

Quid pro quo? What factors influence IPO allocations to investors?

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Summary

Investment banks face potential conflicts of interest when conducting initial public offerings (IPOs) of shares. They work for issuing firms, and advise them on the pricing and allocation of the shares. They also have long-term relationships with buy-side investors for whom they offer trading, research, and many other services. IPOs are, on average, underpriced (i.e. the offer price is below the price at which shares trade immediately after the IPO) and investors who are allocated shares benefit from any such underpricing. Research to date into the determinants of IPO allocations has been limited by a lack of relevant data, particularly about the revenues from the buy-side clients of the bookrunning investment bank, and about the subsequent trading activity of investors. This paper draws on data gathered as part of the UK Financial Conduct Authority's market study of investment and corporate banking. The paper finds evidence that syndicate banks make favourable allocations to investors who provide them with information likely to be useful in pricing the IPO, particularly investors who submit price-sensitive bids, and those who attend meetings with the issuer before the IPO. At the same time, book-runners make favourable allocations to investors from whom they generate the greatest revenues elsewhere in their business, notably through brokerage commissions. Long-only investors seem to receive more favourable allocations than hedge funds. We do not find evidence that banks make less favourable allocations to investors who go on to sell those shares shortly after the IPO, nor that they favour investors who provide aftermarket liquidity.

1 Overview

Purpose

Initial public offerings (IPOs) play a vital role in the UK economy, enabling companies to raise finance for investment, expansion, and continuing operations. They provide investment opportunities for pension funds, insurance companies, other institutional investors, and individuals. A key aspect of a well-functioning primary market is an effective allocation process and there have been concerns from issuers and investors that when issuing equity or debt the issuing banks may favour certain investors (Wholesale Sector Competition Review (FCA, 2015a)). On 22 May 2015, the FCA launched a market study to investigate competition in investment and corporate banking, focusing on primary market services. As part of this market study the FCA decided to examine the transparency of the allocations process when issuing equity.

In this paper we seek to understand if the IPO allocation process works in the interest of issuer clients or whether conflicts of interest may result in banks favouring their highest-revenue clients when deciding on final allocations in IPOs.

We assemble a detailed dataset on IPO allocations, on the revenues that banks receive from IPO investors, on meetings between issuers and investors, and on the trading behaviour of IPO investors. The dataset covers all IPOs conducted out of the UK between January 2010 and May 2015. We complement this dataset with evidence about banks' allocation policies and qualitative responses of market participants about the factors they perceive to be important in the allocation process. We use this data to address the following questions

- What are the determinants of IPO allocations?
- What revenues do investment banks earn from IPO investors, and how do these compare with the fees paid by IPO issuers?
- Do the revenues which investment banks earn from investors drive allocations to those investors?
- Are there significant differences in allocation practices across banks?
- Are investors who hold onto their shares, or who provide liquidity by trading actively in the IPO aftermarket, favoured in the allocation process?

Key findings

Determinants of IPO allocation

We find evidence consistent with book-runners making favourable allocations to investors with whom they generate the greatest revenues elsewhere in their business, notably through brokerage commissions. The scale of the revenues earned by investment banks from institutional investors is considerable, averaging over \$37

bn per year during our sample period. In contrast, we estimate that the annual fees paid by IPO issuers to investment banks were around \$750m. Investors in the top quartile of the book-runners' clients by revenues receive allocations, relative to the amount they bid, which are around 60% higher than those received by investors who have no revenues with the book-runner. This result is driven primarily by allocations in 'hot' IPOs, ie those which are quickest to be fully subscribed. The pattern is broadly the same across individual banks, although for two banks investor revenues appear to have at most a weak impact on IPO allocations.

At the same time syndicate banks make favourable allocations to investors who provide them with information likely to be useful in pricing the IPO. In particular, investors who submit price-sensitive bids, and those who attend meetings with the issuer before the IPO, are favoured in allocations. While both these variables are only indirect evidence of information revelation, our findings lend support to an account in which book-runners reward investors (by scaling them back less) if they provide information to the syndicate banks which is valuable for the pricing of the shares.

Secondary market trading after the IPO

Issuers and investment banks have highlighted that the likely behaviour of investors in the IPO aftermarket is an important consideration when determining IPO allocations.

First, allocating to long-term investors has been mentioned consistently by investment banks and by issuers as an important factor in the IPO allocation process. When looking at the behaviour of investors in the month after the IPO we do not find evidence that those investors who go on to sell their shares quickly after the IPO received lower levels of allocation in that IPO than other investors. This suggests that book-runners are unsuccessful in anticipating which investors will be flippers.

Second, some book-runners have argued that, in allocating shares in an IPO, it is important to ensure that there will be sufficient levels of liquidity in the aftermarket. When looking at liquidity provision we observe high levels of turnover in the first days of trading, which suggests that allocating to liquidity providers is unnecessary for this period. As for longer-term liquidity provision, we do not find evidence that investors who turn out to be liquidity providers are favoured in allocations.

Book-runners sometimes justify allocating to hedge funds in IPOs on the grounds that they provide valuable aftermarket liquidity. We find no evidence for this: hedge funds allocated shares in our sample of IPOs provide negligible aftermarket liquidity, and those which do provide liquidity are not favoured by book-runners in allocations.

Are allocation practices detrimental?

There is no unique optimal allocation or pricing policy for each IPO, and so it is difficult to quantify the extent, if any, to which allocating shares to banks' preferred clients leads to a less favourable outcome for issuers. It is, for example, possible that banks only allocate shares more generously to their favoured clients once the optimal shareholder base has been achieved. However, book-runners face a conflict of interest between issuers and investors when pricing and allocating IPOs. Since the revenues they earn from investors dwarf the fees which they earn from issuers, there is a risk that book-runners will resolve this conflict at the issuers' expense, first, by allocating more shares to high-revenue investors than is optimal for the

issuer and, second, by setting the price of the IPO at a lower than optimal level. In both these ways the book-runners would be maximising the value of the IPO process to their own high-revenue investor clients.

2 Introduction

Initial public offerings (IPOs) enable issuing companies to raise equity finance and provide investors with an asset that can be traded. As such, IPOs have an important role in the financial system. However, doubts remain about how well the market for new equity issues (the primary market) operates for issuers. The IPO boom in the US during the dot-com period – in particular 1999-2000 – witnessed several scandals, including laddering, spinning¹, analyst conflict of interest, as well as quid pro quo arrangements where valuable share allocations were given in return for trading commissions (Liu and Ritter (2010)). There followed a dearth of IPOs for much of the 2000s, even before the 2008 financial crisis (Ritter (2013)). Regulators also responded by outlawing specific practices and requiring investment banks to implement policies to address conflicts of interest. In the US, concerns that financial markets were not effectively serving the needs of growing companies led to investigations that resulted in the passing of the JOBS Act.² Despite all this attention, there is still limited evidence on whether IPOs are now run in the interests of the issuing companies.

In the UK, the Financial Conduct Authority (FCA) began a review of wholesale financial markets in 2014. This led to the launch of a market study into investment and corporate banking in May 2015. The Terms of reference included a detailed review of allocations in IPOs.³ The research in this paper forms part of the market study, and benefits from the sort of data that has not previously been available to researchers. All banks with operations in the UK, which includes all the leading investment banks, are subject to regulation by the FCA. The FCA used their powers under the Financial Services and Markets Act 2012, to gather detailed information on IPOs conducted from the UK between January 2010 and May 2015.⁴ This dataset allows us to consider a range of issues about IPO pricing, allocation, syndicate structure, fees, and post-IPO trading.

The main question we address in this paper is how IPO allocations are determined. The underpricing of IPOs is well documented and represents ‘money left on the table’ for the original owners of the company.^{5, 6} That money is picked up by those who are allocated shares at the IPO which immediately trade higher than the offer price. But the causes and effects of this underpricing remain the subject of debate.

¹ Laddering is the practice of allocating shares on the understanding that investors will buy additional shares in the immediate aftermarket. Spinning refers to the practice of allocating shares to corporate executives in order to influence their decisions in future corporate investment banking transactions.

² The Jumpstart Our Business Startups Act was passed into law in 2012 and requires the SEC to write rules that facilitate cost-effective access to capital for companies of all sizes while promoting investor protection.

³ This Wholesale Sector Competition Review was launched in July 2014 (FCA, 2014) with a discussion document that invited responses from market participants on a range of issues. In February 2015 the FCA issued a feedback statement (FCA, 2015a) on the views that had been expressed, and announced that they would launch two market studies. The first would focus on Investment and Corporate Banking, and the second on Asset Management. The Terms of reference for the former, to which this paper is related, were published in May 2015 (FCA, 2015b) with questionnaires and data requests being sent out to relevant parties in June 2015.

⁴ Conducted from the UK means all activities undertaken from or in the UK, regardless of the location of the client or the legal entity into which the activity is booked for accounting reasons.

⁵ ‘Underpricing’ is a technical term used to describe cases where IPO shares are offered to investors at a discount (i.e. the offer price is below the price at which shares trade immediately after the IPO).

⁶ Jenkinson and Ljungqvist (2001) survey the academic evidence on underpricing, and Jay Ritter produces a wealth of data for the US and other countries on his website <https://site.warrington.ufl.edu/ritter/ipo-data/>.

A benign interpretation sees underpricing as an equilibrium phenomenon. Given the asymmetry of information about the valuation of companies, investment banks reward investors who reveal useful pricing information by making preferential allocations of underpriced shares to them (Benveniste and Spindt, 1989). A less benign view is that conflicts of interest help to explain underpricing. Investment banks may reward those buy-side investor clients who generate revenues for the bank through broking and other services with allocations of underpriced IPOs (Reuter (2006), Nimalendran, Ritter and Zhang (2007), Ritter and Zhang (2007), Goldstein, Irvine, and Puckett (2011)). An alternative possible explanation is that underpricing generates excess demand for the shares, which gives the issuer more control over the initial shareholders. In particular, they may favour long-term holders of the shares over those who are likely to immediately sell (often referred to as 'flippers') in the after-market. This favouritism may well be rational: those intending to hold onto the shares have greater incentives to research the company before the IPO and may provide more information during book-building. A rather different potential explanation is that long-term investors may play a more active role in monitoring the company, and so corporate governance and long-term performance may be improved (see discussion in Ritter and Welch (2002)).

Previous attempts to adjudicate between these hypotheses, which are clearly not mutually exclusive, have been limited by lack of data. However, a few researchers have obtained access to IPO allocation books, with details of how investors bid. The first such study was by Cornelli and Goldreich (2001) who obtained allocation books for 39 IPOs run by a single European investment bank. They found that price-sensitive bids and bids revised during the book-building were favoured. Certain investor types also received better allocations: those who participated regularly in the particular bank's IPOs, domestic investors, pension funds, and insurance companies – who are likely to be long-term investors. However, a later study by Jenkinson and Jones (2004) using 27 allocation books for a different European investment bank found rather different results. They found no evidence that bids that had price-limits, or were revised during the book-building, were favoured. However, they found evidence that investors perceived to be long-term holders obtained preferential allocations compared to perceived flippers.

