lead underwriters per IPO. After a thorough research of the current literature, the following section presents the four hypotheses which will be tested in the empirical part of the paper.

Hu & Ritter (2007) and Jeon et al. (2015) found a negative relationship between the number of lead underwriters and the level of underpricing for US IPOs. According to them, the most important arguments for the negative relationship between the number of lead underwriters and underpricing are that the bargaining power of the issuing firm increases leading to lower underpricing. In general, it seems that every factor that reduces information asymmetry, simultaneously reduces the level of underpricing. IBs that underwrite IPOs are most profitable when they are the only party with adequate knowledge of stock valuation of the issuing firms. The addition of multiple lead underwriters reduces the information asymmetry on several levels. A good example is that the visibility of the issuing firm increases when multiple lead underwriters are involved in the IPO. Ultimately, an increase in lead underwriters per IPO reduces information asymmetry, which reduces underpricing. This relationship has not been empiricly tested for European IPOs. Since, the differences between US and European IPOs are diminishing, it is plausible that a similar relationship exists for European IPOs. The relationship for European IPOs will be tested in the following hypothesis.

H1: An increase in the level of average lead underwriters for European IPOs reduces the level of underpricing

If the correlation of the first hypothesis can be confirmed, the paper aims to find determinants of this relationship. The size of the deal value indicates how much money was paid for the shares of the issuing firm. The reward for buying the stocks from the issuing firm are twofold. Lead underwriters receive a standard commission worth around 7 percent of the deal value. Thereafter, the underwriters receive the difference between the share price and the offer price. Since the IBs do not know beforehand if they will be able to sell all stock with a profit, there is

a certain level of risk involved by facilitating the IPO. With a higher deal value, the level of risk increases, which could be an argument for investment banks to share the lead underwriter position with multiple IBs. Moreover, IBs have a limited budget for investment activities. Hence, an increased deal value will force IBs to form a syndicate with other IBs to accumulate enough money to buy the shares. Concluding, if the deal value of the IPO increases, IBs are more prone to sharing the lead underwriter position with other IBs, due to an increase in risk and budget constraints. This relationship is captured in the second hypothesis.

H2: An increase in deal size of European IPOs increases the average number of lead underwriters per IPO

Before going public, several issuing firms have raised capital by working together with VC or PE companies. The literature is ambiguous about what effect this has on the number of lead underwriters and underpricing. The presence of VC and PE companies can pressure issuing firms to select an underwriting bank that has friendly ties with the VC or PE company. This would mean that involvement of equity financing firms increases the number of lead underwriters. Opposingly, the certification theory states that the presence of VC or PE increases the chance of buying successful stock. During the roadshow, underwriters schedule meetings with potential investors to convince them of buying the IPO stock for a favourable price. Depending on the stock, it can be a time-intensive process that requires the help of multiple underwriters. However, when underwriters can highlight the involvement of VC or PE companies in the issuing firm, it becomes easier to persuade potential investors of buying the stock. This involvement is seen as a sign that the stock is promising, since other companies have decided to invest previously. This reduces the work of underwriters and therefore the work can be done by less underwriters. Hence, previous investment of risk capital firms will lead to a lower average number of lead underwriters per IPO. This study predicts that the effect of the certification theory is stronger than the reciprocity theory, leading to the following hypothesis.

H3: Issuing firms backed by either VC or PE increases the average number of lead underwriters for European IPOs.

The final hypothesis predicts a positive relationship between capital requirements for IBs and the average number of lead underwriters. To reduce the risk-taking behavior of banks, the Basel committee imposed new financial regulations. As a result of these regulations, the banks are obliged to hold more capital against their RWA. These changes will likely impact their economic activities. For example, they reduce the number of loans granted or cut in their investment portfolio. If IBs are forced to limit their investments due to higher capital requirements, this will also result in a limitation of the funds for underwriting IPOs. Since the supply of issuing firms going public is expected to remain relatively stable, this could mean that IBs are forced to cooperate more with other IBS to collect enough funds to buy the shares of the issuing firm. They will form a syndicate with multiple IBs in the role of lead underwriters sharing risks, responsibilities and costs. To rephrase, an increase in the capital requirements for IBs will limit their investment options and purchasing power, which will lead to an increased number of average lead underwriters per IPO deal. This prediction is leads to the final hypothesis.

