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European IPO Syndicates Changes and Pricing, Evidence from the Frankfurt Stock Exchange

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Abstract

Over the years literature on IPOs has mentioned the changes on syndicate size and composition, being clear about the increase in the number of co-managers per syndicate and the simultaneous decrease of its total number of participants. Such changes in size have consequences on the quality of the service provided by syndicate, namely in valuation and pricing accuracy. Thus, this study targets European IPOs syndicates considering its potential changes in size over time and its impact on pricing accuracy, not discarding the specificities inherent to this market, namely bookbuilding differences which impact information available when it comes to the filling range creation and the limitation of price revisions to its range.

The empirical results indicate a steady increase in the number of joint bookrunners over the years, but regarding the total number of participants in the syndicate, time did not appear to be significant. The results suggest that syndicates accurately revise the price during the bookbulding according to the uncovered information, yet syndicate size only affects pricing accuracy to the extent that larger syndicates are more likely to revise the price downwards. A higher mispricing was found for offerings where the price was revised to the limits of the filling range. Adding, larger filling ranges are associated with higher mispricing, yet syndicate size does not appear to have any relationship with the filling range.

Keywords: Initial Public Offerings, IPO syndicates, Underpricing, Pricing Revisions.
JEL-Codes: C12; G24; G30; G34.

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1. Introduction

Initial Public Offerings (IPOs) are the first attempt of privately held firms to acquire capital in the public equity market. Authors argue firms go public for several different reasons, for instance, it may be to use shares as means to future acquisitions (Brau & Fawcett, 2006), to take advantage of market timing (Pagano, Panetta, & Zingales, 1998) or, simply, to raise capital.

Although going public offers different advantages for firms its process is not so simple, existing a large amount of literature covering first issuances of equity that empirically demonstrate irregularities around IPOs, namely underpricing, both short term and long term (Krigman, Shaw, & Womack, 1999; Ritter, 1991; Loughran & Ritter, 1995).

To do an initial public offering, issuing firms must hire an investment bank to underwrite the offering and lead the underwriting syndicate. To select the lead underwriter firms will held a competition between investments banks (typically referred to as "bake-off") where they will analyze and select the lead underwriter according to overall reputation, analyst coverage provided and general industry expertise, (Brau & Fawcett, 2006; Krigman, Shaw, & Womack, 2001).

The underwriting syndicate will be in charge, among others, of valuing the IPO, providing certification through prestige, supplying analyst coverage and market making for the offer (Kim & Ritter, 1999; R. Carter & Manaster, 1990; Chen & Ritter, 2000; Ellis, Michaely, & O'hara, 2000; Cliff & Denis, 2004).

Regarding IPO valuation, possibly the most interesting role, literature agrees on the importance of the market demand assessment made through bookbuilding. The method typically starts in the U.S. with the determination of preliminary price range, followed by a roadshow where underwriters introduce the offering company to potential investor and record their interests on the firm's equity to later revise the price. Price revisions are highly important and one of the main factors contributing to a precise price (Benveniste & Spindt, 1989; Ritter & Welch, 2002; Spatt & Srivastava, 1991; Cornelli & Goldreich 2003).

However, despite the strong adoption of bookbuilding by European IPOs (Ritter, 2003), the process differs for both regions, causing significant changes on information flows (Hanley, 1993; Jenkinson, Morrison, & Wilhelm Jr, 2006). While in the U.S. the IPO process starts with the definition of the price range that is issued in the red herring,

in Europe the price range is established after analysts have researched the firm and investors have been contacted, allowing for earlier information trade in European IPOs.

Additionally, in Europe it is not common to adjust the offering price to values outside the preliminary price range, which is typical for U.S. offerings. Thus, although bookbuilding allows for price revisions in both markets, filling range limitations may be jeopardizing price calibrations in Europe. Nonetheless, given the information trade, one should expect more precise filling ranges in European IPOs (Jenkinson et al., 2006).

Also, several authors have been noticing significant changes on U.S. syndicates size and composition (Chen and Ritter, 2000; Ljungqvist & Wilhelm Jr, 2003; Loughran and Ritter (2004) Corwin & Schultz, 2005). The authors observe a constant increase in the number of co-managers over the years at the same time syndicates size decreases. Those changes are in line with benefits found on the literature for the inclusion of more co-managers (Chen & Ritter, 2000; Corwin & Schultz, 2005; Ljungqvist & Wilhelm Jr, 2003). The number of co-managers is associated with higher accuracy in pricing, analyst coverage, market making and increased certification.

Given such findings and the U.S. centric literature (Ritter, 2003), this dissertation will start with the assessment of syndicate size changes in European markets. Followed by the main objective of studying the pricing accuracy of European syndicates, considering the potential changes syndicates have been suffering and the differences in the bookbuilding methods, namely filling range limitations and the filling range size.

To perform these studies, a sample of 126 IPOs taking place at the Frankfurt Stock Exchange between 2004 and 2011 was selected. First, methodology based on Corwin and Schultz (2005) will be used to assess the changes on the main syndicate size characteristics, number of total underwriters in the syndicate and number of joint-bookrunners (equivalent to co-managers for U.S. IPOs). Then, studies of likelihood and dimension of price revisions considering syndicate size characteristics will be done.

Once again resourting to Corwin and Schultz (2005), impacts of syndicate size on underpricing, accounting for price revisions will be approached.

With respect to filling range limitations and size, our study relies on some bases of Jenkinson et al. (2006) and Löffler, Panther, and Theissen (2005) methodologies.

In short, evidence was found suggesting the number of joint bookrunners is associated with time periods, increasing steadily over time. The results found indicate syndicates

revise the price correctly according to the information uncovered, however syndicate size only impacts pricing to the extent that larger syndicates are more likely to revise the price downards. Regarding bookbuilding filling ranges, our results suggest mispricing increases when prices are revised to the limits of the filling range and also when filling ranges are larger, which, as in Hanley (1993), might mean larger filling ranges are an indication of underwriters insecurity about the price. Regarding syndicate size and filling ranges, no evidence was found suggesting any relationship between both matters.

After this introduction, Section 2 presents the main literature review on syndicates formation (Section 2.1), roles (Section 2.2), costs (Section 2.3) and changes (Section 2.4), including the hypothesis formulation (Section 2.5), followed by the presentation of the sample selected for this study in Section 3. Section 4 addresses the methodology adopted in this study followed by the empirical results found in section 5. Lastly, main conclusions are described in Section 6.

2. Literature Review

2.1. Syndicate formation

For most IPOs, a group of underwriters called syndicate is formed to work together and go through with the IPO. The underwriters are typically investment banks which will serve as intermediaries between companies seeking capital and investors capable of providing the capital (Wilhelm Jr, 2005). The issuing firm starts by selecting the book manager (lead underwriter or book runner), the underwriter responsible to lead the IPO process.

According to surveys conducted directly to CFOs, when selecting the book runner firms will look specially for underwriter's overall reputation and status, the quality and reputation of the research department/analyst, and the underwriter's industry expertise and connections (Brau & Fawcett, 2006); (Krigman et al., 2001).

If there is a "bake-off"[1] for the book runner choice, there is a higher chance of the issuing firm selecting some bank(s) to be co-manager(s). It is also possible for the lead underwriter to advise the issuers on possible co-managers (Corwin & Schultz, 2005).

Unfortunately, for some companies there will be no choices available for lead manager. In Krigman et al. (2001) survey it was reported, by 13% of CFOs (from a total of 62), that the selected book runner was the only one willing to underwrite their IPO.

Once the book manager is selected, it will draft a letter of intent. This letter will state the terms and conditions agreed between the book runner and the issuer for the IPO, protecting the underwriter of uncovered expenses in case the IPO is not concluded. Adding, it will be present in the document the fee structure and a "commitment by the company to grant a 15 percent overallotment option to the underwriter" (Ellis et al., 2000, p. 1042).

Soon, the lead manager will be analyzing the company characteristics as well as preparing together with the company a registration statement for filing with the SEC.

Apart from this managing underwriter(s), the issuing firm and especially the lead manager are responsible for choosing the remaining non-managing underwriters to assist the operation (Ellis et al., 2000). These underwriters will do less work and are relatively cheaper to include. Corwin and Schultz (2005) found the main determinant for the inclusion of a specific underwriter in the syndicate is the participation in previous IPO syndicates directed by the same lead manager, demonstrating the importance of relationships.

[1] Competition held by the firm owners to choose the bank(s) which will do the firm's Initial Public Offering.

Another reason pointed by Chowdhry and Nanda (1996) for the inclusion of more underwriters is to increase the loss and risk bearing capacity. In case the syndicate suffers a loss, lead underwriters may be able to obligate less "powerful" syndicate members to share in the losses, under the pressure of not being included in future offerings. This suggests that larger syndicates should be expected for riskier offers.

2.2. Underwriters' role

The syndicate is settled to perform the technical activities necessary for the IPO realization. The main tasks to be done included reputation and certification of the IPO, providing analyst coverage, market making and price stabilization, and valuation and information production (Corwin & Schultz, 2005).

2.2.1. Valuation and Information Production

Underwriters must evaluate the company and reach an adequate price for the future stock, which understandably is an arduous task since many issuing firms are young[2], making it difficult to forecast future cash flows. Kim and Ritter (1999) results demonstrate that investment bankers use accounting information as well as comparable firm's multiples to establish a price range, however, it is the information they obtain about the market's demand for the issuing firm capital that contributes significantly for higher pricing accuracy.

The assessment of market demand is (often) done by a process named bookbuilding where a preliminary price range is established. Afterwards, underwriters go on a road show, presenting the company to potential investors, recording indications of interest (bids) which transmit useful information to calibrate the price more accurately (Benveniste & Spindt, 1989; Ritter & Welch, 2002; Spatt & Srivastava, 1991).

