

Underwriting Syndicate Structure and the Bookbuilding Pricing Mechanism: Evidence from IPOs in France, Germany, Italy, and the UK

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Abstract

In this thesis, I study the impact of underwriting syndicate structure on the bookbuilding pricing mechanism based on a sample of 1,013 IPOs in France, Germany, Italy, and the UK between 1995 and 2010. More specifically, I examine whether the numbers of bookrunners and co-managers in underwriting syndicates are positively related to both the capability of bookbuilding to produce information about investor demand and the bargaining power of issuers to negotiate on higher filing price revisions. Empirical evidence indicates that, if the filing price underestimates the market valuation of an issuer's shares, underwriting syndicates with a higher number of co-managers possess a greater capability to identify this type of mispricing and produce a marginally greater amount of information about the excess investor demand. Regression results also indicate that underwriting syndicates with a higher number of bookrunners are associated with greater accuracy of recognising whether IPOs are overpriced at the start of the bookbuilding phase. Regression analysis fails to provide consistent evidence which would suggest that the inclusion of additional underwriters in underwriting syndicates is associated with superior bargaining power of issuers. I conjecture that the mixed evidence about the impact of underwriting syndicate structure on the bookbuilding pricing mechanism is likely a result of the exchange of information between underwriters and investors that takes place in the pre-marketing phase of the European IPO process, and the availability of information about investor demand on when-issued markets.

Keywords: Initial public offering, Underwriting syndicate, Bookbuilding, Information production, Bargaining power

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1 Introduction

The most commonly used mechanism for pricing and allocating IPO shares in the U.S. and, increasingly, Europe is bookbuilding (Ljungqvist et al, 2003). The most important feature of bookbuilding is related to the central role that underwriters play in producing information about investor demand for IPO shares. In a typical bookbuilt IPO, the underwriters first advise the issuer on an initial filing price range, which they then submit as part of the preliminary prospectus. Next, in the so-called bookbuilding phase, the underwriters promote the IPO to institutional investors during a road show and build an order book from non-binding indications of interest which they collect from the investors. Finally, they use the information contained in the order book to advise the issuer on the final offer price and the allocation of shares (Benveniste and Spindt, 1989).

The various economic implications of the bookbuilding pricing mechanism have been studied extensively. However, the IPO literature has so far devoted little attention to analysing how the effectiveness of bookbuilding to result in more accurate final offer prices is affected when an IPO is handled by more than one underwriter, which is a common feature of the way IPOs have been conducted in the last few decades (Hu and Ritter, 2007; Ljungqvist et al, 2009; Lowry et al, 2017).

The bargaining power hypothesis proposed by Hu and Ritter (2007) argues that, in IPOs managed by multiple bookrunners (i.e., underwriters that are in charge of coordinating the majority of IPO processes), issuers should be able to negotiate on both higher initial filing price ranges and final offer prices compared to IPOs led by a single bookrunner. This is because, in IPOs with multiple bookrunners, bookrunners should fear incurring costs associated with exerting a low level of effort which, in turn, should incentivise them to compete with other bookrunners of the underwriting syndicate. Hu and Ritter (2007) analyse U.S. IPOs in 2001-2005 and find that the number of bookrunners in an underwriting syndicate is negatively related to both IPO underpricing and the percentage difference between the filing price (i.e., the midpoint of the initial filing price range) and the first trading day closing price. Despite low statistical significance of regression coefficients, Hu and Ritter (2007) consider these findings to be in line with their bargaining power hypothesis.

Corwin and Schultz (2005) posit the information production hypothesis which argues that, by hiring a higher number of co-managers (i.e., underwriters that are primarily tasked with providing research coverage), issuers should gain access to

information on the demand of a broader network of investors. This, in turn, should allow the underwriting syndicate to discover more information indicating if an IPO is mispriced at the start of the bookbuilding phase and, as a result, how much the filing price must be revised. In their study of U.S. IPOs in 1997-2002, Corwin and Schultz (2005) find supportive evidence to their hypothesis. More specifically, they observe that the number of co-managers is positively related to both the likelihood and magnitude of filing price revisions if the market valuation of an issuer's shares is at least 20 percent higher than the valuation implied by the filing price.

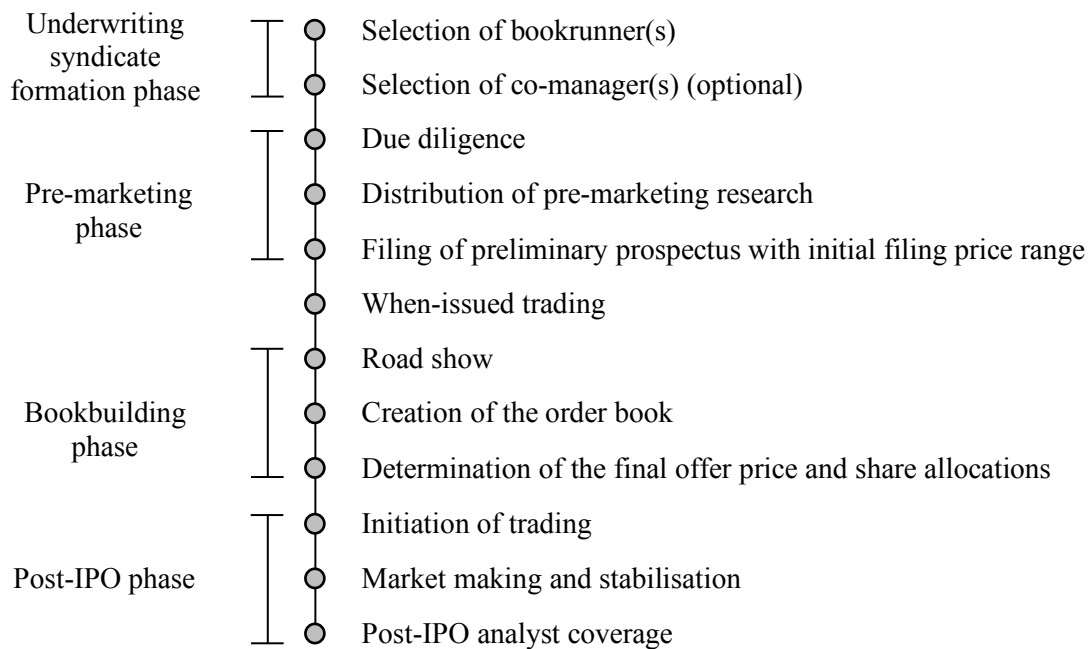
In this thesis, I examine whether the bargaining power hypothesis of Hu and Ritter (2007) and information production hypothesis of Corwin and Schultz (2005) hold in the context of IPOs in France, Germany, Italy, and the UK between 1995 and 2010. This thesis has potential to contribute to IPO literature in two ways. First, it attempts to expand the scarce body of research on the impact of underwriting syndicate structure on the bookbuilding pricing mechanism by focusing on four European IPO markets in the context of which, to my knowledge, the predictions of Hu and Ritter (2007) and Corwin and Schultz (2005) have not been tested. In addition to that, this thesis has potential to add to the understanding of the implications of one major difference between the European and U.S. IPO processes, namely, that in Europe, underwriters produce information about investor demand in two distinct stages.

This thesis is structured as follows. Section 2 provides an overview of the process in which bookbuilt IPOs are carried out in Europe. Section 3 explains the theoretical framework used to formulate the hypotheses studied in this thesis. Section 4 outlines the methodology used to empirically test the hypotheses. Section 5 describes the sources of data and the steps involved in the creation of the final sample. Section 6 reports the evidence obtained from the empirical analysis. Section 7 summarises and discusses the empirical evidence. Section 8 presents the conclusion.

2 IPO process in Europe

Figure 1 summarises the process of carrying out a bookbuilt IPO in Europe. This process consists of four major phases: the underwriting syndicate formation phase, the pre-marketing phase, the bookbuilding phase, and the post-IPO phase. The next few subsections will describe the individual steps that constitute these phases, as well as explain when-issued trading, which is an activity that occurs without the involvement of issuers and their underwriters.

Figure 1: IPO process in Europe



2.1 Underwriting syndicate formation phase

The IPO begins with the selection of the underwriters, who carry out the IPO and sell shares to investors on behalf of the issuing firm. Although the issuer may directly approach investment and universal banks with proposals of becoming their underwriters, the typical way in which an issuer hires underwriters is by organising a so-called beauty contest.

In a beauty contest, the issuer invites several candidate underwriters to pitch their proposed IPO strategies, potential IPO valuation ranges, and competitive advantages over other candidates (Krigman et al, 2001; Jenkinson and Jones, 2009a). Based on the information presented in the pitches, as well as several other factors, the issuer decides which candidate should receive the mandate of the bookrunner, i.e. the lead underwriter that is in charge of the entire IPO process and – something that is central to bookbuilt IPOs – constructing the order book. In a survey of executives at U.S. companies, Krigman et al (2001) find that the five most important factors for appointing an underwriter to the role of the bookrunner are related to the underwriter's overall reputation, analyst coverage capabilities, industry expertise, institutional investor client network, and proposed pricing of IPO shares. In interviews with executives at companies that listed shares in the Netherlands, van den Assem et al (2017) also find underwriter reputation and industry expertise to be important when choosing the bookrunner. However, they also find that, to issuers in Dutch IPOs, the

most important factor in appointing the bookrunner is related to issuers' prior or concurrent relationships with underwriters, whereas quality of analyst coverage and proposed IPO pricing are viewed as being significantly less important. Although this thesis does not consider IPOs in the Netherlands, it may be that the decision-making process of issuers listing shares in France, Germany, Italy, and the UK is more similar in this respect to that of Dutch issuers than issuers in the U.S.

In the last few decades, and particularly after the Internet bubble of 1999-2000, it has become increasingly common for IPOs to be managed by more than one bookrunner (Hu and Ritter, 2007; Lowry et al, 2017). Hu and Ritter (2007) argue that the observed trend of a rising average number of bookrunners managing IPOs after the Internet bubble may be a result of issuers starting to place less emphasis on hiring bookrunners with all-star analyst coverage. Hu and Ritter (2007) conjecture that banks with prestigious analysts demand a large portion of the gross spread to carry out an IPO as a bookrunner. This, in turn, prevents other banks from joining the underwriting syndicate as joint bookrunners, as the remainder of the gross spread is not sufficiently enticing for them to accept the proposal of sharing bookrunner responsibilities. Hu and Ritter (2007) hypothesise that, as the number of high risk companies going public after the Internet bubble decreased, having all-star analyst coverage became less important to issuers. This, in turn, made issuers more frequently consider hiring multiple bookrunners rather than a single bookrunner with all-star analyst coverage to manage their IPOs. Another explanation for the rising average number of bookrunners managing IPOs that is also based on the argument that IPO compensation imposes a limit on the number of bookrunners in an underwriting syndicate is related to the growing proportion of large IPOs after the Internet bubble. This is because, as Hu and Ritter (2007) find, large IPOs are more likely to be managed by multiple bookrunners, as the fees associated with the gross proceeds of such IPOs are high enough for it to be profitable for banks to accept joint bookrunner mandates.

Another hypothesis put forward by Hu and Ritter (2007) is that, after the Internet bubble, due to low activity on IPO markets, banks became more willing to accept joint bookrunner mandates, as it allowed them to at least partially solve the problem of excess working capacity. It is also possible that having to share bookrunner responsibilities became increasingly unavoidable because specialised investment banks, who traditionally captured the majority of the IPO underwriting business, suddenly had to compete for the dwindling number of bookrunner mandates with

universal banks due to the repeal of the Glass-Steagall Act in 1999 (Hu and Ritter, 2007; Lee, 2008; Vithanage et al, 2016a). Finally, the growing trend of hiring multiple bookrunners may also be related to the rising proportion of venture-capital- and private-equity-backed IPOs. Hu and Ritter (2007) suggest that, because private equity and venture capital firms have strong relationships with their preferred banks, and because there are typically multiple financial sponsors in buyout-backed IPOs, such IPOs are more likely to be managed by multiple bookrunners, as all financial sponsors strive to reward their relationship banks with joint bookrunner mandates.

Nevertheless, the hypotheses presented above do not explain why issuers would want to hire multiple bookrunners in the first place. One way of explaining this is to focus on the potential advantages of having multiple bookrunners in an underwriting syndicate. The theoretical benefits to issuers that have been identified in the IPO literature are mostly related to the superior information production and agency conflict reduction capability of underwriting syndicates with multiple bookrunners. Examining whether issuers in France, Germany, Italy, and the UK also reap these benefits is the central objective of this thesis. However, the argumentation that is used to establish the potential relationship between the number of bookrunners and the capability of an underwriting syndicate to produce information or mitigate agency problems will be presented further in the theoretical framework section, after a detailed description of how the bookbuilding pricing mechanism works in practice, how it facilitates information production, and how it may suffer from an agency problem.

In consultation with the bookrunners, the issuer may also appoint one or several other banks to the role of co-managing underwriters or, in other words, co-managers. While bookrunners are responsible for coordinating all steps of the IPO process, the tasks that co-managers are charged with are generally limited to producing and distributing research analyst reports. Although co-managers may allocate a certain portion of shares to their investors and assist in market making activities, their overall influence on these processes is overshadowed by that of the bookrunners (Loughran and Ritter, 2004; Corwin and Schultz, 2005). As a result, co-managers also tend to receive substantially lower fees than bookrunners. In a typical bookbuilt IPO, the gross spread is divided in a 1:1:3 split into three portions: the management fee, the underwriting fee, and the selling concession (Chen and Ritter, 2000; Torstila, 2001). The majority of the management fee is claimed by the bookrunners because of their dominant role in coordinating the entire IPO process. The underwriting fee is divided

between all underwriters based on the number of shares they have underwritten. The selling concession is split between all underwriters based on the number of shares they allocate to investors. Typically, the bookrunners are credited with allocating the majority of IPO shares, so they also receive the majority of the selling concession (Corwin and Schultz, 2005).

The observation that co-management appointments are rarely associated with high fees raises the question as to why banks would want to accept co-manager roles. Ljungqvist et al (2009) report that banks view co-manager mandates as an opportunity to establish relationships with issuers and, in turn, acquire an advantage in competing for bookrunner mandates in issuers' future equity and debt offerings. Such strategic behaviour on the part of co-managers may explain why bookrunners also strive to limit the number of co-managers in underwriting syndicates. Corwin and Schultz (2005) quote one investment banker saying that "if we're the lead (bookrunner), the best number of co-managers is zero," and suggest that, by negotiating on the minimum portion of the gross spread they would require to carry out IPOs as bookrunners, banks also attempt to influence the inclusion of co-managers in underwriting syndicates.

2.2 Pre-marketing phase

Once the underwriting syndicate is formed, the bookrunners are tasked with creating the preliminary prospectus. The preliminary prospectus is a draft version of the final prospectus and is submitted as part of the initial request for the listing of shares on the stock exchange targeted by the issuer. To submit the preliminary prospectus, the underwriters must ensure that it complies with requirements for the quality and type of information that must be disclosed in prospectuses. Since July 1, 2005, all issuers willing to offer IPO shares to the public on a regulated stock market in the European Union must conform to the EU Prospectus Directive, which essentially harmonised prospectus disclosure standards across all EU member states (Directive 2003/71/EC, 2003). Prior to the Prospectus Directive coming into force, however, issuers had to comply with prospectus regulations of their respective target stock exchanges. To ensure compliance with the Prospectus Directive or the requirements that preceded it in the case of IPOs before July 1, 2005, the underwriters carry out the process of due diligence. As part of due diligence, the underwriters collect and verify all financial, commercial, and legal information about the issuer that is relevant for the creation of the preliminary prospectus (Gajewski and Gresse, 2006). In Europe, however, efforts

exerted in conducting due diligence also help towards producing pre-marketing research, which is necessary for the next step of the pre-marketing phase.

As soon as due diligence ends, research analysts associated with the members of the underwriting syndicate produce and distribute research reports with the intention of ‘warming up’ institutional investors to the idea of participating in the IPO (Jenkinson and Jones, 2004). In the U.S., analysts are prohibited from commenting on IPO valuations or otherwise producing and distributing research until the expiration of the so-called quiet period, which typically lasts until 40 days after an IPO. Prior to the expiration of the quiet period, underwriters in U.S. IPOs may only distribute pink herrings, in which they may only disclose an announcement of an issuer’s intention to raise equity through an IPO and basic facts about the issuer (Jenkinson et al, 2006). Pre-marketing analyst research in Europe, on the other hand, often includes such information as indicative IPO valuation ranges. Furthermore, underwriters in European IPOs frequently invite investors to provide feedback on these indicative valuation ranges or otherwise express their level of interest in the IPOs.

The pre-marketing phase of the European IPOs process involves the participation of all underwriting syndicate members. Research analysts of any co-manager may produce pre-marketing research, but they may only distribute it after receiving approval from the bookrunners, who are responsible for ensuring consistency across all research reports. After distributing pre-marketing research, the members of the underwriting syndicate solicit feedback from their clients and communicate it to the bookrunners, who then consult this information when setting the initial filing price range (Jenkinson et al, 2006).

Once sufficient information about the potential valuation of the issuer’s shares is discovered and the filing price is set, the bookrunners produce the preliminary prospectus and submit it to the listing authority of the target stock exchange. As soon as the listing authority approves the preliminary prospectus, the underwriters distribute it to potential institutional investors (Ellis et al, 2000). Then, two things happen in European bookbuilt IPOs: first, investors begin trading in so-called when-issued markets; and second, the underwriters proceed with initiating the bookbuilding phase.

2.3 When-issued trading

As soon as the initial filing price range is submitted, brokers unrelated to the underwriting syndicate establish an over-the-counter when-issued market, in which

investors trade in forward contracts related to the issuer's shares prior to their official listing on the target stock exchange (Aussenegg et al, 2006). U.S. securities regulation essentially forbids when-issued trading of IPO shares whereas, for example, virtually all IPOs in Germany in 1999-2004 and slightly less than half of IPOs in Italy in 1995-2002 had active when-issued markets (Aussenegg et al, 2006; Cornelli et al, 2006). When-issued trading in the issuer's shares continues until the first day of their trading on the target stock exchange. Therefore, when setting final offer prices, underwriters in European IPOs can also take advantage of the relatively inexpensive information that can be obtained from when-issued market quotes, which are reported on brokers' webpages and trading platforms (Aussenegg et al, 2006).

2.4 Bookbuilding phase

The bookbuilding phase begins with the road show, in which the management team of the issuer and the underwriters invite institutional investors to attend formal presentations about the IPO and schedule one-on-one meetings with the issuer's executive team.

At this stage of the European IPO process, the investors have already had the chance to assess the IPO based on pre-marketing research and the preliminary prospectus, and they may have already been in contact with the underwriters to disclose their level of interest in IPO shares, which suggests that, overall, road shows could be less valuable to investors in IPOs in Europe than in the U.S. Nevertheless, in a survey of institutional investors, Jenkinson and Jones (2009b) find that, despite having access to pre-marketing information, investors in European IPOs still find attendance of road shows important for deciding on whether to purchase an issuer's shares. The results of the survey show that investors particularly value discussions that take place during the road shows, as these discussions allow the investors to form a more informed opinion about the valuations of the IPOs and acquire 'soft' information about the level of other investors' interest in the offerings. In addition to that, survey results indicate that investors highly appraise the opportunity to assess the quality of issuers' management during meetings with issuers' executives. Finally, Jenkinson and Jones (2009b) also show that investors view attendance of road shows as an opportunity to influence share allocations.

During the road show, the underwriters collect legally non-binding indications of interest from the investors. These indications come in the form of strike, limit, or

step bids, in which the investors express how many shares and (or) at what price they would be willing to acquire them. Investors in European IPOs are free to decide which underwriter to submit their bids to, whereas in the U.S. all bids are submitted to the bookrunners (Jenkinson and Jones, 2004). All bids are then used to construct an order book, which is a process otherwise known as ‘building the book’ and is also where the term ‘bookbuilding’ originates from. Based on the order book, the underwriters construct a demand curve for IPO shares, which allows them to make a more informed decision as to which final offer price to set for the IPO (Cornelli and Goldreich, 2001). In addition to that, the bookrunners also use the order book to advise the issuer on the allocation of shares. One central feature of the bookbuilding pricing mechanism, the implications of which will be discussed further in the theoretical framework section, is that in bookbuilt IPOs bookrunners generally have full discretion in deciding on who receives shares and how to ration allocations relative to submitted bids.