H4: Higher capital requirements for IBs increase the average number of lead underwriters for European IPOs

4. Data

4.1 Data Collection

The dataset used in this paper consists of data regarding IPOs in Europe between 2010 and 2021. The data is pulled from several databanks and is primarily coming from Bloomberg and S&P Capital IQ[1]. The dataset describes European IPO deals done between 2010 and 2021 on the ten biggest European exchange markets. The dataset excludes IPOs concerning companies with less than 5 million euros in assets or that did not have the appropriate data available. Several IPOs in the dataset are officially located in a country outside of Europe. This can be due to a change in ownership structure or for tax purposes. To keep the dataset as clean as possible, these entries are omitted from the dataset. The dataset consists of tens of datapoints per IPO deal. The following section next part briefly discusses the relevant datapoints, before working towards the hypotheses.

Hu & Ritter (2007) found evidence for a negative relationship between multiple lead underwriters and the level of underpricing. Since there is a clear distinction between the tasks and responsibilities of lead underwriters and other underwriters, the dataset only counts the number of lead underwriters per IPO deal as reported by Bloomberg. This is captured in the variable Lead_Underwriters. Since there is a high variety in the number of lead underwriters per IPO, this paper opts to use a count variable, rather than a dummy variable indicating if the IPO used multiple lead underwriters, as done by Hu & Ritter (2007).
Underpricing equals the percentual difference between the variables Offerprice_per_Share and Shareprice_First_Trading_Day as retrieved from Bloomberg and S&P Capital IQ. Deal_Value indicates the total sum of the stock transaction in euros. Furthermore, the Standard Industrial Classification (SIC) code represents a four-digit number that indicates the industry of the issuing firm. These codes have been transferred into dummy variables indicating 1 if the IPO is part of that industry and 0 if the IPO is not part of the industry. Moreover, the dataset differentiates between buyout backed firms and non-buyout backed firms by the means of the dummy variable VC_Or_PE_Backed. Companies previously financed by either VC or PE are noted with 1, 0 if otherwise. Underwriter_Ranking is a number between 0 and 1 and measures the reputation of underwriting banks. A higher number reflects a better reputation. (Migliorati & Vismara, 2014) Age measures the oldness of the companies and is calculated as the difference between 2023 and the year the country is founded, retrieved from official websites of the issuing firms. The market sentiment is captured by the proxy Real_GDP_Growth. This is the annual percent change in global GDP. (Real GDP Growth, 2023)

To assess the impact of changed capital requirements in the form of new regulations, it is necessary to define a proxy for capital requirements. The Basel committee imposed new regulations during the last decade which affected the capital levels of banks and thus their investment options. However, the impact of the regulations differs per bank. There are several rules which only apply for specific group of banks. For example, banks deemed systemically important are required to hold extra capital in the form of the systemic risk buffer. This paper will not go over each individual regulation. Instead, this paper uses the actual measured capital total capital ratio of a group of international banks as the input for the proxy. The data is retrieved from the latest monitoring report of the Bank for International Settlements BIS. (Basel III Monitoring Report, 2023) This report assesses the impact of the Basel III regulations on a sample of 181 internationally active banks. Per individual regulation, the report measures the

[1] The dataset was provided by my supervisor B. Hammer. The dataset will be made available when the working paper will be published.

compliance to this regulation. Since the regulations dictate a minimum level of capital requirements, the banks are free to hold more capital than obliged.
From the monitoring report, the total capital as a percentage of RWA is chosen as the proxy for capital requirements. It captures the total risk-taking behaviors well and it is the most complete datapoint.