These contrasting findings from prior studies leave important questions unanswered. Do the different results reflect differential allocation policies used by these two particular banks, or varying market conditions for the two samples of deals?⁷ Can we draw more general conclusions about the way investment banks decide IPO allocations from these two European banks? None of the major US-based investment banks has been subjected, to date, to detailed analysis. And, in the light of the various scandals, fines, and regulatory interventions in recent years, has behaviour changed since the earlier studies, whose samples were pre-2001?

This latter question is particularly relevant as regulators in many countries have required investment banks to define policies about the way they conduct allocations of IPOs. The FCA, for example, expects banks to manage potential conflicts by implementing appropriate internal allocation policies and by operating effective systems and controls.⁸ As part of the market study we obtained banks' allocation policies. Their wording varies, but those of the most active book-runners were largely similar in content. Here is an extract from one such bank: 'The amount of

⁷ For example, it may be that investors bid differently when markets are hot and cold, and so banks' allocation policies may also depend on market conditions. The IPOs in the Jenkinson and Jones sample were noticeably more over-subscribed than those in the Cornelli and Goldreich sample.

⁸ As set out in SYSC 10.1.11 R and SYSC 10.1.15G.

trading commission or other income received or expected to be received by the Firm from a particular investor client should not be a relevant factor in the decision to allocate securities to that client. [...] Prohibited allocation practices: [...] Any other type of “quid pro quo” arrangement under which an allocation is made conditional on or linked with a compensating benefit such as the investor’s participation in a “cold” deal or payment of excessive commissions on trading in the aftermarket or in other securities.’

Previous research has found evidence of behaviour consistent with *quid pro quo* arrangements. Goldstein, Irvine and Puckett (2011) find evidence that investors increase round-trip stock trades⁹ and pay unusually high trading commissions to book-runners around the time of an IPO. Reuter (2006) obtained detailed information on broking commissions paid by mutual funds which he finds are correlated with the holdings of IPOs by the same bank. However, in both of these studies a direct link between the *quid* and the *quo* has been limited by lack of data, and in particular a lack of access to a range of banks’ allocation books.

The other main constraint faced by previous analysis has been the lack of information about the revenues which institutional investors generate for investment banks. These revenues vary by investor depending on the services they buy from the bank, such as broking services (across equities, fixed income, derivatives etc.), research (often bundled as part of trading commission), currency hedging, and, in the case of hedge funds, a variety of ‘prime brokerage’ services.¹⁰ In the absence of a large sample of allocation books and associated revenue data, Jenkinson and Jones (2009) attempt to discriminate between the various theories of IPO underpricing by surveying institutional investors for their perceptions of the factors that influence receiving an IPO allocation. In general, the various proxies for information revelation – such as submitting price-sensitive bids and attending meetings during the book-building – were seen as much less important than being perceived as a long-term investor and, in particular, being a broking customer of the book-runner. However, while survey evidence of investor perceptions is interesting, a detailed direct analysis of the bids, allocations and investor characteristics has not yet been carried out.

This study contributes to the existing evidence in four main ways. First, the FCA gathered information from all the main investment banks on the IPOs they conducted from the UK between January 2010 and May 2015. As many banks have their European headquarters in London, the sample covers companies issuing on most European exchanges and companies from across Europe, as well as some from Africa, and the Middle-East. After excluding various, generally small, fixed price offerings, our sample comprises 220 IPOs, raising close to \$100 bn and conducted by 19 banks.¹¹ For each of these deals we have the ‘book’ for the deal – with investor names, their detailed bidding history, and their final allocations. We obtained data from all the leading global investment banks and are therefore able to compare and contrast outcomes across banks.

Second, banks were asked to provide information on the revenues they made each year from their investor clients. This enables us to conduct an in-depth analysis of whether the ongoing economic relationship between the sell-side and the buy-side influences IPO allocations. The extent of the revenues is considerable, averaging \$37 billion per year across the banks in our sample. By comparison, we estimate that in 2014 IPOs generated investment banking fees of around \$750m. We combine

⁹ By churning stocks investors can inflate commission revenues.

¹⁰ Prime brokerage services refer to a bundle of services typically provided to hedge funds. These services may include for example securities lending, financing, or global custody services.

¹¹ See Section 3 for a detailed description of the sample and of the selection criteria we use.

detailed book-building data with investor revenues to investigate whether the allocations are skewed towards certain types of investors.

Third, as part of the market study, the FCA gathered a variety of additional information. A qualitative questionnaire was sent to investors, investment banks, issuers/owners (including private equity funds) and other market participants.¹² The responses showed clear differences of opinion about the factors that influence allocation and one contribution of this paper is to test which views are more consistent with the evidence. We also document various important developments in the primary equity market, as far as it operates in Europe, particularly issuers' use of corporate finance advisers. The growth of corporate finance advisers can, at least partly, be seen as a response to the potential for conflicts of interest faced by investment banks, so we explore what impact they have on IPO outcomes. Information was also gathered on IPO fees, and we find that most IPOs in our sample have a fixed element, as well as a discretionary component, which depends on how satisfied the issuer is with the performance of the bank in executing the IPO. These two features of European IPOs – corporate finance advisers and discretionary fees – appear to be less widespread in the US. The IPO fees paid in our sample of IPOs are similar in size to the findings of Abrahamson et al. (2011), averaging around 2.8% of proceeds.

Finally, for a subset of IPOs whose primary listing is in the UK, we combine our allocation data with detailed trading data that the FCA gathers for monitoring and compliance purposes to track whether investors sell their shares quickly once trading starts. The responses to the FCA's information request suggest that investors who are seen as likely long-term holders of the shares should receive preferential allocation. Flipping activity was investigated in the US by Aggarwal (2003) for the period May 1997 – June 1998, using data provided by the Securities and Exchange Commission. She found that flipping during the first two days of trading accounted for 19% of trading volume, and 15% of shares offered at the IPO, and that flipping was more pronounced in hot IPOs. We explore how our sample of IPOs compares to this much earlier US finding, to see how successful investment banks are at avoiding allocating shares to flippers.

Our main results are as follows. First, we find some evidence that the way investors bid influences their allocations. We analyse three features of bids: whether they are price-limited, whether they are submitted early in the book-building process, and whether the bids are revised during the book-building. Previous research has found that such bid features may provide information and, therefore book-runners may reward these investors with better allocations.¹³ Regarding price-sensitive bids – as opposed to 'strike' bids that demand a particular quantity of shares but without specifying a price limit – we find that such bids receive a slightly higher allocation across the whole sample of IPOs. However, this effect is only present in issues where there is a corporate finance adviser. Moreover, when we run our econometric models separately for each of the leading investment banks, we find considerable variation – and for some banks allocations are similar regardless of the type of bid that investors submit. This may explain the conflicting results found, for two different banks, by Cornelli and Goldreich (2001) and Jenkinson and Jones (2004). For the other bid features, we find little evidence that either bidding early or revising bids during the

¹² The questions asked as part of the FCA study took into account questions asked in Jenkinson and Jones (2009) so as to provide some comparability, although Jenkinson and Jones surveyed only institutional investors.

¹³ Following the existing academic literature, we focus on allocations relative to bids, or 'normalised rationing' – the ratio of the proportionate allocation relative to the proportionate quantity bid for (at the issue price); see Cornelli and Goldreich (2001).

book-building has any significant impact on allocations. We also find, in line with previous research, that large bids consistently get higher proportionate allocations.

Second, we analyse whether bidder characteristics or actions during the book-building process affect their allocations. We find that those investors who participate in meetings before or during the book-building process receive preferred allocations. Although it is impossible to know how much information flows from investors to the book-runners during such meetings, participation may demonstrate a more active engagement with the IPO and the issuer, and the evidence suggests that book-runners reward such investors. Being a frequent bidder also has a small, positive impact on allocations. Regarding investor types, we find across the whole sample, that around one-fifth of all shares are allotted to hedge funds. However, relative to the amount they bid, we find that book-runners scale-back hedge funds significantly more than long-only investors.

Third, we find that investor revenues have a significant impact on IPO allocations. We measure the economic relationship between investors and banks by constructing, for each book-runner, a quartile ranking of investors based on how much revenue they generate (from all activities, and not just from the trading of any particular IPO). For the overall sample we find that allocation rates increase steadily across the investor-revenue quartiles. Investors in the top quartile of the book-runners' clients receive allocations, relative to the amount they bid, that are around 60% higher than those received by investors who are not clients of the book-runner. We find that this effect is largely driven by preferential allocations in hot IPOs.¹⁴ We find significant, but smaller, revenue effects for the second and third quartile of investors. We find only small reductions in these preferential allocations when the issuer employs a corporate finance adviser. When we run separate regressions for each of the top banks we find some interesting heterogeneity. The pattern is broadly the same across individual banks, although for two banks investor revenues appear to have at most a weak impact on IPO allocations. These results suggest therefore that the majority of the largest banks allocate shares more generously to their investor clients that generate more revenues.

Fourth, for the subset of IPOs where we have detailed information on post-IPO trading, we explore whether flipping, topping up, or providing liquidity in the form of actively buying and selling in the aftermarket has an impact on IPO allocations. The responses to the FCA's information request and meetings with industry participants, suggested that being perceived as a flipper should impact negatively on IPO allocations. Of course, implementing such a policy requires the book-runner to anticipate flipping by investors. However, we find no evidence that investors who, in the event, flip a given IPO are penalised in terms of allocation. Indeed, investors who flip within the first week appear to receive slightly higher allocations than other investors. However, investors who previously flipped IPOs run by a particular investment bank do tend to get slightly smaller allocations in future IPOs. The fact that book-runners do not reduce allocations to future flippers does not mean that they allocate more to investors who flip. It does, however, suggest that investment banks are unable to anticipate which investors are likely to flip their shares. Some banks reported to the FCA that a further objective when making IPO allocations was to ensure sufficient aftermarket liquidity in the shares. We find high levels of turnover in the first days of trading, which suggests that allocating to liquidity providers is unnecessary for this period. As for longer-term liquidity provision, we do not find evidence that book-runners favour liquidity providers when they make

¹⁴ We designate IPOs as hot when the time taken for the book to be covered (ie demand equals supply at the bottom of the price range) is quicker than the median.

allocations. Book-runners sometimes justify the inclusion of hedge funds in IPO allocations on the grounds that hedge funds provide valuable aftermarket liquidity. We find no evidence either that hedge funds provide significant aftermarket liquidity, or that those which provide some liquidity are given favourable IPO allocations.