Cornelli and Goldreich (2003) found that the bids placed by investors account for most of the cross-sectional variation in offer prices relative to the initial indicative price range.

Corwin and Schultz (2005) argued this valuable information is obtained and contributes to a more accurate pricing due to the differences among underwriters of an IPO

[2] The average age of firms going public in the U.S. is about seven years, while on Europe the median average has been found to be higher than twenty years (Loughran & Ritter, 2004; Ritter, 2003).

syndicate. Different underwriters have different clients and serve different regions, resulting in diverse demand channels. Once, the underwriters of an IPO share their information among each other, the book-manager will be able to price the stock according to a more precise market demand. According to this rational, it is expected that issuers and book-managers will choose underwriters for the syndicate with different customer bases.

Although bookbuilding allows for accurate calibrations of the price, some authors found that the price adjustment do not fully reflect the information obtained, occuring only a partial adjustment (Bradley & Jordan, 2002; Hanley, 1993; Loughran & Ritter, 2002). The foundations for the existence of the partial adjustment phenomenon are based on Benveniste and Spindt (1989)'s model of IPO underpricing. Their model argues that regular investors must be compensated with more underpricing to reveal truthful information to an underwriter during the bookbuilding. So, to compensate information revealers, offer prices are only partially adjusted, leading to a connection between IPOs with large price revisions and large initial returns, as later empirically supported by Hanley (1993).

2.2.1.1. U.S. vs. European Bookbuilding

European markets adoption of bookbuilding started to increase in the 90s (Ritter, 2003). Today, bookbuilding is the most used method to price the issues in both markets.

While in the U.S. the IPO process starts with the definition of the price range that is issued in the red herring, in Europe the price range is established after analysts have researched the firm and investors have been contacted (Hanley, 1993). In the U.S. IPOs, analysts are prohibited from issuing research reports or recommendations before the price range is established[3] (Jenkinson et al., 2006).

The second step for the U.S. method includes the roadshow and the contact between the sell-side and investors, while on European IPOs only the contact between sell-side and investors is done. Only on the third step of European bookbuilding the price range is defined.

This difference between U.S. and European methods strongly affects information exchanges, allowing for earlier information trade in the process of European IPOs

[3] This does not imply there is total absence of contact between U.S. investors and the underwriters in the pre-filing period, but the amount and exchange of information for U.S. investors is severely mitigated (Jenkinson et al., 2006).

comparing to U.S. IPOs and so it might contribute to less uninformed investors.

There are naturally some differences amongst European countries, for instance, the German stock exchange prohibited syndicate banks from releasing research to investors in the two weeks prior to the offering. However, this does not disable them from exchanging information during other periods.

In German IPOs, the price range is typically set after the bookbuilding has started[4] and IPOs are never priced above the maximum range, which is also rare for other European countries (Jenkinson et al., 2006; Ritter, 2003). The opposite happens in the U.S., where often the price is adjusted to values outside the range, being even possible to fill a new range with the SEC to accommodate the revised price. This justifies the fact that the initial range is significantly inferior for U.S. offerings compared to European ones.

It is also common in Germany for retail investors to participate in the bookbuilding through their local banks, making it harder and costly to contact all these individual investors and reconfirm market demand to revise the price range (although by moving individual investors orders to online methods would drastically reduce the costs).

Regulation differences make comparisons difficult, but it would be expected more accurate price ranges for European IPOs given the information exchange.

2.2.2. Underwriter Reputation and Certification

Underwriter's reputation has been addressed frequently throughout literature due to its importance and frequently it is shared the idea that less prestigious underwriters tend to underprice more than underwriters with higher reputation (Johnson & Miller, 1988)[5].

Carter and Manaster (1990) go deeper into the reputation importance, developing a model which is empirically aligned with previous results. They found a price run-up variance of 0.1109 against a variance of 0.1424 for non-prestigious observations and a mean return difference of 0.0634 between the groups of IPOs underwritten by non-prestigious (0.1950) and prestigious underwriters (0.1316). The results are similar to those found by Johnson and Miller (1988), which indicate a mean initial return of 6.49% for prestigious underwriters and 14.07% for non-prestigious, despite the different methods adopted to

[4] See Appendix A for a summary illustration of the timeline of the bookbuilding process for both markets provided by Jenkinson et al. (2006).

[5] Despite the large amount of literature in favor of this statement there is research indicating opposite results. Beatty and Welch (1996) find a higher underpricing for IPOs with both prestigious underwriters and auditors in the 90s.

rank underwriters[6].

A Later study conducted by R. B. Carter, Dark, and Singh (1998) attested the empirical significance of both methods considered by Carter and Manaster (1990) and Johnson and Miller (1988) and also for Megginson and Weiss (1991)'s rank, based on market share, in the IPOs initial return and document an impact of reputation on long run performance of IPOs. However, when the different measures are evaluated simultaneously only the Carter and Manaster (1990) measure of prestige remains significant throughout time.

Investment banks send a message to investors about the IPOs they underwrite because they put this hard-won reputation at risk (Wilhelm Jr, 2005). This message acts as a certification of the IPO, where underwriters' prestige indicates a more or less accurate pricing (Corwin & Schultz, 2005). The authors add the participation of reputable underwriters in the syndicate, especially co-managers, increases certification to the IPO since it also indicates a possible competition to be the book manager.

2.2.3. Analyst Coverage

The analyst coverage post issue is of great importance for both issuing companies and investment bankers, existing evidence suggesting highly rated analysts contribute to underwriter's market share (Dunbar, 2000) and alongside reputation, it is a principal reason for firms switching underwriters for future offerings (Cliff & Denis, 2004; Krigman et al., 2001). Chen and Ritter (2000) predicted a difficult path for underwriters entering the market without a "well-regarded" analyst available to cover issuing companies.

This importance for firms arises due to the impact of "buy" recommendations, especially after the lock-up provision has expired, Chen and Ritter (2000). Bradley, Jordan, and Ritter (2008) found a 3% announcement abnormal return for firms with unanticipated analyst coverage initiations in the year after the IPO.

On the investors' side, analyst coverage may help decide which firms to follow (Das, Guo, & Zhang, 2006). Adding, authors have argued that analysts prefer to cover only firm on which they have positive expectations, resulting on positive analyst coverage on

[6] R. Carter and Manaster (1990)'s reputation measure is based on underwriter's position in tombstone announcements, ranking them from 0 to 9, being 9 for the most prestigious banks. Their ranking is also concerned with the investment banks companies maintain. In case the position of investments banks changes from the tombstone to a second announcement or firms switch underwriters in following offers, the ranks are readjusted. Other measurements of prestige usually are estimated through market share and size of offering measure, such as the Megginson and Weiss (1991)'s rank.

average, being a possible explanation for the abnormal announcement return found by Bradley et al. (2008).

2.2.4. Market Making and Price Stabilization Activities

One of the most important roles of underwriters after the IPO date are the market making activities. Ellis et al. (2000) found that the lead underwriter is always the dominant market maker, representing 60% of the trading volume in the first few days after the stock begins trading, and about 50% of the total volume when measured over the first few months of trading.

They found the main underwriter also accumulates a substantial number of shares after the first day of trading (4% of total stock issued), this amount is significantly higher for stocks that trade below issuing price (up to 22%). Schultz and Zaman (1994) reach a similar result where about 20% of the shares are repurchased by underwriters in the first three days of aftermarket trading.

These actions carried by underwriters are an attempt to stabilize the price. Aggarwal (2000) presented three ways underwriters exert stabilization activities, two of which are aimed to stimulate demand: placing a bid to purchase shares at a price lower or equal than the offer price till an increase in demand occurs to defer a price drop or taking a short position in IPOs of weak demand by allocating more than the stated size of the offering and posteriorly buying them back in the secondary market. The other way is done by taking away the selling concession of the members of the selling group whose clients are quickly flipping their stocks.

2.3. Payment to the Syndicate and Competition

The spreads (fees) are the main source of payment for the underwriters in exchange for the work provided. Chen and Ritter (2000) reported more than 90% of gross spread for 1,111 IPOs were precisely 7% (U.S. IPOs). The authors consider this spread to be "above competitive levels" since it is higher than in most other regions and spreads would differ for different sized deals if they were based on costs[7].

In fact, the 7% spread marks an upper bound for European fees, whose average spreads

[7] This research done by Chen and Ritter (2000) suggesting clustering of fees resulted in a lawsuit by the U.S. Department of Justice against 32 underwriters, which was later dropped due to lack of evidence of explicit collusion (Abrahamson, Jenkinson, & Jones, 2011).

are about three percentage points lower, much more variable, and have been falling (Abrahamson et al., 2011).

This phenomenon is even more surprising when considering that investment banks working in both markets charge different fees. The industry participants argued the difference was explained by the fact that U.S. offerings used the bookbuilding method and in Europe the tender auction method used was less time consuming and less expensive. As seen above, Europe as largely adopted bookbuilding in the 90s and the spreads difference were still maintained, thus, their argument falls apart.

A more plausible explanation presented by Abrahamson et al. (2011) is the higher competition in Europe, reflected by the Herfindahl index, where it is clear the U.S. IPO market is sustained by the hands of fewer investment banks.

A following explanation refers to the maturity of the market. Europe market start point was a series of fragmented markets, where older IPO techniques were substituted by bookbuilding. Europe was used to low fees and there was no meeting point for spreads to concentrate, which was the opposite of the U.S. market where the IPO market is established and underwriters compete on basis beyond fees (Chen & Ritter, 2000).