Once the issuer and the bookrunners agree on the final offer price and the allocation of shares, they create the final prospectus and submit it to the listing authority of the target stock exchange. As soon as the listing authority approves the final prospectus and gives permission to proceed with listing shares, the underwriters distribute shares to the investors, and soon after that the shares open for trade on the secondary market.

2.5 Post-IPO phase

As soon as secondary market trading in IPO shares begins, the underwriters assume the role of market makers. As market makers, the underwriters post firm bid and ask quotes and actively serve as counterparties to investors trading in shares in order to foster liquidity in the secondary market (Ellis et al, 2000). In the event of downward price pressure, the underwriters may also attempt to stabilise the share price. There are two ways in which underwriters perform aftermarket stabilisation. First, they may commit to posting stabilising bids and purchase shares in the secondary market at or below the final offer price, effectively creating a price floor below which shares would not be traded (Aggarwal, 2000); and second, they may use the overallotment option, which is otherwise referred to as the green shoe (Ellis et al, 2000).

After the IPO, the underwriters also begin issuing post-IPO analyst recommendations and research reports with views on the issuer’s valuation and financial estimates. Because research analysts in European IPOs are not subjected to

the same quiet periods that are imposed on analysts in U.S. IPOs, post-IPO analyst coverage in European IPOs typically begins as soon as the shares are listed on the target stock exchanges (Ritter, 2003).

3 Theoretical framework

In this section, I will first introduce the empirical theories that are critical for understanding how bookbuilding facilitates information production, and how syndicated underwriting may affect this function of the bookbuilding pricing mechanism. Then, I will explain how the bookbuilding pricing mechanism IPOs may suffer from an agency conflict, and how underwriting syndicate structure can address it. While discussing the potential impact of underwriting syndicate structure on the bookbuilding pricing mechanism, I will also formulate the hypotheses I intend to study in this thesis.

3.1 Information production in the bookbuilding phase

3.1.1 Information production: the overall framework

In IPOs, underwriters are tasked with pricing securities that have never been publicly traded. Although underwriters have access to a wide range of techniques for calculating the intrinsic value of IPO shares, historically, IPOs in both the U.S. and Europe have, on average, been underpriced (Loughran et al, 1994). One explanation proposed in the IPO literature for the observation that underwriters leave money on the table is that IPO pricing also requires accurate estimation of investor demand. Benveniste and Spindt (1989) show that the central objective of the bookbuilding phase – collection of non-binding indications of interest from investors during the roadshow – serves exactly that purpose.

At first glance, the obvious obstacle which may prevent underwriters from obtaining informative indications of interest is that investors have few incentives to disclose their positive assessment of an issuer's shares. This is because, by not disclosing this information to the underwriters, the investors may afterwards profit from selling the potentially more underpriced shares in the secondary market. However, as Benveniste and Spindt (1989) propose, the bookbuilding pricing mechanism mitigates this problem by also granting the bookrunners full discretion over the allocation of shares. Since the investors are aware that the bookrunners control share allocations, the investors and bookrunners form an implicit bond in which the investors understand that,

if they disclose favourable private information, the underwriters will compensate them for the theoretical profit they would lose out on with a higher portion of shares than other investors. On the other hand, the investors also know that, if they bid uninformatively for issues they evaluate favourably, the underwriters will punish them with smaller share allocations. Therefore, as Benveniste and Spindt (1989) show, by incentivising investors with more favourable share allocations to truthfully disclose information, underwriters in bookbuilt IPOs can produce information about investor demand and set more accurate final offer prices, thereby reducing underpricing.

3.1.2 Information production and underwriting syndicate structure

So how can the structure of an underwriting syndicate or, more specifically, the numbers of bookrunners and co-managers in an underwriting syndicate affect the information production function of the bookbuilding phase? Corwin and Schultz (2005) hypothesise that, due to co-managers having investor clienteles that complement those of bookrunners, having a higher number of co-managers in an underwriting syndicate should provide an issuer with access to a broader and more diversified network of information channels. Therefore, by surveying the interest of a broader network of investors during the bookbuilding phase, an underwriting syndicate with a higher number of co-managers should be in a more advantageous position to discover more information about investor demand and make a more informed decision as to which final offer price they should set.

Corwin and Schultz (2005) study U.S. IPOs in 1997-2002 and find supporting evidence for their hypothesis that underwriting syndicates with a higher number of co-managers should be associated with superior information production during the bookbuilding phase. More specifically, they report that the number of co-managers is positively related to the magnitude of filing price revisions if the market valuation of an issuer's shares is at least 20 percent higher than the valuation implied by the filing price. More importantly, however, Corwin and Schultz (2005) also find that underwriting syndicates with a higher number of co-managers are more efficient at recognising whether IPOs are under- or overpriced at the start of the bookbuilding phase and, in turn, identifying whether final offer prices should be set above or below the filing prices. Finally, Corwin and Schultz (2005) also observe that, by revising filing prices more accurately, underwriting syndicates with a higher number of co-managers are able to reduce underpricing more effectively.

Considering the findings of Corwin and Schultz (2005), direct application of the information production hypothesis in the context of IPOs that took place between 1995 and 2010 in France, Germany, Italy, and the UK produces the following hypotheses:

Hypothesis 1A: The number of co-managers in underwriting syndicates should be positively related to the amount of information discovered during the bookbuilding phase, as reflected by the absolute magnitude of filing price revisions.

Hypothesis 2A: The number of co-managers in underwriting syndicates should be positively related to the likelihood that underwriters correctly identify whether an IPO is under- or overpriced at its filing price.

Apart from the study of Corwin and Schultz (2005), the hypothesis about the link between the number of co-managers and the information production function of the bookbuilding phase has been given limited attention in the IPO literature. Moreover, the evidence regarding this hypothesis has been mixed. With respect to studies about the relationship between the number of co-managers and filing price revisions, only Popescu and Xu (2011) find underwriting syndicates composed of a high number of co-managers to be associated with, on average, higher filing price revisions than underwriting syndicates with a low number of co-managers. Jeon and Lee (2015) are unable to find a statistically significant relationship between the number of co-managers and the magnitude of filing price revisions. Finally, Jeon et al (2015) and Vithanage et al (2016a) report that the number of co-managers may actually be negatively related to the magnitude of filing price revisions.

With respect to studies on the impact of the number of co-managers on underpricing, the only findings that are consistent with the information production hypothesis of Corwin and Schultz (2005) are those of Aggarwal et al (2002). Jeon et al (2015) and Vithanage et al (2016b) are unable to find a statistically significant relationship between the number of co-managers and underpricing. Finally, after taking into consideration the negative effect of the number of co-managers on filing price revisions, Vithanage et al (2016a) do not find the hiring of additional co-managers to be associated with any further changes in underpricing.

All studies presented in this subsection focus on IPOs in the U.S. To my knowledge, there have been no studies that would examine the validity of the

information production hypothesis proposed by Corwin and Schultz (2005) in the context of IPOs in France, Germany, Italy, and the UK.

One final remark that must be made regarding the information production hypothesis of Corwin and Schultz (2005) is that, although this hypothesis only focuses on predicting the effect of employing a higher number of co-managers on the information production function of bookbuilding, it seems plausible to conjecture that the inclusion of additional bookrunners in underwriting syndicates could have a similar effect. More specifically, having a higher number of bookrunners in underwriting syndicates could also be associated with broader and more diversified investor clienteles and, as a result, a superior capability to discover more information during the bookbuilding phase. Based on this argumentation, I also formulate the following hypotheses in the context of IPOs that took place between 1995 and 2010 in France, Germany, Italy, and the UK:

Hypothesis 1B: The number of bookrunners in underwriting syndicates should be positively related to the amount of information discovered during the bookbuilding phase, as reflected by the absolute magnitude of filing price revisions.

Hypothesis 2B: The number of bookrunners in underwriting syndicates should be positively related to the likelihood that underwriters correctly identify whether an IPO is under- or overpriced at its filing price.

3.1.3 Partial adjustment of filing prices

Despite the proposed capability of the bookbuilding pricing mechanism to produce information about investor demand, Hanley (1993) finds that underwriters only partially revise filing prices in response to information about investor demand discovered during the bookbuilding phase. Moreover, it appears that underwriters prefer to reward cooperative investors with smaller portions of shares than if they were to fully revise filing prices and, by extension, completely eliminate underpricing.

The most surprising finding of Hanley (1993), however, is that underpricing is most severe in IPOs with the highest filing price revisions. Hanley (1993) argues that this finding may be in line with the prediction of Benveniste and Spindt (1989) that, if a substantially high percentage of investors indicates that they are willing to pay a much higher price for an issuer's shares, the underwriters will not be able to completely eliminate underpricing. This is because, to fully revise the filing price, the underwriters

would also have to compensate the investors for truthfully disclosing their information. If the total number of shares required to fully compensate the investors for providing positive information exceeds the total number of shares initially offered in the IPO, the underwriters face two options. The first option is to increase the number of offered shares, thereby diluting the ownership stakes of pre-IPO shareholders. The second option is to revise filing prices upwards but still leave IPO shares underpriced, thereby limiting the investors' required compensation. Therefore, the observation that IPOs that are the most mispriced at the start of the bookbuilding phase remain severely underpriced even after underwriters revise filing prices suggests that the dilution of pre-IPO shareholders is the less preferred option for responding to information about abnormally high levels of excess investor demand.

3.2 The agency conflict between issuers and underwriters

3.2.1 The issuer-underwriter agency conflict: the overall framework

The explanation proposed by Hanley (1993) for the partial adjustment phenomenon has found support in the IPO literature. However, there is an alternative, albeit non-mutually exclusive, explanation which conjectures that the inability of the bookbuilding phase to completely eliminate underpricing may be a result of a principal-agent problem.

Baron (1982) argues that there may be information asymmetries between issuers and underwriters. More specifically, Baron (1982) conjectures that underwriters may be more informed about the value of IPO shares and potential investor demand than issuers. From this perspective, issuers hire underwriters to gain access to their superior information. However, because the issuers cannot observe the effort exerted by the underwriters in discovering new information about investor demand, an agency conflict arises, in which the underwriters have an incentive to misreport their information to minimise the distribution and marketing costs required to sell a sufficient number of shares at a given price. In a formal model, Baron (1982) shows that, by taking advantage of underwriters' superior information, issuers may raise higher IPO proceeds. However, to achieve this, the issuers must accept underpricing as an agency cost that must be incurred to induce underwriters to exert effort.

Loughran and Ritter (2002) explore the agency conflict between issuers and underwriters further and propose a prospect theory, in which underwriters take advantage of issuers' tendency to disproportionately anchor expectations on filing

prices. Loughran and Ritter (2002) argue that issuers evaluate news that their wealth has increased due to positive filing price revisions differently from news that underwriters ultimately left significant amounts of money on the table. In fact, instead of assessing these wealth effects separately, depending on the total number of shares they sell and the number of secondary shares they retain in an IPO, the issuers may fail to get upset about underpricing and net losses against gains. For example, if the net result from selling a small number of highly underpriced shares and retaining a large number of secondary shares, whose market value rises on the first day of trading, is positive, the issuers may end up being satisfied with the outcome of the IPO. In turn, knowing about the complacency of issuers in assessing underpricing separately from filing price revisions, the underwriters may have an incentive to set lower final offer prices. The reason for this is that lower final offer prices allow the underwriters to reward rent-seeking behaviour of regular investors, who try to influence share allocations by generating abnormally high trading commissions with the brokers of the underwriters.

3.2.2 The issuer-underwriter agency conflict and underwriting syndicate structure

So how can underwriting syndicate structure affect the agency conflict between issuers and underwriters? Hu and Ritter (2007) posit the bargaining power hypothesis which argues that, by hiring multiple bookrunners, an issuer may be able to mitigate the issuer-underwriter agency conflict and achieve superior bargaining power in negotiating on IPO pricing due to the competition that may arise between the bookrunners. More specifically, Hu and Ritter (2007) conjecture that, in the pre-marketing phase, the bookrunners may end up competing to advise the issuer on a higher filing price with the intention of avoiding the risks of being either fired or demoted to the position of co-managers or receiving a lower number of shares for allocation and, as a result, a lower portion of the selling concession. Then, in the bookbuilding phase, the bookrunners may end up competing in expending higher levels of effort to achieve a higher chance of being included in the issuer's seasoned equity offerings, which results in a higher filing price revision and, by extension, a higher final offer price and a lower level of underpricing.

Hu and Ritter (2007) analyse U.S. IPOs in 2001-2005 and find that the number of bookrunners in underwriting syndicates is negatively related to underpricing and the percentage difference between the filing price and the first trading day closing price.

Although the statistical significance of these findings is low, Hu and Ritter (2007) interpret them as evidence that underwriting syndicates with a higher number of bookrunners set higher filing and final offer prices.

Considering the findings of Hu and Ritter (2007), by extending the bargaining power hypothesis to the context of IPOs that took place between 1995 and 2010 in France, Germany, Italy, and the UK, I arrive at the following hypothesis:

Hypothesis 3A: The number of bookrunners in underwriting syndicates should be positively related to the magnitude of filing price revisions, irrespective of whether an issuer's shares are over- or underpriced at the filing price.

Despite its intuitive appeal, evidence related to the bargaining power hypothesis proposed by Hu and Ritter (2007) has been mixed. For example, Lee (2008) finds little to no evidence which would suggest that the magnitude of filing price revisions is significantly related to the number of bookrunners. The more surprising findings, however, are those of Jeon et al (2015) and Vithanage et al (2016a), who show that the number of bookrunners may actually be negatively related to the magnitude of filing price revisions.

With respect to studies on the impact of the number of bookrunners in underwriting syndicates on the level of underpricing, Abrahamson et al (2011) and Vithanage et al (2016a, 2016b) provide evidence that is consistent with the bargaining power hypothesis of Hu and Ritter (2007). Jeon et al (2015), on the other hand, report that the number of bookrunners is unrelated to underpricing.

All studies presented in this subsection except for Abrahamson et al (2011) focus on IPOs in the U.S. Abrahamson et al (2011) consider both U.S. and European IPOs, but do not analyse the effect of having multiple bookrunners in underwriting syndicates on underpricing for IPOs in Europe and the U.S. separately. To my knowledge, there have been no other studies that would investigate whether the bargaining power hypothesis of Hu and Ritter (2007) holds in the context of IPOs in France, Germany, Italy, and the UK.

One last remark that must be made with respect to the bargaining power hypothesis of Hu and Ritter (2007) is that the inclusion of additional co-managers in underwriting syndicates could also have a benefit associated with alleviating the issuer-underwriter agency conflict. This is because, as Corwin and Schultz (2005) argue, if

co-managers acquire information about the demand of their clients, they have two options for reporting this information. If the co-managers convey this information to the bookrunners, the bookrunners then get to decide whether to consider this information when setting the final offer price, which would be in line with the information production hypothesis of Corwin and Schultz (2005). However, if the co-managers are interested in competing for bookrunner mandates in the issuer's seasoned equity offerings, they also have the option of reporting this information directly to the issuer. It could therefore be conjectured that, by 'whispering in the issuers' ears, co-managers provide issuers with more bargaining power in negotiating on higher final offer prices with the bookrunners, which would address the agency conflict explored by Baron (1982) and Loughran and Ritter (2002). Based on this argumentation, I also formulate the following hypothesis in the context of IPOs that took place between 1995 and 2010 in France, Germany, Italy, and the UK:

Hypothesis 3B: The number of co-managers in underwriting syndicates should be positively related to the magnitude of filing price revisions, irrespective of whether an issuer's shares are over- or underpriced at the filing price.

4 Methodology

To test the hypotheses, I employ a methodology that is broadly based on the empirical model used by Corwin and Schultz (2005) in their study of U.S. IPOs in 1997-2002. In the next few subsections, I will explain the key aspects of the model used in this thesis.

4.1 Filing price revisions and the total return

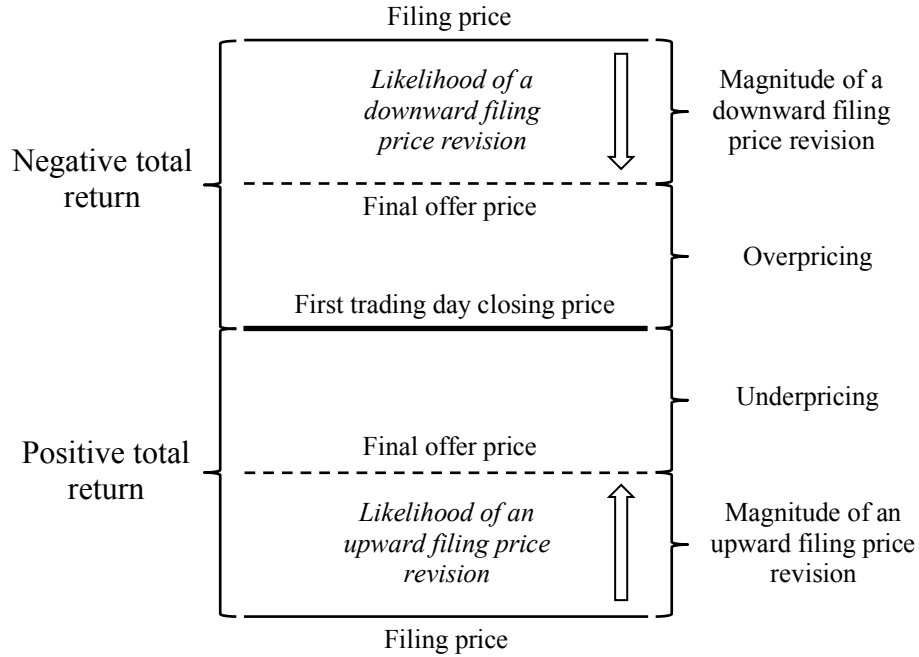
Figure 2 illustrates the interrelationship between the filing price, the final offer price, and the first trading day closing price. As we will see, these measures are used to establish the following dependent variables in the empirical model of this thesis:

- Likelihood of upward filing price revisions;
- Magnitude of filing price revisions.

Furthermore, these measures are used to calculate the following independent variables:

- Value of the total return if it is positive;
- Value of the total return if it is negative.

Figure 2: The interrelationship between the filing price, the final offer price, and the first trading day closing price



The line in the middle of Figure 2 is the *First trading day closing price*. Everything above it represents a scenario in which the *Filing price*, i.e. the midpoint of the initial filing price range, is set too high, and the overall market valuation of IPO shares turns out to be lower than anticipated by underwriters. Everything below the first trading day closing price, on the other hand, represents a scenario in which the filing price underestimates investor demand. The percentage difference between the first trading day closing price and the filing price is defined as the *Total return*:

$$Total\ return = \frac{First\ trading\ day\ closing\ price - Filing\ price}{Filing\ price}$$

For the purpose of explaining the model further, let us consider the scenario in which the total return is positive, i.e. in which the filing price is set lower than the eventually observed market price for IPO shares. If the filing price underestimates investor demand, it can be argued that the underwriters failed to discover all information relevant to IPO pricing during the pre-marketing phase. This means that the underwriters have an opportunity to discover the remainder of the information during the bookbuilding phase. If, in fact, the bookbuilding phase is successful in incentivising investors to reveal their level of interest in the IPO, the underwriters face two decisions: first, whether to take newly discovered information into consideration and revise the filing price upwards; and second, by how much to revise to it. The former

represents the *Likelihood of an upward filing price revision*, while the latter represents the *Magnitude of an upward filing price revision*, which is calculated as:

$$\text{Magnitude}(\text{Filing price revision}) = \frac{\text{Final offer price} - \text{Filing price}}{\text{Filing price}}$$

where the *Final offer price* is the share price that issuers and underwriters agree upon at the end of the bookbuilding phase. The remaining difference between the first trading day closing price and the final offer price is the initial return. If the initial return is positive, it is generally said that IPO shares were underpriced.

If the bookbuilding pricing mechanism works as proposed in the information production framework of Benveniste and Spindt (1989), we should expect to see that, the larger the potential undervaluation of an IPO, the more likely it should be that the underwriters discover and respond to this type of mispricing with an upward filing price revision. Furthermore, the magnitude of this filing price revision should be greater as well.