Whether these findings are detrimental to the market depends on a number of factors. Since we do not know what the optimal structure of each IPO's investor base is, we cannot say whether allocating shares to banks' preferred clients leads to a less favourable outcome for issuers. It is for example possible that banks only allocate shares more generously to their favoured clients once the optimal shareholder base has been achieved. Banks could also allocate only to those favoured clients that are at the same time valuable investors across other dimensions.¹⁵ However, our econometric approach attempts to quantify and disentangle these effects. The consistent finding is that investors receive preferential allocations if they have generated more revenue for the investment bank, and that the effects are most pronounced in hot IPOs. This suggests that a quid pro quo relationship could exist between some investment banks and their clients in respect of IPO allocations. Since the value of allocations increases with underpricing of the shares, there is a risk that book-runners will resolve the conflict of interest they face at the issuers' expense.

The remainder of the paper is organised as follows. In the next section we describe the data that we collected and recent developments of the institutional setup within which IPOs are conducted. In the fourth section we analyse the determinants of allocation, in particular the impact that the broking relationship between investor and investment banks has on the scale-back an investor receives relative to all other investors. In section five we analyse investors' trading activity in the IPO aftermarket and whether IPO shares are allocated depending on how investors behave in the aftermarket. Section six concludes.

¹⁵ Table A7 in Annex 3 shows that high revenue investors also tend to submit more price sensitive bids, attend meetings more frequently and are more active in the IPO market.

3 Institutional setting and data

IPOs outside the US have historically been conducted using a variety of techniques (Jenkinson and Ljungqvist (2001)), but in recent years IPOs in most major markets have been carried out under the US book-building approach (Ljungqvist, Jenkinson, and Wilhelm (2003)). This is true for the - predominantly European - IPOs in this study, allowing us to compare our findings with previous academic work that has focused on book-building. At the same time, the European IPO market has innovated beyond US practice, mainly in the structuring of fees and the use of corporate finance advisers, and we explore the effects of these developments on IPO outcomes.

The FCA requested information from market participants on the IPOs managed from their UK offices in the period January 2010 to May 2015. All major investment banks have operations in London, from which they handle IPOs for issuers from across Europe, the Middle East, and Africa (EMEA). The FCA complemented its information requests with a wide range of meetings with investment banks, investors, issuing companies, and owners. In this section we describe the institutional setting of the IPO market, provide a description and breakdown of the data, and explain how we construct the key variables for the econometric analysis.

Our sample of IPOs

IPOs are typically conducted by syndicates of investment banks with one or more banks acting as book-runner, and other banks playing a more junior role (see Corwin and Schultz (2005) on the structure of syndicates and Hu and Ritter (2007) on the use of multiple book-runners).¹⁶ As a generalisation, the book-runners perform the following roles in IPOs: they advise the issuer on an indicative price range within which to offer the shares; they receive orders directly from all investors, who state the size of their demand together with any price limits, as well as disclosing their identity; they keep a running record of demand (ie they 'build a book'); and they recommend to the issuer the price which should be set for the IPO and how to allocate the shares among investors. The other syndicate banks are generally not involved in these activities.¹⁷ Therefore, when the FCA requested that banks supply information on the IPOs in which they had played a syndicate role, book-runners were able to supply extensive information, while junior syndicate members at best tended to provide information only on the bids which their clients had submitted to the book-runner.

The FCA requested data from banks operating in the UK on IPOs conducted between January 2010 and May 2015, regardless of the location of issuer, listing authority, or

¹⁶ For smaller IPOs, such as those on junior exchanges, including the Alternative Investment Market in London, a single bank may handle the IPO. However, these IPOs tend not to be conducted by book-building and so are not included in our sample.

¹⁷ Industry participants make a distinction between book-runners who are 'active book-runners' (who in many IPOs are also given the title 'global co-ordinators') and book-runners who are not. Only 'active book-runners' perform the order-taking, record-keeping, and allocation functions described here. In this paper only 'active books' are included in our definition of book-runners, because our focus is on those parties that make pricing and allocation decisions. Even under this narrow definition of 'book-runner', a number of the IPOs in our sample have multiple book-runners. Information on bank roles in an IPO was given to the FCA as part of the information request.

target investors. In total, 32 banks provided 801 books (of orders and allocations) on 410 IPOs over the sample period.¹⁸ The difference between the number of books and the number of IPOs reflects the fact that, in many cases, more than one bank sent the FCA data in respect of the same IPO.

For the purpose of our analysis, we exclude fixed price IPOs, and we ignore books submitted by banks that were not book-runners. These filters reduce the sample to 431 books on 255 IPOs. We then apply two further filters. First, we exclude 25 books which include information only on the final state of demand and do not include bid histories, which we require as they contain variables which are key to our analysis. Second, we remove books which include allocations relating to less than 75% of the total shares which (according to Dealogic) were sold in the IPO, on the grounds that these books were incomplete.¹⁹ The final sample comprises 372 books from 19 banks on 220 IPOs.

Table 1 provides information of the distribution of our sample. As is well known, IPOs tend to come in waves, and this is a feature of our sample period (see panel A). Our sample includes only 17 transactions from 2012, whereas in 2014 there were 77. The total capital raised by the firms in our sample is nearly \$160bn, with the median IPO raising \$477m. To give a sense of what proportion of the IPO market our sample covers, we use data from Dealogic to calculate the total IPO proceeds raised by issuers on EMEA exchanges – which is a somewhat broader classification than our sample of transactions managed by banks operating in the UK, but is the closest estimate of the overall market. For the corresponding period the total amount raised was \$211bn, so our sample represents around three-quarters of EMEA IPOs by value.²⁰

Table 1 also contains details of the primary exchange on which the issuers listed (see panel B), with London-listed IPOs comprising around one-third of the total number of IPOs in the sample. Panel C shows the main country of origin of the issuing companies. Again, the UK has the highest number of IPOs, but under one-quarter of the IPOs are for UK firms – which reflects the fact that many non-UK companies choose to list in London. 20 companies in our sample listed on multiple exchanges.

Table 1: Transactions by year, primary exchange and issuer country

Panel A: IPOs by year

Year	Number	Median size (\$m)	Total value (\$bn)
2010	38	517.26	34.54
2011	21	383.01	21.19
2012	17	289.22	10.82
2013	38	512.66	25.01
2014	77	497.01	46.14
Jan-May 2015	29	369.27	21.75
Total	220	476.92	159.45

Panel B: IPOs by primary exchange

¹⁸ Banks that played junior roles in the syndicate did not generally have the overall allocation books for the IPOs.

¹⁹ We also dropped one unusual IPO for which only three distinct investors were recorded.

²⁰ The proportion by value varies by year from a low of 65% in 2012 to 83% in 2015. Given that we focus on bookbuilt IPOs, which tend to be medium to large transactions, the proportion of IPOs by number of transactions in our sample is much lower: our 220 IPOs compare to 707 total IPOs in the Dealogic sample.

Exchange	Number	Median size (\$m)	Total value (\$bn)
London	74	384.06	42.57
Frankfurt	22	565.61	14.88
Milan	13	487.08	6.50
Warsaw	12	442.23	8.78
Paris	11	869.44	7.53
Nasdaq	9	71.03	0.78
Copenhagen	7	575.59	6.12
Johannesburg	7	199.61	1.96
Amsterdam	6	1218.58	8.23
Madrid	6	1196.31	10.79
Other	33	469.40	21.53
Multiple exchanges	20	585.40	29.79
Total	220	476.92	159.45

Panel C: IPOs by issuer country

Country	Number	Median size (\$m)	Total value (\$bn)
UK	57	392.28	33.11
Germany	23	538.44	14.94
Russian Federation	18	462.99	12.21
Italy	15	505.62	12.41
France	12	887.03	9.56
Poland	11	464.07	8.70
Denmark	8	534.45	6.35
Spain	8	1196.31	13.27
Netherlands	7	1150.86	7.45
South Africa	7	199.61	1.96
Switzerland	7	804.68	14.73
Other	47	379.14	24.77
Total	220	476.92	159.45

This table shows the number of IPOs by year (Panel A), by the primary exchange on which they were listed (Panel B), and by the principal country of origin of the issuing company (Panel C). For each panel Median size and total value refer to IPO proceeds, including both primary and secondary shares.

Fees, syndicate structure and the role of corporate finance advisers

The relationship between the issuer and the book-runner is one of client and service provider, and much of this paper concerns the way in which banks provide services to issuers in IPOs.²¹ The banks' responses to the FCA's qualitative information request pointed to a close working relationship between the two sides during the IPO. Nearly all of the banks explicitly stated that, during book-building, they are in continuous dialogue with the issuer, and that, in a typical allocation process, the client is given an opportunity to review and amend the book-runner's proposal and has the final say in case of disagreement.

The explicit remuneration received by banks for participating in IPOs is the fee paid by the issuer, expressed as a percentage of IPO proceeds. The main variation in market practice in our sample is whether part of this remuneration takes the form of a 'discretionary fee'. In IPOs without a discretionary fee, the apportionment of fees is in line with US practice. That is, the total fee is largely pre-agreed among the book-runners and the other syndicate banks, typically pro-rata to their underwriting of the IPO. In IPOs with a discretionary fee, part of the total fee is pre-agreed (again pro-rata to underwriting), but the discretionary part is paid to syndicate banks at the issuer's discretion. The issuer may even choose not to pay out this discretionary fee at all.²²

The introduction of discretionary fees is one of two major innovations in European IPOs over the last ten years. The other is a growing tendency by issuers to appoint a corporate finance adviser for their IPO. Corporate finance advisers – such as Lazard, Rothschild, and STJ Advisors – are used on IPOs for a number of reasons, including as a response to the potential conflicts of interest that investment banks face when balancing the interests of their buy-side clients and the issuing company. The services that they provide to firms coming to the public markets before the launch of the IPO may include helping to select the book-runner and other syndicate banks and recommending investors and markets to target in the IPO. During the offering the corporate finance adviser may guide the issuer in setting the indicative price range and the final price and in choosing the investors to receive an allocation. After the IPO, in cases where there is a discretionary fee, the corporate finance adviser may recommend whether and how this fee should be paid out among the syndicate banks according to their respective contributions. Therefore, corporate finance advisers provide issuing firms with support at critical decision points – in particular, choosing the book-runner, pricing, and allocation.²³

Information on syndicate structure, IPO fees, and the prevalence of corporate finance advisers, is provided in Table 2. On average, a syndicate includes around five banks, but the range in our sample is large (see panel A): some, generally smaller, IPOs are handled by a single bank whereas two IPOs involve 19 banks. The mean number of active book-runners is 1.69. Recall that, under our definition, book-runners are the banks that actually run the process and have the most complete information (ie are 'active books'); the number of banks designated as book-runners on the IPO prospectus is around twice as high (the mean is 3.38 per IPO). We identify corporate finance advisers as having a role in the IPO for around one-third of the sample. These 'advised IPOs' tend to be larger in transaction value and have a slightly higher mean number of active book-runners.