A final explanation is the accountancy of legal expenses, where these are paid out of the gross spread for the U.S., while in Europe they are largely reimbursed by the issuers or vendor separately from the gross spread. Yet, this last possibility only explains a small fraction of the spreads difference (Abrahamson et al., 2011).

U.S. underwriters know the spreads are high but competing on them would harm themselves. Instead of competing on spreads, Chen and Ritter (2000) and Hansen (2001) found supporting evidence of bank competition on the basis of reputation, placement service and underpricing, which as seen above are facts of great importance for firms when choosing the underwriters.

Besides competition on fees in a primary stage, once within a syndicate, banks can keep on competing both on spreads and positions for future offerings. Corwin and Schultz (2005) alerted for potencial prevention measurses by lead underwriters, such as a lower limit for the fees to be received, jeopardizing the entrance of other members. The objetive of lead underwriters is to limit the inclusion of non-leading managers, which may fight to secure leading positions on future offerings. Competition within a syndicate relates once again for the importance of relationships between banks, a major determinant for

syndicate inclusion.

2.4. Syndicates Evolution

Several authors have noticed the changes on syndicate size. Chen and Ritter (2000) describe the 80s IPOs with the inexistence of co-managers in most IPOs, and 20 years later in 2000 they observe almost all IPOs have at least one or more co-managers.

Ljungqvist and Wilhelm Jr (2003) reported similar findings, as they observe a tremendous change in the underwriting syndicates in a period of just 4 years. Referring their own words, "the average underwriting syndicate consisted of 19 banks in 1996, falling to 15 in 2000" at the same time "the number of lead and co-lead underwriters (…) increased, from 2.4 in 1996 to 3.7 in 2000", (Ljungqvist & Wilhelm Jr, 2003, p. 728). Prestige underwriters per syndicate also increase, after 1999 the authors find the median IPOs had a top ranked underwriter involved (measured using Carter and Manaster (1990)'s method).

A few years later, Loughran and Ritter (2004) and Corwin and Schultz (2005) found the same patterns once again, even for a small time period sample.

These authors found the reasons associated to these changes are related to the syndicate roles, which are improved for larger syndicates. Corwin and Schultz (2005) found that an increase in the number of co-managers results in a higher accuracy in offer prices, higher analyst coverage and higher number of market makers.

Davidson III, Xie, and Xu (2006) found that the number of co-managers is positively associated with placement risk (price uncertainty).

On the other hand, Hu and Ritter (2007)'s results suggest that underpricing is lower for IPOs with multiple bookrunners (1% less underpricing per additional bookrunner in results of a higher filing range and greater responsiveness to positive market conditions).

According to these findings on benefits for larger syndicates, issuers should be tempted to include the maximum co-managers as possible. Nevertheless, due to the competition constraints mentioned above, issuers will find difficulties in including many co-managers, especially prestigious ones which require large share allocations. If the size of the offer is substantial, issuing firms may find it easier to include co-managers due to the larger expected proceeds granting a larger allocation to each underwriter.

If fees increase with syndicate size, the issuing firm may prefer a smaller syndicate, abdicating the benefits of more underwriters. Although the clustering of fees at 7%, (Chen

& Ritter, 2000; Hansen, 2001), Corwin and Schultz (2005) still found some degree of correlation between syndicate size and fees, where spread rises in symphony with syndicate size.

2.5. Hypothesis Development

Considering the consistent findings on syndicate size changes suggesting an increase in the number of co-managers and a decrease in the total number of underwriters in syndicates over the years (Chen and Ritter, 2000, Corwin and Schultz, 2005, Ljungqvist & Wilhelm Jr, 2003, Loughran and Ritter, 2004) and the U.S. centric literature (Ritter, 2003), this thesis first aims to assess the syndicate size changes in the European market.

Hypothesis 1: European IPO Syndicates size is changing over time.

Followingly, given the higher accuracy in offer prices found by Corwin and Schultz (2005) and the lower underpricing for IPOs with multiple bookrunners found by Hu and Ritter (2007) in the U.S. market, this thesis will study whether larger syndicates provide more accurate pricing and/or lower underpricing.

Hypothesis 2: Larger European syndicates achieve more accurate pricing.

Lastly, it is necessary to consider the differences between European and U.S. IPOs, especially in what bookbuilding concerns. Given the information trade in sooner stages for European IPOS (Hanley, 1993, Jenkinson et al., 2006) happening before the decision of the initial filling range which leads to smaller filling ranges when compared to U.S. IPOs, and considering prices are rarely adusted to values outside the initial filling range, it is necessary to assess what are the implications of filling range matters in pricing accuracy, once again, also considering syndicates size.

Hypothesis 3.1: Filling range limitations on price revisions in Europe jeopardize accurate pricing.

Hypothesis 3.2: Larger syndicates present higher price certainty evidenced by the filling range size.

3. Sample Selection and Description

This section is destined to explain how the data and sample for this research were selected and present the main descriptive statistics.

3.1. Sample selection and considerations

The attempt to fill the literature gap regarding European IPOs and its syndicates brings along difficulties concerning data availability. Moreover, the European market is composed by several countries and stocks exchanges and to include all of the European IPOs it would be necessary to consider differences between each market despite the many similarities.

Therefore, the German market, namely the Deutsche Börse[8] (Frankfurt Stock Exchange), was selected. The German market is the third largest stock exchange in Europe, only surpassed by the London Stock Exchange and Euronext Stock Exchange in market capitalization[9], and so has relevance in size and impact in the European context, capable of providing a good representation of the main European markets, attending to the difficulties above.

The Frankfurt Stock Exchange regulated market is divided into two main segments, the Prime Standard and General Standard[10], being the first one oriented to companies wishing to position themselves towards international investors and were most of the IPOs occur. Naturally, Prime Standard admissions are conditioned to higher transparency requirements and additional follow-up obligations.

In a first stage, data about 201 IPOs was manually collected from the Primary Market Statistics database of the Deutsche Börse AG, selecting all issues between January 1st, 2000, and February 4th, 2021, in the Prime Standard segment, including the issues done in this segment whose companies moved years later to other segments, thus not appearing in the Database when selecting Prime Standard New Issues.

The information available in this platform includes the name of the issuing firm,

[8] Germany has eight stock exchanges, being the Frankfurt Stock Exchange, managed by the Deutsche Börse AG, the most relevant. Through Xetra and Börse Franfurt trading platforms, the Frankfurt Stock Exchange comprises more than 95% of all German publicly listed companies and 85% of all foreign publicly listed companies, according to Anna Schwander and Isabel Trojette, on Bloomberg Law, 2019.

[9] The market capitalization of the Euronext Stock Exchange, London Stock Exchange and Deutsche Börse as of September 1, 2021, is $4.2 trillion, $3.8 trillion, and $2.59trillion, respectively according to Tradinghours Platform.

[10] Other segments include Scale, Basic Board, Quotation Board, REITs and CEINEX.

offering date and subscription period, offering mechanism, bookbuilding filling range, final offer price, first trading price recorded, emission volume, free float percentage, market capitalization on the first quotation, syndicate members and the shareholder structure before and after the offering.

From this initial sample, offerings that were not priced using bookbuilding, units, rights, investment funds and REITs related offerings are excluded due to nature of operations just as in Corwin and Schultz (2005), resulting in a reduction of the sample by 19 and 14 issues, respectively.

Additionally, from the period of 2000 up to 2005, offerings lacked information on syndicate participants specificities, resulting in a reduction of the sample by 42 IPOs.

The final sample for most of this work comprises 126 IPOs from the years of 2004 to 2021[11].

The remaining necessary information was collected from Refinitiv Eikon and Datastream databases, namely, the closing price of the first trading day and the aftermarket standard deviation of continuously compounded daily returns from days 21 through 125 after the offering.

R. Carter and Manaster (1990) and Migliorati and Vismara (2014) rankings of European underwriters are both used to rank the banks in this sample. Since the banks to be ranked in this sample are operating in Europe one could argue that the suitable rank should be the rank provided by Migliorati and Vismara (2014), especially when considering the specific ranking for the Frankfurt Stock Exchange they provide. However, the rank calculation method[12] results in very low ranks attributed to most of the major U.S. banks. For example, JP Morgan Chase and Morgan Stanley are ranked as 0.24 and 0.21, respectively, using equally weighted metrics, while in Carter and Manaster (1990)'s rank, they are considered very prestigious. In comparison, two of the largest and most prestigious German banks, Deutsch bank and Commerzbank, score 0.733 and 1, respectively.

Thus, considering that the IPOs in this sample occurred in the Prime Standard Segment and the main objective is to be oriented to the international scene, a factor that explains the large amount of U.S. underwriters in the sample[13], underwriters will be considered

[11] See appendix B for the number of IPOs per year.
[12] Migliorati and Vismara (2014) report the reputation measure (standardized on the number of IPOs) using both equally and proceeds-weighted metrics, the number of IPOs, and the capital raised in each market.
[13] Almost 50% of the IPOs in the sample have at least one U.S. bank leading the syndicate.

prestigious if they have a rank above 8 in the Carter and Manaster (1990)'s rank or they are one of the top 5 German banks according to Migliorati and Vismara[14], whose most recent rank is avaible at the official webpage of Jay Ritter[15].

Consequently, in the case of underwriters that have been acquired, the attributed rank will correspond to the acquirer ranking, given that Migliorati and Vismara (2014) treat the acquired companies as part of the new parent.

The appointments in the underwriting syndicates are different for European markets and it is crucial for this work to understand them. The global coordinator (treated in this study as leader) is usually the same bank as the bookrunner, but it is also responsible for the coordination of the different tranches of the offering. The following highest position is the joint bookrunner (or joint lead manager), which the U.S. equivalent would be referred to as co-manager. Lastly, in Europe there are co-lead managers and co-managers, whose U.S. equivalance would be 'other syndicate members' or non-managing underwriters (Jenkinson & Jones, 2009).