Although the intuition for the relationship between negative total returns and the likelihood and magnitude of downward filing price revisions is similar, I do not use overall total return values in my empirical model. Instead, I explicitly distinguish between positive and negative values of the total return. The reason for this is that the relationship between total returns and filing price revisions may be non-linear. Depending on whether the total return is above or below zero, underwriters may be differently incentivised to react to information about the potential mispricing of IPO shares. For example, if the underwriters observe that the filing price overestimates investor demand, they may have a strong incentive to fully revise the filing price downwards to avoid incurring costs associated with aftermarket stabilisation and displeasing investors, who would have otherwise bought overvalued shares. However, if the underwriters identify that the IPO would be underpriced at the filing price, they may exhibit more discretion when deciding whether to revise the filing price and, if so, how much to revise it. In this case, the underwriters would not necessarily strive to fully respond to information about excess investor demand, as that would allow them to extract the type of economic rents predicted by the agency conflict theory of Baron (1982) and the prospect theory of Loughran and Ritter (2002). Therefore, it could be argued that the marginal effect of an increase in the total return on the magnitude and

likelihood of an upward filing price revision should be smaller when the total return is positive than when it is negative.

4.2 Underwriting syndicate structure

I consider two measures for describing the structure of an underwriting syndicate:

- Number of bookrunners;
- Number of co-managers.

In addition to the stand-alone values for the numbers of bookrunners and co-managers in underwriting syndicates, I also consider their interactions with measures of the total return. These interaction terms are between:

- Number of bookrunners and value of total return if it is positive;
- Number of bookrunners and value of total return if it is negative;
- Number of co-managers and value of total return if it is positive;
- Number of co-managers and value of total return if it is negative.

The intuition behind the use of interaction terms is that they allow for an examination of how the relationship between underwriting syndicate structure and filing price revisions changes depending on the type and level of mispricing that exists at the start of the bookbuilding phase. Without conditioning this analysis on total return measures, it would not be possible to conclude whether the decision to employ a higher number of underwriters is associated with superior information production, as predicted by Corwin and Schultz (2005).

To further explain this argument, let us consider a hypothetical scenario in which interaction terms are not used, and the relationship between the stand-alone measure for the number of bookrunners and the magnitude of filing price revisions turns out to be positive. This finding would imply that the hiring of an additional bookrunner is associated with a higher, i.e. more upward or less downward, filing price revision, irrespective of whether the IPO was over- or underpriced at the filing price. If we assume that issuers are only interested in maximising IPO proceeds, the implication that underwriting syndicates with a higher number of bookrunners are associated with higher final offer prices would represent supporting evidence for the bargaining power hypothesis of Hu and Ritter (2007). The interpretation of the positive coefficient with respect to the predictions of Corwin and Schultz (2005), on the other hand, would be less straightforward. If an IPO is underpriced at the filing price, the positive coefficient on the number of bookrunners would, indeed, suggest that underwriting syndicates with

a higher number of bookrunners are more effective in producing information during the bookbuilding phase, which would confirm the predictions of Corwin and Schultz (2005). However, the same would not be true for IPOs that are overpriced at filing prices. In this case, the positive coefficient on the number of bookrunners would imply that underwriting syndicates with a higher number of bookrunners produce less information. This is because, for the information production hypothesis of Corwin and Schultz (2005) to be true for IPOs that are overpriced at filing prices, filing price revisions associated with underwriting syndicates with a higher number of bookrunners would have to be smaller, or more downward.

Therefore, by including interaction terms between underwriting syndicate structure and total return measures in my empirical model, I am able to analyse if underwriting syndicate structure measures have both a total-return-independent, i.e. fixed, and a total-return-dependent effect on filing price revisions. However, although it can be argued that it would be sufficient to interact the numbers of bookrunners and co-managers with the overall percentage value of the total return, I separately interact underwriting syndicate structure measures with values of the total return if they are positive and if they are negative. This approach allows for an examination of whether the effect of the total return on the relationship between underwriting syndicate structure and filing price revisions is non-linear.

4.3 Market return

So far, we have implicitly assumed that filing prices are only revised in response to the previously undiscovered, firm-specific information that underwriters successfully incentivise investors to reveal during the bookbuilding phase. However, filing price revisions may also be driven by factors that neither issuers, underwriters, nor investors could anticipate when setting filing prices, because these factors ensue after the submission of the preliminary prospectus. One example of such a factor is a change in overall macroeconomic conditions. Lowry and Schwert (2004) argue that, because the IPO process often takes multiple months, it is plausible that, between the submission of the preliminary prospectus and the date on which issuers and underwriters agree on final offer prices, there may be some macroeconomic developments which impact the valuation of IPOs. Therefore, issuers and underwriters may also have an incentive to revise filing prices so that they reflect the impact of these macroeconomic developments on the IPOs.

One measure that Lowry and Schwert (2004) suggest as a proxy for changes in macroeconomic conditions is stock market returns. Consistent with this logic, I include the following measures in my empirical model:

- Value of the stock market return;
- Interaction term between the value of the stock market return and the number of bookrunners;
- Interaction term between the value of the stock market return and the number of co-managers.

More specifically, I consider the return on the Morgan Stanley Capital International (MSCI) Europe index, which covers large- and mid-cap stocks across 15 European countries, including the four countries considered in this thesis, consists of more than 400 stocks, and represents 85 percent of total stock market capitalisation in countries covered by this index (MSCI, 2017). I calculate the value of the return on the MSCI Europe index in the following way:

$$\text{Market return} = \frac{\text{MSCI Europe}_{\text{Pricing date}} - \text{MSCI Europe}_{\text{Filing date}}}{\text{MSCI Europe}_{\text{Filing date}}}$$

In addition to the stand-alone value of the stock market return, I also separately interact this measure with the numbers of bookrunners and co-managers in underwriting syndicates. The decision to use interaction terms is motivated by the argument that the relationship between underwriting syndicate structure and filing price revisions may also depend on the level of stock market returns. More specifically, application of the bargaining power hypothesis of Hu and Ritter (2007) suggests that, if the stock market index rises during the bookbuilding phase of an IPO, it could be that issuers that hire a higher number of bookrunners or co-managers have greater bargaining power in negotiating on a more adequate response to this information.

4.4 Regression specification

Now that we have explored measures related to filing price revisions, total and market returns, and underwriting syndicate structure, we can examine the overall specification of the regressions that will be used to study the hypotheses outlined in Sections 3.1.2 and 3.2.2. The regression specification can be summarised as follows:

$$\begin{aligned} Y = & \beta_0 + \beta_1 \cdot \text{TR}_{>0\%} + \beta_2 \cdot \text{TR}_{<0\%} + \beta_3 \cdot \text{MR} + \\ & + \beta_4 \cdot \text{No.of Bookrunners} + \beta_5 \cdot \text{No.of Bookrunners} \times \text{TR}_{>0\%} \\ & + \beta_6 \cdot \text{No.of Bookrunners} \times \text{TR}_{<0\%} + \beta_7 \cdot \text{No.of Bookrunners} \times \text{MR} + \end{aligned}$$

$$\begin{aligned}
& + \beta_8 \cdot \text{No. of Co-managers} + \beta_9 \cdot \text{No. of Co-managers} \times TR_{>0\%} + \\
& + \beta_{10} \cdot \text{No. of Co-managers} \times TR_{<0\%} + \beta_{11} \cdot \text{No. of Co-managers} \times MR + \\
& + \sum_{j=12}^n \beta_j \cdot \text{Control}_j + \varepsilon
\end{aligned}$$

where $TR_{>0\%}$ is the value of the total return if it is positive, $TR_{<0\%}$ is the value of the total return if it is negative, and MR is the value of the market return.

Corwin and Schultz (2005) examine the impact of underwriting syndicate structure on three different dependent variables: the likelihood of upward filing price revisions, the likelihood of downward filing price revisions, and the magnitude of filing price revisions. In this thesis, however, I choose not to focus on the likelihood of downward filing price revisions, and instead only examine the determinants of the likelihood of upward filing price revisions and the magnitude of filing price revisions. The decision to disregard the likelihood of downward filing price revisions is driven by the finding that less than one percent of observations in the sample used in this thesis (which will be described in more detail in Section 5) have filing price revisions with a magnitude of exactly zero. This suggests that the likelihood of downward filing price revisions is essentially equal to one minus the likelihood of upward filing price revisions. If I were to separately examine the determinants of the likelihood of downward filing price revisions using the same regression specification, the resulting coefficients would mirror the coefficients obtained from the analysis of the determinants of upward filing price revisions.

Consistent with Corwin and Schultz (2005), I first study the relationship between underwriting syndicate structure and the likelihood of upward filing price revisions by using a probit regression model. Then, I employ an OLS regression model to assess the link between underwriting syndicate structure and the magnitude of filing price revisions. To examine the hypotheses outlined in Sections 3.1.2 and 3.2.2, the coefficients of interest in both regression models are all those coefficients that are associated with the numbers of bookrunners and co-managers in underwriting syndicates. For the purpose of further explaining this, let us consider the linear regression model used to analyse the determinants of the magnitude of filing price revisions. In this regression model, the effect of a change in either the number of bookrunners or the number of co-managers on the magnitude of filing price revisions can be represented as follows:

$$\frac{\partial(\text{Magnitude of filing price revision})}{\partial(\text{No. of Bookrunners})} = \beta_4 + \beta_5 \cdot TR_{>0\%} + \beta_6 \cdot TR_{<0\%} + \beta_7 \cdot MR$$

$$\frac{\partial(\text{Magnitude of filing price revision})}{\partial(\text{No. of Co-managers})} = \beta_8 + \beta_9 \cdot TR_{>0\%} + \beta_{10} \cdot TR_{<0\%} + \beta_{11} \cdot MR$$

β_4 and β_8 describe the fixed, i.e. unconditional on other factors, effect of a change in underwriting syndicate structure on the magnitude of filing price revisions. β_5 , β_6 , β_9 , and β_{10} represent the potential non-linear dependency of this effect on the type and level of mispricing that exists at the start of the bookbuilding phase. Finally, β_7 and β_{11} show the potential linear dependency of this effect on the extent to which macroeconomic conditions have changed between the submission of the preliminary prospectus and the setting of the final offer price.

4.5 Control variables

In addition to measures related to underwriting syndicate structure and total and market returns, the regression specification also includes the following control variables:

- Average bookrunner reputation;
- Average co-manager reputation;
- Natural logarithm of expected IPO proceeds;
- Binary variable for IPOs of issuing firms operating in regulated industries;
- Binary variable for IPOs of issuing firms operating in tech industries;
- Binary variables for stock exchanges targeted for listing;
- Binary variables for IPO listing years.

The next few subsections will explore why these control variables are included in the regression specification and how they are calculated in more detail.

4.5.1 Underwriter reputation

One important factor that must be controlled for because of its potential impact on filing price revisions is the reputation of banks that constitute underwriting syndicates. Hanley (1993) argues that prestigious underwriters are more likely to possess the skills required to more accurately price IPOs and be able to survey a superior network of investors for information on their demand. Moreover, as Beatty and Ritter (1986) conjecture, because prestigious underwriters are concerned with preserving their reputation capital, they may be particularly disincentivised from shirking the responsibility of accurately pricing IPOs, as a track record of handling mispriced IPOs could lead to a loss of future IPO business. Therefore, underwriting syndicates with

more prestigious underwriters may be associated with superior information production during the bookbuilding phase and more correct responses to new information in terms of the direction and magnitude of filing price revisions. For this reason, I consider the following underwriter reputation measures:

- Average proceeds-weighted Migliorati-Vismara bookrunner reputation;
- Average proceeds-weighted Migliorati-Vismara co-manager reputation;
- Average equal-weighted Migliorati-Vismara bookrunner reputation;
- Average equal-weighted Migliorati-Vismara co-manager reputation.

In line with other empirical studies of IPOs in the U.S., Corwin and Schultz (2005) use Carter-Manaster reputation ranks, which are based on the relative position of an underwriter's name on IPO tombstone announcements (Carter and Manaster, 1990). However, the use of Carter-Manaster reputation ranks in this thesis is unfeasible because the publishing of tombstones is not a common practice in Europe, as evidenced by the finding of Migliorati and Vismara (2014) that underwriters in only 32.5 percent of their sample of IPOs in France, Germany, Italy, and the UK in 1995-2010 can be assigned a Carter-Manaster reputation rank.

Instead, as a measure of underwriter reputation, I use reputation scores calculated by Migliorati and Vismara (2014), who follow the approach of Megginson and Weiss (1991) and proxy an underwriter's reputation with their market share. Migliorati and Vismara (2014) calculate two types of reputation scores: an equal-weighted score, which bases the calculation of an underwriter's market share on the number of companies this underwriter has taken public between 1995 and 2010; and a proceeds-weighted score, which uses the amount of capital this underwriter has raised in the same time period as the respective measure for calculating their market share. Migliorati and Vismara (2014) calculate both reputation scores in two steps. First, they assign the rank of one to the underwriter with the highest market share measure. Then, they assign reputation ranks of all other underwriters as a fraction of the maximum based on respective numbers of IPOs underwritten or amounts of capital raised.

In my empirical model, I alternate between using equal- and proceeds-weighted Migliorati-Vismara reputation scores. This decision is motivated by the argument that, on unregulated stock markets such as London's Alternative Investment Market (AIM) and the Marché Libre and Alternext markets of Euronext, which are associated with smaller IPOs and a more central certification role of underwriters, the number of

companies that an underwriter has taken public may be perceived as a better indication of their expertise in the eyes of issuers than the amount of capital raised. On these markets, the proceeds-weighted reputation score might not adequately capture the reputation capital of underwriters that specialise in handling large quantities of less capital-intensive offerings (Migliorati and Vismara, 2014). Therefore, by alternating between using equal- and proceeds-weighted Migliorati-Vismara reputation scores, I can control for the likelihood that either one of these scores is more meaningful in predicting the likelihood and magnitude of filing price revisions.

4.5.2 *Expected proceeds*

I follow Corwin and Schultz (2005) in controlling for the natural logarithm of expected proceeds, which is calculated as:

$$\ln(\text{Expected proceeds}) = \ln(\text{Filing price} * \text{Number of shares offered})$$

Expected proceeds is one of the measures of IPO size that is used in the IPO literature as a proxy for valuation uncertainty. The overarching reason to control for valuation uncertainty is driven by the argument proposed by Hanley (1993) that issuing firms whose share values are viewed by investors as being highly uncertain should more often have their filing prices revised. This is because, if underwriters are concerned with the valuation uncertainty associated with a specific IPO, they are more likely to set a more conservative, i.e. lower or wider, initial filing price range which, in turn, leaves more room for revising the filing price if the information about investor demand discovered during the bookbuilding phase requires it. Therefore, by including measures related to valuation uncertainty in the regression specification, I can analyse the effect of underwriting syndicate structure on the bookbuilding pricing mechanism after taking into consideration the potential relationship between filing price revisions and valuation uncertainty.

IPO size is seen as a proxy for valuation uncertainty because, as Beatty and Ritter (1986) conjecture, smaller IPOs should, on average, be more speculative than larger issues. Therefore, it could be that the likelihood and magnitude of filing price revisions is negatively related to IPO size. Consistent with Corwin and Schultz (2005), Hu and Ritter (2007), and Hanley (1993), I account for IPO size by calculating expected proceeds rather than gross proceeds. The reason for this is that expected proceeds reflect the level of valuation uncertainty that exists at the time the underwriters set the initial filing price range, whereas gross proceeds reflect the valuation uncertainty that remains

after the underwriters and investors have exchanged information in the bookbuilding phase, which suggests that gross proceeds are endogenous to filing price revisions. Therefore, in the context of studying the determinants of the likelihood and magnitude of filing price revisions, the use of expected proceeds as a measure of IPO size and, by extension, a proxy for valuation uncertainty is more justified.

4.5.3 Industry binary variables

Another measure that is used in the IPO literature as a proxy for valuation uncertainty is the industries in which issuers operate. One particularly common approach is to distinguish issuers operating in regulated and tech industries from those operating in all other industries. The intuition behind this approach is that, as Davidson et al (2006) conjecture, it is more challenging to estimate the values of tech offerings, whereas the opposite is likely to be true for IPOs in regulated industries. Tech issuers are, on average, riskier firms with more uncertain natures of business which may be more unfamiliar to investors (Ljungqvist and Wilhelm, 2003; Vithanage et al, 2016a). Therefore, consistent with the findings of Ljungqvist and Wilhelm (2003) and Lowry and Schwert (2004), it could be hypothesised that tech industry IPOs should be associated with higher likelihoods and magnitudes of filing price revisions. Issuing firms in regulated industries, on the other hand, are perceived as having lower levels of valuation uncertainty due to the mature nature of their businesses, the riskiness of which is presumed to be contained by regulation (Loderer et al, 1991). As a result, it could be conjectured that IPOs in regulated industries should be associated with lower likelihoods and magnitudes of filing price revisions.

Consistent with this logic, I include binary variables for tech and regulated industry IPOs in my empirical model. The tech industry binary variable takes the value of one if the primary four-digit SIC code of an issuer corresponds to the tech industry definition of Loughran and Ritter (2004), whereas the value of the regulated industry binary variable is assigned based on the regulated industry definition of Davidson et al (2006). Please refer to Table 1 in the Appendix to see the codes and definitions of SIC industries used to assign values of these industry-related binary variables.

4.5.4 Stock exchange binary variables

In addition to the aforementioned control variables, the regression specification also considers the following stock exchange binary variables:

- *London Official List* for IPOs on the Official List of the London Stock Exchange;
- *London AIM* for IPOs on the Alternative Investment Market of the London Stock Exchange;
- *Marché Libre and Alternext* for IPOs on the Marché Libre and Alternext markets of Euronext Paris;
- *Euronext Paris* for IPOs on all other markets of Euronext Paris;
- *Frankfurt* for IPOs on the Frankfurt Stock Exchange;
- *Milan* for IPOs on the Milan Stock Exchange.

The purpose of these binary variables is to isolate the potential effects that differences between stock exchanges may have on filing price revisions. One example of such a difference is related to the findings of Cornelli et al (2006) and Aussenegg et al (2006) that not all European stock exchanges have equally active when-issued markets. For example, on Frankfurt and Milan stock exchanges, which have the most active pre-IPO forward markets, it could be that underwriters revise filing prices more accurately because they can more consistently take advantage of the information about investor demand that is observable on when-issued markets.

It can also be argued that there may be differences across stock exchanges in the way underwriters carry out bookbuilt IPOs in practice. For example, as Ljungqvist and Wilhelm (2002) show, on the Frankfurt Stock Exchange, activities that constitute the bookbuilding phase are carried out, on average, over 11 days, whereas the respective figures for IPOs on Euronext Paris and the London Stock Exchange are 15 and 17 days. If the increased duration of the bookbuilding phase allows underwriters to survey a higher number of investors for information about their interest in IPOs, it could be hypothesised that IPOs on Euronext Paris and the London Stock Exchange should be associated with more accurate final offer prices.

To account for the unregulated status of the AIM, Marché Libre, and Alternext markets, I further split binary variables representing IPOs on the London Stock Exchange and Euronext Paris. More specifically, I distinguish between IPOs on London's Official List, London's AIM, Marché Libre and Alternext markets of Euronext Paris, and IPOs on all other markets of Euronext Paris. The main argument that motivates the decision to include separate binary variables for IPOs on the AIM and Marché Libre and Alternext markets is related to the fact that these markets are not

governed by their respective national listing authorities. Moreover, unlike the main markets of the London Stock Exchange and Euronext Paris, issuers listing shares on AIM, Marché Libre, and Alternext markets are not required to comply with the EU Prospectus Directive. On these unregulated markets, the responsibility for certifying that issuers comply with admission and disclosure requirements is entirely delegated to the underwriters (Gajewski and Gresse, 2006; Vismara et al, 2012; Migliorati and Vismara, 2014). As a result, because underwriters in IPOs on unregulated markets of the London Stock Exchange and Euronext Paris face greater reputational risks, it could be hypothesised that IPOs on these unregulated markets should be more accurately priced compared to IPOs on regulated markets.