²¹ We use the term 'issuer' indifferently both for firms issuing new shares and for pre-IPO owners selling existing shares.

²² We discuss discretionary fees in more detail in Chapter 8 of the interim report.

²³ We discuss the role of corporate finance advisers in more detail in Chapter 6 of the interim report.

We obtained fee information for 188 of the 220 IPOs (as noted by Abrahamson et al. (2011), fees for European IPOs are not always reported). As we show in Panel B of Table 2, the mean (median) fee is 2.77% (2.50%) for our sample. This is similar to the fees found by Abrahamson et al. (2011) for their sample of European IPOs conducted from 2001-2007. They found average fees of 3.34% for IPOs raising \$100-500m and of 2.39% for larger IPOs (the median size of IPOs in our sample is \$477m). All IPOs in our sample have a fixed fee and 71% of IPOs also a discretionary fee. The mean (median) discretionary fee that was paid for our sample is 0.45% (0.34%), which represents 16.3% (13.6%) of the total fees paid.²⁴ Information on the maximum potential discretionary fee is not available, but the qualitative evidence received from banks suggests that the discretionary fee is paid in full in about 50% of cases.²⁵ IPOs with corporate finance advisers have on average slightly lower average fees, although given their larger average deal size this is to be expected. However, it is noticeable that the proportion of the total fee that is discretionary is higher when there is a corporate finance adviser: the mean (median) proportion is 29.5% (22.5%) for advised IPOs, and 12.4% (6.4%) for those IPOs without a corporate finance adviser.

²⁴ Our estimate is a lower bound of the total discretionary fee component. Syndicate banks that were not subject to the information request but did receive a discretionary fee are not captured and not all banks that were subject to the information request provided information on discretionary fees received.

²⁵ Based on 16 responses covering ECM transactions in general, not only IPOs.

Table 2: Syndicate structure, fees and the prevalence of corporate finance advisers**Panel A: Syndicate structure**

	Mean	Median	Min	Max	Median IPO proceeds USD m	Number of IPOs
Total syndicate size, whole sample	5.1	4.50	1	19	477	220
- IPOs with corporate finance advisers	5.6	5	1	19	650	71
- IPOs without corporate finance advisers	4.9	4	1	19	392	149
Book-runners, whole sample	3.38	3	1	11		
- IPOs with corporate finance advisers	3.68	3	1	9		
- IPOs without corporate finance advisers	3.24	3	1	11		
Active book-runners, whole sample	1.69	2	1	4		
- IPOs with corporate finance advisers	1.83	2	1	3		
- IPOs without corporate finance advisers	1.62	2	1	4		

Panel B: Fees

	IPO fees - mean		IPO fees - median		Median IPO proceeds USD m	Number of IPOs
	Total fee	... of which discretionary	Median	.. of which discretionary	Median IPO proceeds USD m	
Total	2.77%	0.45%	2.50%	0.34%	385	188
- With corporate finance advisers	2.41%	0.71%	2.45%	0.55%	563	51
- Without corporate finance advisers	2.90%	0.36%	2.50%	0.16%	348	137

Panel A provides summary information on the syndicate structure for the 220 IPOs in our sample. We distinguish between IPOs with and without a corporate finance adviser. Book-runners are all bookrunning banks as reported by Dealogic. Active book-runners are the subset of banks that are designated as active in the allocation process, as explained in Section 3. Syndicate members are counted as book-runners only if they were active book-runners. Panel B summarizes IPO fees for 188 of the IPOs where this information was available. Where the fee was split into a fixed fee and a discretionary fee, the 'Total fee' column sums the fixed fee and the amount of discretionary fee actually paid to the banks subject to the FCA's information request. The discretionary fee is also presented separately.

Table 3: Investors' bidding behaviour

Investors						
	All issues		Hot issues		Cold issues	
	Mean (%)	Median (%)	Mean (%)	Median (%)	Mean (%)	Median (%)
Price sensitive	46.57%	48.68%	29.95%	23.08%	55.64%	57.53%
... step bids	9.61%	8.86%	7.06%	5.34%	10.70%	9.82%
Strike bids	54.28%	51.54%	71.20%	77.10%	45.02%	42.66%
... money bids	36.05%	31.19%	50.08%	55.47%	33.08%	28.18%
Median number of bids		140		363		97
Revised bids	41.96%	42.22%	39.20%	40.08%	44.28%	44.56%
Attended at least one meeting	20.4%	18.9%	21.92%	20.08%	20.62%	21.46%
Attended pilot fishing	6.4%	4.2%	6.06%	4.71%	7.15%	5.76%

The table shows bid characteristics over the full sample as well as over hot issues and cold issues. Hot (cold) IPOs are below (above) the median of the time till full subscription at the lower end of the initial price range. Price sensitive bids are those in which the bidder sets a maximum price she/he is willing to pay. Step bids are bids in which a bidder sets multiple price limits for different amount of shares. We denote as 'strike bids' those bids that do not have a price limit and as 'money bids' all bids that are strike bids and are expressed in currency, not in number of shares. Revised bids refer to revisions in price, quantity, or type of bid. Meetings are in most cases one-on-one meetings between issuers and investors. Pilot fish meetings are meetings that took place before the IPO was announced.

Table 4: Investors' revenues

Revenues from investors							
	2010	2011	2012	2013	2014	Average	2010-2014 Total
Total revenue (\$m)	31,718	40,992	37,732	38,191	38,456	37,418	187,089
Revenues (\$m)							
Top five banks by revenue	2010	2011	2012	2013	2014	Total	Revenue clients
Bank A	9,000-10,000	8,000-9,000	7,000-8,000	7,000-8,000	7,000-8,000	39,000-40,000	1,400-15,00
Bank B	n.a.	8,000-9,000	7,000-8,000	8,000-9,000	8,000-9,000	32,000-33,000	500-600
Bank C	6,000-7,000	6,000-7,000	5,000-6,000	5,000-6,000	5,000-6,000	29,000-30,000	2,700-2,800
Bank D	5,000-6,000	4,000-5,000	4,000-5,000	4,000-5,000	4,000-5,000	23,000-24,000	500-600
Bank E	3,000-4,000	4,000-5,000	3,000-4,000	3,000-4,000	3,000-4,000	17,000-18,000	1,600-1,700

In this table the total revenues derived from investors, across all banks, are presented by year. In addition, annual totals for the top five banks by revenue are also presented, as is the number of investor clients for each bank. Revenues are global and span all services provided by the investment bank to the investor.

Table 5: Investors' outcomes**Panel A: Outcomes**

	Mean	Median	Min	Max	
Subscription	4.5	2.6	1	28	
Offer price relative to initial price range	40%	40%	-120%	140%	
Offer price relative to revised price range	50%	50%	0%%	280%	
Underpricing 1st day	4.8%	3.8%	-27.5%	49.7%	
- with corporate finance adviser	4.4%	3.7%	-12.9%	37.9%	
- without corporate finance adviser	5.0%	3.8%	-27.5%	49.7%	
Underpricing 1st week	5.4%	4.4%	-22.3%	51.7%	
- with corporate finance adviser	4.9%	4.9%	-22.3%	45.5%	
- without corporate finance adviser	5.6%	3.9%	-18.61	51.7%	

Panel B: Total % of allocation

	Hot		Cold		Full sample	
Type	Mean	Median	Mean	Median	Mean	Obs.
- Hedge fund	14.87	13.49	18.60	16.97	17.87	8568
- Long only	32.95	34.43	26.14	24.86	27.63	8414
- Others	52.09	47.37	55.80	51.62	54.85	41321
Revenue quartile						
- no revenues	43.18	29.41	48.31	39.44	45.90	

- bottom quartile	8.65	5.86	9.23	7.64	9.14	
- 25-50	15.24	14.18	11.50	11.28	12.92	
- 50-75	18.29	18.03	18.64	18.09	18.65	
- top 25	32.98	32.44	23.74	22.20	26.97	

Panel C: Normalised rationing

	Hot		Cold		Full sample	
Type	Mean	Median	Mean	Median	Mean	
- Hedge fund	0.55	0.54	0.66	0.64	0.63	
- Long only	1.08	1.08	0.95	0.96	0.98	
- Others	0.74	0.71	0.77	0.77	0.77	
All	0.78	0.74	0.79	0.79	0.78	
Revenue quartile	Q1 – lowest revenue	Q2	Q3	Q4 – highest revenue	No revenues	
Normalised rationing - mean	0.67	0.79	0.96	1.16	0.71	
- with corporate finance adviser	0.63	0.78	0.89	1.17	0.65	
- without corporate finance adviser	0.69	0.79	0.99	1.15	0.74	

Panel A shows the level of subscription at the offer price, the offer price relative to the initial and revised price range (offer price minus lower end of range divided by the difference between upper and lower end of range), and the underpricing of the shares after one day of trading and after one week of trading (underpricing is the difference between secondary market closing price and offer price divided by the offer price). Panel B shows the average and median percentage of shares allocated by investor type and by revenue type. Panel C shows normalised rationing (the ratio of percent allotted to percent bid) by investor type and by revenue type.

Investors and bidding behaviour

Investor demand in our sample of bookbuilt IPOs is overwhelmingly institutional. Moreover, demand from retail investor clients tends to be institutionalized in the sense that it is consolidated by banks which place block orders on behalf of private clients.²⁶ A strength of our dataset is that it is derived from a large number of banks; however this also creates challenges when analysing investors. In particular, investor names are not consistently recorded either across banks or, in some cases, within a given bank (both across IPOs and for different parts of the information provided, such as allocation books, information on meetings, and revenue data). In some cases, the differences are trivial, involving special characters (in particular accents), abbreviations, and misspellings. However, investor names can also have legal or descriptive terms attached ('fund', 'plc' etc.) or refer to a specific geographical location ('Geneva', 'UK', etc.). In the latter case the question of whether to match investors with and without the geographical reference is more debatable. In some cases the investor will be identical – 'XYZ fund' may be the same as 'XYZ fund, Geneva'. However, there will be other cases where XYZ fund submits bids from two separate geographical offices. In this case, the decision to match the names – and so treat them as a single investor – depends on whether the bids are submitted by the same decision maker and whether they are treated as a single investor by the investment bank. In general, when we match books, revenues, meetings, and trade data, we do so in two stages: first we match investors using a 'narrow' match that only corrects spelling mistakes and ignores special characters and abbreviations; we then take the unmatched investors and conduct a 'wide' match that treats investors from an investment group as a single unique investor.²⁷ In Appendix 2 we provide more information on the matching procedure and check our main results for robustness with respect to the way we match investors.