The syndicates who include co-managers are just 20 of the 126. Rarely, there is also a co-bookrunner, a position between joint-book runners and co-lead managers. Overall, most of the syndicate's participants are leaders, joint-book runners, and co-lead managers.

The percentage of shares allocated per underwriter decreases according to its position. The leaders which are the global coordinators get most of the shares, followed by the joint-book runners, and the remaining get only a small portion, with the joint-lead and co-managers getting a very low percentage, many times between 1% to 2%, especially for co-managers.

3.2. Sample Descriptive Statistics

Descriptive statistics for the sample are expressed on Panel A of Table I. The IPOs on this sample raised on average €420 million, with an average and median underpricing of 3.98% and 1.51%, respectively. The price revision, measured as the percentage return from the midpoint of the original filing range to the offer price, is on average negative -2,84%, with a median also negative of -2.55%. The price revision in this sample is significantly lower than the mean of 6.82% found by Corwin and Schultz (2005). A possible

[14] See appendix B for prestigious underwriters.
[15] Available at: https://site.warrington.ufl.edu/ritter/ipo-data/.

explanation is the limit established by the filling range, where European syndicates rarely adjust the price to values outside this range (Ritter, 2003). In fact, for the 126 IPOs in this sample, only once was the price revised to a value outside the filling range.

The width of the filling range, measured as the difference between the high point and the lowest point of the filling range divided by the midpoint, as an average of 20.36%, approximately 4 percentage points higher than the 16% found by Jenkinson et al. (2006) for the German market between 1994 and 1999. The mean aftermarket standard deviation from days 21 through 125 used as measure of risk, is 2.61%.

The average number of underwriters in a syndicate is 4, the average number of leaders is 1.73 while for joint-book runners is 0.82. Regarding prestige leaders, the average is 1.25, while for joint-book runners, at least 75% of syndicates do not have a prestigious joint-book runner.

Panel B of Table 1 presents the offers and underwriter characteristics by time periods given that the date of the sample IPOs ranges from 2004 to 2021. The average IPO size, measured as the offer proceeds, increases substantially during the sample period, from €241 million to €690 million, between the first and last period. Underpricing is low for most of the periods, except for 2009-2012 where it is negative. The mean price revision was only positive in the period of 2007-2008, but close to zero, the same period where the highest standard deviation was observed. The width size is slightly higher for most recent period, with the highest average occurring in the period of 2009-2012.

The mean number of syndicate size has increased consistently, with the number of joint-book runners leading the growth, moving from 0.18 in 2004-2006 to 1.81 in 2017-2021. The number of leaders has also increased from 1.55 to 2.04, between the same time periods. These results are consistent with the ones found by Ljungqvist and Wilhelm Jr (2003), Chen and Ritter (2000), and Corwin and Schultz (2005), for the time periods of 1996-2000, 1985-1997, and 1997-2002, respectively, except for the number of total participants in the syndicate.

The number of active underwriters has not oscillated hardly during the sample period, except for the number of underwriters who performed as joint-book runners which increased from 10 to 27, as expected given the increase in the average number of joint-book runners per IPO.

Table 1: Summary Statistics for Offer and Syndicate Characteristics

Panel A comprises offer and underwriter characteristics distribution. Panel B shows the mean value of each variable by time period. The sample includes 126 IPOs from the Frankfurt Stock Exchange issued from 2004 to 2021, excluding units, rights, investment funds, and REITs. Underpricing is defined as the percentage return from the offer price to the first day's closing price (obtained at Refinitiv Eikon database). Offer Proceeds is the total value of all shares sold in the IPO, including "greenshoe". The Price Revision is the percentage return from the midpoint of the original filing range to the offer price. Filling Range Width equals the difference between the highest and lowest points of the filling range divided by the midpoint. Aftermarket Standard Deviation is estimated using continuously compounded daily returns from days 21 through 125 after the IPO. An underwriter is defined as prestigious if it ranks above 8 in the Carter and Manaster (1990)'s rank (1-9) or is a top 5 bank in the Migliorati and Vismara (2014)'s rank for the Frankfurt Stock Exchange (equally weighted measure). Both Carter and Manaster, (1990) and Migliorati and Vismara (2014) ranks are obtained from Jay Ritter´s web page at https://site.warrington.ufl.edu/ritter/ipo-data/. The number of active underwriters is total number of different underwriters that participate in at least one syndicate during a given time period. Similarly calculated are the number of active leaders and joint-bookrunners.

Panel A: Distribution of Offer and Underwriter Characteristics

	Mean	Min	25th Percentile	Median	75th Percentile	Max
Offer Proceeds (million €)	419.65	3.17	61.74	152.74	396.92	4641.49
Underpricing (%)	3.98	-26.92	-0.54	1.51	7.75	39.47
Price Revision (%)	-2.84	-27.27	-8.76	-2.55	3.02	13.55
Filling Range Width (%)	20.36	6.80	15.38	19.35	23.53	66.67
Aftermarket Standard Deviation (%)	2.61	0.93	1.84	2.38	3.16	5.83
No. of Leaders	1.73	1.00	1.00	2.00	2.00	5.00
No. of Joint Book Runners	0.82	0.00	0.00	0.00	1.00	8.00
Total Participants	4.04	1.00	2.00	3.00	5.00	14.00
No. of Prestige Leaders	1.25	0.00	0.00	1.00	2.00	4.00
No. Prestige Joint-Book Runners	0.56	0.00	0.00	0.00	0.00	6.00

Panel B: Offer and Underwriter Characteristics by Year

	2004-2006	2007-2008	2009-2012	2013-2016	2017-2021
No. of IPOs	38	18	20	24	26
Offer Proceeds (million €)	241.18	371.74	259.99	578.61	689.76
Underpricing (%)	4.31	6.34	-1.04	2.63	6.97
Price Revision (%)	-0.83	0.18	-6.89	-4.64	-3.08
Width Size (%)	18.13	18.66	25.53	20.16	21.02
STD (%)	2.51	3.70	2.85	2.20	2.20
No. of Leaders	1.55	1.61	1.55	1.92	2.04
No. of Joint-Book Runners	0.18	0.11	0.60	1.46	1.81
Total participants	3.53	3.39	3.75	4.67	4.88
No. of Prestige Leaders	1.16	1.06	0.90	1.54	1.50
No. of Prestige Joint Book Runners	0.13	0.00	0.50	1.13	1.12
No. of Active Leaders	22	15	20	18	15
No. of Active Joint-Book Runners	10	6	12	19	27
Active total underwriters	37	29	37	33	40

4. Methodology

This section aims to present the methodology used to test the formulated hypotheses. Topic 4.1. focus on hypothesis 1 regarding the changes over time on European syndicates sizes and topics 4.2. and 4.3. target hypothesis 2 and 3, respectively, which relate to pricing matters.

4.1. Syndicates Size Determinants

The primary research to be done consists of identifying the main syndicate size determinants and assessing the changes syndicates have been suffering throughout the years according to the literature. Thereby, adopting Corwin and Schultz (2005) methodology, we estimate the following Poisson regressions (1) and (2):

$$Number\ of\ Underwriters_i = \alpha + \beta_1 Log(expected\ proceeds)_i + \beta_2 Aftermarket\ Standard\ Deviation_i + \beta_3 Prestige\ Leader\ Dummy_i + \beta_4 Non - NonGerman\ IPO\ Dummy_i + \gamma(Time\ controls)_i + \varepsilon_{i,t} \quad (1)$$

$$Number\ of\ Joint\ Bookrunners_i = \alpha + \beta_1 Log(expected\ proceeds)_i + \beta_2 Aftermarket\ Standard\ Deviation_i + \beta_3 Prestige\ Leader\ Dummy_i + \beta_4 Non - NonGerman\ IPO\ Dummy_i + \gamma(Time\ controls)_i + \varepsilon_{i,t} \quad (2)$$

In model (1) the dependent variable is the total number of underwriters, while in model (2) the dependent variable is only the number of joint bookrunners participating in a syndicate. Aside from the dependent variable both models are similar. As independent variable there is the natural log of expected proceeds, with the expected proceeds measured as the number of shares offered (excluding greenshoe) multiplied by the midpoint of the filling range. According to the literature, larger offers will grant larger allocations (fees), which will make it easier for inclusion of more underwriters, especially for prestigious co-managers (Corwin and Schultsz, 2005). The following dependent variable is the aftermarket standard deviation measured using continuously compounded returns from days 21 through 125 after the IPO. Such variable is included to account for offer risk, which according to literature, should be positively related to the number of underwriters (Chowdhry and Nanda, 1996). Finally, there is a dummy variable taking the value of one when there is a prestigious leader in the syndicate, and zero otherwise. According to Chowdhry

and Nanda (1996), prestigious and powerful underwriting leaders may have the capacity to force smaller banks to participate in the offering to increase loss and risk bearing capacities in case of syndicate losses.

To control for any effect inherent to IPOs of non-German firms we include a dummy variable taking the value of one when the issuing firm is not German and zero otherwise. Lastly, to control for time changes, dummies for the time periods comprising the sample IPOs are used.

4.2. Syndicates Pricing Accuracy

One of main purposes of this study is to assess whether certain syndicates are able to better price an issue.

4.2.1. Price Revisions

In a primary stage, pricing accuracy is affected by the ability a syndicate has to embody the information about market demand obtained during the bookbuilding[16]. Correctly incorporating such information would ultimately contribute to a more precise price.