4.5.5 IPO listing year binary variables

To control for potential effects of time-specific variations in the severity of the issuer-underwriter agency conflict on the information production function of the bookbuilding phase, I include binary variables for IPO listing years in my empirical model. This is necessary because, during time periods with systemically severe agency problems, the effectiveness of the bookbuilding phase in arriving at more accurate final offer prices may be diminished. One example of such a time period is the Internet bubble of 1999-2000, which was fuelled by an abnormally high number of Internet and tech companies raising capital through IPOs.

Ljungqvist and Wilhelm (2003) argue that at the core of the Internet bubble was an aggravation of the issuer-underwriter agency conflict, which was caused by wide-scale changes in pre-IPO ownership structures and insider selling behaviours within issuing firms. More specifically, as Ljungqvist and Wilhelm (2003) find, issuing firms had more dispersed pre-IPO insider ownership structures; they raised a higher proportion of capital by issuing new shares instead of selling shares held by pre-IPO insiders; CEOs and venture capital funds held smaller stakes of pre-IPO equity; and a higher percentage of offerings included directed share programs, which allowed ‘friends and family’ to purchase new shares at final offer prices. For this reason, as Ljungqvist and Wilhelm (2003) conjecture, in 1999-2000, pre-IPO shareholders were less incentivised to monitor efforts exerted by underwriters during the bookbuilding phase and bargain for more accurate filing price revisions with bookrunners.

Loughran and Ritter (2004) offer an alternative perspective on the aggravation of the issuer-underwriter agency conflict observed during the Internet bubble of 1999-

2000. They posit the changing issuer objective function hypothesis which argues that, compared to other years, issuers in 1999-2000 were systemically less interested in maximising IPO proceeds and avoiding excessive underpricing. Instead, during the Internet bubble, issuers placed greater emphasis on maximising profits from seasoned equity offerings and insider sales after the expiration of lock-up periods. Loughran and Ritter (2004) suggest that issuers maximised their new objective functions by hiring underwriters with all-star research analysts. All-star analyst coverage was important to issuers because, as Aggarwal et al (2002) show, superior research coverage can shift the aggregate demand curve for issuers' shares upwards, which in turn can allow insiders to sell shares at higher secondary market prices after the expiration of lock-up periods. Loughran and Ritter (2004) argue that, because tech industry IPO valuations during the Internet bubble were predominantly driven by perceived future growth prospects rather than the value of existing assets, the issuers were particularly determined to ensure superior research coverage with bullish recommendations. This, in turn, caused them to become more willing to accept lower filing prices. It could also be argued that this type of complacency exhibited by issuers during the Internet bubble may have also led to less accurate filing price revisions.

5 Data collection

In this section, I will describe the sources of data and the steps involved in the creation of the final sample used to study the hypotheses outlined in Sections 3.1.2 and 3.2.2.

5.1 IPO characteristics

Data on IPO characteristics is retrieved from the Securities Data Company Platinum (SDC Platinum) database. The initial dataset covers a total of 4,342 IPOs in France, Germany, Italy, and the UK between 1995 and 2010, and contains information on final offer prices, initial filing price ranges, underwriting syndicate structures, numbers of offered shares, gross proceeds, IPO timelines, stock exchanges targeted for listing, and SIC industry codes.

5.1.1 Sample delimitations

Following other studies in the IPO literature, I exclude follow-on and rights offers, issues by investment funds and real estate investment trusts (SIC codes 6726 and 6798), as well as IPOs offering a combination of shares and warrants, i.e. unit issues, or

consisting entirely of depositary receipts (Corwin and Schultz, 2005; Hu and Ritter, 2007). Finally, I exclude IPOs that did not involve bookbuilding.

5.1.2 *Initial filing price range*

For many IPOs, SDC Platinum does not explicitly report initial filing price ranges. This is likely a result of certain stock exchanges having less stringent rules for the content of preliminary prospectuses. For example, issuers listing shares in Germany and the UK are not subjected to the rule that preliminary prospectuses must include such information. However, if issuers do not report an initial filing price range in the preliminary prospectus, they typically disclose it in a filing amendment (Ljungqvist and Wilhelm, 2002).

If SDC Platinum is able to provide information on filing amendments for an IPO that otherwise does not have an explicitly reported initial filing price range, I calculate the filing price revision based on the midpoint of the price range disclosed in the earliest available filing amendment. This decision is motivated by the argument made by Bradley and Jordan (2002) that, if the final offer price is different from the midpoint of the price range disclosed in a filing amendment, this delta should still represent a response to new information discovered by the underwriters during the bookbuilding phase.

5.1.3 *Underwriting syndicate structure*

SDC Platinum splits the initial sample of 4,342 IPOs into a total of 5,756 different IPO tranches. An IPO is split into multiple tranches in the following cases: if it is also marketed outside the domestic market of the issuer, if it contains a designated tranche for strategic investors, or if it offers multiple types of securities. In many cases, SDC Platinum reports different underwriting syndicate compositions for different tranches of an IPO. To assess the overall underwriting syndicate structure of an IPO, I manually aggregate underwriter identities and roles from all tranches, remove duplicates, and assign underwriter roles based on the most senior position that a specific underwriter was appointed to across all tranches.

SDC Platinum distinguishes between seven different underwriter roles: ‘book runner’, ‘joint book runner’, ‘joint lead manager’, ‘co-lead manager’, ‘co-manager’, ‘syndicate member’, and ‘global coordinator’. Following Lee (2008), I split underwriters into two groups: *bookrunners*, which corresponds to SDC Platinum designations ‘book runner’ and ‘joint book runner’; and *co-managers*, which

corresponds to designations ‘joint lead manager’, ‘co-lead manager’, and ‘co-manager’. Consistent with Corwin and Schultz (2005), I find that the global coordinator designation is shared among the bookrunners of an underwriting syndicate, which allows me to ignore it. Finally, I disregard the syndicate member designation because it is only reported for four IPOs.

5.1.4 Gross and expected proceeds

Due to the fact that the sample spans a total of 16 years, over the course of which cumulative inflation ranged from 13 percent in Germany to 44.6 percent in the UK, I express gross and expected proceeds in 2010 purchasing power using the World Bank country-specific annual GDP deflator index.

5.1.5 Stock exchange binary variables

Several complications must be addressed when assigning stock exchange binary variables. The first complication is related to the way in which SDC Platinum reports the codes of stock exchanges that issuers target for their IPOs. For example, the SDC Platinum code ‘LO’ is defined as ‘London AIM’ in the internal glossary of the database; however, inspection of IPO prospectuses reveals that issuers with this stock exchange code intend to list their shares on the Official List of the London Stock Exchange. Taking into account the prevalence of this misclassification, I choose the stock exchange code ‘LO’ to represent the London Official List market.

This type of inconsistency is even more pronounced for IPOs in Germany. For example, prospectuses of IPOs that, according to SDC Platinum, are planning to list shares on stock exchanges with codes ‘BE’, ‘DU’, or ‘SU’, which are defined as ‘Berlin’, ‘Düsseldorf’, and ‘Stuttgart’, often state that issuers intend to list shares exclusively on the Frankfurt Stock Exchange. Due to overall scarcity of prospectuses for German IPOs in SDC Platinum, I am unable to verify stock exchange codes for the majority of German issues and make an informed decision as to which German stock exchange codes to disregard when assigning IPOs to the Frankfurt group. For this reason, I choose all codes of German stock exchanges in SDC Platinum to represent the Frankfurt group.

The second complication is related to the structural changes experienced by European stock exchanges between 1995 and 2010 which must be taken into account when assigning stock exchange binary variables. For example, Euronext Paris did not exist prior to the merger of Paris Bourse and the stock exchanges of Belgium, the

Netherlands, and Portugal in September of 2000. Before the merger, Paris Bourse consisted of the Premier Marché, Second Marché, Nouveau Marché, and Marché Libre markets. Premier Marché, Second Marché, and Nouveau Marché continued to exist on Euronext Paris up until the creation of a new consolidated market called Eurolist in 2005. In the same year, Euronext Paris also established a new unregulated market called Alternext, which operated in parallel to Marché Libre (Vismara et al, 2012). Considering these structural changes, I assign all SDC Platinum stock exchange codes related to the Eurolist, Premier Marché, Second Marché, and Nouveau Marché to the Euronext Paris group.

To see the resulting list of SDC Platinum stock exchange codes used to assign stock exchange binary variables, please refer to Table 2 in the Appendix.

5.1.6 Data corrections

In many IPOs, values for the initial filing price range, final offer price, gross proceeds, and the number of offered shares are either missing for certain tranches of an IPO or are different from one another. Moreover, in some cases, the inherent logic described in the SDC Platinum definition library for the calculation of variables does not hold (Thomson Reuters, n.d.). For example, number of offered shares times final offer price does not always equate to gross proceeds. To account for these inconsistencies, I collect a similar dataset for all IPOs reported by SDC Platinum from the Factset database. After matching IPOs using SEDOL identifiers, I cross-check data from SDC Platinum with respective data from Factset and manually assign unique variable values for those IPOs that are split into multiple tranches by SDC Platinum. However, because the coverage of offer characteristics in Factset is significantly more limited than in SDC Platinum, collection of data from Factset does not allow me to verify all potentially erroneous variable values reported by SDC Platinum. As a result, for many IPOs, I have no other option but to make a subjective decision as to which variable values to assign when consolidating IPO tranches.

5.2 First trading day closing prices and stock market returns

Data on first trading day closing prices and daily returns of the MSCI Europe index between 1995 and 2010 is collected from Factset.

5.3 Underwriter reputation

As described in Section 4.5.1, I use the reputation scores calculated by Migliorati and Vismara (2014) to measure the reputation of underwriters. To match underwriters found

in the SDC Platinum IPO sample with their Migliorati-Vismara reputation scores, two complications must be addressed.

The first complication is related to the fact that Migliorati and Vismara (2014) split underwriter reputation scores by the stock exchanges on which underwriters have carried out IPOs between 1995 and 2010. More specifically, they calculate separate reputation scores for the following stock exchanges:

- *London Official List* for the Official List of the London Stock Exchange;
- *London AIM* for the Alternative Investment Market of the London Stock Exchange;
- *Marché Libre* for the Marché Libre market of Euronext Paris;
- *Euronext Paris (including Alternext)* for all other markets of Euronext Paris, including the Alternext market;
- *Frankfurt* for the Frankfurt Stock Exchange;
- *Milan* for the Milan Stock Exchange.

Migliorati and Vismara (2014) motivate the need to calculate stock-exchange-specific reputation scores by arguing that the European IPO industry is characterised by a high degree of national fragmentation. More specifically, they report that 82.5 percent of IPOs in their sample are handled by domestic underwriters, which suggests that the reputational capital that an underwriter has acquired by taking companies public in Italy, for example, may not necessarily carry over to handling IPOs in the UK. Furthermore, Migliorati and Vismara (2014) identify that underwriters in European IPOs exhibit a high degree of specialisation in terms of the markets on which they tend to list their clients' shares. For example, as Migliorati and Vismara (2014) report, out of all underwriters, Evolution Securities has been in charge of the highest number of IPOs on London's AIM market, yet it has virtually had no underwriting business on London's Official List or elsewhere in Europe.

Migliorati and Vismara (2014) differentiate the London AIM and the Marché Libre market of Euronext Paris from the London Official and other Euronext Paris markets. The reason for this treatment of the London AIM and Marché Libre markets can be explained by the finding of Migliorati and Vismara (2014) that underwriters that operate on these markets are significantly different from underwriters that operate on other markets. More specifically, underwriters on the London AIM and Marché Libre

markets are younger, smaller, less likely to be commercial banks, and earn a higher proportion of fees from the IPO business.

However, despite both Alternext and Marché Libre being unregulated markets of Euronext Paris, Migliorati and Vismara (2014) do not differentiate Alternext from other markets the same way I do to assign stock exchange binary variables. Instead, Migliorati and Vismara (2014) consider Alternext to be part of the Euronext Paris group. They motivate the decision not to distinguish Alternext from other markets of Euronext Paris by the fact that they were not able to find similar differences in underwriter characteristics between Alternext and other markets that they were able to identify for the London AIM and Marché Libre markets.

Therefore, to match underwriters found in the SDC Platinum IPO sample with their stock-exchange-specific reputation scores, I consider a second stock exchange categorisation methodology that aims to be as consistent with Migliorati and Vismara (2014) as possible. To see the resulting list of SDC Platinum stock exchange codes used to assign underwriter reputation values, please refer to Table 3 in the Appendix.

The second complication that arises in matching underwriters found in the SDC Platinum IPO sample with their reputation scores is related to the observation that, between 1995 and 2010, many underwriters have either changed names, merged with, or been acquired by other underwriters. In these cases, Migliorati and Vismara (2014) assume that the new underwriter entities inherit the reputation capital of all prior entities and assign the same scores to both new and old underwriter entities. I adopt the same approach in assigning Migliorati-Vismara reputation scores to underwriters in my sample. To do this, I use the list of underwriter name changes and mergers and acquisitions between underwriters that is provided by Migliorati and Vismara (2014), and manually check corporate histories of those underwriters in my sample that are missing reputation scores on the Internet.

5.4 Final sample construction

Table 4 in the Appendix shows the steps undertaken to construct the final sample. Due to the fact that the consolidation of all 5,756 tranches into unique IPOs would require a substantial amount of manual work, I perform this step as the very last. However, while undertaking all preceding steps, I check that at least one tranche of an IPO passes the restriction imposed by the specific step to avoid erroneously removing tranches that should be considered in the consolidation. Therefore, Table 4 shows the numbers of

IPO tranches rather than the numbers of unique IPOs, with the exception of the last line, which shows the number of unique IPOs in the final sample.

First, I remove all IPOs that do not pass restrictions common in the IPO literature, which reduces the sample by 1,984 IPO tranches. Then, I exclude those IPOs that were not listed on stock markets considered in the categorisation methodology of Migliorati and Vismara (2014), as well as those IPOs for which I cannot calculate Migliorati-Vismara underwriter reputation scores. After that, I collect data on IPO characteristics, first trading day closing prices, and returns on the MSCI Europe index from Factset. I am only able to obtain this data for those IPOs in the SDC Platinum sample that have SEDOL identifiers. After matching the IPO sample obtained from SDC Platinum with data from Factset, I am left with 2,894 IPO tranches. I then require that at least one tranche of an IPO has data that I can use to calculate the filing price. After that, I remove all IPOs with abnormally high levels of filing price revisions and initial returns, which leaves the sample with 1,775 IPO tranches. As the final step, I consolidate all IPO tranches into the final sample, which consists of 1,013 unique IPOs.

6 Empirical findings

In this section, I will present empirical evidence about the relationship between underwriting syndicate structure and filing price revisions based on the sample of 1,013 IPOs that took place in France, Germany, Italy, and the UK between 1995 and 2010. To do this, I will first report sample descriptive statistics and examine the relationships between different variables using histograms, scatterplots, and boxplots. Then, I will describe the results of the regression analysis.

6.1 Descriptive statistics

6.1.1 Overall sample descriptive statistics

Panel A of Table 5 in the Appendix reports the descriptive statistics for the sample of 1,013 IPOs in France, Germany, Italy, and the UK in 1995-2010. On average, first trading day closing prices are 23.5 percent higher than filing prices. In fact, the midpoints of initial filing price ranges underestimate investor demand in two thirds of IPOs. The highest total return is observed in the IPO of Finmatica Srl, which was listed in November of 1999 on the Milan Stock Exchange. In this IPO, the market valuation of IPO shares was 8.4 times higher than the valuation implied by the filing price. The IPO that is associated with the greatest overestimation of investor demand is the IPO

of GROUP Technologies AG, which took place on the Frankfurt Stock Exchange in November of 2000. In this IPO, the first trading day closing price was 63.8 percent lower than the filing price.

The mean filing price revision is close to zero, which indicates that, on average, final offer prices remain unchanged in relation to the midpoints of initial filing price ranges. The offering with the largest upward filing price revision, 100.5 percent, is the IPO of D+S Europe AG, which took place on the Frankfurt Stock Exchange in May of 2000. The offering with the largest downward filing price revision, negative 60.7 percent, is the IPO of PAION AG, which was listed on the Frankfurt Stock Exchange in February of 2005.

In 74 percent of all IPOs, the final offer price is set within the bounds of the initial filing price range. Final offer prices are also significantly clustered around the lower and upper bounds of the initial filing price ranges. To illustrate this, I calculate two separate ratios by dividing final offer prices by the lower and upper bounds of the initial filing price ranges and present the resulting ratio histograms for the entire sample in Panel A of Figure 3 in the Appendix. In this figure, if the ratio of final offer price to lower bound is lower than one, this indicates that the final offer price was set below the lower bound of the initial filing price range. Similarly, if the ratio of final offer price to upper bound is greater than one, this indicates that the final offer price was set above the upper bound. Therefore, the noticeable declines in distribution densities below the offer-price-to-lower-bound and above the offer-price-to-upper-bound ratio values of one suggest that final offer prices are rarely set outside the bounds of the initial filing price ranges.

Another observation that can be made about filing price revisions is that there appears to be a change in the relationship between the total return and the magnitude of filing price revisions around the total return value of zero. More specifically, as the scatterplot in Figure 4 in the Appendix illustrates, above the total return value of zero, further increases in the extent to which IPOs are underpriced at their filing prices do not seem to be associated with nearly as proportionate increases in the magnitude of filing price revisions as reductions in overpricing. Therefore, the data seems to support the argument made in Section 4.1 about the potential non-linearity of the relationship between filing price revisions and total returns and validate the use of separate measures for positive and negative total return values in regressions.

Panel A of Figure 5 in the Appendix shows underwriting syndicate structure bar charts for the entire sample. Overall, more than two thirds of IPOs are carried out by a single bookrunner. A further 25 percent of IPOs are managed by two and only 6 percent – by three or more bookrunners. Approximately one third of IPOs does not feature co-managers in underwriting syndicates. A further 20 percent of issuers employs one, 19 percent – two, and 27 percent – three or more co-managers. The IPO with the highest number of bookrunners, 10, is the IPO of Enel Green Power SpA, which was listed on the Milan Stock Exchange in November of 2010. The IPO with the highest number of co-managers, 58, is the IPO of Deutsche Telekom AG, which took place on the Frankfurt Stock Exchange in November of 1996.

Figure 6 in the Appendix illustrates the relationship between underwriting syndicate structure and the magnitude of filing price revisions by using boxplots. Panel A of Figure 6 shows boxplots for different numbers of bookrunners in underwriting syndicates, whereas Panel B – for different numbers of co-managers. In line with the intuition described in Section 4.2, both panels in Figure 6 separately plot the relationship between the magnitude of filing price revisions and underwriting syndicate structure measures depending on whether IPOs are under- or overpriced at the start of the bookbuilding phase. Overall, no obvious dependency can be identified. The only exception to this is the boxplot in Panel B for positive total returns. In this boxplot, it can be speculated that there may be a positive relationship between the number of co-managers in underwriting syndicates and the magnitude of filing price revisions. However, because this analysis does not control for other potential determinants of the magnitude of filing price revisions, a conclusion about the relationship between underwriting syndicate structure and filing price revisions cannot be made based on this analysis alone.

6.1.2 Descriptive statistics by listing year

Panel B of Table 5 in the Appendix reports the development of sample IPO characteristics over time and shows that the sample encapsulates the most widely studied event in the history of global equity markets, namely, the Internet bubble of the late 1990s. More specifically, descriptive statistics for years 1998 to 2000 reflect the abnormal numbers of tech industry IPOs and levels of underpricing that are well-documented for this time period in the IPO literature (Ljungqvist and Wilhelm, 2003; Loughran and Ritter, 2004). For example, the overall proportion of tech industry IPOs

in 1998-2000 in the sample is 43.7 percent, which is more than double the respective figure for all other years, 18.5 percent. With respect to the initial return, IPOs in 1998-2000 were, on average, underpriced by 36.7 percent, whereas IPOs in all other years were associated with the substantially more subdued average underpricing of 8.9 percent.