Across the 220 IPOs in our sample we identify about 20,000 distinct investors²⁸, who submitted around 41,000 bids. In Table 3 we present summary information on these bids. Bidding behaviour can be described under the following headings: price sensitivity, timing, and revisions. Price sensitivity is reflected in 'limit bids', which include a maximum price per share that the investor will pay; a subset of these are 'step' bids, by which investors break their demand down into a schedule of sub-orders, each with its own price limit. Bids which do not include a price limit are 'strike' bids, meaning that investors are prepared to pay up to the top of the book-building range for the shares. The issue of price sensitivity is important as those bids that include a price limit, as well as a maximum quantity, are more informative to issuers, and, to the extent that allocations are used to reward investors for the production of information (Benveniste and Spindt (1989)), may result in preferential allocations. Table 3 shows that, in the average IPO, 46.57% of bids are price sensitive bids (limit or step). The table also shows this breakdown separately for 'hotter' and 'colder' IPOs, where 'hotter' ('colder') IPOs are the half of the sample in which the shares offered were quickest (slowest) to be fully subscribed by investors at the bottom of the book-building range.²⁹ The incidence of price-sensitive bids

²⁶ UK and other European privatisation IPOs have often included a dedicated retail tranche, but in such cases retail investors are allocated according to a fixed rule and not at the discretion of the issuer and book-runner.

²⁷ When we match investors across books, in particular for the investor fixed effect models, we only use the 'wide' match. Appendix 2 shows robustness tests using only the 'narrow' match.

²⁸ About 9,000 when aggregating investors using the 'wide' match and about 16,000 using the 'narrow' match.

²⁹ We use this ex-ante measure of 'hotness' because it is communicated to investors during the IPO. An alternative measure of 'hotness' is the level of oversubscription (ie the ratio of demand to supply). However, this is an ex-post measure which is not known for certain until after the end of the book-building (order-taking) period.

varies sharply according to the hotness of the IPO, with an average of 29.95% of bids being price-sensitive in hotter IPOs versus 55.64% in colder IPOs.³⁰

Institutional investors are commonly divided into two broad classes: long-only investors and hedge funds. Long-only investors, typically pension funds, insurance companies, sovereign wealth funds, and endowments, are expected to have a long-term investment horizon (although they are not precluded from taking a short-term view). Hedge funds may apply a number of investment approaches, but some will have a very short-term investment outlook. This is acknowledged by the IPO book-runners in our sample who, in their meetings with the FCA, stated that the perceived benefit of including hedge funds as investors in IPOs is precisely that they do not hold onto their allocations and therefore provide aftermarket liquidity.

To gain a sense of the relative importance of long-only investors and hedge funds as IPO investors, we used investor classifications of long-only, hedge fund or mixed/undefined. These classifications are consistent with those provided by a corporate finance adviser.³¹ For those that could be clearly defined, roughly equal numbers of investors were classified as hedge funds and long-only. We investigate whether allocations are influenced by the type of investor in the next section.

Finally, in its data request to banks the FCA asked for information on the meetings held between the issuing firm and potential investors before and during the IPO.³² Private meetings held between the issuer's management and investors before the launch of the IPO are referred to by industry participants as 'pilot fishing'. Meetings after the launch of the IPO may be 'one-on one' or they may be part of (non-public) group presentations by the issuer's management. Participation in meetings may be related to information production/gathering by investors, who may then contribute their views to the book-runners either directly at the meetings, or via their subsequent bids. However, the extent to which useful information is communicated to the issuer or their investment bank as a result of such meetings is unknown. Table 3 shows that, in the average (median) IPO 20.4% (18.9%) of investors participated in at least one meeting, 6.4% (4.2%) of investors attended the pilot fishing. Attendance of meetings or pilot fishing does not vary substantially between hot and cold IPOs.

Investor broking business with book-runners

A number of academic studies have argued that book-runners make preferential allocations to investors with whom they do broking business (see Reuter (2006), Jenkinson and Jones (2009), Goldstein et al. (2011)). If there is a link between IPO allocations and broking business, this could mean that book-runners profit from IPOs, not only through IPO fees, but through the extra broking commissions generated from investors favoured in IPO allocations. As part of its information request the FCA asked both banks and buy-side investors whether they believed that IPO allocations were motivated by the wider business relationship between the two sides (see Figure 1). The responses indicate a sharp difference of opinions between these two groups of respondents. On the whole, banks considered that their business

³⁰ This inverse relationship between price-sensitivity and hotness is in line with the findings of two papers which have studied the levels of price-sensitivity in European IPO books: Cornelli and Goldreich (2001), which found more price-sensitivity in a colder sample, and Jenkinson and Jones (2004), which found less price-sensitivity in a hotter sample.

³¹ This has the advantage of allowing us to classify different types of investors in a way that is consistent with market participants' classifications. The data allows us to classify about 50% of investors as hedge fund, long-only fund or others. There are cases where one investor is matched to two different investor types. In these cases we classify the investors as 'mixed' and do not include them in the hedge fund or long-only sample.

³² Most banks submitted only data on one-on-one meetings but not on group meetings.

relationship with investors had little or no impact on IPO allocations, and noted that this practice was in line with their own stated allocation policies. The FCA's own guidance³³ suggests that firms should have a conflicts of interest policy in relation to the management of an offering of securities. Banks' internal allocation policies vary in their wording but those of the most active book-runners were largely similar in content and, as in the example quoted in the introduction, explicitly prohibit any quid pro quo arrangement between IPO allocations and compensating benefits (including broking revenues, participation in future IPOs, etc.).

Buy-side investors, on the other hand, were more inclined to see a positive relationship between their business relationship with the book-runner and IPO allocations. The difference between the responses of banks and investors on this point is striking because the responses of banks and investors to other questions in the survey are broadly similar.³⁴

Each investment bank was asked to provide the annual revenues they derived from each of their investor clients for each year from 2010-14 inclusive.³⁵ In Table 4 we present the total revenue, by year, across all banks and for the top five banks separately. Revenues from investors average \$37.4 billion per year over the sample period. Data is less complete for 2010, for which some banks were not able to provide data, but the overall revenues for the remaining years are remarkably stable – varying between \$37.7 billion and \$41.0 billion. Among the top five banks by revenues we see large differences in terms of the number of investors and the size of the revenues they generate. These fees from investors dwarf the fees investment banks receive from issuers for conducting IPOs. Over the same five years, investment banking fees from IPOs were on average around \$385m per year (see Table 2, panel B), or around 1% of the fees generated by investors.

IPO outcomes

The outcome of an IPO can be expressed in terms of demand, allocation, and pricing. As shown in Table 5 (panel A), the total demand, at the offer price, divided by the total allocation (the subscription rate) averages 4.5 in our total sample of IPOs. The sample is skewed, with some IPOs being very heavily oversubscribed (28 times in the case of one IPO); the median level of subscription is 2.6. Table 5 (panel B) also shows the average and median total allocation for different investor categories and for hot and cold IPOs. The categories of long-only investors and hedge funds each represent an average of around a quarter of total demand, but hedge funds receive an appreciably lower percentage of the allocations (18% vs 28% for long-only investors). In Section 4 we explore the 'normalised rationing' (ie the percentage of total demand divided by the percentage of total allocation) of these investor categories in a multivariate setting.

Table 5 (panel A) also shows that the IPOs in our sample are priced, on average, 40% above the lower bound of the initial price range (taking the whole span of the price range as 100%). As Figure 2 illustrates, all but nine IPOs in our sample were priced within the indicative pricing range set for the IPO. This 'stickiness' of the initial price range in European IPOs has been noted previously by Jenkinson et al. (2003) and this market practice – which is not observed in the US – could work to the

³³ This guidance is available at <http://www.handbook.fca.org.uk/handbook/SYSC/10/1.html>.

³⁴ Our investor survey is based on only ten responses; however, results are corroborated by evidence in Jenkinson and Jones (2009)

³⁵ The data request was not limited to revenues from brokerage business but included all services provided to an investor.

detriment of issuers if the initial price range was found, during the book-building process, to be inappropriate.

The final pricing was clustered at three points: the lower and upper bounds and the mid-point.³⁶ Table 5 (panel A) shows that the average initial returns for IPOs in the sample are 4.8% and 5.4% for the first day and first week respectively.³⁷ It is noteworthy that the initial returns on IPOs in EMEA during the sample period were low by historical standards³⁸, and lower than first-day returns for US IPOs during the same period (which averaged 12.6% for 2010-2014).³⁹ As Table 5 shows, IPOs in which there was a corporate finance adviser show slightly lower first-day and first-week returns than those of other IPOs.

Trade data

We used the FCA's transaction reporting dataset ZEN⁴⁰ for details on all trades done within a month of the IPO for a subset of 65 of the IPOs in our sample. The subset includes all IPOs for issuers for which the FCA is the competent regulatory authority.⁴¹ The data includes all trades, on-exchange or off-exchange, which involve at least one counterparty based in the European Economic Area. Table 11 summarises the data obtained in this way. We describe investors as 'toppers-up' if they are allocated shares in the IPO and then buy further shares in the first week following the IPO. We define investors as 'flippers' if they are allocated shares in the IPO and then sell at least 50% of their allocation within the week after the IPO. As Table 11 shows, around 8% of all investors top up and around 4% flip, with most of both activities occurring on the first day. Hedge funds on average flip slightly more frequently than long only investors, while long-only investors top up much more frequently.

³⁶ In a sample of European IPOs analysed by Jenkinson et al. (2003), 44% of IPOs were priced at the upper bound of the range, and only 7% at the lower bound, with a similarly low fraction of around 10% priced outside their initial range. In contrast, they report almost 50% of a comparable sample of US IPOs were priced outside the initial price range. The authors provide a possible theoretical justification for such practice within an information revelation model, but they do not take account of quid pro quo incentives.

³⁷ This compares with 6.7% and 7.2% respectively for all EMEA IPOs in the Dealogic database for the same period.