Based on Corwin and Schultz (2005) methodology to address price revisions adjustments, two different types of models are applied.

Firstly, probit models are used to test the likelihood of positive (3) and negative (4) offer price revisions in response to the information uncovered given certain syndicate characteristics.

Posteriorly, ordinary least squares (OLS) regressions (5) are used to test if syndicate structure characteristics affect the size of the price revisions in response to information uncovered.

$$Upward\ Price\ Revision_i = \alpha + \beta_1(\ Syndicate\ charactheristic)_i + \beta_2\ Return > 10\%\ Dummy_i + \beta_3 Negative\ Return\ Dummy_i + + \beta_4 Log(expected\ proceeds)_i + \beta_5 Aftermarket\ Standard\ Deviation_i + \varepsilon_{i,t} \quad (3)$$

[16] As seen in the literature reviewed above, although investment bankers use accounting information as comparable firm's multiples, the assessment of market demand is the main driver for the price range estimation (Kim & Ritter, 1999).

$$Downward\ Price\ Revision_i = \alpha\ + \beta_1(\ Syndicate\ charactheristic)_i\ + \beta_2\ Return > 10\%\ Dummy_i\ + \beta_3 Negative\ Return\ Dummy_i + + \beta_4 Log(expected\ proceeds)_i\ +\ \beta_5 Aftermarket\ Standard\ Deviation_i + \varepsilon_{i,t} \quad (4)$$

$$Percentage\ Price\ Revision_i = \alpha\ + \beta_1(\ Syndicate\ charactheristic)_i\ + \beta_2\ Return > 10\%\ Dummy_i\ + \beta_3 Negative\ Return\ Dummy_i + \beta_4 Log(expected\ proceeds)_i\ +\ \beta_5 Aftermarket\ Standard\ Deviation_i \varepsilon_{i,t} \quad (5)$$

For both models (3) and (4) the independent variables are the syndicate characteristics, two total returns measures, natural log of expected proceeds, corresponding to the mid-point of filling range multiplied by shares offered and the aftermarket standard deviation.

The main syndicate characteristics to analyze in each model are the number of joint-bookrunners and the total participants in the syndicate[17]. Additionally, given the high importance of price revisions to achieve higher pricing accuracy, the number of leaders, the number of prestigious leaders and the number of prestigious joint-bookrunners are also included. Each syndicate characteristic variable is included in an individual regression to avoid correlation problems, resulting in a total of six regressions for each model, where the first regression includes all independent variable except a variable for a syndicate characteristic and the following regressions include all independent variables from the first regression plus one syndicate characteristic.

The return variables used assume a crucial role as a measure of the information syndicates can possibly uncover. Corwin and Schultz (2005) believe the information uncovered during the bookbuilding should be reflected in the return from the midpoint of the filling range to the closing price on the first trading day, thus, positive (negative) information should mean a positive (negative) return.

There is a dummy variable equal to one when the total return is negative or zero and a dummy variable equal to one when the total return is larger than 10%, being total return measured from the midpoint of the filling range to the closing price on the first day of trading. Corwin and Schultz (2005) use a dummy for negative returns or equal to zero

[17] Corwin and Schultz (2005) methodology include extra variables such as the return itself when it is larger than 20% and syndicate characteristics are studied through interaction with positive and negative returns.

based on Ruud (1993) findings, suggesting aftermarket support by underwriters constrains prices from falling below the offer price. Regarding the proxy for positive information uncovered, Corwin and Schultz (2005) do not focus on total returns larger than 10% but rather on total returns greater than 20%, their argument is that some underpricing may be desired and offer prices may be adjusted only in case underpricing is significantly larger than foreseen. The choice for 10% in this study is due to the fact that average underpricing in our sample is significantly smaller compared to theirs (3.98% versus 39.51%). The authors large underpricing is a characteristic of the IPOs during the Dot-Com Bubble (covered in their sample from 1999 to 2000), and are aligned with the results from Ljungqvist and Wilhelm Jr (2003) and Loughran and Ritter (2002). Given the more stable historic underpricing covered in our sample, it was considered only underpricing above 10% to be "unintentional"[18].

In short, models (3) and (4) are exactly similar except for the dependent variables, which in one case covers positive revisions and negative in the other. The reasoning for the inclusion of both models is to observe separately the impact of positive and negative information uncovered on negative revisions and positive revisions. This separation allows to observe how information uncovered induces more easily underwriters to a positive (negative) revision than it induces them not to do a negative (positive) revision[19].

Model (5) is similar to the ones above considering the same independent variables, but it is computed using OLS regressions and the dependent variable is the percentage change from the filing price to the offer price, allowing to estimate the magnitude of the price revision rather than the likelihood of a price revision.

4.2.2. Underpricing

By revising the price during the bookbuilding, syndicates also reduce underpricing. Price revisions are one of the most well-informed actions a syndicate can make about price before the offering date. However, syndicate composition can have other implications on pricing besides price revisions. As Corwin and Schultz (2005) argue, co-managers and non-managing syndicate members help to certify the offerings' quality and reduce

[18] When considering 20% as in Corwin and Schultz (2005), or even 15%, the results remain very similar in our study.

[19] For instance, when faced with some positive information, underwriters may still be reluctant to revise the price upward, but that same information is already enough for them not to discard a negative revision. By doing both model (3) and (4) it is possible to account for such scenarios.

asymmetric information about the IPO value. In that case, larger syndicates with more and prestigious co-managers may be related with lower underpricing.

To investigate such additional effects on underpricing after accounting for price revisions, two-stage least squares (2SLS) regressions of underpricing are estimated on the total number of participants and the number of joint-bookrunners, with the control variables previously used in above models, resulting in two 2SLS models, (6) and (7). The 2SLS regressions allow to account for the number of join-bookrunners and total participants endogeneity.

In model (6), the first stage regression is similar to regression of model (2) adding a control variable for price revision, measured as the adjustment from the filling price to the offer price:

$$Number\ of\ Joint\ Bookrunners_i = \alpha + \beta_1 Log(expected\ proceeds)_i + \beta_2 Aftermarket\ Standard\ Deviation_i + \beta_3 Prestige\ Leader\ Dummy_i + \beta_4 Price\ Revision_i + \beta_5 NonGerman\ IPO\ Dummy_i + \gamma(Time\ Controls)_i + \varepsilon_{i,t}$$

In the second stage the log of 1 plus underpricing is regressed on the number of joint-bookrunners estimated in the first stage regression, the log of expected proceeds, aftermarket standard deviation, a dummy variable for a prestigious leader, a variable for price revision and times controls to account for underpricing impacts caused by the time periods covered in the sample (especially considering 2008 crisis and 2020 Covid-19 pandemic).

$$Log(1 + Underpricing)_i = \alpha + \beta_1 (Number\ of\ Joint\ Bookrunners)_i + \beta_2 Log(expected\ proceeds)_i + \beta_3 Aftermarket\ Standard\ Deviation_i + \beta_4 Prestige\ Leader\ Dummy_i + \beta_5 Price\ Revision_i + \varepsilon_{i,t}$$

Model (7) regressions are similar to model (6) but the syndicate characteristic variable number of joint-bookrunners in the first stage regression is replaced by the total number of participants in the syndicate, being the estimated results used in the second stage regression.

4.3. Filling Range Limitations and Syndicate Size

Syndicates in European IPOs rarely revise the price to values outside the filling range, as evidenced by our sample where only once such event occurred. This reluctancy may spoil pricing accuracy. If a syndicate obtains information during the bookbuilding process suggesting the price needs to be corrected to a value outside the filling range and to respect the range boundaries they do not totally revise it, pricing accuracy will be hurt.

Simultaneously, the filling range itself may also act as a limitation where, given the reluctancy to "jump" outside it, smaller ranges will not allow for significant price revisions.

On the other hand, authors (e.g., Hanley (1993)) argued that the price range is an indication of the certainty underwriters have about the price of the issue. In that case, smaller filling ranges would be an indication of higher price certainty and would be expected a higher pricing accuracy for such issues.

For the filling range limitations study we resort to some bases of Jenkinson et al. (2006) and to Löffler et al. (2005), whose methodology was developed to study the Frankfurt Stock market.

Löffler et al. (2005) defined pricing error (or mispricing) as: offer price error = (Pi – offer) /offer price, where Pi is the first exchange price of stock I and as in Jenkinson et al, (2006), the width range, as previously mentioned, is the difference between the highest and lowest point of the filling range divided by the midpoint.

Evolving from these two basic concepts the below OLS models are estimated to test hypothesis 3.1.:

$$Pricing\ Error_i = \alpha + \beta_1\ Positive\ Revision_i + \beta_2 Total\ Positive\ Revision_i + \beta_3 Width\ Range_i + \beta_4 Log(expected\ proceeds)_i + \beta_5 Aftermarket\ Standard\ Deviation_i + \gamma(Time\ Controls)_i + \varepsilon_{i,t} \quad (8)$$

$$Pricing\ Error_i = \alpha + \beta_1\ Negative\ Revision_i + \beta_2 Total\ Negative\ Revision_i + \beta_3 Width\ Range_i + \beta_4 Log(expected\ proceeds)_i + \beta_5 Aftermarket\ Standard\ Deviation_i + \gamma(Time\ Controls)_i + \varepsilon_{i,t} \quad (9)$$

In the above model (8), pricing error is regressed on a dummy variable equal to one

when there is a positive (negative in model (9)) revision of the price, a dummy variable equal to one when there is a positive (negative in model (9)) total revision, the width range as measured by Jenkinson et al. (2006), the natural log of expected proceeds, aftermarket standard deviation and time controls. A total revision occurs when the price is revised to the boundary of the filling range, occurring a total positive revision when the revised price equals the upward limit of the filling range, and a total negative revision when the revised price equals the downward limit of the filling range.