4.2 Descriptive statistics

Before discussing the regression models, it is important to review the dataset by means of the descriptive statistics to spot preliminary relationships or trends within the dataset.
Table 1 shows the mean, standard deviation, minimum and maximum value of the variables used in this research. To indicate if the variables are changing over time, table 2 describes the mean for each variable per year. The average level of underpricing in the sample of this paper is 8.3% This is slightly lower than the global average, however, the level of underpricing usually is lower in Europe than in the US (Ritter, 2003) The level of underpricing fluctuates over time, but in recent years, the average number is increasing. The COVID-19 crisis does not seem to affect the characteristics of IPOs substantially. The number of IPOs throughout the years is stable, however 2021 caused a peak of 176 IPOs. A possible explanation for this peak is that companies waited with going public until the COVID-19 outbreak was under control. Moreover, the average number of lead underwriters per IPO is 3, with a maximum of 21 underwriters for one IPO. The number increased between 2010 and 2013, however, since 2014 the number of lead underwriters decreased slightly, before it stagnated. This significantly differs from the patterns in years before 2010. The stagnation could be interpreted as a sign that the optimal number of underwriters, under the current market conditions, is close to 3. Moreover, 63% of the issuing firms went public without the help of PE or VC. The number of VC and PE backed firms grew steadily between 2010 and 2017, however, from 2018 onwards the number started to decrease again. The percentage of capital held against RWA increased steadily throughout the years. This is an indication that banks were complying with the imposed regulations of the Basel committee. The IPOs were relatively even distributed across the different industries. However, the most popular industry were manufacturing (SIC D) and services (SIC I) Finally, the average underwriter ranking per IPO deal decreases between 2010 and 2021. A lower ranking means that the IPO deal was executed by underwriters with a lower reputation than before. The reputation is calculated by a combination of the number of IPOs taken public previously and the total money raised. (Migliorati & Vismara, 2014) This indicates that the involvement of relative inexperienced or smaller investment banks as underwriters increased throughout the years.

Table 1: Summary Statistics per Variable

Variable	Obs	Mean	Std. Dev.	Min	Max
Underpricing	539	.083	.223	-.903	2.8
Offerprice_per_Share	539	10.258	23.206	.04	485.57
Market_Cap_IPO	539	936.599	2723.542	0	41372.6
Underwriter_Ranking	539	.315	.405	0	1
Deal_Value	539	3.516e+08	7.649e+08	1584000	7.652e+09
Real_GDP_Growth	539	3.771	2.505	-2.8	6.3
Lead_Underwriters	539	3.006	2.725	1	21
Total_Capital_Requirement	539	.144	.052	0	.18
IPO_Deals_Per_Year	539	90.219	61.882	2	176
Age	539	37.748	56.6	2	658
VC_or_PE_Backed	539	.371	.484	0	1
SIC A	539	.007	.086	0	1
SIC B	539	.02	.142	0	1
SIC C	539	.03	.17	0	1
SIC D	539	.349	.477	0	1
SIC E	539	.108	.31	0	1
SIC F	539	.054	.226	0	1
SIC G	539	.108	.31	0	1
SIC H	539	.087	.282	0	1
SIC I	539	.236	.425	0	1

Table 2: Descriptive Statistics per Year

Year	Underpricing	Offerprice_per_Share	Total_Capital_Requirement	Lead_Underwriters	Real_GDP_Growth	IPO_Deals_Per_Year	Age	VC_or_PE_Backed
2010	.035	14.235	*	3.5	5.4	2	31	.5
2011	-.031	10.332	0.0905	3.667	4.3	12	95.167	.167
2012	.001	12.26	0.1051	4.857	3.5	7	43.429	.286
2013	.06	8.662	0.1182	4.667	3.4	18	74.556	.167
2014	.023	11.659	0.1302	3.325	3.5	40	46.75	.475
2015	.044	9.208	0.1429	3.522	3.4	46	40.022	.522
2016	.069	7.904	0.1513	3.171	3.3	35	57.714	.514
2017	.14	13.664	0.1557	2.688	3.8	16	45.25	.438
2018	.056	12.069	0.1625	2.676	3.6	74	32.081	.419
2019	.092	7.366	0.1704	2.968	2.8	63	32.524	.317
2020	.106	18.131	0.1752	2.3	-2.8	50	22.52	.28
2021	.119	8.443	0.1769	2.852	6.3	176	31.205	.335