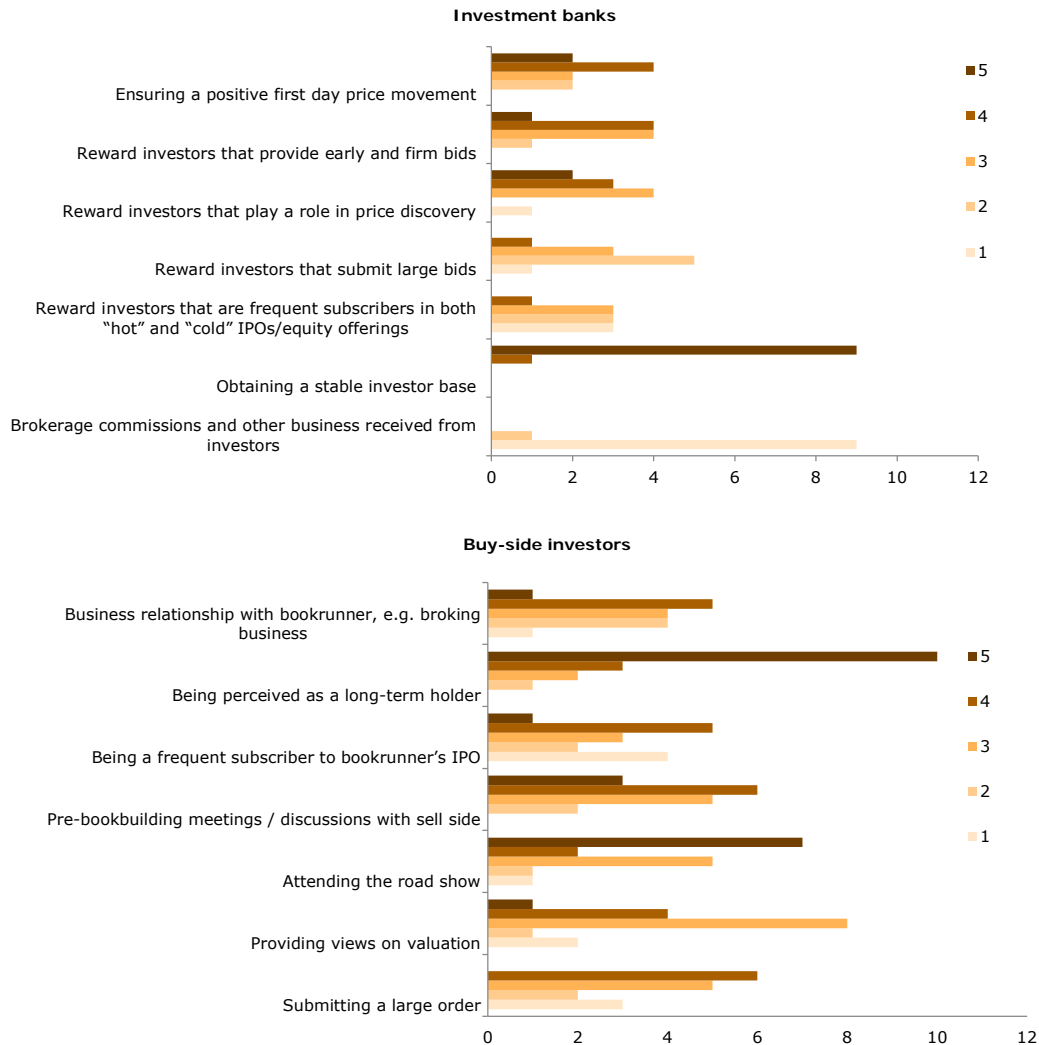
³⁸ According to Chambers and Dimson (2009) average underpricing of IPOs on the LSE for 2000-2007 was 19.86%, median underpricing was 8.5%.

³⁹ Average underpricing in the US was 12.6% in 2010-2014 (Jay Ritter, <https://site.warrington.ufl.edu/ritter/ipo-data/>, February 2016).

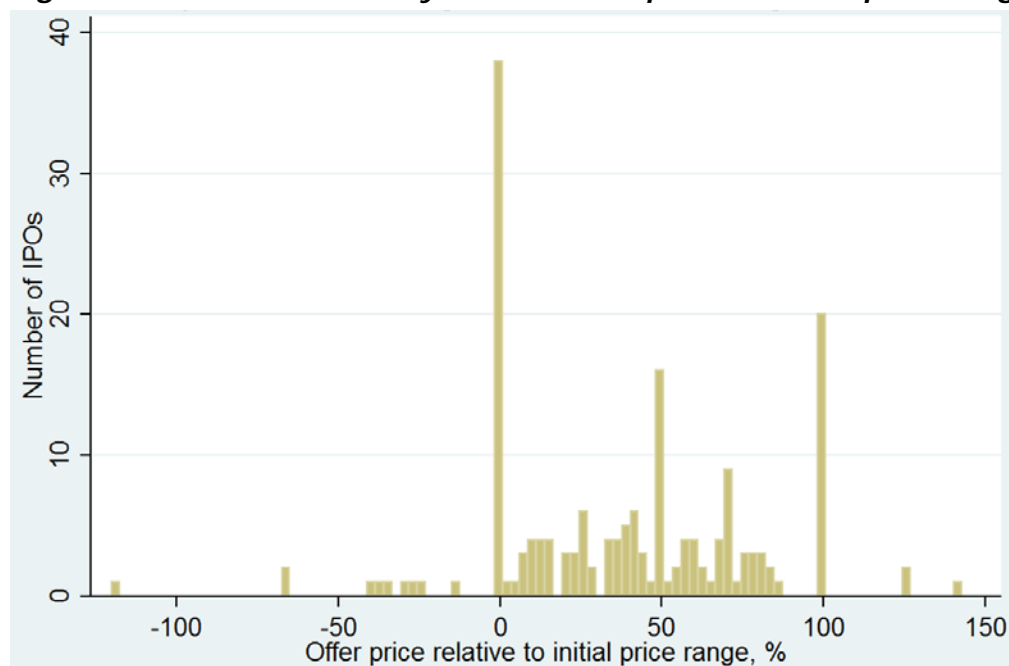
⁴⁰ See FCA (2015c) for a description of the dataset.

⁴¹ The MiFID database contains a list of all shares admitted to trading on EU regulated markets and their relevant competent authority (see <http://mifiddatabase.esma.europa.eu/>).

Figure 1: Banks and buy-side investors' views on what factors are important in determining IPO allocations.



Responses of investment banks and buy-side investors to the question 'Please score the factors that influence the allocation decision where one is unimportant to the decision and five is extremely important'. The x-axis shows the number of responses received for each score. The survey was answered by all investment banks and a selection of large buy-side investors and buy-side industry organisations.

Figure 2: Number of IPOs by ratio of offer price to initial price range

Source: Dealogic database and bank responses to the Investment and Corporate Banking Market Study.

4 IPO allocations and buy-side revenues

As mentioned in the introduction investment banks face a conflict of interest when advising issuers in the IPO allocation process.⁴² Underpricing of IPO shares makes them desirable for the buy-side investor clients from whom, as we have shown, investment banks earn significant revenues. The banks' responses to the FCA's information request and stated allocation policies show that they recognise this conflict of interest (see Figure 1). In this section we test whether revenues received from buy-side clients influence the way in which syndicate banks allocate shares.

To understand if an investor receives a relatively more favourable allocation we calculate the normalised rationing of investors. This allows our results to be compared to earlier analyses by Cornelli and Goldreich (2001) and Jenkinson and Jones (2004). Normalised rationing is the allocation-to-bid ratio of an individual investor divided by allocation-to-bid ratio of all investors in that IPO. The higher the normalised rationing variable for an investor, the less that investor's demand is scaled back compared with other investors in the IPO. For example, normalised rationing of one means that an investor is scaled back in line with the scaling back in that IPO as a whole, and normalised rationing of 0.5 means that an investor is scaled back twice as much as the scaling back in the IPO as a whole.⁴³

Table 5 (panel C) shows normalised rationing for different investor types and IPOs. The average normalised rationing is 0.78. Investors who have high revenues with banks have on average higher values, ie are scaled back less than other investors. We also see that long-only funds are treated more favourably than hedge funds. To the extent that the former are perceived as more likely to be long-term holders than the latter, this would be consistent with the survey evidence that allocations favour long-term investors.

Disentangling the various attributes of investors is clearly a challenge. It is possible that the buy-side investors who pay high broking revenues to syndicate banks have characteristics that are genuinely desirable for the issuer: they may contribute to the price discovery process or be likely to become long-term shareholders. To estimate the impact of the various possible determinants of allocation, as suggested by the alternative theories, we use an econometric analysis.

Econometric approach

We follow earlier studies and regress normalised rationing on bid and bidder characteristics. However, an important contribution of this study is, for the first time, to test whether the revenues generated by IPO investors for book-runners (notably,

⁴² The FCA's information request and subsequent meetings with issuers and banks have highlighted that, in principle, issuers can influence the allocation process and have the final say over allocation. However, the attention paid by issuers to the allocation process varies from one IPO to another and, at the least, investment banks play an advisory role in the process by proposing the initial allocation. Where we refer to the banks' role in allocation we recognize that decisions are made jointly between issuers, investment banks and, in some cases, corporate finance advisers.

⁴³ The amount bid is a choice variable potentially vulnerable to order inflation by investors. In bilateral meetings with the FCA most investment banks expressed the view that order inflation in IPO markets was not prevalent. Banks also stated that their syndicate desks were generally able to identify bids which are inflated. If order inflation did occur we would expect it to be consistent among investor types. Table 6 shows that our results hold also when analysing these investor types separately.

but not only, broking revenues) have any impact on allocations. We also explore the role of corporate finance advisers and the extent to which investors are able to profit from their relationship with the investment bank. We start by estimating the models using the whole sample of IPOs, and then test the extent of variation in allocation practices across the leading banks.

As explained above, normalised rationing is the ratio of percent allocated to percent bid. Our baseline regression is specified for each investor i , active in IPO j , with book-runner k as:

$$\begin{aligned} \text{Normalized rationing}_{i,j,k} &= \alpha + \sum_{n=0}^N \beta_n \text{bid characteristic}_{i,j,k,n} + \sum_{n=1}^N \gamma_n \text{bidder characteristics}_{i,j,k,n} \\ &+ \sum_{n=1}^N \gamma_n \text{revenues}_{i,j,k,n} + \varepsilon_{i,j,k} \end{aligned}$$

We include IPO fixed effects to control for any unobserved drivers of normalised rationing that are common to all investors in a given IPO, and bank fixed effects to control for any unobserved policies that impact on all investors with the same bank.⁴⁴ Because our dataset contains more than one book per IPO for some IPOs, we cluster standard errors at the IPO level.⁴⁵

Starting with bid characteristics, the size of an order may be an important factor in allocation. Larger orders may provide certainty to the issuer that the IPO will be successful or may help attract other investors by certifying the quality of the IPO. On the other hand, issuers may prefer to avoid a concentrated shareholder base. We include in our regression dummy variables for the first and second quartile of the bid size distribution in order to proxy for these effects. Banks and investors stated in the responses to the FCA's information request that an investor's contribution to the price discovery process is an important determinant of IPO allocation.⁴⁶ We test whether information being revealed through the order book is a driver of allocation by including in the regressions dummies for price sensitive bids and bids that are revised during the book-building process. Price sensitive bids are either limit bids or step bids. Revised bids are bids in which quantity, price, or type was changed from the initial bid. Early bids may provide issuers with more useful information, and certainty, than bids submitted late in the book-building period. We include a dummy that equals one if a bid was in the first quartile of all bids ordered by time to test whether issuers reward early expressions of demand.

Regarding bidder characteristics, investors may express information on pricing not only through their bidding behaviour but also through meetings with the issuer. We include a dummy variable that equals one if a meeting between the investor and the issuer took place. We also create a dummy variable that equals one if an investor was selected to take part in 'pilot fishing' meetings, that is, meetings held before the

⁴⁴ As robustness checks we also include investor fixed effects in some later regressions.