6.1.3 Descriptive statistics by stock exchange

Panel C of Table 5 in the Appendix reports the descriptive statistics by the stock exchanges on which sample IPOs were listed. The most represented stock exchange is the Frankfurt Stock Exchange with 389 IPOs. 53 of the 267 IPOs taken public on Euronext Paris were listed on the exchange-regulated *Marché Libre* and *Alternext* markets, whereas 96 of the 210 IPOs taken public on the London Stock Exchange were listed on the exchange-regulated *Alternative Investment Market*. The least represented stock exchange in the sample is the Milan Stock Exchange with 147 IPOs.

The sample encapsulates the well-documented abnormal activity of tech industry issuers listing shares on the *Neuer Markt* market of the Frankfurt Stock Exchange during the Internet bubble years (Aussenegg et al, 2002). More specifically, 166, or 43 percent, of the 389 issuers listing shares on the Frankfurt Stock Exchange in 1995-2010 were operating in tech industries. The overall prevalence of tech industry IPOs on the Frankfurt Stock Exchange is also reflected in the abnormally high mean initial return value of 36.2 percent.

Panel B of Figure 3 in the Appendix shows histograms for the offer-price-to-upper-bound and offer-price-to-lower-bound ratios by stock exchange. Overall, the previously described observation that final offer prices appear to be constrained by the upper and lower bounds of initial filing price ranges holds for all stock exchanges in the sample.

Panel B of Figure 5 in the Appendix shows bar charts of underwriting syndicate structure measures after splitting sample IPOs by the stock exchanges on which they were taken public. IPOs on the *Marché Libre*, *Alternext*, and *AIM* markets are associated with the smallest underwriting syndicates. Only nine IPOs on these markets were managed by more than one bookrunner, and only ten issuers listing shares on these markets included co-managers in their underwriting syndicates. One final observation is that the Milan Stock Exchange is the only stock exchange with a higher proportion of IPOs carried out by underwriting syndicates with more than one bookrunner.

6.2 Regression results

6.2.1 *Likelihood of upward filing price revisions*

Panel A of Table 6 in the Appendix shows the results of probit regressions in which the dependent variable equals one if the final offer price was set above the filing price, and zero otherwise. All regressions presented in Panel A include two measures related to the total return, the stand-alone values for the numbers of bookrunners and co-managers in underwriting syndicates, and several control variables. More specifically, the total return measures include values of the total return if it is positive, and its values if it is negative. The control variables include average Migliorati-Vismara bookrunner and co-manager reputation scores, the natural logarithm of expected IPO proceeds, as well as binary variables for IPOs operating in tech and regulated industries, IPO listing years, and stock exchanges targeted for listing. Regressions (1), (3), and (5) control for underwriter reputation using equal-weighted Migliorati-Vismara scores, whereas regressions (2), (4), and (6) – using proceeds-weighted scores.

Regressions (1) and (2) attempt to explain the likelihood of upward filing price revisions without considering its potential relationship with the interaction between the underwriting syndicate structure and total return measures, and the return on the MSCI Europe index. The results of regressions (1) and (2) indicate that the likelihood of upward filing price revisions is a significantly positive function of the total return. The more underpriced an IPO at the start of the bookbuilding phase, the more likely it is that the underwriters set the final offer price above the filing price. Similarly, the larger the potential overvaluation of an IPO, the less likely it is that the underwriters make the IPO even more overpriced by revising the filing price upwards. Therefore, the bookbuilding phase appears to succeed at producing information about the type and extent of mispricing that is implicit in the filing price.

The difference between regression coefficients on positive and negative total return values suggests that underwriters react much stronger to information indicating that an IPO is overvalued at its filing price than to information about its potential undervaluation. The comparatively low coefficients on positive total return values provide support to the supposition that, due to the issuer-underwriter agency conflict explored by Baron (1982) and Loughran and Ritter (2002), underwriters exhibit more discretion with respect to deciding whether they should respond to information about excess investor demand. On the other hand, the relatively high coefficients on negative

total return values are consistent with the notion that underwriters have a strong incentive to avoid aftermarket stabilisation and reputational costs associated with overpriced IPOs.

With respect to the stand-alone measures of underwriting syndicate structure in regressions (1) and (2), only the number of bookrunners appears to be significantly related (albeit only at the 10 percent level) to the likelihood of upward filing price revisions. However, the coefficients on this variable are negative in both regression specifications, which suggests that underwriting syndicates with a higher number of bookrunners are less likely to make upward filing price revisions.

Regressions (3) and (4) add interaction terms between measures of underwriting syndicate structure and total returns. In both regressions (3) and (4), the coefficients on the interaction term between the number of bookrunners and negative total return values are positive and statistically significant at the 5 percent level. This means that, if an IPO is overvalued at the start of the bookbuilding phase, underwriting syndicates with higher numbers of bookrunners are less likely to make the mistake of aggravating this type of mispricing further through upward filing price revisions. The statistically insignificant coefficients on the interaction term between the number of bookrunners and positive total return values, on the other hand, indicate that the hiring of additional bookrunners is not associated with a different likelihood of the correct response to information about the potential undervaluation of IPO shares implicit in the filing price.

The results of regressions (3) and (4) about the relationship between the likelihood of upward filing price revisions and the number of co-managers in underwriting syndicates are less straightforward. The highly statistically significant and negative coefficients on the stand-alone measure for the number of co-managers suggest that, if the total return is close to zero, the inclusion of additional co-managers in an underwriting syndicate makes it less likely that the filing price is revised upwards. Therefore, underwriting syndicates with a higher number of co-managers seem to be more conservative in situations when the filing price is close to accurately estimating the market valuation of an issuer's shares. The coefficients on the interaction term between the number of co-managers and positive total returns are positive and statistically significant at the 1 percent level. This finding indicates that, the more underpriced an IPO at its filing price, the more likely it is that underwriting syndicates with a higher number of co-managers correctly recognise this type of mispricing and revise filing prices upwards. The most counterintuitive finding, however, is related to

the negative and statistically significant coefficients on the interaction term between the number of co-managers and negative total returns. The negative sign of these coefficients implies that, the more the filing price overestimates the market demand for an issuer's shares, the more likely it is that underwriting syndicates with a higher number of co-managers make the IPO even more overpriced by revising filing price upwards.

Regressions in the last two columns of Panel A of Table 6 in the Appendix add three measures related to the return on the MSCI Europe index between IPO filing and pricing days. More specifically, these regressions include the stand-alone value of the market return and interaction terms between the market return and the numbers of bookrunners and co-managers in underwriting syndicates. In both regressions (5) and (6), coefficients on all measures related to the market return are not significantly different from zero, which suggests that the likelihood of upward filing price revisions cannot be explained by market returns. Underwriters appear to be disregarding such publicly available information which, as Lowry and Schwert (2004) argue, may be related to news about changes in macroeconomic conditions. Furthermore, the statistical insignificance of coefficients on all interaction terms with underwriting syndicate structure measures implies that the hiring of additional underwriters is not associated with a different likelihood that filing prices are revised in response to public information. One final remark regarding the results of regressions (5) and (6) is that the central findings of regressions (3) and (4) about the relationship between underwriting syndicate structure and the likelihood of upward filing price revisions are robust to the inclusion of market return measures.

6.2.2 Magnitude of filing price revisions

Panel B of Table 6 in the Appendix shows the results of OLS regressions in which the dependent variable is the magnitude of filing price revisions, which is defined as the percentage change from the filing price to the final offer price. Overall, regression specifications in Panel B are identical to regression specifications in Panel A, in which the dependent variable was the likelihood of upward filing price revisions.

Coefficients on positive total return values in both regressions (1) and (2) of Panel B imply that there is a positive relationship between the magnitude of filing price revisions and the extent to which underwriters underestimate investor demand when setting filing prices. However, although this relationship is statistically significant in

both regressions, its economic significance is low. These coefficients are particularly small compared to the coefficients on negative total return values. The statistically significant coefficients on negative total return values suggest that an increase in the potential overvaluation of IPO shares is associated with an almost equally high reduction in the magnitude of filing price revisions. This difference in regression coefficients represents supportive evidence to the observation made based on Figure 4 in Section 6.1.1 about the potential non-linearity of the relationship between the mispricing of IPOs implicit in filing prices and the extent to which underwriters correct it with filing price revisions. Finally, regressions (1) and (2) show that both the numbers of bookrunners and co-managers in underwriting syndicates are unrelated to the magnitude of filing price revisions.

Regressions (3) and (4) add interaction terms between measures of underwriting syndicate structure and total return values. The statistically insignificant coefficients on all measures related to the number of bookrunners suggest that having a higher number of bookrunners in underwriting syndicates is not associated with a different magnitude of filing price revisions, irrespective of how over- or underpriced the IPO was at the start of the bookbuilding phase.

With respect to evidence on the effect of the number of co-managers on filing price revisions, regressions (3) and (4) show that underwriting syndicates with a higher number of co-managers are associated with higher filing price revisions if filing prices underestimate investor demand for IPO shares. Therefore, this finding confirms the observation made based on Figure 6 in Section 6.1.1. Nevertheless, although it is statistically significant, the economic effect of the coefficient on the interaction term between the number of co-managers and positive total returns is low. For example, if the first trading day closing price is higher than the filing price by the sample average of 23.5 percent, the hiring of an additional co-manager is associated with only a 0.23 percent increase in the magnitude of the filing price revision. Finally, unlike its interaction term with positive total returns, the interaction term of the number of co-managers with negative total returns does not appear to be significantly different from zero.

Regressions (5) and (6) add three measures related to the return on the MSCI Europe index between IPO filing and listing dates, and present surprising results about how underwriters respond to information that is publicly available prior to IPO listing dates. More specifically, the negative and statistically significant coefficient on the

stand-alone value of the market return goes against the intuition that, if there are positive macroeconomic news between an IPO's filing and listing dates, this information should reflect favourably on the valuation of the IPO and, in turn, warrant a higher filing price revision. Moreover, looking at the statistically insignificant coefficients on the interaction terms between measures of underwriting syndicate structure and returns on the MSCI Europe index, it appears that the hiring of additional underwriters is not associated with a different magnitude of the response to this information. One final observation about the results of regressions (5) and (6) of Panel B is that the key findings of regressions (3) and (4) about the relationship between underwriting syndicate structure and the magnitude of filing price revisions hold even after accounting for the potential effect of market returns on filing price revisions.

7 Discussion

In this section, I will first summarise the empirical evidence and relate it to the hypotheses outlined in Section 3. Then, I will explore the potential explanations for the inability of the empirical evidence to confirm all hypotheses, critically discuss the shortcomings of the methodology used in this thesis, and present suggestions for further research.

7.1 Empirical evidence and hypotheses

7.1.1 Information production and underwriting syndicate structure

In Section 3.1.2, I formulated the following hypotheses about the potential impact of underwriting syndicate structure on the information production function of the bookbuilding pricing mechanism based on the information production hypothesis of Corwin and Schultz (2005):

Hypothesis 1A: The number of co-managers in underwriting syndicates should be positively related to the amount of information discovered during the bookbuilding phase, as reflected by the absolute magnitude of filing price revisions.

Hypothesis 1B: The number of bookrunners in underwriting syndicates should be positively related to the amount of information discovered during the bookbuilding phase, as reflected by the absolute magnitude of filing price revisions.

Hypothesis 2A: The number of co-managers in underwriting syndicates should be positively related to the likelihood that underwriters correctly identify whether an IPO is under- or overpriced at its filing price.

Hypothesis 2B: The number of bookrunners in underwriting syndicates should be positively related to the likelihood that underwriters correctly identify whether an IPOs is under- or overpriced at its filing price.

Panel A of Table 7 in the Appendix summarises the empirical evidence related to these hypotheses. Overall, the empirical evidence for the sample of IPOs in France, Germany, Italy, and the UK in 1995-2010 provides mixed support to the information production hypotheses explored in this thesis and, by extension, the information production hypothesis of Corwin and Schultz (2005). More specifically, the results of the empirical analysis only partially confirm hypotheses 1A, 2A, and 2B. Regression analysis shows that, if the filing price underestimates the market valuation of an issuer's shares, underwriting syndicates with a higher number of co-managers possess a greater capability to identify this type of mispricing and discover a marginally greater amount of information about the excess investor demand. In addition to that, regression results indicate that underwriting syndicates with a higher number of bookrunners are associated with greater accuracy of recognising if an IPO is overpriced at the start of the bookbuilding phase.

At the same time, however, the empirical evidence also partially contradicts hypothesis 2A, as it points towards a higher propensity of underwriting syndicates with a higher number of co-managers to erroneously make upward, rather than downward, filing price revisions when IPOs are overvalued at their filing prices. It seems that such underwriting syndicates are worse at recognising that investor demand is weaker than expected when submitting the preliminary prospectus. It could therefore be speculated that, in IPOs that are overvalued at the start of the bookbuilding phase, the inclusion of additional co-managers in underwriting syndicates introduces unwarranted overconfidence to the process of setting final offer prices.

Finally, the results of the empirical analysis fail to provide support to hypothesis 1B. The hiring of additional bookrunners does not appear to be associated with a different amount of information produced during the bookbuilding phase, irrespective of whether IPOs are under- or overpriced at their filing prices.

7.1.2 The bargaining power of issuers and underwriting syndicate structure

In Section 3.2.2, I used the bargaining power hypothesis of Hu and Ritter (2007) to establish the following hypotheses about the potential impact of underwriting syndicate structure on the bargaining power of issuers and, by extension, the severity of the issuer-underwriter agency conflict:

Hypothesis 3A: The number of bookrunners in underwriting syndicates should be positively related to the magnitude of filing price revisions, irrespective of whether an issuer's shares are over- or underpriced at the filing price.

Hypothesis 3B: The number of co-managers in an underwriting syndicate should be positively related to the magnitude of filing price revisions, irrespective of whether an issuer's shares are over- or underpriced at the filing price.

Panel B of Table 7 in the Appendix shows the empirical evidence related to these hypotheses. Overall, the empirical evidence for the sample of IPOs in France, Germany, Italy, and the UK in 1995-2010 provides weak support to the notion that underwriting syndicate structure is positively related to the bargaining power of issuers in negotiating on higher filing price revisions with bookrunners. More specifically, the regression analysis provides no support to hypothesis 3A and only partial support to hypothesis 3B.

Regression results show that there is no evidence which would suggest that the hiring of an additional bookrunner creates an incentive for the bookrunners in an underwriting syndicate to exert higher levels of effort during the bookbuilding phase and suggest higher filing price revisions to the issuer with the objective of securing bookrunner mandates in future SEO deals of the issuer. Therefore, the inclusion of additional bookrunners in underwriting syndicates does not grant issuers superior bargaining power and mitigate the issuer-underwriter agency conflict.

On the other hand, regression analysis presents evidence that is in line with the hypothesis put forward by Corwin and Schultz (2005) that co-managers 'whisper in the issuer's ear' with the favourable information about the valuation of shares that they obtain from their network of investors. This, in turn, implies that, if there is potential for discovering information about excess investor demand, by having at least one co-manager in the underwriting syndicate, issuers gain bargaining power in negotiating on higher filing price revisions and become better equipped to mitigate the agency problem

with bookrunners. Nevertheless, the economic effect of this finding is low due to the magnitude of the coefficient used to make this interpretation.

Furthermore, although this finding is in line with the hypothesis of Corwin and Schultz (2005), it cannot be considered as being fully consistent with the bargaining power hypothesis of Hu and Ritter (2007). In the model used to formulate their hypothesis, Hu and Ritter (2007) do not distinguish between the scenario in which underwriters underestimate investor demand at the start of the bookbuilding phase from the scenario in which the underwriters overestimate the demand. Therefore, the observation that the empirical results do not indicate that the inclusion of additional co-managers is also simultaneously positively related to the magnitude of filing price revisions when IPOs are overvalued at their filing prices does not allow me to confirm the validity of the bargaining power hypothesis of Hu and Ritter (2007) in the context of this thesis.

7.2 Empirical evidence and alternative explanations

There are three potential explanations for the inability of the empirical evidence to confirm all hypotheses studied in this thesis.

7.2.1 Pre-marketing research coverage and filing price revisions

As explained in Section 2.2, one important difference between the U.S. and European IPO processes is that underwriters in European IPOs are not prohibited from distributing research analyst reports prior to the submission of the preliminary prospectus. As a result of this institutional difference, underwriters in European IPOs can engage in an early exchange of information with investors, which may allow the underwriters to set more accurate filing prices. Similar to the challenge faced in the bookbuilding phase, however, to achieve this theoretical benefit in the pre-marketing phase, underwriters must find a way to incentivise investors to truthfully disclose their assessment of the indicative valuation ranges that are included in pre-marketing research analyst reports.

Jenkinson et al (2006) explore the interaction between investors and underwriters in the pre-marketing phase of the European IPO process and develop a model which shows that there are two mechanisms which underwriters in European IPOs must simultaneously employ to ensure truthful cooperation of investors. First, they must commit to setting final offer prices within the bounds of initial filing price ranges, irrespective of the information that is discovered during the bookbuilding phase;

and second, they must commit to rationing share allocations of those investors that participated in the pre-marketing information exchange in favour of retail investors if an IPO turns out to be substantially oversubscribed during the bookbuilding phase. Jenkinson et al (2006) show that the fear of being punished due to the strong demand of retail investors, who may have exogenously become informed about the potential undervaluation of an issuer's shares, coupled with the underwriters' commitment not to exceed the initial filing price range when setting the final offer price incentivises investors not to misreport their private information in the pre-marketing phase.

The theoretical model of Jenkinson et al (2006) predicts that European IPOs should be associated with inflexible, or 'sticky', initial filing price ranges. This stickiness should be reflected in an insensitivity of filing price revisions to the information about investor demand discovered during the bookbuilding phase and a clustering of final offer prices at the upper bounds of initial filing price ranges. In fact, the observations made in Section 6.1.1 and the empirical evidence presented in Sections 6.2.1 and 6.2.2 are in line with this prediction of Jenkinson et al (2006). Therefore, it can be conjectured that the inability of the empirical evidence to confirm all hypotheses about the impact of underwriting syndicate structure on the bookbuilding phase may be explained by the pricing commitment that underwriters in European IPOs make to extract information from investors in the pre-marketing phase. More specifically, it could be that, in European IPOs, the limits that underwriters impose on their own pricing decisions in the bookbuilding phase make it unlikely for the hypothesised effects of employing higher numbers of bookrunners and co-managers on filing price revisions to transpire consistently.

The capability of the pre-marketing phase to produce information about investor demand prior to setting filing prices, however, also suggests that there may be an omitted variable bias in the empirical model used in this thesis. It could be that the effort exerted by underwriters in providing pre-marketing research coverage or their overall pre-marketing research coverage capabilities affect the extent to which they commit to setting final offer prices within the bounds of the initial filing price ranges. Moreover, underwriting syndicate structure could also have an on impact the effectiveness of the pre-marketing phase in producing information about investor demand. More specifically, the inclusion of both additional bookrunners and co-managers in underwriting syndicates could grant issuers access to broader and more diversified networks of information channels, which they can survey in the pre-

marketing phase, and superior bargaining power in negotiating on higher initial filing price ranges with bookrunners.

Taking into account this potential bias of the empirical model used in this thesis, I identify two areas for further research. First, further research into the impact of underwriting syndicate structure on the bookbuilding pricing mechanism in European IPOs could focus on controlling for the effect of pre-marketing research coverage on filing price revisions; and second, further research on European IPOs could examine the effect of underwriting syndicate structure on the effectiveness of the pre-marketing phase in producing information about investor demand.

7.2.2 Due diligence and filing price revisions

Hanley and Hoberg (2010) argue that theories of information production in the bookbuilding phase disregard the role of due diligence in producing information about the intrinsic value of an issuer's shares and, in turn, determining filing prices. In fact, assuming that underwriters' level of effort exerted in the pre-marketing phase is reflected in the content of the preliminary prospectuses, Hanley and Hoberg (2010) find that the level of effort exerted in carrying out due diligence is negatively related to both the magnitude of filing price revisions and the level of underpricing. Therefore, as Hanley and Hoberg (2010) conjecture, rigorous due diligence may reduce the need for information production in the bookbuilding phase.