Lastly, considering the information the filling range size may potentially transmit regarding the price uncertainty by the syndicate, as mentioned by Hanley (1993), the filling range size is regressed on control variables used previously and on the main syndicate size characteristics, the total number of participants in the syndicate (10) and the number of joint-bookrunners (11), using OLS models. Thus, to test hypothesis 3.2. the goal is to find evidence of higher price certainty for larger syndicates or syndicates with more joint-book managers, which should be reflected in the filling range size.

$$Width\ Size_i = \alpha + \beta_1(Total\ Participants)_i + \beta_2 Log(expected\ proceeds)_i + \beta_3 Aftermarket\ Standard\ Deviation_i + \beta_4 Prestige\ Leader\ Dummy_i + \gamma(Time\ Controls)_i + \varepsilon_{i,t} \quad (10)$$

$$Width\ Size_i = \alpha + \beta_1(Number\ of\ Joint\ Bookrunners)_i + \beta_2 Log(expected\ proceeds)_i + \beta_3 Aftermarket\ Standard\ Deviation_i + \beta_4 Prestige\ Leader\ Dummy_i + \gamma(Time\ Controls)_i + \varepsilon_{i,t} \quad (11)$$

5. Empirical Results

5.1. Syndicates Size and Composition Determinants

The estimation outputs for models (1) and (2) regarding the determinants of syndicate size and composition, described in Table 2, show the natural log of offer proceeds is very significant in both regressions, with the number of total underwriters and joint-bookrunners increasing as expected offer proceeds increase. As expected, the number of joint-book runners increases steadily during the sample period, after controlling for other factors. Regarding the total number of underwriters per syndicate, despite the descriptive statistics showing an increase, the time period dummies did not reveal to be significant, does it is concluded that time is not affecting the total syndicate number of participants, unlike the results found by Corwin and Schultz (2005), where time controls revealed to be significant suggesting not only a steady increase in the number of joint-bookrunners but also a consistent decrease in the total number of participants in the syndicate.

The measure of risk is not statistically significant in both regressions, leading to the exclusion of Chowdhry and Nanda (1996) suggestions, that riskier offers are expected to be handled by a larger number of underwriters. However, the suggestion that a more powerful underwriter should be able to include smaller banks in the offer is not discarded, being a possible reason for the statistical significance of the dummy for a prestigious underwriter in the total participants regression. The results demonstrate that if at least 1 leader is prestigious the total number of underwriters should increase by 0.25.

Finally, the control dummy for foreign offerings occurring in the Frankfurt Stock Exchange is not statistically significant in both regressions.

Table 2: Determinants of Syndicate Size

Table 2 lists coefficient estimates from regressions of syndicate size measures on several offer characteristics. The sample consists of 126 IPOs issued from 2004 to 2021, excluding units, rights, investment funds, and REITs. Expected proceeds are the number of shares offered (excluding greenshoe) multiplied by the midpoint of the filling range. Aftermarket standard deviation is calculated from continuously compounded returns from days 21 through 125 after the IPO. The Prestige Leader Dummy equals 1 if there is at least one leading underwriter with a rank above 8 in the Carter and Manaster (1990)'s rank or is one of the top5 banks in Frankfurt according to Migliorati and Vismara (2014). Dummies are included for the time periods of the sample. A dummy equal to 1 is included if the offering company is not German. Poisson regressions are used since the dependent variable is a count. The T-statistics and Z-statistics based on robust standard errors are listed in parentheses below the coefficients. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable	Number of Total Underwriters	Number of Joint-Book Runners
Log (expected proceeds)	0.353***	0.654***
	(10.95)	(6.89)
σ	-0,031	0.019
	(-0.88)	(0.13)
Prestige Leader Dummy	0.253**	0.006
	(2.57)	(0.02)
2007-2008 Dummy	-0.069	-0.742
	(-0.74)	(-0.86)
2009-2012 Dummy	0.099	1.142**
	(1.16)	(2.11)
2013-2016 Dummy	-0.058	1.449***
	(-0.53)	(2.74)
2017-2021 Dummy	-0.003	1.660***
	(-0.03)	(3.15)
Non-German Dummy	0.113	0.340
	(1.00)	(1.47)
Intercept	-5.518***	14.190***
	(-9.24)	(-7.53)
R^2	0.2636	0.4160

5.2. Syndicates Pricing Accuracy

5.2.1. Price revisions

The outputs from the probit models (3) and (4) used to test the likelihood of positive and negative offer price revisions in response to the information uncovered given certain syndicate characteristics and the OLS regressions (5) used to test if syndicate structure affects the size of the price revisions in response to information uncovered are shown in Table 3.

Panel A presents the output from the probit models (3) for positive price revisions, while Panel B presents the output for probit models (4) concerning negative price revisions.

In Panel A the first probit regression includes as independent variables only the log of expected proceeds, aftermarket standard deviation and total return variables. The results meet the expectations, with the dummy for a return above 10% being positive and significant. Also, the dummy for a negative return has a negative coefficient and is highly significant. Just as in Corwin and Schultz (2005), if the total return from the filing price is large and positive the offer price is likely to be revised upward, and if the total return is negative, an upward correction of the price is less likely.

The following probit regression includes separate interaction terms for syndicate size measures. Unlike the results found by the authors, in our study there is no evidence suggesting the inclusion of additional syndicate members, namely joint-book runners, increase the probability of upward price revisions. In case any of the syndicate size measures appeared significant it would be concluded that information is more likely to be embodied when there is an additional increase of the respective measure.

Moving to Panel B, when computing the probit models (4), the dummy variable for a total return above 10% turned out to be a quasi-complete separation that perfectly predicts binary response failure. In other words, when there is a return above 10%, the price revision is very rarely negative in our sample. Thus, it indicates that having a return above 10% is a much stronger sign that there will be no negative revision than it is a sign that a positive revision will occur. To overcome the problem concerning the quasi-complete separation predicted by this particular return variable, the models were estimated without it.

Table 3: Offer Price Revisions

Panels A and B present estimates of probit regressions for the likelihood of offer price revisions. Panel C reports OLS regressions with the percentage change from the midpoint of the filling range to the offer price (IPO Total Return). The sample consists of 126 IPOs in the Frankfurt Stock Exchange from 2004 to 2021, excluding units, rights, investment funds, and REITs. Panel A presents a probit regression with the dependent variable equal to 1 if the offer price is greater than the midpoint of the filling range and 0 otherwise. In Panel B the dependent variable is a dummy equal to 1 if the offer price is less than the midpoint of the filling range and 0 otherwise. The dummy for a return larger than 10% equals 1 if the return from the midpoint of the filling range to the closing price on the first day of trading is larger than 10%, and 0 otherwise. The dummy for negative return equals 1 if the return from the midpoint of the filling price to the closing price of the first trading day is negative or zero, and 0 otherwise. Expected proceeds are the number of shares offered (excluding greenshoe) multiplied by the midpoint of the filling range. Aftermarket standard deviation is calculated from continuously compounded returns from days 21 to 125 after the IPO. One underwriter is considered prestigious if it has a rank above 8 in the Carter and Manaster (1990)'s rank or is one of the top5 banks in Frankfurt according to Migliorati and Vismara (2014). Heteroskedasticity-consistent Z-statistics are reported in parentheses below the coefficients in Panels A and B and T-statistics are reported in parentheses for the OLS regressions in Panel C. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Probit Regressions with Upward Price Revision Dependent Variable						
Dummy for Return>10%	1.092***	1.094***	1.098***	1.020**	1.091***	1.156***
	(2.63)	(2.61)	(2.61)	(2.42)	(2.61)	(2.72)
Dummy Negative Return	-1.731***	-1.730***	-1.730***	-1.782***	-1.733***	-1.733***
	(-4.75)	(-4.75)	(-4.74)	(-4.98)	(-4.62)	(-4.73)
No. of Leaders		-0.085				
	-	(-0.44)	-	-	-	-
No. of Joint Book Runners	-	-	0.017 (0.14)	-	-	-
Total Participants in the Syndicate	-	-	-	-0.082 (-0.91)	-	-
No. of Prestige Leaders	-	-	-	-	0.008 (0.208)	-
No. Prestige Joint-Book Runners	-	-	-	-	-	0.126 (0.74)
Log (Expected Proceeds)	-0.014	0.127	-0.024	0.106	-0.188	-0.081
	(-0.11)	(0.09)	(-0.17)	(0.49)	(-0.10)	(-0.54)
σ	0.092	0.093	0.096	0.069	0.091	0.115
	(0.62)	(0.63)	(0.65)	(0.46)	(0.146)	(0.77)
Pseudo R^2	0.4758	0.4767	0.4759	0.4812	0.4758	0.4795
Panel B: Probit Regressions with Downward Price Revision Dependent Variable						
Dummy Negative Return	2.346***	2.349***	2.428***	2.525***	2.338***	2.410***
	(7.83)	(7.81)	(7.61)	(7.06)	(7.77)	(7.60)
No. of Leaders		-0.051				
	-	(-0.24)	-	-	-	-
No. of Joint Book Runners	-	-	0.247* (1.93)	-	-	-
Total Participants in the Syndicate	-	-	-	0.229** (2.28)	-	-
No. of Prestige Leaders	-	-	-	-	0.081 (0.35)	-
No. Prestige Joint-Book Runners	-	-	-	-	-	0.289* (1.72)
Log (Expected Proceeds)	-0.939	-0.780	-0.224*	-0.437**	-0.138	-0.232*
	(-0.84)	(-0.58)	(-1.67)	(-2.20)	(-0.80)	(-1.68)
σ	-0.392***	-0.388***	-0.351**	-0.390***	-0.407***	-0.356**
	(-2.63)	(-2.66)	(-2.27)	(-2.62)	(-2.87)	(-2.29)
Intercept	1.578	1.354	3.663	6.984**	2.360	3.868
	(0.70)	(0.55)	(1.41)	(2.02)	(0.75)	(1.44)
Pseudo R^2	0.4767	0.4770	0.4993	0.5191	0.4776	0.4971