⁴⁵ We cluster standard errors at the IPO level to account for the fact that books for the same IPO may not be independent observations. We also run robustness tests using only one book per IPO and clustering standard errors at the investor level. Results are shown in Annex 2.

⁴⁶ Looking at IPOs by one investment bank, Cornelli & Goldreich (2001) found that informative bids (defined as those which are price-sensitive, early, or revised during book-building) receive better allocations. On the other hand Jenkinson and Jones (2004) conducted a similar study and found little evidence that informative bids were rewarded. However, their data came from a different bank from that in the Cornelli and Goldreich (2001) sample, and in hotter market conditions: either of these differences could have explained the contrasting results. In a survey of buy-side investors Jenkinson and Jones (2009) found scant support for the notion that investors are rewarded (by higher allocations) for information on pricing which they reveal to the book-runner during an IPO.

intention to float is announced which are used by investment banks and issuers as an early gauge of demand for the IPO.⁴⁷

We proxy for an investor's overall activity in the IPO market by including a dummy that equals one for the most active quartile of investors and a dummy for those investors who participate in only one IPO in our sample. The second variable might capture individual investors who could receive special treatment from issuers or investment banks for reasons not observable to us, eg 'family and friends'.

To test whether investor revenues are associated with normalised rationing after controlling for the factors above we include four dummy variables that capture the strength of the revenue relationship. Within each IPO we group investors in quartiles according to the broking revenues they generate for the book-runner in the year of the IPO.⁴⁸ We include in the regression four dummy variables for investors who have a business relationship with the book-runner (outside the IPO business) and hence with whom the book-runner generates positive revenues. These dummy variables correspond to the four quartiles into which such investors are grouped according to the revenues which the book-runner generates with them. Those investors who have no revenues with the book-runner are used as the omitted control group, ie the dummy variables measure the effect of revenues relative to those investors that do not have a business relationship with the bank. We use revenue quartiles, rather than the absolute amount of the revenues received, for two reasons. First, although the information requested from the banks was in respect of 'total revenues received in each year for all services provided to this investor', it is likely that some banks were more inclusive than others in computing overall revenues. It is notable that some investment banks were able to provide this information extremely quickly, and others required several weeks to gather and compute the information. Therefore, the relative revenues of investors within a bank are likely to be more accurately measured than differences in revenues between banks. By using quartile rankings we address this issue. Second, there may be concerns about the strict linearity of the relationship between revenues and allocations, not least because some of the bank-investor revenues are very large. Of course, if banks do indeed link allocations in a simple linear way to absolute revenues, then our approach of focusing on the ranking of investors for a given bank will tend to under-state the results.⁴⁹

Results

The first column of Table 6 shows the results of our baseline regression. Looking across the columns in Table 6 we estimate whether the results change when splitting the sample into hot and cold IPOs. Typically investment banks communicate to the market when an IPO is fully subscribed at the bottom of the range, and the timing of this announcement is considered by market participants a signal of the demand for the IPO.⁵⁰ The reason is that, as we show in Figure 2, very few IPOs are priced outside of the initial price range, so that IPOs with high demand are ex-ante more likely to be underpriced. Ex post, this is confirmed: the average underpricing of the

⁴⁷ Both variables are derived either from the meetings data submitted by banks or from information on meetings recorded in the books. We define pilot fishing as any meeting that took place before the announcement date or as a meeting that has been explicitly marked as pilot fishing. Most meetings submitted to us are one-on-one meetings, which are likely to be more informative than group meetings.

⁴⁸ Because we have yearly revenue data the timing of revenues relative to the IPO varies. We explore different assumptions on the timing of revenues relative to the IPO later on in this section.

⁴⁹ In Annex 2 we show results with alternative specifications of the revenue variable.

⁵⁰ This market practice has been confirmed by investment banks in bilateral meetings conducted as part of the FCA's Investment and Corporate Banking Market Study.

hot IPOs is 9.3% compared with 2.1% for the cold IPOs.⁵¹ We therefore split the sample into ex-ante 'hot' and 'cold' IPOs according to whether they are above or below the median number of days to full subscription at the lower end of the initial price range.⁵² We also analyse the sample in two further ways: whether or not the issuer employed a corporate finance adviser, and (for a subsample of the investors for whom we have a classification) whether the results differ across long-only and hedge funds.

Starting with bid characteristics, we find that the largest quartile of bids receives nearly a 20% higher allocation (after normalising for their higher bid size) in comparison to the smallest 50% of bids. The second largest quartile of bids receives around 12% higher relative allocation (first column of Table 6). These results are of similar magnitude to those reported in Cornelli and Goldreich (2001). We find that the size effect is less pronounced in hot IPOs, and for the IPOs with a corporate finance adviser. Furthermore, we find that the effect is concentrated on the long-only investors, and that bid size has a much smaller impact for hedge funds, which is only statistically significant for the largest quartile of bids.

Regarding the remaining bid characteristics, in the overall sample we find that price sensitive bids receive around a 7% higher allocation (first column of Table 6). This is driven by the hot IPOs, although the statistical significance is marginal. There is a much larger (and more significant) effect in advised IPOs, which suggests that corporate finance advisers help to reward investors that submit limit or step bids rather than strike bids. Advised IPOs tend to be larger than unadvised IPOs (Table 2) and may generally be more complex and difficult to price, which could mean that price sensitive bids are more valuable in these deals. We find a somewhat stronger positive impact for price sensitive bids when we limit the sample to those investors where we have a long-only or hedge fund designation. In sum, these results suggest that there is evidence that investors who submit more informative bids are rewarded with higher allocations, and that corporate finance advisers encourage this strategy.

Regarding bid revisions and early bids, these factors do not seem to affect normalised rationing in a consistent way. In most specifications the impact of bidding early appears to be negative on normalised rationing, although the results are only occasionally significant. Visual inspection of the data suggests that bid revisions and timing of bids are not necessarily driven by fundamental reasons, but often by institutional constraints, eg investors simply adding orders to the book whenever they receive them from their own end clients.

Much stronger, and positive, results are found for the impact of attending meetings, both during the book-building and in any prior pilot fishing. In all specifications, participation in such meetings increases allocations, and this is particularly the case in hot IPOs. Frequent bidders receive higher normalised rationing, in line with previous research, and we also find that one-time bidders get higher allocations. This effect disappears if we restrict our sample to investors identified as long-only or hedge funds, which is consistent with these one-time investors being awarded shares for other reasons specific to the transaction.

Turning to investor revenues we see that, after controlling for bid characteristics, meeting attendance etc., being in one of the top three revenue quartiles is associated with higher relative allocations than being in the last quartile or not

⁵¹ Untabulated results based on Dealogic and Market study data.

⁵² For a few IPOs, the initial price range was not reported to us, and so we exclude these from this part of the analysis. We also run robustness checks using the final level of oversubscription and ex-post IPO performance as a measure of 'hotness'. The results are shown in Annex 2.

producing any revenues for the investment bank. The coefficients are consistently significant and increasing in the investor's revenue position, ie the more important an investor is in revenue terms for the book-runner of a given IPO, the higher the relative allocation they receive. This is a striking result, not least because it appears to conflict with the survey evidence (Figure 1) where most investment banks stated that investor revenues were 'unimportant' when deciding IPO allocations.

The preferential allocations are also sizeable: being in the top revenue quartile increases the relative allocation by 0.51, which is a large impact given that the sample average normalised rationing is 0.78 (Table 5). The second quartile of investors by revenue also receive economically significant increases in allocation of 0.27.

If investors use their revenue relationship with banks to secure better allocations, one might expect the effect to be strongest for the most desirable IPOs. This is indeed what we find. For the hot IPOs the impact of being in the top quartile of investors by revenue generated increases to 0.64. In cold issues the impact is only 0.28. This is, we believe, an important result. While we have tried to capture as many of the observable actions and characteristics of investors as possible, there may be unobservable and desirable characteristics of bidders that we cannot observe. So one response to the econometric analysis could be that high revenue customers are desirable in ways that we are not capturing. While this is, in principle, a possibility, it would then be challenging to explain why such investors are so much more valuable in hot than cold IPOs.

Given the evidence that allocations are related to investor revenues, and more so in hot than cold issues, do corporate finance advisers reduce this impact? The univariate statistics in Panel C of Table 5 showed only a small difference between advised and unadvised IPOs in terms of the normalized rationing that high revenue investors receive compared to low revenue investors. Having controlled for the various bid and bidder characteristics, columns four and five of Table 6 show similar investor revenue effects in the advised and non-advised samples. Therefore, we do not find evidence that corporate finance advisers reduce significantly the impact of investor revenues on IPO allocations, although, as noted earlier they appear to increase allocations to investors who submit price sensitive bids, and their presence tends to increase the proportion of IPO fees that are discretionary.

Finally, for the subset of investors which were designated as long-only or hedge funds, we find the revenue effects to be considerably stronger for long-only investors. However, it is worth recalling (Table 5) that hedge funds tend to receive lower allocations, relative to their demand, than long-only investors: average normalised rationing for hedge funds is 0.55 compared with 1.08 for long-only investors. Relative to these average levels of rationing, the impacts of revenue on allocation are much more similar for the two investor types.

Bank-by-bank regressions

Up to this point, the results have been based on all IPOs. While we have included investment bank fixed effects, these only allow for differences in the average level of normalised rationing across banks (which are minor) and so do not capture any differences in the way they conduct IPOs. In this section we investigate the extent to which allocation practices differ across banks, by estimating the models separately for the top nine most active book-runners (all remaining book-runners are included in a final group).

Table 7 presents the results for our baseline regression. In order to maintain anonymity we do not reveal the number of observations for each bank, and the order of the banks is random.⁵³ While most variables are consistent in terms of sign and significance with the pooled regressions discussed above, we do see some heterogeneity across banks. In particular the relevance of the price sensitivity of bids for the allocation decision seems to vary considerably by bank, with significant coefficients only being found in half of the regressions. This may explain the differing findings on this issue of Cornelli & Goldreich (2001) and Jenkinson & Jones (2004), which each used a dataset from a different (European) book-runner. Meetings are significant drivers of allocation for the majority of banks, although the impact of pilot fishing meetings is much more variable, both in estimated impact and significance.

Turning to the revenue variables we see a pattern that is remarkably consistent across most of the banks. For six banks the coefficients on the top revenue quartile of investors are similar – ranging from 0.56 to 0.72. For banks four, eight, and the group of smaller book-runners, the coefficient is smaller but remains significant. However, for bank six we find no evidence that those investors who generate the most revenues receive preferential allocation. Therefore, while for most leading IPO book-runners, client revenues clearly drive IPO allocations, the heterogeneity in the results shows that this does not have to be the case: for some banks IPO allocations appear to be separate from the revenue relationship.

⁵³ The number of bids per bank varies from just under 3000 to over 11000, and the ‘other’ group of smaller banks includes around 5500 observations.