Nevertheless, because of several types of direct and indirect costs associated with carrying out due diligence, some underwriters may choose to minimise the amount of effort they expend on this activity and, instead, choose to concentrate their efforts on producing information in the bookbuilding phase. Hanley and Hoberg (2010) posit that, if underwriters shirk their due diligence responsibilities, they may have an incentive to lowball filing prices with the aim of incentivising investors to disclose more information in the bookbuilding phase. In this case, to set more accurate final offer prices compared to the lowballed filing prices, underwriters must make substantial filing price revisions which, in the framework of Benveniste and Spindt (1989), require significant amounts of compensation to investors in the form of increased share allocations and partial adjustment of underpricing.

Hanley and Hoberg (2010) hypothesise that, if issuers cannot incentivise underwriters to exert higher levels effort on due diligence with higher fees, their ability to avoid the agency cost associated with the underwriters' decision to shirk due

diligence responsibilities should depend on their relative bargaining power. In the model used to postulate their bargaining power hypothesis, Hu and Ritter (2007) disregard the potential relationship between a bookrunner's level of effort in performing due diligence and the filing price on which this bookrunner advises an issuer. In fact, the model of Hu and Ritter (2007) assumes that bookrunners suggest filing prices in a way that resembles the prisoner's dilemma in game theory and choose how much effort to exert only with respect to carrying out the bookbuilding phase. However, it could be argued that the hypothesised competition that should arise between bookrunners in multiple bookrunner IPOs should also affect the way in which bookrunners determine their levels of effort in conducting due diligence. Therefore, it could be hypothesised that, by hiring more than one bookrunner, issuers should also gain superior bargaining power in incentivising bookrunners to conduct more rigorous due diligence. In turn, following the argumentation of Hanley and Hoberg (2010), this should result in more information being produced in the pre-marketing phase and, as a result, more accurate filing prices. Vithanage et al (2016a) reach a similar conclusion, but they also argue that underwriting syndicates with a higher number of bookrunners could also be better equipped to handle more arduous due diligence and, in turn, produce more information in the pre-marketing phase due to having more resources to deploy in this part of the IPO process.

Overall, the effectiveness of due diligence in producing information about the intrinsic value of IPO shares and resulting in more accurate filing prices suggests that the empirical model used in this thesis may suffer from another omitted variable bias. This problem may be particularly relevant in this thesis due to the potentially increased dependence of issuers in European IPOs on due diligence to arrive at accurate filing prices, which may be caused by the necessity of committing to pricing IPOs within the bounds of initial filing price ranges.

Considering this potential bias of the empirical model used in this thesis, I propose two additional areas for further research. First, further research into the impact of underwriting syndicate structure on the bookbuilding pricing mechanism in European IPOs could attempt to control for the effect of due diligence on filing price revisions; and second, further research on European IPOs could investigate the effect of underwriting syndicate structure on the effectiveness of due diligence in arriving at more accurate filing prices.

7.2.3 When-issued trading and filing price revisions

The final explanation for the mixed evidence on the hypotheses studied in this thesis is related to the existence of when-issued markets for the shares of European issuers. Aussenegg et al (2006) argue that the fact that, prior to setting final offer prices, underwriters in European IPOs have an essentially costless opportunity to assess investor demand based on publicly available when-issued market quotes makes it likely that the need for information production in the bookbuilding phase is diminished in European IPOs. Aussenegg et al (2006) study IPOs that took place on the Neuer Markt market of the Frankfurt Stock Exchange in 1999-2000 and find that when-issued market returns are positively related to the magnitude of filing price revisions. This finding suggests that when-issued trading does, in fact, reveal information relevant for setting final offer prices. Therefore, the fact that the empirical analysis of this thesis provides mixed evidence on the effect of underwriting syndicate structure on the bookbuilding pricing mechanism may be explained by the fact that information on when-issued market returns can be accessed by underwriting syndicates of all sizes.

Taking into consideration the potential relationship between when-issued market returns and filing price revisions, I propose that further research into the impact of underwriting syndicate structure on the bookbuilding pricing mechanism in European IPOs should strive to control for when-issued market returns.

8 Conclusion

In this thesis, I investigate the impact of underwriting syndicate structure on the bookbuilding pricing mechanism using a sample of 1,013 IPOs in France, Germany, Italy, and the UK between 1995 and 2010. More specifically, I apply the information production hypothesis of Corwin and Schultz (2005) and the bargaining power hypothesis of Hu and Ritter (2007) in the context of IPOs listed on stock exchanges in these four European countries, and examine whether the numbers of bookrunners and co-managers in underwriting syndicates are positively related to both the capability of bookbuilding to produce information about investor demand and the bargaining power of issuers to negotiate on higher filing price revisions. To do this, I employ probit and OLS regressions, in which I use the likelihood that underwriters revise filing prices upwards and the overall magnitude of filing price revisions as respective dependent variables.

In terms of the impact of the number of bookrunners in underwriting syndicates on the information production function of bookbuilding, I am only able to find evidence which suggests that underwriting syndicates with a higher number of bookrunners are more consistent in recognising if an IPO is overpriced at the start of the bookbuilding phase. With respect to the impact of the number of co-managers on this function of bookbuilding, however, the empirical analysis results in three findings. First, if the filing price underestimates the market valuation of an issuer's shares, underwriting syndicates with a higher number of co-managers are more capable of identifying this type of mispricing and producing a marginally greater amount of information about the excess investor demand. Second, underwriting syndicates with a higher number of co-managers are more conservative in deciding whether to revise filing prices upwards when the filing prices are close to matching the market valuations of issuers' shares. Finally, the more the filing prices overestimate the market demand for issuers' shares, the more likely it is that underwriting syndicates with a higher number of co-managers make the IPOs even more overpriced by revising the filing prices upwards. I interpret this last, counterintuitive finding as suggesting that, in IPOs that are overvalued at the start of the bookbuilding phase, the inclusion of additional co-managers in underwriting syndicates may introduce unwarranted overconfidence to the process of setting final offer prices.

Overall, the empirical evidence related to the hypothesis that underwriting syndicate structure should be positively related to the bargaining power of issuers in negotiating on higher filing price revisions with bookrunners is weak. Regression analysis results in no evidence which would suggest that the hiring of additional bookrunners creates an incentive for the bookrunners in an underwriting syndicate to exert higher levels of effort during the bookbuilding phase and compete in suggesting higher filing price revisions. Furthermore, although the number of co-managers is positively related to the amount of information produced about excess investor demand, the observation that it is not simultaneously positively related to the magnitude of filing price revisions when IPOs are overvalued at their filing prices does not allow me to confirm the validity of the bargaining power hypothesis of Hu and Ritter (2007) in the context of this thesis.

Finally, I find evidence supportive of the predictions made by Jenkinson et al (2006) about the implications of the exchange of information that takes place between underwriters and investors during the pre-marketing phase of the European IPO

process. More specifically, I observe that final offer prices are clustered around the upper and lower bounds of the initial filing price ranges, and that there is a noticeable change in the relationship between total returns and the magnitude of filing price revisions around the total return value of zero. I interpret these findings as representing evidence of the commitment that underwriters in European IPOs make to incentivise truthful cooperation of investors in the pre-marketing phase.

I propose the following ideas for further research. First, further investigation into the relationship between underwriting syndicate structure and the bookbuilding pricing mechanism in the context of European IPOs could focus on controlling for pre-marketing research coverage, due diligence, and when-issued market trading; and second, it could also be worthwhile to examine the effects of underwriting syndicate structure on pre-marketing research coverage and due diligence in the same European context.

9 References

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10 Appendix

Table 1: Issuer Industry Categorisation

This table reports the SIC codes and definitions of industries used to categorise sample IPOs as tech or regulated industry offerings based on the methodologies of Loughran and Ritter (2004) and Davidson et al (2006).

SIC industry definition:	SIC codes:
Tech industries (Loughran and Ritter, 2004):	
Computer hardware	3571, 3572, 3575, 3577, 3578
Communications equipment	3661, 3663, 3669
Electronics	3671, 3672, 3674, 3677, 3678, 3679
Navigation equipment	3812
Measuring and controlling devices	3823, 3825, 3826, 3827, 3829
Medical instrument	3841, 3845
Telephone equipment	4812, 4813
Communications services	4899
Software	7371, 7372, 7373, 7374, 7375, 7378, 7379
Regulated industries (Davidson et al, 2006):	
Utilities	4900-4999
Financial institutions	6000-6999

**Table 2: Stock Exchange Categorisation
Used for Assigning Stock Exchange Binary Variable Values**

This table reports the stock exchange categorisation used to assign stock exchange binary variable values. The description of historical stock exchange constituents by Vismara et al (2012) and the definitions found in the SDC Platinum internal glossary are used to select those SDC Platinum stock exchange codes that correspond to the stock exchange categorisation methodology described in Sections 4.5.4 and 5.1.5.

Assigned stock exchange group	Vismara et al (2012)	SDC Platinum stock exchange code	SDC Platinum internal glossary definition
1. London Official List	Official List	LO	London AIM
2. London AIM	AIM	IM	London AIM
3. Euronext Paris (excl. Marché Libre and Alternext)	Eurolist Nouveau Marché Premier Marché Second Marché	E6	Euronext Paris
		EP	Euronext Paris Nouveau Marche
		XP	Euronext Paris Premier Marche
		EM	Euronext Paris Second Marche
		PR	Paris
		PV	Paris - Nouveau Mark
		P5	Paris Premier Marche
		PM	Paris Second Market
4. Marché Libre and Alternext	Marché Libre Alternext	EL	Euronext Paris Marché Libre
		XT	Alternext
		AP	Alternext Paris
5. Frankfurt	Amtlicher Markt Freiverkehr Markt Geregelter Markt Neuer Markt	BE	Berlin
		DU	Dusseldorf
		F	Frankfurt
		FV	Frankfurt Neuer Market
		FO	Frankfurt OTC
		HA	Hamburg
		HR	Hannover
		MN	Munich
		MF	Munich Freiverkehr (OTC)
		SU	Stuttgart
		XE	Xetra
6. Milan	Expandi	M6	MAC AltMkt
	MAC / AIM Italia	M1	Mercato Telematico Azionario (Milan)
	Mercato Ristretto	ML	Milan
	MTA	MY	Milan Expandi
	Mtax	LS	Milan Star
	Nuovo Mercato	N3	Nuovo Mercato
		TM	Sistema Telematico delle Borse Italiane

**Table 3: Stock Exchange Categorisation
Used for Assigning Underwriter Reputation Scores**

This table reports the stock exchange categorisation methodology of Migliorati and Vismara (2014), as described in Section 5.3, used in this thesis to match underwriters found in the SDC Platinum IPO sample with their Migliorati-Vismara reputation scores. The difference of this categorisation methodology from the one reported in Table 2 is that it assigns IPOs listed on the Alternext market of Euronext Paris into the same group as IPOs listed on the main markets of Euronext Paris (group 3).

Migliorati and Vismara (2014)	Vismara et al (2012)	SDC Platinum stock exchange code	SDC Platinum internal glossary definition
1. London Official List	Official List	LO	London AIM
2. London AIM	AIM	IM	London AIM
3. Euronext Paris (excl. Marché Libre)	Alternext	XT	Alternext
	Eurolist	AP	Alternext Paris
	Nouveau Marché	E6	Euronext Paris
	Premier Marché	EP	Euronext Paris Nouveau Marche
	Second Marché	XP	Euronext Paris Premier Marche
		EM	Euronext Paris Second Marche
		PR	Paris
		PV	Paris - Nouveau Mark
		P5	Paris Premier Marche
		PM	Paris Second Market
4. Marché Libre	Marché Libre	EL	Euronext Paris Marché Libre
5. Frankfurt	Amtlicher Markt	BE	Berlin
	Freiverkehr Markt	DU	Dusseldorf
	Geregelter Markt	F	Frankfurt
	Neuer Markt	FV	Frankfurt Neuer Market
		FO	Frankfurt OTC
		HA	Hamburg
		HR	Hannover
		MN	Munich
		MF	Munich Freiverkehr (OTC)
		SU	Stuttgart
		XE	Xetra
6. Milan	Expandi	M6	MAC AltMkt
	MAC / AIM Italia	M1	Mercato Telematico Azionario (Milan)
	Mercato Ristretto	ML	Milan
	MTA	MY	Milan Expandi
	Mtax	LS	Milan Star
	Nuovo Mercato	N3	Nuovo Mercato
		TM	Sistema Telematico delle Borse Italiane

Table 4: Final Sample Construction

This table reports the steps involved in processing the initial dataset obtained from SDC Platinum and constructing the final sample used in the empirical analysis.

Tranches of IPOs reported by SDC Platinum for offerings taking place on stock exchanges in France, Germany, Italy, and the UK in 1995-2010	5 756
Pass common IPO underpricing study restrictions	3 772
Listed on stock exchanges considered by Migliorati and Vismara (2014)	3 521
Can be assigned Migliorati-Vismara bookrunner reputation scores	3 391
Can be assigned Migliorati-Vismara co-manager reputation scores	3 325
Have SEDOL identifiers	2 982
Have Factset data on the first trading day closing price	2 894
Have data on the initial filing price range	1 785
Reconcilable data	1 775
Number of unique IPOs in the final sample after consolidating IPO tranches	1 013

Table 5: Descriptive Statistics

Panel A reports descriptive statistics for the entire sample of IPOs in France, Germany, Italy, and the UK in 1995-2010. Panel B reports the development of average descriptive statistics over time after splitting the sample by IPO listing years. Panel C reports average descriptive statistics after splitting the sample by stock exchange, following the categorisation reported in Table 2. All panels report inflation-adjusted gross proceeds, which are expressed in December 2010 purchasing power. Total return is the percentage change from the filing price, which is measured as the midpoint of the initial filing price, to the first trading day closing price. The magnitude of the filing price revision is calculated as the percentage change from the filing price to the final offer price. Initial return is the percentage change from the final offer price to the first trading day closing price. Underwriter reputation is calculated by matching underwriters found in the SDC Platinum IPO sample with reputation scores calculated by Migliorati and Vismara (2014). The proceeds-weighted reputation score is based on an underwriter's market share in terms of capital raised, whereas the equal-weighted reputation score – in terms of the number of IPOs taken public. The underwriter with the highest market share measure is assigned the reputation score of one. All other underwriters' reputation scores are assigned as a fraction of one, based on their respective market share measures. Reputation scores are averaged if there are multiple bookrunners or co-managers in an underwriting syndicate. Descriptive statistics related to co-manager reputation are calculated based on those IPOs that have at least one co-manager. The numbers of tech and regulated industry offerings are calculated based on categorisation methodologies of Loughran and Ritter (2004) and Davidson et al (2006), which are reported in Table 1.

Panel A: Overall Descriptive Statistics							
	Mean	Stdev	Min	25th pct	Median	75th pct	Max
Gross proceeds, \$m	289.9	818.1	0.06	21.5	53.6	183.7	12 110.8
Total return, %	23.5%	59.2%	-63.8%	-4.8%	7.6%	28.9%	743.7%
Filing price revision, %	-0.2%	12.8%	-60.7%	-5.4%	1.5%	6.6%	100.5%
Initial return, %	22.4%	51.5%	-59.5%	0.02%	5.8%	22.7%	676.5%
Number of bookrunners per IPO	1.4	0.8	1	1	1	2	10
Number of co-managers per IPO	2.2	4.0	0	0	1	3	58
<i>Underwriter reputation:</i>							
Bookrunner – equal-weighted	0.48	0.31	0.01	0.19	0.48	0.72	1
Bookrunner – proceeds-weighted	0.35	0.32	0.001	0.05	0.24	0.57	1
Co-manager – equal-weighted	0.46	0.29	0.004	0.21	0.42	0.62	1
Co-manager – proceeds-weighted	0.25	0.23	0.0003	0.05	0.18	0.38	1
<i>Number of IPOs:</i>							
Total	1 013						
Tech industry	311						
Regulated industry	129						

Table 5: Descriptive Statistics (continued)

Panel B: Descriptive Statistics by Listing Year									
		1995	1996	1997	1998	1999	2000	2001	2002
Gross proceeds, \$m		3 355.2	1 058.3	396.8	178.0	180.5	231.9	403.0	404.1
	<i>Stdev</i>	<i>3 267.6</i>	<i>2 595.2</i>	<i>1 369.3</i>	<i>603.2</i>	<i>494.9</i>	<i>688.5</i>	<i>1 215.8</i>	<i>715.9</i>
Total return, %		33.1%	27.7%	20.9%	45.7%	42.5%	37.1%	-4.3%	0.4%
	<i>Stdev</i>	<i>55.8%</i>	<i>68.3%</i>	<i>43.3%</i>	<i>68.5%</i>	<i>86.6%</i>	<i>69.1%</i>	<i>28.8%</i>	<i>12.5%</i>
Filing price revision, %		23.5%	4.6%	1.3%	6.0%	1.9%	-0.1%	-9.5%	-4.1%
	<i>Stdev</i>	<i>41.6%</i>	<i>9.2%</i>	<i>7.9%</i>	<i>7.1%</i>	<i>9.0%</i>	<i>16.3%</i>	<i>23.3%</i>	<i>9.3%</i>
Initial return, %		6.2%	19.1%	18.7%	36.4%	38.1%	35.6%	5.8%	4.5%
	<i>Stdev</i>	<i>9.4%</i>	<i>44.7%</i>	<i>38.8%</i>	<i>61.2%</i>	<i>78.6%</i>	<i>60.5%</i>	<i>18.3%</i>	<i>5.5%</i>
Number of bookrunners per IPO		3.5	1.5	1.3	1.2	1.3	1.3	1.4	1.5
	<i>Stdev</i>	<i>2.1</i>	<i>0.9</i>	<i>0.6</i>	<i>0.4</i>	<i>0.5</i>	<i>0.6</i>	<i>0.7</i>	<i>0.7</i>
Number of co-managers per IPO		44.5	7.6	3.5	2.6	2.5	2.3	2.5	1.7
	<i>Stdev</i>	<i>10.6</i>	<i>12.3</i>	<i>4.1</i>	<i>3.1</i>	<i>3.2</i>	<i>3.1</i>	<i>4.1</i>	<i>2.8</i>
<i>Underwriter reputation:</i>									
Bookrunner – equal-weighted		0.43	0.47	0.65	0.58	0.51	0.53	0.50	0.50
	<i>Stdev</i>	<i>0.23</i>	<i>0.31</i>	<i>0.31</i>	<i>0.31</i>	<i>0.33</i>	<i>0.32</i>	<i>0.34</i>	<i>0.28</i>
Bookrunner – proceeds-weighted		0.43	0.46	0.49	0.36	0.34	0.34	0.37	0.36
	<i>Stdev</i>	<i>0.30</i>	<i>0.22</i>	<i>0.35</i>	<i>0.35</i>	<i>0.32</i>	<i>0.30</i>	<i>0.33</i>	<i>0.34</i>
Co-manager – equal-weighted		0.29	0.42	0.43	0.52	0.47	0.45	0.44	0.65
	<i>Stdev</i>	<i>0.09</i>	<i>0.25</i>	<i>0.25</i>	<i>0.29</i>	<i>0.30</i>	<i>0.30</i>	<i>0.25</i>	<i>0.27</i>
Co-manager – proceeds-weighted		0.25	0.26	0.29	0.24	0.25	0.23	0.25	0.37
	<i>Stdev</i>	<i>0.12</i>	<i>0.18</i>	<i>0.24</i>	<i>0.21</i>	<i>0.24</i>	<i>0.22</i>	<i>0.16</i>	<i>0.27</i>
<i>Number of IPOs:</i>									
Total		2	22	33	106	188	196	49	25
Tech industry		0	3	7	30	89	95	15	5
Regulated industry		0	3	1	7	18	16	9	2

Table 5: Descriptive Statistics (continued)