Panel C: Percentage Price Update Regressions						
Dummy for Return>10%	0.037*** (2.90)	0.037*** (2.88)	0.035*** (2.67)	0.034** (2.48)	0.037*** (2.88)	0.035*** (2.69)
Dummy Negative Return	-0.098*** (-7.29)	-0.098*** (-7.29)	-0.099*** (-7.31)	-0.099*** (-7.26)	-0.098*** (-7.25)	-0.098*** (-7.26)
No. of Leaders	-	0.001 (0.22)	-	-	-	-
No. of Joint Book Runners	-	-	-0.06* (-1.68)	-	-	-
Total Participants in the Syndicate	-	-	-	-0.004 (-1.48)	-	-
No. of Prestige Leaders	-	-	-	-	0.001 (-0.22)	-
No. Prestige Joint-Book Runners	-	-	-	-		-0.004 (-0.86)
Log (Expected Proceeds)	0.002 (0.61)	0.002 (0.44)	0.006 (1.24)	0.008 (1.36)	0.002 (0.34)	0.004 (0.90)
σ	0.004 (0.421)	0.004 (0.80)	0.003 (0.52)	0.003 (0.67)	0.004 (0.77)	0.003 (0.66)
Intercept	-0.031 (-0.38)	-0.025 (-0.29)	-0.083 (-0.92)	-0.121 (-1.12)	-0.024 (-0.22)	-0.061 (-0.67)
R^2	0.5675	0.5677	0.5749	0.5749	0.5676	0.5696

Overall, the results for panel B are in line with those from Panel A, but similarly to Corwin and Schultz (2005), the results from Panel B are stronger and more consistent than those found in Panel A. The dummy for a return equal or below zero is positive and very significant, suggesting prices are more likely to be revised downwards when the return is negative.

Interestingly, the coefficient on total participants is positive and significant, indicating that when there are more members composing the syndicate, a negative price revision is more likely.

Aftermarket standard deviation revealed to be statistically significant with an unexpected signal. If a company is riskier, one should expect banks to be more prone for downward revisions, the contrary of the results found in these regressions.

Moving to Panel C of Table 3, the regressions study how the size of offer price revisions is affected by the dependent variables, unlike the probit regressions which study the likelihood that a revision occurs. In the first column of Panel C, the regression does not include syndicate size measures. The regression shows that offering prices increase by 3.7 percentage point more when total return is greater than 10% and decline by 9.8 percentage points more when the return is negative or zero. These changes are smaller than the revisions found in U.S. IPOs, (9.1% revision when return greater than 20% and 17.4%

when there is negative returns), one possible explanation is the limitation underwriters have from the filling range. As seen previously underwriters in Europe rarely "jump" to a price outside the filling range.

The coefficients associated to the variables of syndicate size and composition are not statistically significant, which suggest the syndicate size and composition has no effect on the magnitude of offer price revisions, unlike the results found by Corwin and Schultz (2005) that suggest the size of the offer price revisions increase with syndicate size, particularly if more prestigious co-managers (joint-bookrunners) are included.

5.2.2. Underpricing

Table 4 presents the second stage regressions for the 2SLS estimated in models (6) and (7) for the possibility of additional effects in underpricing related to syndicate size, more specifically the number of joint-bookrunners and the number of total participants in the syndicate.

The main conclusions are similar to the results found by Corwin and Schultz (2005) for the U.S. market. There is no sign of additional effects on underpricing once price revisions have been accounted for.

Interestingly, and similarly to their outcome, the price revision variable is still significant with a positive coefficient. One interpretation is that offerings whose price has been positively revised result in greater underpricing.

Corwin and Schultz (2005) interpretation is that the positive coefficient on price adjustment reflect the partial adjustment phenomena mentioned in the literature above.

Table 4: IPO Underpricing and Syndicate Size

Table 4 lists coefficient estimates from 2SLS regressions of the natural log of 1 + underpricing on syndicate characteristics and a set of control variables. The syndicates characteristics to analyze are the number of total participants in the syndicate and the number of joint-bookrunners. The sample includes 126 IPOs from Frankfurt Stock Exchange issued between 2004 and 2021, excluding units, rights, investment funds, and REITs. The first-stage regressions are similar to regressions (1) and (2), adding price revision as an independent variable, measured as the percentage change from the midpoint of the filling range to the offer price and calculate using OLS. The number of joint-bookrunners and total participants used in the second-stage regressions displayed are estimated in the first stage regressions. Expected proceeds are the number of shares offered (excluding greenshoe) multiplied by the midpoint of the filling range. Aftermarket standard deviation is calculated from continuously compounded returns from days 21 through 125 after the IPO. The Prestige Leader Dummy equals 1 if there is at least one leading underwriter with a rank above 8 in the Carter and Manaster (1990)'s rank or is one of the top5 banks in Frankfurt according to Migliorati and Vismara (2014)'s ranking. Dummies are included for the time periods of the sample. The Non-German Dummy equals 1 if the offering company is not German and 0 otherwise. Heteroskedasticity-consistent T-statistics for the first stage regressions and Z-statistics for the second stage regressions are reported in parentheses below the coefficients. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	First Stage	Second Stage	First Stage	Second Stage
	Number of Joint Bookrunners	Log(1+Underpricing)	Number of Total Participants	Log(1+Underpricing)
Log (Expected Proceeds)	0.574***	0.025	1.496***	0.035
	(6.38)	(0.48)	(8.91)	(0.45)
σ	-0.065	0.004	-0.243	0.002
	(-0.80)	(0.45)	(-1.59)	(0.11)
Dummy Prestige Leader	-0.353	0.009	0.267	0.027
	(-1.55)	(0.23)	(0.69)	(1.13)
Total Participants in the Syndicate	-	-	-	-0.020
				(-0.40)
No. of Joint-Bookrunners	-	-0.035	-	-
		(-0.40)		
Price Revision	-0.651	0.344**	-1.908	0.328*
	(-0.63)	(2.27)	(-0.97)	(1.94)
Dummy 2007-2008	-0.069	0.007	0.180	0.014
	(-0.26)	(-0.14)	(0.43)	(0.48)
Dummy 2009-2012	0.443*	-0.007	0.610	-0.010
	(1.73)	(-0.14)	(1.21)	(-0.24)
Dummy 2013-2016	0.780***	0.026	-0.199	-0.006
	(2.98)	(0.32)	(-0.40)	(-0.25)
Dummy 2017-2021	1.130***	0.070	0.044	0.031
	(3.56)	(0.67)	(0.08)	(1.16)
Non-German Dummy	0.267	-	0.463	-
	(1.08)		(0.93)	
Intercept	-10.068***	-0.435	-23.866***	-0.566
	(-6.37)	(-0.47)	(-7.99)	(-0.45)
R^2	0.4926	0.1328	0.6296	0.0785

5.3. Filling Range Limitations and Syndicate Size

The estimation outputs from models (8) and (9) are displayed in Table 5 below. The coefficients for positive and negative revision dummy variables in regressions (8) and (9), respectively, suggest that when a price revision occurs the difference between the expected price (midpoint of the filling range) and the first price recorded on exchange is larger. From another perspective, these results support the findings reached above about the accuracy of price revisions made in the correct direction by syndicates.

Nonetheless, the dummy variables for both positive and negative total revision are simultaneously significant with the positive and negative price revision variables, indicating pricing errors are larger when syndicates adjust the price to the limits of the filling range, backing our initial expectations that price revisions limited by the initial filling range damage pricing accuracy.

Lastly, given the expected limitations on revisions caused by the filling range, it was initially though that oferings with smaller ranges could have higher pricing error.

However, the negative coefficient on width size of the filling range suggests that offerings with smaller relative ranges, keeping everything else constant, present less pricing error. The results support the arguments of Hanley (1993) which were also consired a possible outcome. As Hanley (1993) mentions, when underwriters are unsure of the price of an issue, they are likely to set wider offer ranges to provide greater flexibility in setting the final offer price. Thus, a wider offer range will mean a greater uncertainty about the true value of the issue.

Table 5: Pricing Error and Filling Range Limitations

Table 5 lists coefficient estimates from OLS regressions of mispricing on price revision variables, width range and a set of control variables. The sample includes 126 IPOs from Frankfurt Stock Exchange issued between 2004 and 2021, excluding units, rights, investment funds, and REITs. Total positive revision dummy equals to 1 when the price is revised to the upper boundary of the filling range and zero otherwise. Total negative revision dummy equals to 1 when the revised price equals the downward boundary of the filling range and zero otherwise. Positive revision dummy variable equals to 1 if the offer price is greater than the midpoint the filling range and zero otherwise, negative revision dummy variable equals to 1 if the offer price is less than the midpoint of the filling range and zero otherwise. Width range is measured as the difference between the highest and lowest point of the filling range divided by the midpoint. Expected proceeds are the number of shares offered (excluding greenshoe) multiplied by the midpoint of the filling range. Aftermarket standard deviation is calculated from continuously compounded returns from days 21 through 125 after the IPO. Dummies are included for the time periods of the sample. Heteroskedasticity-consistent T-statistics are reported in parentheses below the coefficients. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Offer Price Error (Mispricing)	
Total Positive Revision	0.151***	-
	(3.70)	
Positive Revision	0.140***	-
	(5.28)	
Total Negative Revision	-	-0.062***
		(-3.99)
Negative Revision	-	-0.175***
		(-7.23)
Width Range %	-0.233*	-0.284***
	(-1.95)	(-3.16)
Dummy 2007-2008	0.006	0.004
	(0.22)	(0.14)
Dummy 2009-2012	0.033	0.018
	(1.48)	(0.80)
Dummy 2013-2016	0.008	-0.007
	(0.36)	(-0.30)
Dummy 2017-2021	0.042	0.018
	(1.44)	(0.51)
Log (Expected Proceeds)	0.012**	0.003
	(2.01)	(0.46)
σ	0.009	0.005
	(1.20)	(0.47)
Intercept	-0.270**	0.125
	(-2.23)	(1.01)
R^2	0.6460	0.5620

Lastly, the filling size itself did not appear to be affected by the total number of participants in the syndicate or the number of joint-bookrunners, as demonstrated by the output from models (10) and (11) displayed in Table 6. Thus, no evidence was found suggesting larger or syndicates with more joint-bookrunners produce smaller filling ranges, demonstrating less price uncertainty.