*No data available

4.2 Regression models

The following section explains how the paper aims to test the proposed hypotheses by the means of regression models. The first hypothesis will be tested through a separate regression model. It states that an increase in the level of average lead underwriters reduces the level of underpricing for European IPOs. The first hypothesis will be tested by using an OLS regression. Arguments for using the OLS regression to test for this hypothesis, rather than a different regression model, are the following. The paper expects a linear relationship between dependent

and independent variable, the outcome variable is normally distributed and the dependent variable is not capped in any way, hence, it would not be sensible to use a Tobit regression model for example. The model uses robust standard errors. Finally, this leads to the following regression model:

$$Underpricing = \beta 0 + \beta 1 * Lead\_Underwriters + \beta 2 * Real\_GDP\_Growth + \beta 3 * IPO\_Deals\_Per\_Year + \beta 4 * Offerprice\_Per\_Share + \beta 5 * Age + \beta 6 * SICA + \beta 7 * SIC\ B + \beta 8 * SIC\ C + \beta 9 * SIC\ D + \beta 10 * SIC\ E + \beta 11 * SIC\ F + \beta 12 * SIC\ G + \beta 13 * SIC\ H + \beta 114 * SIC\ I + \varepsilon$$

The dependent variable tested with this hypothesis is the level of underpricing. The independent variable to test the first hypothesis is the number of lead underwriters per IPO deal. Furthermore, the model consists of several control variables to reduce the residual noise. The control variables account for confounding on both macro and micro level. The control variable Real_GDP_Growth is a proxy for the market sentiment between 2010 and 2021. The state of the economy affects the level of underpricing, hence it is important to control for these year effects in the model. Similarly, the variable IPO_Deals_Per_Year counts the total IPO deals within the dataset per year. It seems plausible that if there is a high supply of IPOs, the underwriting banks need to share the investment to ensure that all IPOs are executed properly. On a more micro level, the regression model test for IPO specific factors such as the age of the issuing firm, industry sector and offer price of the stock. The variable Age is added to control for information asymmetry. Megginson & Weis (1991) found that older firms have a lower degree of information asymmetry than younger firms. This implies that older firms tend to be less underpriced. Offer_Price_Per_Share gives an indication of the status and reputation of the IPO and the perceived growth potential by underwriters. Since companies with a higher stock price are traditionally seen as more valuable and more likely to become successful, the offer price per share during an IPO could influence the average number of underwriters per IPO. (Loughran & McDonald, 2013) Hence you could argue that the need for multiple underwriters is lower when the offer price increases. Finally, the regression model consists of industry dummy variables to account for industry-specific effects. For example, Loughran & Ritter (2004) proposed to distinct between technology and non-technology firms. Since most firms nowadays can be described as tech firms in a certain way, this study did not make this separation. However, by including the sector dummy variables, the paper accounts for industry specific fixed effects. To account for potential year-effect in the regression model, it would have been an alternative to include year dummies into the regression. However, the year dummies were highly collinear with the variables IPO_Deals_Per_Year and Real_GDP_Growth. Hence, the choice was made to exclude them from the regression model.

The second regression model aims to test the second, third and fourth hypothesis of this paper. Since these hypotheses have the same dependent variable, it is possible to combine them into one regression model. The Poisson regression model is used to test the hypotheses. This type of regression model is well suited for testing the relationship between a count dependent variable and one or more independent variables. (Woolridge, 2012) When using the Poisson regression, it is important to determine if the count variables in the dataset are independent of each other and that there is no evidence of overdispersion. Firstly, the independence assumption entails that the outcome of the count variable are not related to each other. The number of lead underwriters for one IPO does not directly impede the number of lead underwriters for another IPO, hence, the independence assumption holds. Moreover, overdispersion occurs when the standard deviation of the dependent variable is bigger than the mean value. Looking at the dataset, it can be concluded that this is not the case. The Poisson regression model uses the

same dataset as the OLS regression model earlier. However, it excludes the observations in the year 2010 and 2011, since there was no data available for the total capital requirements in these years. Finally, this leads to the following Poisson regression model:

$$\log(Lead\_Underwriters) = \beta 0 + \beta 1 * \log(Deal\_Value) + \beta 2 * VC\_Or\_PE\_Backed + \beta 3 * Total\_Capital\_Requirement + \beta 4 * Real\_GDP\_Growth + \beta 5 * IPO\_Deals\_Per\_Year + \beta 6 * Age + \beta 7 * Underwriter\_Ranking + \beta 8 * SICA + \beta 9 * SIC\ B + \beta 10 * SIC\ C + \beta 11 * SIC\ D + \beta 12 * SIC\ E + \beta 13 * SIC\ F + \beta 14 * SIC\ G + \beta 15 * SIC\ H + \beta 16 * SIC\ I$$