		2003	2004	2005	2006	2007	2008	2009	2010
Gross proceeds, \$m		256.4	224.1	572.8	238.2	276.0	435.2	294.4	419.8
	<i>Stdev</i>	559.6	435.7	1 218.2	392.8	528.2	752.6	525.9	710.4
Total return, %		19.7%	10.2%	6.6%	3.6%	7.0%	3.4%	10.8%	-4.4%
	<i>Stdev</i>	40.2%	23.5%	21.6%	17.9%	22.0%	14.0%	10.6%	15.3%
Filing price revision, %		0.3%	-2.8%	-1.0%	-2.2%	-0.8%	-4.2%	4.4%	-7.6%
	<i>Stdev</i>	7.6%	8.9%	13.7%	10.3%	11.5%	6.8%	6.2%	12.6%
Initial return, %		19.3%	12.9%	7.3%	5.8%	7.5%	7.7%	6.1%	3.4%
	<i>Stdev</i>	39.3%	18.9%	12.4%	12.3%	15.1%	10.7%	7.1%	7.6%
Number of bookrunners per IPO		1.4	1.3	1.7	1.6	1.6	1.5	1.8	2.2
	<i>Stdev</i>	0.5	0.6	0.8	0.9	1.1	0.7	1.3	1.9
Number of co-managers per IPO		0.8	1.3	1.8	1.0	0.9	1.4	1.2	1.4
	<i>Stdev</i>	1.6	2.9	2.2	1.6	1.5	2.7	1.6	1.6
<i>Underwriter reputation:</i>									
Bookrunner – equal-weighted		0.43	0.40	0.45	0.39	0.36	0.32	0.37	0.36
	<i>Stdev</i>	0.24	0.28	0.25	0.30	0.27	0.29	0.27	0.31
Bookrunner – proceeds-weighted		0.25	0.31	0.46	0.33	0.29	0.32	0.52	0.30
	<i>Stdev</i>	0.29	0.32	0.32	0.32	0.28	0.33	0.42	0.28
Co-manager – equal-weighted		0.28	0.45	0.38	0.43	0.44	0.38	0.08	0.36
	<i>Stdev</i>	0.24	0.26	0.27	0.32	0.33	0.40	0.12	0.31
Co-manager – proceeds-weighted		0.18	0.29	0.25	0.24	0.26	0.25	0.13	0.23
	<i>Stdev</i>	0.19	0.29	0.17	0.21	0.24	0.27	0.22	0.29
<i>Number of IPOs:</i>									
Total		19	67	55	110	97	14	5	25
Tech industry		0	16	10	20	16	1	3	1
Regulated industry		7	11	11	17	18	2	0	7

Table 5: Descriptive Statistics (continued)

Panel C: Descriptive Statistics by Stock Exchange							
		London		Euronext Paris		Frankfurt	Milan
		Official List	AIM	Euronext Paris (excl. Marché Libre and Alternext)	Marché Libre and Alternext		
Gross proceeds, \$m		734.5	63.1	385.4	14.8	209.6	265.5
	<i>Stdev</i>	831.8	110.4	1 116.4	11.7	783.6	632.0
Total return, %		8.7%	14.4%	15.2%	4.8%	39.6%	16.7%
	<i>Stdev</i>	30.2%	27.7%	42.7%	14.4%	71.9%	73.5%
Filing price revision, %		-1.9%	-0.3%	0.0%	0.1%	1.2%	-2.7%
	<i>Stdev</i>	13.0%	15.2%	11.4%	7.4%	12.4%	14.8%
Initial return, %		10.0%	15.1%	14.1%	4.6%	36.2%	18.6%
	<i>Stdev</i>	21.8%	23.9%	33.4%	10.8%	63.8%	65.0%
Number of bookrunners per IPO		1.7	1.1	1.4	1.0	1.3	1.9
	<i>Stdev</i>	0.9	0.3	0.8	0.2	0.6	1.2
Number of co-managers per IPO		2.7	0.1	2.5	0.1	2.6	2.2
	<i>Stdev</i>	2.6	0.6	4.8	0.4	3.8	5.0
<i>Underwriter reputation:</i>							
Bookrunner – equal-weighted		0.62	0.28	0.56	0.47	0.47	0.40
	<i>Stdev</i>	0.24	0.23	0.31	0.37	0.32	0.28
Bookrunner – proceeds-weighted		0.52	0.17	0.37	0.24	0.33	0.37
	<i>Stdev</i>	0.25	0.21	0.34	0.38	0.32	0.28
Co-manager – equal-weighted		0.45	0.27	0.53	0.40	0.48	0.25
	<i>Stdev</i>	0.24	0.20	0.29	0.36	0.30	0.26
Co-manager – proceeds-weighted		0.30	0.17	0.28	0.16	0.25	0.17
	<i>Stdev</i>	0.23	0.14	0.27	0.30	0.21	0.18
<i>Number of IPOs:</i>							
Total		114	96	214	53	389	147
Tech industry		26	11	65	14	166	29
Regulated industry		20	25	18	3	38	25

Table 6: Underwriting Syndicate Structure and Filing Price Revisions

Panel A of this table reports estimates from probit regressions in which the dependent variable is a binary variable that equals one if the final offer price was set above the filing price, which is measured as the midpoint of the initial filing price range, and zero otherwise. Panel B reports estimates from OLS regressions in which the dependent variable is the magnitude of filing price revisions, which is measured as the relative change from the filing price to the final offer price. Total return is the relative change from the filing price to the first trading day closing price. Positive total return is the value of the total return if it is positive. Negative total return is the value of the total return if it is negative. Market return is the relative change in the value of the MSCI Europe index from the filing date to the pricing date. Underwriter reputation is calculated by matching underwriters found in the SDC Platinum IPO sample with reputation scores calculated by Migliorati and Vismara (2014). The proceeds-weighted reputation score is based on an underwriter's market share in terms of capital raised, whereas the equal-weighted reputation score – in terms of the number of IPOs taken public. The underwriter with the highest market share measure is assigned the reputation score of one. All other underwriters' reputation scores are assigned as a fraction of one, based on their respective market share measures. Reputation scores are averaged if there are multiple bookrunners or co-managers in an underwriting syndicate. If there are zero co-managers in an underwriting syndicate, the co-manager reputation score equals zero. Expected proceeds are calculated as the number of offered shares times the filing price and are expressed in December 2010 purchasing power. Binary variable values for tech and regulated industry offerings are assigned based on categorisation methodologies of Loughran and Ritter (2004) and Davidson et al (2006), which are reported in Table 1. All regressions include binary variables for IPO listing years and stock exchanges, which are reported in Table 2. Regression coefficients for IPO listing year and stock exchange binary variables are not reported due to space considerations. Regressions in both panels report White-Huber heteroskedasticity-consistent standard errors in parentheses.

Table 6: Underwriting Syndicate Structure and Filing Price Revisions (continued)

Panel A: Probit Regressions with Upward Filing Price Revision Dependent Variable						
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	-1.984** (0.937)	-1.811* (0.931)	-1.727* (1.016)	-1.695 (1.038)	-1.835* (1.014)	-1.781* (1.037)
Positive total return	2.144*** (0.597)	2.147*** (0.597)	0.549 (1.040)	0.706 (1.010)	0.701 (1.012)	0.847 (0.981)
Negative total return	12.87*** (3.950)	13.01*** (3.970)	0.531 (7.597)	0.420 (7.550)	0.958 (7.431)	0.799 (7.413)
Market return					-2.350 (2.278)	-2.389 (2.225)
Number of bookrunners	-0.151* (0.0839)	-0.160* (0.0844)	-0.0106 (0.141)	-0.00219 (0.138)	-0.00865 (0.143)	-0.00145 (0.139)
Number of bookrunners interacted with:						
Positive total return			0.281 (0.733)	0.139 (0.665)	0.196 (0.707)	0.0653 (0.638)
Negative total return			14.54** (6.786)	14.79** (6.750)	14.38** (6.653)	14.64** (6.641)
Market return					0.853 (0.974)	0.843 (0.958)
Number of co-managers	-0.00841 (0.0171)	-0.00702 (0.0169)	-0.139*** (0.0362)	-0.140*** (0.0357)	-0.138*** (0.0361)	-0.140*** (0.0358)
Number of co-managers interacted with:						
Positive total return			1.324*** (0.294)	1.355*** (0.295)	1.335*** (0.294)	1.364*** (0.296)
Negative total return			-1.937*** (0.501)	-1.949*** (0.498)	-1.970*** (0.494)	-1.977*** (0.492)
Market return					-0.321 (0.375)	-0.272 (0.362)
Equal-weighted bookrunner reputation	0.516*** (0.178)		0.495*** (0.180)		0.498*** (0.179)	
Equal-weighted co-manager reputation	-0.186 (0.190)		-0.281 (0.197)		-0.280 (0.193)	
Proceeds-weighted bookrunner reputation		0.373** (0.182)		0.327* (0.187)		0.322* (0.186)
Proceeds-weighted co-manager reputation		-0.747*** (0.252)		-0.865*** (0.263)		-0.847*** (0.261)
Natural log of Expected proceeds	0.172* (0.103)	0.173 (0.108)	0.134 (0.115)	0.149 (0.122)	0.150 (0.115)	0.162 (0.122)
Tech industry	-0.200* (0.119)	-0.223* (0.120)	-0.238* (0.129)	-0.257** (0.130)	-0.245* (0.129)	-0.261** (0.130)
Regulated industry	0.0349 (0.174)	0.0194 (0.172)	-0.00401 (0.171)	-0.0153 (0.170)	0.00428 (0.171)	-0.00983 (0.171)
Listing year binary variables	✓	✓	✓	✓	✓	✓
Stock exchange binary variables	✓	✓	✓	✓	✓	✓
Pseudo R ²	0.429	0.431	0.474	0.477	0.477	0.480

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6: Underwriting Syndicate Structure and Filing Price Revisions (continued)

Panel B: OLS Regressions with Magnitude of Filing Price Revision Dependent Variable						
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.319*	0.314	0.270**	0.263**	0.264**	0.257**
	(0.190)	(0.191)	(0.109)	(0.111)	(0.111)	(0.113)
Positive total return	0.0259***	0.0258***	-0.0137	-0.0136	-0.00983	-0.00972
	(0.00695)	(0.00697)	(0.0201)	(0.0201)	(0.0201)	(0.0200)
Negative total return	0.920***	0.921***	0.839***	0.838***	0.839***	0.838***
	(0.0582)	(0.0581)	(0.0982)	(0.0982)	(0.0979)	(0.0979)
Market return					-0.186***	-0.185***
					(0.0717)	(0.0716)
Number of bookrunners	-0.00236	-0.00238	0.00143	0.00144	0.00114	0.00114
	(0.00387)	(0.00397)	(0.00579)	(0.00585)	(0.00598)	(0.00604)
Number of bookrunners interacted with:						
Positive total return			0.0163	0.0162	0.0145	0.0143
			(0.0162)	(0.0162)	(0.0161)	(0.0161)
Negative total return			0.0537	0.0549	0.0546	0.0558
			(0.0447)	(0.0446)	(0.0453)	(0.0451)
Market return					0.0344	0.0332
					(0.0375)	(0.0375)
Number of co-managers	-0.000173	-0.000175	-0.00174	-0.00173	-0.00168	-0.00168
	(0.00105)	(0.00106)	(0.00117)	(0.00117)	(0.00118)	(0.00119)
Number of co-managers interacted with:						
Positive total return			0.00960**	0.00962**	0.00947**	0.00947**
			(0.00451)	(0.00454)	(0.00451)	(0.00454)
Negative total return			-0.000537	-0.000455	-0.000721	-0.000626
			(0.0108)	(0.0108)	(0.0108)	(0.0108)
Market return					-0.00127	-0.000643
					(0.0147)	(0.0147)
Equal-weighted bookrunner reputation	0.00103		0.00129		0.00155	
	(0.00865)		(0.00867)		(0.00863)	
Equal-weighted co-manager reputation	-0.0101		-0.00860		-0.00806	
	(0.00856)		(0.00842)		(0.00835)	
Proceeds-weighted bookrunner reputation		0.00261		0.00160		0.00145
		(0.00756)		(0.00743)		(0.00740)
Proceeds-weighted co-manager reputation		-0.0174		-0.0169		-0.0164
		(0.0137)		(0.0138)		(0.0137)
Natural log of Expected proceeds	-0.00403	-0.00341	-0.00576	-0.00487	-0.00483	-0.00391
	(0.00864)	(0.00921)	(0.00854)	(0.00914)	(0.00859)	(0.00920)
Tech industry	0.00568	0.00540	0.00374	0.00350	0.00250	0.00226
	(0.00603)	(0.00610)	(0.00592)	(0.00598)	(0.00605)	(0.00611)
Regulated industry	0.0195*	0.0195*	0.0214*	0.0213*	0.0207*	0.0206*
	(0.0116)	(0.0116)	(0.0116)	(0.0116)	(0.0116)	(0.0116)
Listing year binary variables	✓	✓	✓	✓	✓	✓
Stock exchange binary variables	✓	✓	✓	✓	✓	✓
R-squared	0.565	0.566	0.577	0.577	0.580	0.580

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7: Summary of Hypotheses and Empirical Evidence

Panel A: Underwriting Syndicate Structure and Information Production			
Hypotheses based on the information production theory of Corwin and Schultz (2005):		Empirical evidence:	
		IPOs underpriced at filing prices	IPOs overpriced at filing prices
1A:	The number of co-managers should be positively related to the amount of information discovered during the bookbuilding phase, as reflected by the absolute magnitude of filing price revisions.	Positive coefficient, p-value < 0.05, Low economic effect.	Not significant.
1B:	The number of bookrunners should be positively related to the amount of information discovered during the bookbuilding phase, as reflected by the absolute magnitude of filing price revisions.	Not significant.	Not significant.
2A:	The number of co-managers should be positively related to the likelihood that underwriters correctly identify whether an IPO is under- or overpriced at its filing price.	Positive coefficient, p-value < 0.01.	Negative coefficient, p-value < 0.01.
2B:	The number of bookrunners should be positively related to the likelihood that underwriters correctly identify whether an IPO is under- or overpriced at its filing price.	Not significant.	Positive coefficient, p-value < 0.05.
Panel B: Underwriting Syndicate Structure and the Issuer-Underwriter Agency Conflict			
Hypotheses based on the bargaining power theory of Hu and Ritter (2007):		Empirical evidence:	
3A:	The number of bookrunners should be positively related to the magnitude of filing price revisions, irrespective of whether an issuer's shares are over- or underpriced at the filing price.	Not significant.	
3B:	The number of co-managers should be positively related to the magnitude of filing price revisions, irrespective of whether an issuer's shares are over- or underpriced at the filing price.	Positive coefficient, p-value < 0.05, Low economic effect, Valid only for positive total returns.	

Figure 3: Final Offer Prices Relative to Initial Filing Price Ranges

This figure shows histograms of Final Offer Price / LFILE and Final Offer Price / HFILE ratios, in which LFILE and HFILE are the lower and upper bounds of the initial filing price range, respectively. If the Final Offer Price / LFILE ratio is lower than one, the final offer price was set below the lower bound of the range. If the Final Offer Price / HFILE ratio is greater than one, the final offer price exceeds the upper bound. Panel A shows histograms of overall sample ratio values between 0.5 and 99.5 percentiles. Panel B splits the sample by stock exchange and shows histograms of ratio values between 2.5 and 97.5 percentiles. In both panels, vertical axes represent distribution densities.

Panel A: Overall Sample

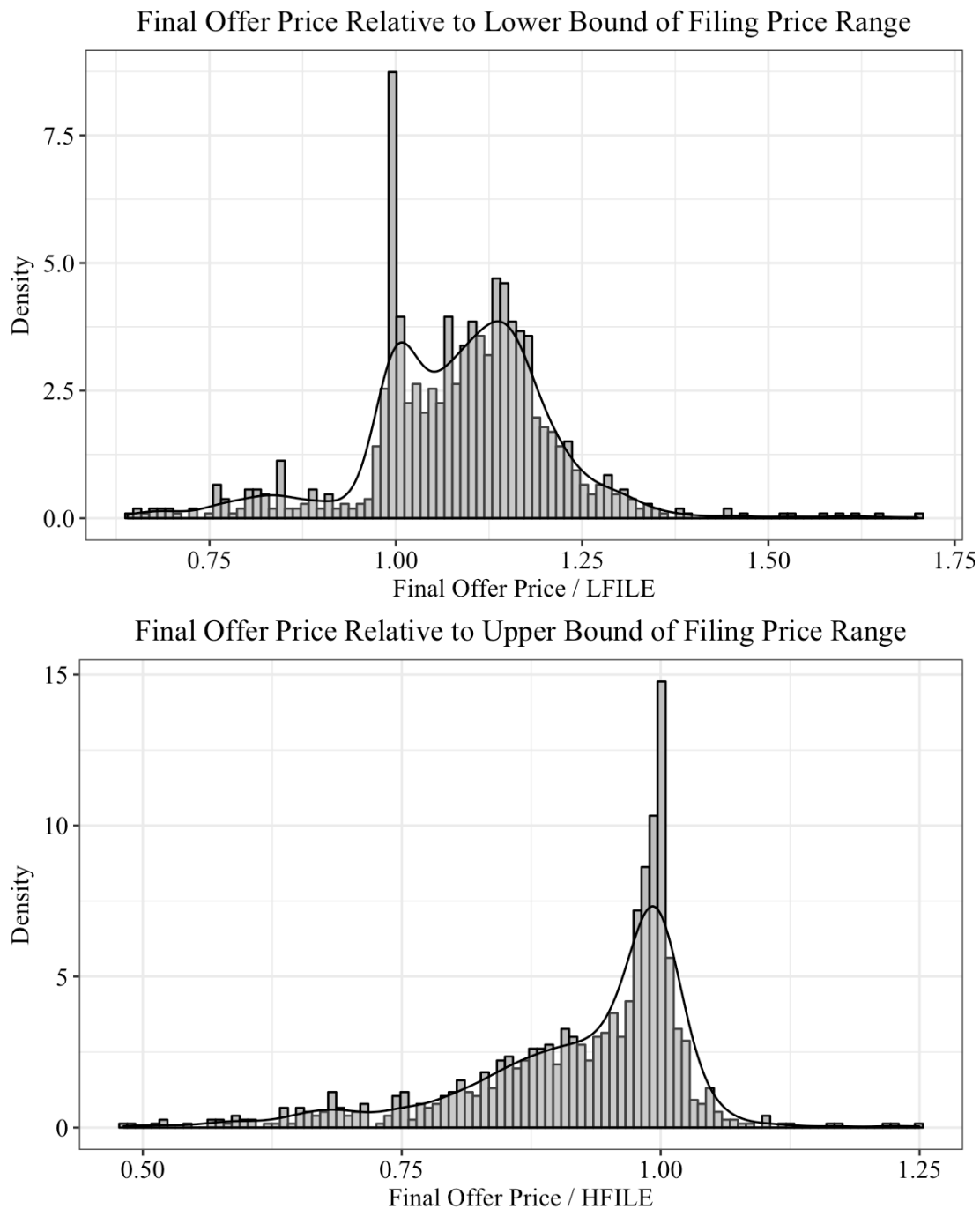


Figure 3: Final Offer Prices Relative to Initial Filing Price Ranges (continued)

Panel B: Sample Split by Stock Exchange

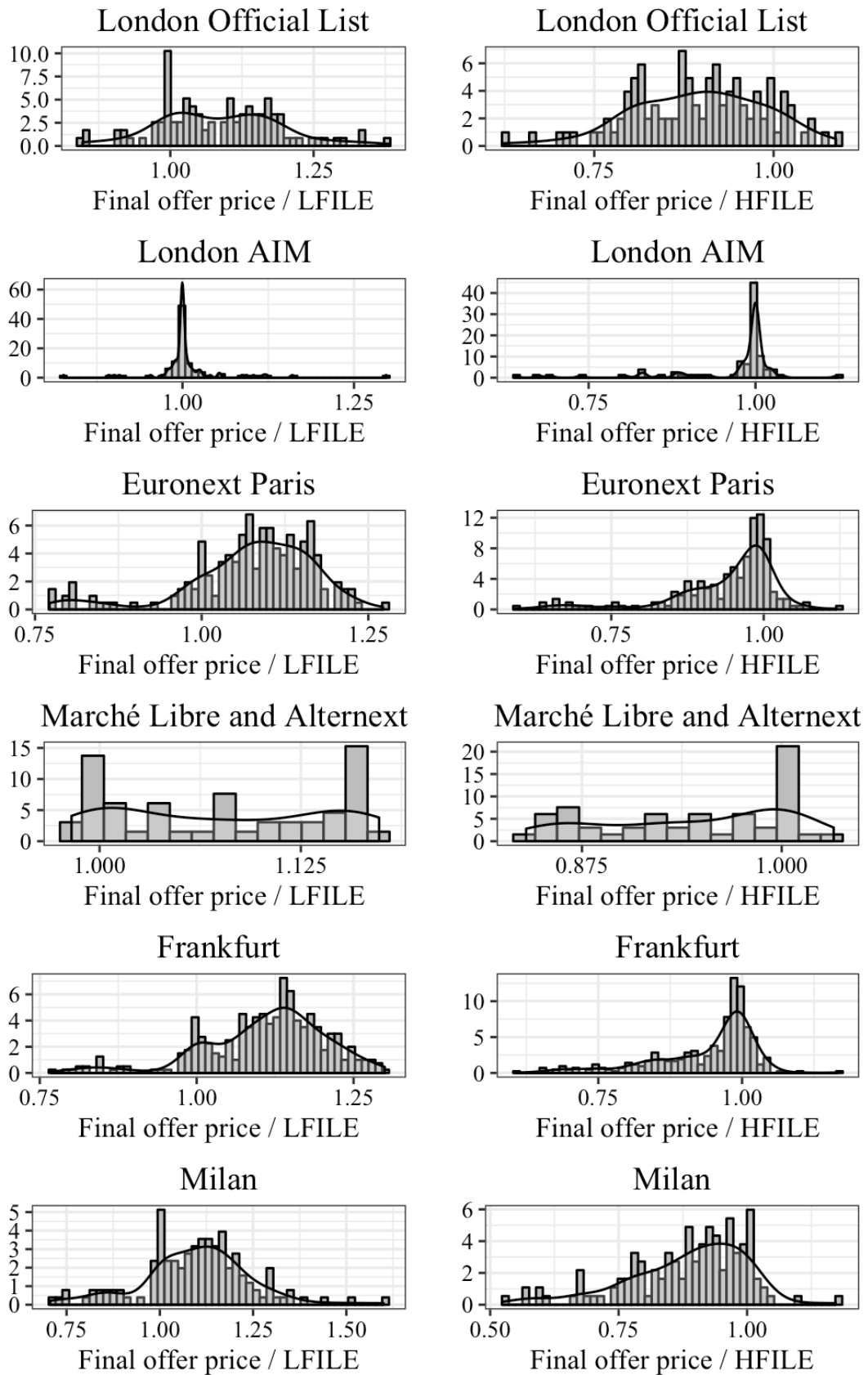


Figure 4: Magnitude of Filing Price Revisions Relative to Total Returns

This figure shows a scatterplot of total returns to the magnitude of filing price revisions. The magnitude of filing price revisions is the percentage change from the filing price to the final offer price. The total return is the percentage change from the filing price to the first trading day closing price.