Table 6: Filling Range Size and Syndicate Size

Table 6 lists coefficient estimates from OLS regressions of Width Range (Width Size) on syndicate size characteristics and a set of control variables. The sample includes 126 IPOs from Frankfurt Stock Exchange issued between 2004 and 2021, excluding units, rights, investment funds, and REITs. Width range is measured as the difference between the highest and lowest point of the filling range divided by the midpoint. The syndicate size characteristics are the total number of participants in the syndicate and the total number of joint-bookrunners. Expected proceeds are the number of shares offered (excluding greenshoe) multiplied by the midpoint of the filling range. Aftermarket standard deviation is calculated from continuously compounded returns from days 21 through 125 after the IPO. The Prestige Leader Dummy equals 1 if there is at least one leading underwriter with a rank above 8 in the Carter and Manaster (1990)'s rank or is one of the top5 banks in Frankfurt according to Migliorati and Vismara (2014)'s ranking. Dummies are included for the time periods of the sample. Heteroskedasticity-consistent T-statistics are reported in parentheses below the coefficients. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Width Range %	
Total Participants in the Syndicate	0.000 (0.10)	-
No of Joint-Bookrunners	-	-0.001 (-0.24)
Log (Expected Proceeds)	-0.023** (-2.23)	-0.022** (-2.48)
σ	-0.006 (0.465)	-0.006 (-0.77)
Dummy Prestige Leader	0.083*** (4.35)	0.083*** (4.23)
Non-German Dummy	0.048*** (2.68)	0.049*** (2.64)
Dummy 2007-2008	0.028 (1.48)	0.028 (1.49)
Dummy 2009-2012	0.067** (2.51)	0.068** (2.56)
Dummy 2013-2016	0.022 (1.06)	0.023 (1.09)
Dummy 2017-2021	0.047*** (3.18)	0.049*** (3.13)
Intercept	0.560*** (3.02)	0.541*** (3.24)
R^2	0.2409	0.2410

Furthermore, the dummy for the inclusion of a prestige leader in the syndicate is statistically significant and has a positive sign, suggesting that filling ranges are 8% larger for issues whose syndicate has a high reputation bank. The control dummy for non-German issues suggests syndicates might be less certain of the true price, which can be explained by the presence of several Asian issues in the sample that are usually conducted by firms seeking to escape from the typical severe underpricing of Chinese IPOs, being unknown and harder to price (Hanley, 1993). Thus, by placing a larger filling range, banks can do larger future revisions. Despite the very low impact of offering size on the width range, the output suggests a positive relation between offering size filling range width, contradicting Benveniste and Spindt (1989)'s findings.

Lastly, the evidence suggests the periods of 2009-2012 and 2017-2021, which are the ones with larger average width ranges, are relevant and have impact on width range. Both these periods comprise economic shocks, namely the 2008 recession and the Covid-19 pandemic in 2020, which exacerbate the uncertainty in financial markets.

6. Conclusion

The purpose of dissertation was to study European IPOs, assessing the changes in its syndicates size, pricing accuracy and filling range limitations. For that purpose, a sample of 126 IPOs taking place in the Frankfurt Stock Exchange between 2004 and 2011 was used.

The results demonstrate both the number of total participants in the syndicate and the number of joint-bookrunners is highly dependent on the size of the offer, consistent with Corwin and Schultz (2003). However, only the number of joint-bookrunners appeared to be affected by the time controls, demonstrating a steady increase throughout time.

The results suggest that a higher number of participants is more likely if the syndicate has a highly reputable leader as suggested by Chowdhry and Nanda (1996).

Evidence found also indicates that syndicates do indeed revise the price correctly according to information uncovered, but, unlike Corwin and Schultz (2003), no evidence was found suggesting positive price revisions are more likely for syndicates with higher number of joint-bookrunners. Regarding the likelihood of negative price revisions, these seem to be more likely when syndicates are larger and less likely for riskier firms. Finally, no evidence was found suggesting larger or smaller revisions for different syndicate sizes. However, it was found a significantly smaller price revision in our sample in both the presence of positive (3,7%) and negative (-9,8%) information when compared to U.S. price revisions where Corwin and Schultz (2005) found revisions of 9,1% and -17,4%, for positive and negative information, respectively.

Regarding underpricing, once price revisions have been accounted for, no evidence was found suggesting larger or syndicates with more joint-bookrunners achieve better pricing. Interestingly, and in line with Corwin and Schultz (2003), even though price revisions were accounted for in the first stage regressions of our 2SLS models, they remained significant in the second stage regressions. Corwin and Schultz (2003) interpretations are that these results reflect the partial adjustment phenomena (Bradley & Jordan, 2002; Hanley, 1993; Loughran & Ritter, 2002). This interpretation is particularly interesting considering the price revisions limiations observed in this market.

In sum, the results support the hypothesis that only larger syndicates are more likely to revise the price downards.

Lastly, the output from our models suggest mispricing increases when prices are

revised to the limits of the filling range.

Larger filling range sizes also indicate higher mispricing, which goes along with the claims of Hanley (1993), which states larger filling ranges are an indication of price uncertainty by syndicates. According to our study, the filling range size itself is not associated with syndicate size.

In order to increase the relevance of the results, in future studies a larger sample, preferably including other European markets should be used. Moreover, the impacts of syndicate size and composition could be applied to other imporant roles syndicates have, namely analyst coverage and market making.

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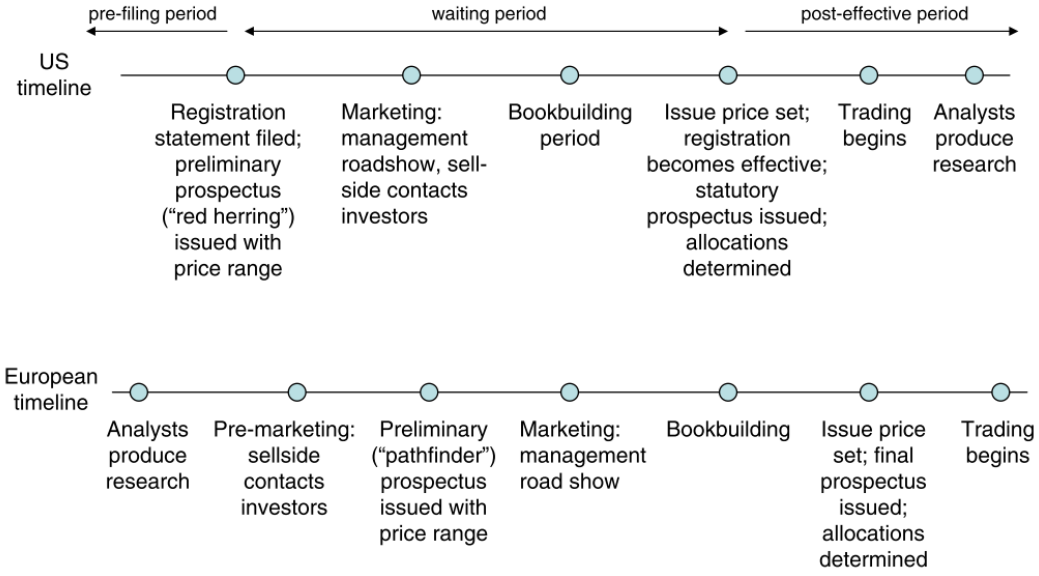
Appendices

Appendix 1: U.S. and European Bookbuilding Process Timeline by Jenkinson et al. (2006)



Appendix 2: Appendix B: Number of IPOs per year

Number of IPOS per year

Year	No. IPOs
2004	1
2005	13
2006	24
2007	16
2008	2
2009	1
2010	4
2011	8
2012	7
2013	3
2014	5
2015	12
2016	4
2017	7
2018	13
2019	1
2020	4
2021	1

Appendix 3: Prestigious Banks

Prestigious Banks from the sample. Banks are considered prestigious if they have a Carter & Manaster rank above 8 or are one of the top five banks in Frankfurt according to Migliorati and Vismara (*). Only Deutsche Bank meets both criteria (**).

Prestigious Banks
Bank of America Merrill Lynch
Barclays
BNP Paribas
BofA Securities
China Internat. Capital co.
Citicorp Securities Inc
Citigroup
Commerzbank*
Crédit Agricole
Credit Suisse
Deutsche Bank**
Goldman Sachs
HSBC
Jefferies
JPMorgan Chase
KKR Capital
Landesbanken*
Morgan Stanley
Oddo & Cie*
RBC CM
Santander
Société Générale*
UBS
Wells Fargo