The dependent variable is the count variable Lead_Underwriters. There are three independent variables complemented with several control variables. The first independent variable is log(Deal_Value). As discussed in the literature section, the deal value of an IPO is expected to have a significant positive relationship with the number of lead underwriters. There is a high variability in the deal value amongst IPOs in the dataset. To reduce the influence of extreme outliers, the regression model uses the logarithm of the independent variable. The second hypothesis tests a possible relationship between the capital structure of the issuing firm and the number of lead underwriters. This is captured in the dummy explanatory variable VC_Or_PE_Backed. Finally, the third independent variable is Total_Capital_Requirement. This proxy captures the effect of newly imposed Basel regulations and is expected to positively affect the number of lead underwriters per IPO. Compared to the first regression model, most control variables are also used in the second regression model for a similar line of reasoning. In addition, the control variable Underwriter_Ranking is added to the Poisson regression model. Migliorati & Vismara (2014) argued that an objective ranking for many European underwriters was lacking, hence they created a ranking to grade underwriters, based on previous underwriting behavior. Traditionally, the reputation of the underwriting bank influenced the level of underpricing. According to Loughran & Ritter (2004), IPOs executed by top-tier underwriters led to less underpricing in the 1980s. However, in the years after, and especially during the dotcom bubble, the reputation of the underwriter had an opposing effect on underpricing. Hence, the average underwriting ranking per IPO is used to control for IPO specific effects.

5. Results and Interpretation

5.1 Results OLS regression

The first objective of the paper is to examine the relationship between the number of lead underwriters and the level of underpricing for European IPOs. The output of the regression model in table 3 shows that there is a slight significant negative relationship between the number of lead underwriters and the level of underpricing. The mean value of the dependent variable is 0.083, which equals 8.3%. The coefficient belonging to Lead_Underwriters equals 0.004, which implies that an increase of one extra underwriter leads to a decrease in underpricing of 0.4 percentage point significant at the 0.1 level. This result is in line with the prediction made earlier in the paper that less money will be left on the table if more lead underwriters are involved in IPOs. The regression model leads to two points of discussion. Firstly, the regression model does not deliver a significant relationship on the more conventional threshold of p = 0.05. This suggests weaker evidence against the null hypothesis and therefore, it is important to proceed with a cautious interpretation. Secondly, since the coefficient of the explanatory variable is rather low, the effect of one extra underwriter per IPO

seems minimal. However, the average deal value of IPOs in the sample of the paper is nearly 352 million euros. This indicates that the reduction of 0.4 percentage point in the level of underpricing reduces the expected profits of IBs with 1.4 million euros. The decrease in expected profits is divided in accordance with the allocation of shares. Nevertheless, the impact of sharing the underwriting position with multiple IBs is substantial. IBs should take into consideration that a joint lead underwriter role weakens their bargaining power and this should be regarded when expressing interest in forthcoming underwriting positions. The high standard deviation of underpricing, which can be seen in table 1, indicates that there is greater variability of uncertainty in the level of underpricing. This implies that the level of underpricing fluctuates severely and can be negative as well, meaning that the stock is sold for less than the offer price. In addition, the R2 statistic 0.034 showcases that the number of lead underwriters only explains a small portion of the variance in the level of underpricing. The explanatory power of the model might be limited, however, the individual variable effects can still give valuable insights of the relationship between lead underwriters and underpricing.

Table 3: Results OLS Regression

Underpricing	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Lead_Underwriter	-.004	.003	-1.66	.098	-.01	.001	*
Offerprice_Per_Share	0	0	1.00	.318	0	.001	
Real GDP Growth	-.005	.004	-1.15	.249	-.014	.004	
IPO_Deals_Per_Year	.001	0	2.66	.008	0	.001	***
Age	0	0	-1.19	.233	0	0	
SICA	-.321	.04	-8.04	0	-.4	-.243	***
SICB	-.28	.035	-7.92	0	-.35	-.211	***
SICC	-.262	.039	-6.70	0	-.339	-.185	***
SICD	-.219	.038	-5.84	0	-.293	-.146	***
SICE	-.252	.037	-6.89	0	-.325	-.18	***
SICF	-.186	.036	-5.12	0	-.258	-.115	***
SICG	-.239	.028	-8.67	0	-.293	-.185	***
SICH	-.201	.04	-5.05	0	-.28	-.123	***
SICI	-.213	.025	-8.44	0	-.263	-.164	***
Constant	.291	.036	8.04	0	.22	.362	***