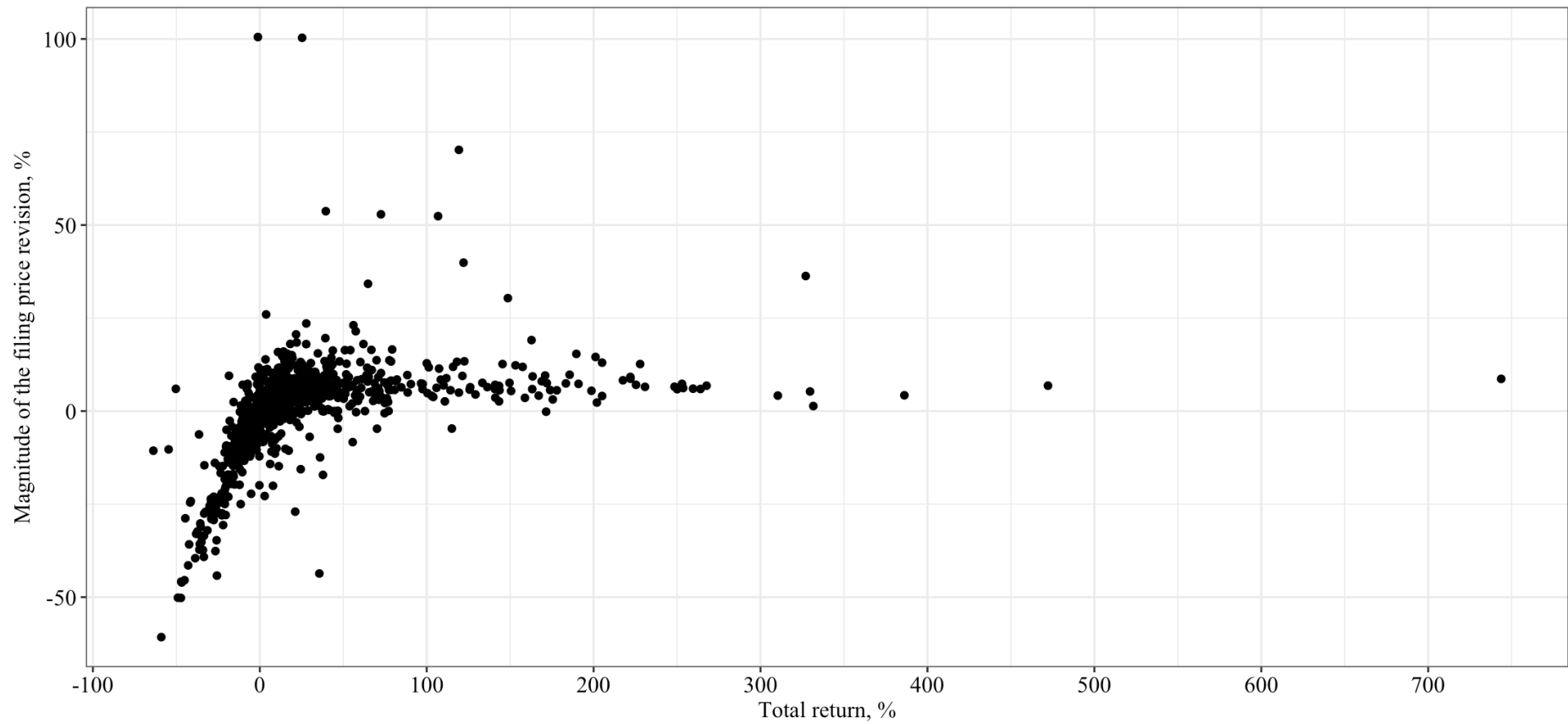


Figure 5: Underwriting Syndicate Structure

This figure shows bar charts of underwriting syndicate structure measures. Panel A shows bar charts for the entire sample. Panel B shows bar charts after splitting sample IPOs by the stock exchanges on which they are listed. In both panels, vertical axes represent the numbers of sample IPOs.

Panel A: Overall Sample

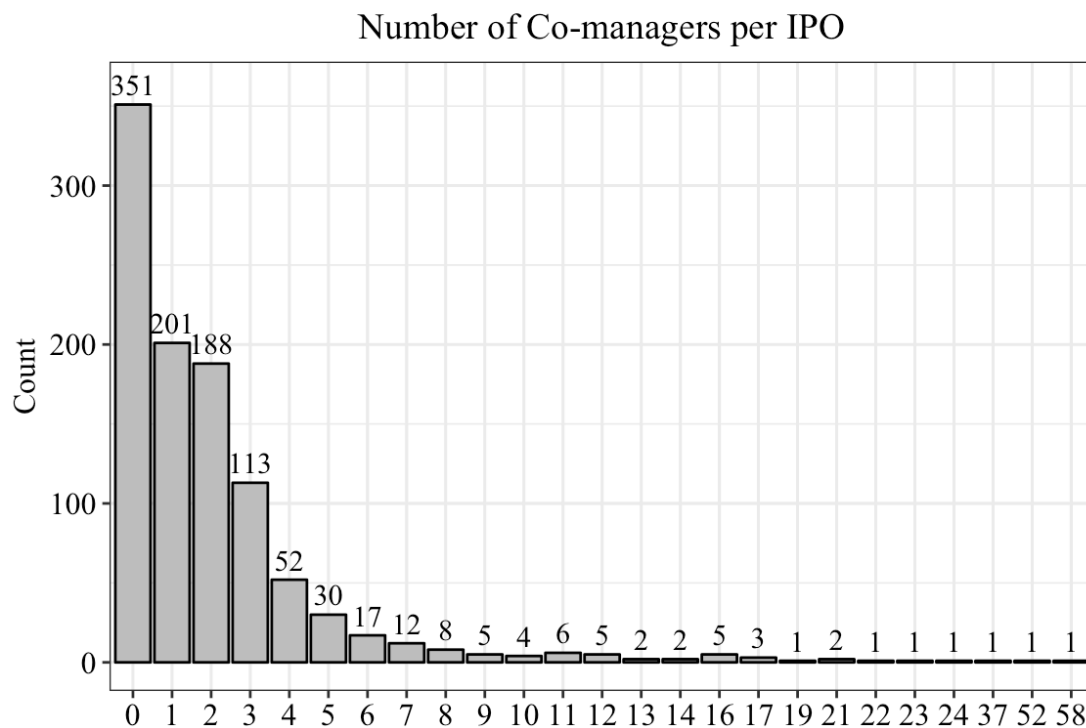
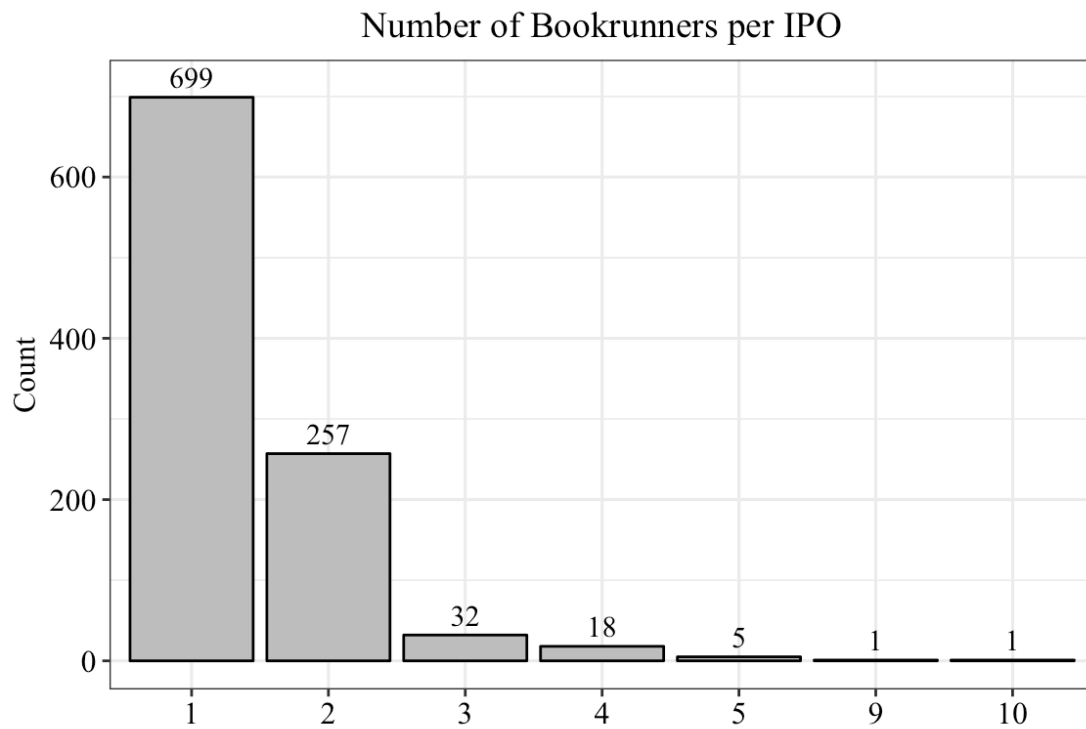


Figure 5: Underwriting Syndicate Structure (continued)

Panel B: Sample Split by Stock Exchange

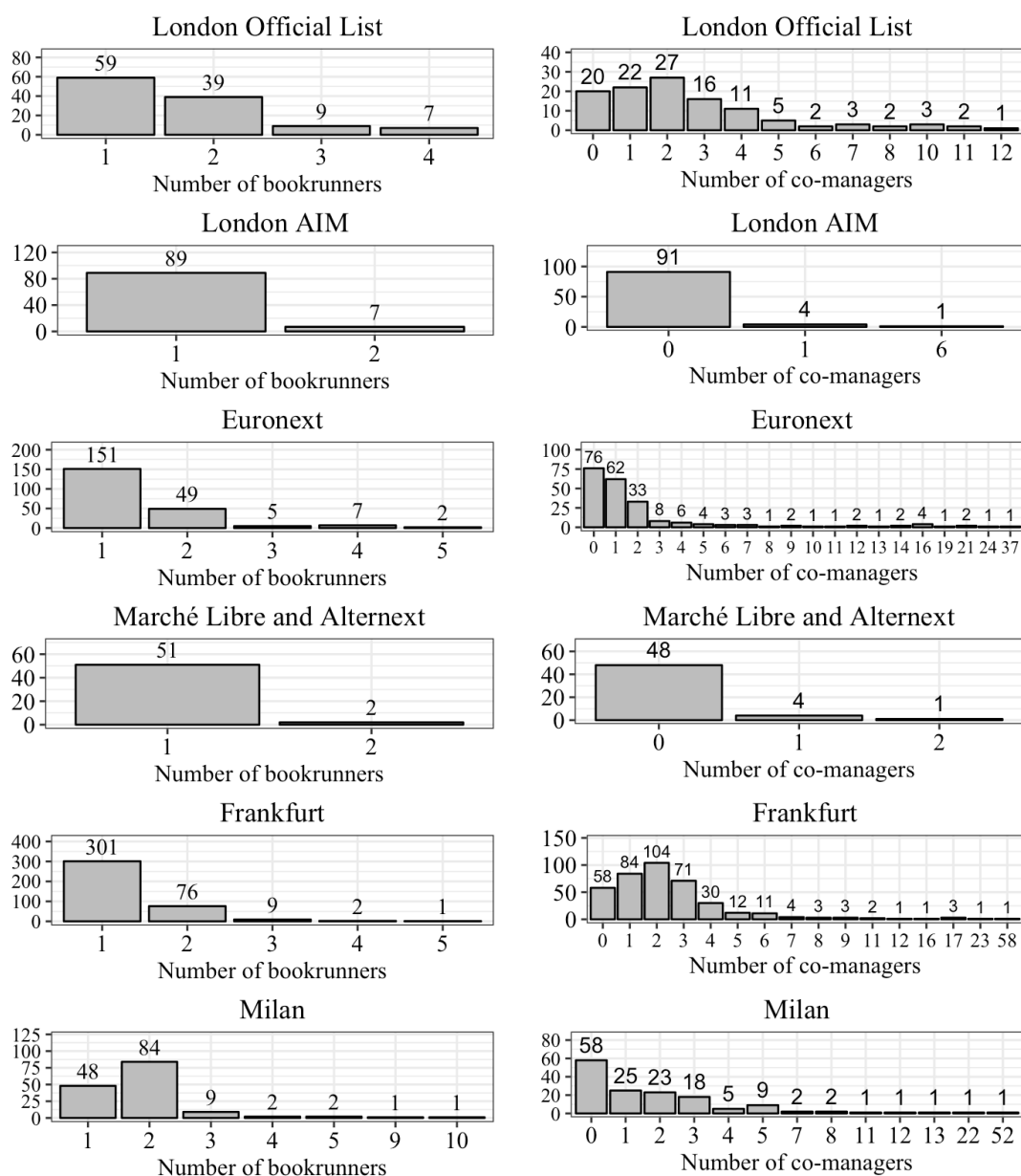


Figure 6: Underwriting Syndicate Structure and Filing Price Revisions

Panel A shows boxplots of the relationship between the magnitude of filing price revisions and the number of bookrunners in underwriting syndicates. Panel B shows the relationship between the magnitude of filing price revisions and the number of co-managers. In both panels, the magnitude of filing price revisions and underwriting syndicate structure measures are separately plotted for IPOs with negative and positive total return values. In both IPO subsamples, filing price revision values are separately winsorised at the 2.5 and 97.5 percentiles. The line in the middle of a boxplot is the median filing price revision. The lower and upper hinges correspond to filing price revision values between 25 and 75 percentiles. The upper whisker represents values that are no further than 1.5 times the distance between the 25 and 75 percentiles from the upper hinge. The lower whisker represents values that are no less than 1.5 times the distance between the 25 and 75 percentiles from the lower hinge. Dotted values beyond the whiskers represent outliers.

Panel A: Number of Bookrunners and Magnitude of Filing Price Revisions

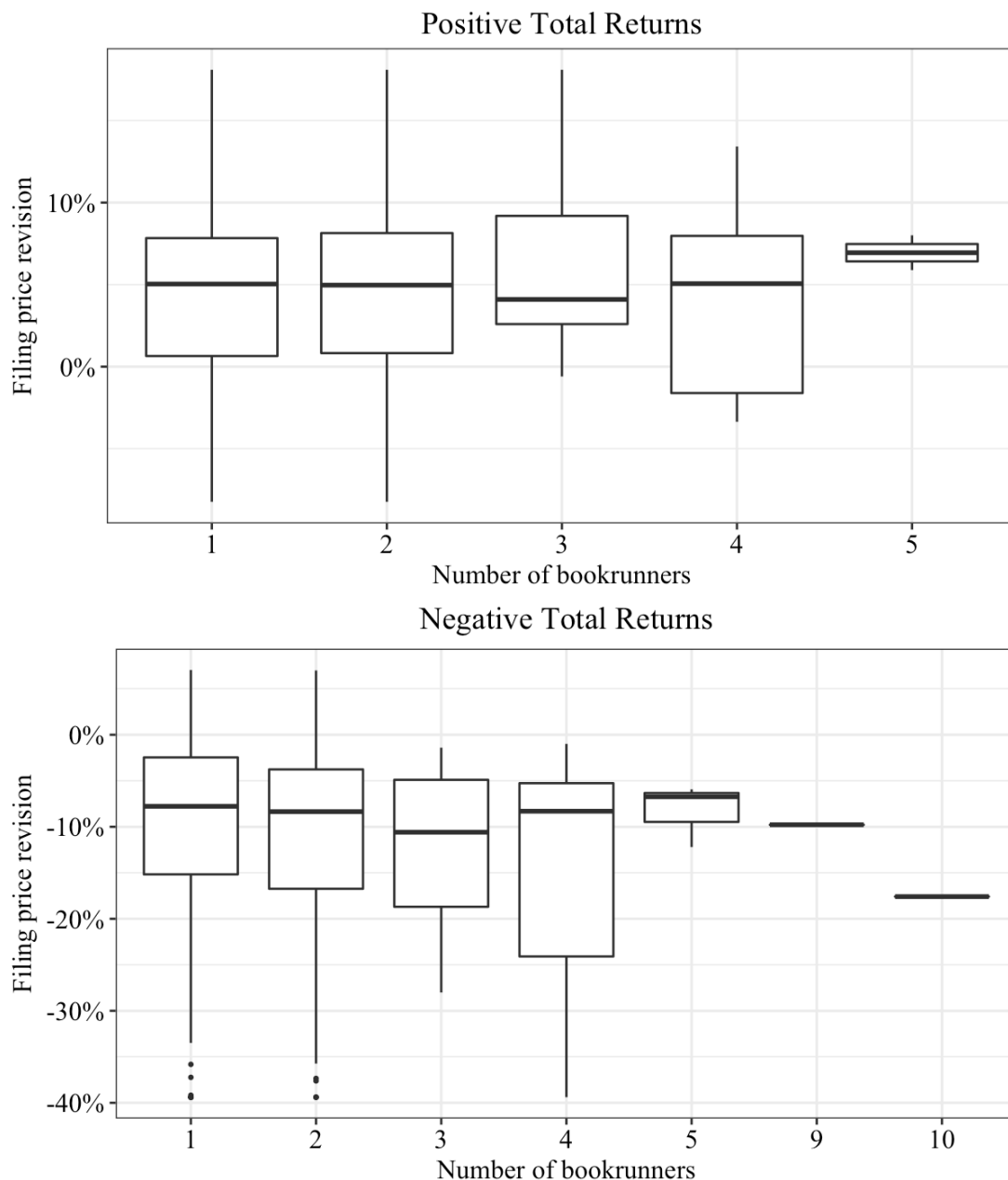


**Figure 6: Underwriting Syndicate Structure and Filing Price Revisions
(continued)**

Panel B: Number of Co-managers and Magnitude of Filing Price Revisions