Mean dependent var	0.083	SD dependent var	0.223
R-squared	0.034	Number of obs	539
F-test	.	Prob > F	.
Akaike crit. (AIC)	-78.383	Bayesian crit. (BIC)	-18.327

*** $p<.01$, ** $p<.05$, * $p<.1$

Several diagnostic tests were performed to check the robustness of the regression model. The White test is used to check if the variance of the residuals is constant across all levels of the independent variables. (Wooldridge, 2012) Since the model uses robust standard errors, it is recommended to use the White test, rather than the Breusch-Pagan test. As shown in appendix A, the high P-value of 0.9996 fails to reject the null hypothesis of homoskedasticity. Furthermore, the VIF test for multicollinearity amongst independent variables was executed. The results did not indicate any worrying signs for collinearity among the relevant variables, as seen in appendix B.

5.2 Results Poisson Regression

Now that the negative relationship between the number of lead underwriters and the level of underpricing has been proven, the following section discusses the results of the remaining hypotheses as tested by the Poisson regression. The R2 is significantly higher than in the first model, meaning that the explanatory model is bigger. The first explanatory variable tested is the log(Deal_Value). The independent and dependent variable are both transformed by taking the logarithmic value, therefore, the model is regarded as a logarithmic regression model. This means that the interpretation of the coefficient is measured in proportional changes rather than absolute changes. Table 4 indicates that there is a positive relationship between the deal value of the IPO and the number of lead underwriters significant at the highest level. The null hypothesis can be rejected. An increase of 1% in the deal value results in an increase of 0.281% in the number of lead underwriters.

This result is in line with the prediction of this study and confirms that IBs are more willing to share the role of underwriter if the size of the IPO increases. The analysis does not provide a significant relationship for the second variable VC_Or_PE_Backed. This means that based on the dataset from this paper, IPOs backed by VC or PE do not have a higher or lower number of lead underwriters on average. However, the sign of the coefficient is positive, so it could be argued that a positive relationship is more likely than a negative relationship. The fourth hypothesis proposed that the total capital requirements are positively correlated with the number of lead underwriters per IPO. The p-value of 0.892 implies that based on this dataset there is no statistical proof for such a relationship. The discussion section provides a possible explanations for this lack of statistical evidence. Finally, the underwriter ranking is positively correlated with the number of lead underwriters at the highest level of significance. This result is surprising, because it implies that more experienced underwriters prefer to share the underwriting tasks with multiple lead underwriters. Further research is required to analyze this relationship more in depth, as the existing literature predicted an opposing relationship. Several diagnostics were conducted to assess the robustness of the model. After conducting a goodness of fit test, which can be seen in appendix C, this study concludes that the regression model is a good fit to the data.

Table 4: Poisson Regression Model

Lead_Underwriters	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
ln_Deal_Value	.281	.043	6.56	0	.197	.365	***
VC_Or_PE_backed	.069	.049	1.39	.165	-.028	.165	
Total_Capital_Requirement	.186	1.374	0.14	.892	-2.507	2.879	
Real_GDP_Growth	-.018	.033	-0.52	.601	-.083	.048	
IPO_Deals_Per_Year	.001	.001	1.63	.103	0	.003	
Age	.001	.001	1.02	.307	-.001	.002	
Underwriter_Ranking	1.058	.072	14.68	0	.917	1.199	***
SICA	-.477	.184	-2.60	.009	-.837	-.117	***
SICB	-.088	.156	-0.56	.575	-.394	.219	
SICC	-.306	.12	-2.56	.011	-.541	-.071	**
SICD	-.419	.077	-5.47	0	-.569	-.269	***
SICE	-.195	.11	-1.77	.076	-.411	.021	*
SICF	-.366	.109	-3.36	.001	-.579	-.153	***
SICG	-.468	.08	-5.83	0	-.625	-.31	***
SICH	-.334	.105	-3.17	.002	-.541	-.128	***
SICI	-.413	.073	-5.63	0	-.557	-.269	***
Constant	-1.389	.409	-3.40	.001	-2.19	-.588	***

Mean dependent var	2.989	SD dependent var	2.637
Pseudo r-squared	0.265	Number of obs	525
Chi-square	.	Prob > chi2	.
Akaike crit. (AIC)	1782.836	Bayesian crit. (BIC)	1851.050

*** $p<.01$, ** $p<.05$, * $p<.1$

6. Conclusion

This study found a significant negative relationship between the number of lead underwriters and the level of underpricing. After performing an OLS regression on a sample of 539 European IPOs between 2010 and 2021, it can be concluded that the composition of the underwriting syndicate affects the level of underpricing. Hu & Ritter (2007) and Jeon et al. (2015) were the first to link the number of lead underwriters to the level of underpricing. They found similar results for US IPOs in different timeframes. This strengthens the validity of this research and suggests further research to analyze the relationship more in depth.
A logical next step would be to determine what factors influence the number of lead underwriters. This paper paved the way by testing the effect of several determinants
It revealed that the deal value of IPOs influences the average number of lead underwriters per IPO. After reaching a certain threshold, IBs are willing to share the lead underwriting position with other banks. The presence of equity financing firms or total capital requirements for IBs did not proof to be of any explanatory value. However, with a different methodology or more elaborate dataset, it would be worth wile to reassess these hypotheses.

It is important to acknowledge certain limitations inherent in this study that might impact the interpretation of the findings. The first constraint of this paper is the limited observations in the early years of the sample. Several observations were dropped because they either lacked datapoints or did not meet the predefined criteria. This means that the dataset could be disproportionally represented. Furthermore, the methodology of choosing the proxy for total capital requirements can be questioned. Since the Basel regulations do not have an equal impact on all IBs, it is difficult to pick one number as a proxy for the changed regulation. A proposition for further research is to make a clear distinction between capital requirements and the investment budget of IBs. By doing this, it is possible to first research the effect of changed investment budget on the average number of lead underwriters per IPO. If a significant relationship can be established, then the next step would be to analyze if the change in investment budget of IBs is affected by increased capital requirements.
In addition, the paper assumes that underwriting activities are exclusively conducted by IBs. However, it is not unlikely that different types of financial institutions are competing with IBs for underwriting IPOs. To analyze if the introduction of new financial institutions affects the level of underpricing, these IPOs should be included in the dataset.

This study found that the number of lead underwriters for European IPOs has a negative effect on the level of underpricing. The addition of one extra lead underwriter, reduces the level of underpricing with 0.4%. Hence, issuing firms tend to favor the involvement of multiple lead underwriters when selling their stock, aiming to minimize the potential losses due to underpricing. In contrary, the earnings of IBs are reduced when the level of underpricing increases. Since IBs receive a fixed commission of nearly 7% of the deal value on top of the potential gain of underpricing, there is no reason to believe that the supply of IBs willing to buy the securities of the issuing firm will reduce in the short term. However, if the average level of underpricing gets below a certain threshold, this could reduce the expected earnings of IBs to such extent, that they lose their interest in underwriting. Therefore, governments find themselves in a challenging situation. On one hand they aspire to stimulate economic growth and investment by reducing the level of underpricing. This can be reached by imposing regulations that incentivize cooperation between IBs to share lead underwriting positions. Opposingly, if the level of underpricing drops below a certain level, this could impede IBs from facilitating IPOs, which would be even more harmful for the economy.

References

Abrahamson, M., Jenkinson, T., & Jones, H. (2011) "Why don't US issuers demand European fees for IPOs?." The Journal of Finance 66.6: 2055-2082.

Admati, A. R., DeMarzo, P. M., Hellwig, M. F., & Pfleiderer, P. (2014). Fallacies and irrelevant facts in the discussion on capital regulation. *Central Banking at a Crossroads: Europe and Beyond, London*, 33-50.

Akyol, A. C., Cooper, T., Meoli, M., & Vismara, S. (2014). Do regulatory changes affect the underpricing of European IPOs?. Journal of Banking & Finance, 45, 43-58.

Balin, B. J. (2008). Basel I, Basel II, and emerging markets: A nontechnical analysis. Available at SSRN 1477712.

Bancel, F., & Mittoo, U. R. (2009). Why do European firms go public?. *European financial management*, *15*(4), 844-884.

Basel III Monitoring Report. (2023). In *BIS*. https://www.bis.org/bcbs/publ/d546.pdf

Begenau, J. (2020). Capital requirements, risk choice, and liquidity provision in a business-cycle model. *Journal of Financial Economics*, *136*(2), 355-378.

Cliff, M. T., & Denis, D. J. (2004). Do initial public offering firms purchase analyst coverage with underpricing?. *The Journal of Finance*, *59*(6), 2871-2901.

Flagg, D., & Margetis, S. (2008). What Characteristics of Underwriters Influence Underpricing?. The Journal of Private Equity, 11(2), 49-59.

Fraisse, H., Lé, M., & Thesmar, D. (2020). The real effects of bank capital requirements. Management Science, 66(1), 5-23.

Hu, Y., & Ritter, J. R. (2007). Multiple bookrunners in IPOs(Doctoral dissertation, University of Florida).

Ibbotson, R. G., & Ritter, J. R. (1995). Initial public offerings. Handbooks in operations research and management science, 9, 993-1016

Jenkinson, T., & Jones, H. (2009). Competitive IPOs. European Financial Management, 15(4), 733-756.

Jeon, J. Q., Lee, C., Nasser, T., & Via, M. T. (2015). Multiple lead underwriter IPOs and firm visibility. Journal of Corporate Finance, 32, 128-149.

King, P., & Tarbert, H. (2011). Basel III: an overview. Banking & financial services policy report, 30(5), 1-18.

Lall, R. (2009). Why Basel II failed and why any Basel III is doomed (No. 2009/52). GEG working paper.

Ljungqvist, A. (2007). IPO underpricing. Handbook of empirical corporate finance, 375-422.

Loughran, T., & Ritter, J. (2004). Why has IPO underpricing changed over time?. *Financial management*, 5-37.

Loughran, T., & McDonald, B. (2013). IPO first-day returns, offer price revisions, volatility, and form S-1 language. *Journal of Financial Economics*, *109*(2), 307-326.

Megginson, W. L., & Weiss, K. A. (1991). Venture capitalist certification in initial public offerings. *The journal of finance*, *46*(3), 879-903.

Migliorati, K., & Vismara, S. (2014). Ranking underwriters of european ipos. *European Financial Management*, *20*(5), 891-925.

Ritter, J. R. (2003). Differences between European and American IPO markets. *European financial management*, *9*(4), 421-434.

Real GDP Growth. (2023). [Dataset; IMF]. In *annual percentage change*. https://www.imf.org/external/datamapper/NGDP_RPCH@WEO/WEOWORLD

Rock, K. (1986). Why new issues are underpriced. *Journal of financial economics*, *15*(1-2), 187-212.

Shin, H. S. (2011). Macroprudential policies beyond Basel III. BIS papers, 1(5).

Torstila, S. (2001). What determines IPO gross spreads in Europe?. European Financial Management, 7(4), 523-541

Wooldridge, Jeffrey M., (2012). *Introductory econometrics : a modern approach*. Mason, Ohio :South-Western Cengage Learning,

Appendix:

Appendix A: White test for homoskedasticity

White's test for Ho: homoskedasticity
against Ha: unrestricted heteroskedasticity

chi2(61) = 31.48
Prob > chi2 = 0.9994

Appendix B: VIF test OLS regression

	VIF	1/VIF
SICD	125.21	.008
SICI	99.364	.01
SICG	53.349	.019
SICE	53.308	.019
SICH	44.374	.023
SICF	28.903	.035
SICC	16.768	.06
SICB	11.928	.084
SICA	5.044	.198
IPO_Deals_Per_Year	2.022	.495
Real_GDP_Growth	1.933	.517
Age	1.116	.896
NumberofLU	1.115	.897
OfferpriceSplitadj~R	1.038	.964
Mean VIF	31.819	.

Appendix C: Goodness of fit Poisson regression model

Deviance goodness-of-fit = 352.2925
Prob > chi2(522) = 1.0000

Pearson goodness-of-fit = 375.997
Prob > chi2(522) = 1.0000