Table 6: Determinants of allocation

VARIABLES	Normalised rationing						
	Baseline (1)	Hot (2)	Cold (3)	Advised (4)	Non-advised (5)	Long-only (6)	Hedge fund (7)
Largest	0.192*** (5.860)	0.161*** (3.267)	0.229*** (6.682)	0.170*** (3.437)	0.208*** (4.706)	0.398*** (6.860)	0.0845*** (3.873)
Large	0.117*** (4.288)	0.103** (2.493)	0.161*** (6.872)	0.107** (2.646)	0.126*** (3.373)	0.231*** (6.305)	0.0239 (1.049)
Price sensitive bid	0.0692** (2.414)	0.0703* (1.731)	0.0210 (1.030)	0.116*** (3.839)	0.0305 (0.677)	0.159*** (3.996)	0.174*** (6.531)
Money bid	-0.0490 (-1.322)	-0.0575 (-1.082)	-0.0848*** (-4.267)	-0.0410 (-1.248)	-0.0551 (-0.887)	0.0457 (0.911)	0.0708*** (3.069)
Early	-0.0267 (-0.768)	-0.0219 (-0.393)	-0.0349** (-2.139)	-0.0516** (-2.134)	-0.00896 (-0.155)	-0.0254 (-0.802)	0.0642*** (3.607)
Revised bid	0.0138 (0.516)	-0.0151 (-0.361)	0.0434*** (2.737)	0.0624** (2.596)	-0.0228 (-0.547)	-0.102** (-2.016)	0.0380** (1.986)
Meeting	0.235*** (11.44)	0.278*** (10.14)	0.138*** (4.932)	0.256*** (8.489)	0.225*** (7.823)	0.290*** (7.740)	0.163*** (5.765)
Pilot fishing	0.244*** (4.393)	0.278*** (3.959)	0.139** (2.502)	0.239*** (3.361)	0.253*** (2.797)	0.358*** (2.673)	0.161*** (3.037)
Frequent bidder	0.0767*** (3.241)	0.103*** (2.754)	0.0415** (2.119)	0.0548* (1.726)	0.0923*** (2.733)	0.116*** (3.246)	0.0498*** (2.742)
One-time bidder	0.165*** (3.228)	0.219*** (2.723)	0.0848** (2.133)	0.202** (2.195)	0.146** (2.335)	0.404* (1.817)	0.0377 (0.337)
1 st revenue quartile	0.514*** (9.515)	0.635*** (8.435)	0.278*** (7.129)	0.492*** (8.194)	0.528*** (6.209)	0.673*** (5.288)	0.265*** (8.209)
2 nd revenue quartile	0.272***	0.333***	0.168***	0.269***	0.274***	0.390***	0.167***

	(7.312)	(6.319)	(4.360)	(7.259)	(4.513)	(7.529)	(6.299)
3 rd revenue quartile	0.0946***	0.127***	0.0482*	0.0848**	0.102***	0.202***	0.0858***
	(3.567)	(3.588)	(1.671)	(2.517)	(2.640)	(3.236)	(3.475)
4 th revenue quartile	-0.0169	-0.0176	-0.00854	-0.0271	-0.00962	0.00877	0.0355**
	(-0.716)	(-0.553)	(-0.315)	(-0.995)	(-0.261)	(0.174)	(2.061)
Constant	0.578***	0.572***	0.640***	0.572***	0.593***	0.696***	0.290***
	(15.91)	(10.49)	(30.56)	(15.80)	(11.83)	(13.82)	(10.03)
Observations	52,199	32,294	16,487	22,802	29,397	11,256	11,334
R-squared	0.086	0.082	0.136	0.090	0.084	0.170	0.134
Bank fixed effects	yes	yes	yes	yes	yes	yes	yes
IPO fixed effects	yes	yes	yes	yes	yes	yes	yes

The dependent variable is normalised rationing, ie the ratio of percent allotted to percent bid. Largest (large) bids are in the top (second) quartile of the bid size distribution. Price sensitive bids are limit bids or step bids. Money bids are bids expressed in currency which are not price sensitive bids. We construct the revenue quartiles by ranking, for each book-runner and for each IPO, all investors by the revenues they have had with the book-runner in the year of the IPO. The revenue dummies need to be interpreted relative to the investors who did not have any revenues with that book-runner. Meeting is a dummy that takes the value one if the investor participated in a meeting with the issuer. Pilot fishing refers to meetings that took place before the announcement date or which were labelled as pilot fishing meetings by the investment banks. Frequent bidder is a dummy with value one for investors that participated in at least 50 IPOs. One-time bidders are bidders that participated in only one IPO. Hot (cold) IPOs are below (above) the median of IPOs in the distribution of days till full subscription at the bottom of the range. Investor fixed effects are defined using the 'wide' matching algorithm. T-stats are given in parentheses based on robust standard errors clustered at the IPO level.

Table 7: The determinants of allocation, bank-by-bank regressions

VARIABLES	Normalised rationing									
	Bank 1	Bank 2	Bank 3	Bank 4	Bank 5	Bank 6	Bank 7	Bank 8	Bank 9	others
Largest	0.185**	0.205***	0.0268	0.123*	0.218***	0.197***	0.371***	0.287*	0.522***	0.177***
	(2.197)	(4.003)	(0.361)	(1.991)	(4.561)	(2.975)	(4.450)	(2.087)	(3.406)	(3.335)
Large	0.125**	0.131***	0.0438	0.132**	0.192**	0.0774**	0.0479	0.138***	0.222***	0.0738*
	(2.154)	(3.195)	(0.802)	(2.309)	(2.320)	(2.132)	(0.784)	(4.810)	(3.528)	(1.744)
Price sensitive bid	0.0109	0.0882***	0.100**	-0.0378	0.154***	-0.142	0.459**	0.0919	0.0178	0.0810***
	(0.192)	(2.938)	(2.228)	(-0.440)	(6.224)	(-0.947)	(2.249)	(1.074)	(0.260)	(3.284)

Money bid	-0.131**	-0.00307	0.00468	-0.162	0.174**	-0.411**	0.211**	-0.0681*	-0.0291	0.0106
	(-2.219)	(-0.109)	(0.105)	(-1.508)	(2.259)	(-2.285)	(2.427)	(-2.218)	(-0.793)	(0.332)
Early	0.0753**	-0.00833	-0.0994***	0.179	-0.0772**	0.150	0.0518	-0.154*	-0.00619	-0.0323
	(-2.627)	(-0.346)	(-2.898)	(1.408)	(-2.284)	(0.712)	(1.079)	(-2.035)	(-0.0805)	(-0.922)
Revised bid	0.0403	0.0283	0.0368	-0.0339	-0.0457	-0.0178	0.0435	-0.00678		
	(0.952)	(1.228)	(0.625)	(-0.693)	(-0.447)	(-0.304)	(0.668)	(-0.188)		
Meeting	0.297***	0.157***	0.173***	0.431***	-0.0431	0.211***		0.380	0.492***	0.338***
	(3.964)	(4.181)	(4.837)	(8.542)	(-0.572)	(3.817)		(1.633)	(4.877)	(3.287)
Pilot fishing	0.426***	0.206***	0.221*	0.152*	0.635*	-0.336		0.653***	-0.0901	0.133
	(3.353)	(3.750)	(1.873)	(1.848)	(1.990)	(-0.843)		(4.090)	(-0.627)	(0.902)
Frequent bidder	0.0550**	0.0910*	-0.00455	-0.0591	0.00494	-0.0119	0.152***	0.230***	-0.0852***	0.0851**
	(2.060)	(1.939)	(-0.118)	(-0.694)	(0.132)	(-0.189)	(3.354)	(5.346)	(-3.742)	(2.643)
One-time bidder	0.287**	0.240***	0.356***	-0.0710	0.172	-0.232**	0.0617	-0.0244	0.299	0.106**
	(2.586)	(3.593)	(3.221)	(-1.329)	(1.637)	(-2.490)	(1.591)	(-0.641)	(1.214)	(2.212)
1 st revenue quartile	0.626***	0.578***	0.717***	0.449*	0.637**	-0.0170	0.573**	0.250***	0.563***	0.308***
	(7.412)	(10.38)	(5.872)	(1.824)	(2.683)	(-0.108)	(2.673)	(3.794)	(9.172)	(2.812)
2 nd revenue quartile	0.380***	0.249***	0.670***	0.0935*	0.134***	-0.186	0.294*	0.222**	0.123	0.258***
	(5.159)	(6.569)	(3.450)	(1.727)	(2.918)	(-0.891)	(1.953)	(2.356)	(1.191)	(3.048)
3 rd revenue quartile	0.165***	0.160***	0.344***	-0.0381	0.0156	-0.442**	-0.203*	0.102	0.00460	0.0809
	(3.363)	(5.005)	(5.624)	(-0.747)	(0.178)	(-2.483)	(-1.918)	(1.144)	(0.0466)	(1.548)
4 th revenue quartile	-0.0294	-0.0263	0.511***	-0.123***	-0.144***	-0.501**	-0.427***	0.0151	-0.0988	0.0120
	(-0.811)	(-0.581)	(5.490)	(-4.634)	(-5.401)	(-2.443)	(-5.083)	(0.197)	(-1.440)	(0.287)
Constant	0.433***	0.365***	0.445***	0.601***	0.438***	1.149***	0.281***	0.587***	0.302***	0.586***
	(8.381)	(14.22)	(11.28)	(9.061)	(5.723)	(4.048)	(5.239)	(15.05)	(6.669)	(18.17)

Observations	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
R-squared	0.086	0.097	0.090	0.172	0.082	0.096	0.156	0.116	0.116	0.134
Bank fixed effects	no	no	no	no	no	no	no	no	no	no
IPO fixed effects	yes	Yes	yes	yes	yes	yes	yes	yes	yes	yes

The dependent variable is normalised rationing, ie the ratio of percent allotted to percent bid. Largest (large) bids are in the top (second) quartile of the bid size distribution. Price sensitive bids are limit bids or step bids. Money bids are bids expressed in currency which are not price sensitive bids. We construct the revenue quartiles by ranking, for each book-runner and for each IPO, all investors by the revenues they have had with the book-runner in the year of the IPO. The revenue dummies need to be interpreted relative to the investors who did not have any revenues with that book-runner. Meeting is a dummy that takes value one if the investor participated in a meeting with the issuer. Pilot fishing refers to meetings that took place before the announcement date or which were labelled as pilot fishing meetings by the investment banks. Frequent bidder is a dummy with value one for investors that participated in at least 50 IPOs. One-time bidders are bidders that participated in only one IPO. Hot (cold) IPOs are below (above) the median of IPOs in the distribution of days till full subscription at the bottom of the range. Investor fixed effects are defined using the 'wide' matching algorithm. Bank names and number of observations are not disclosed to preserve confidentiality. T-stats are given in parentheses based on robust standard errors clustered at the IPO level.

Robustness tests

Although we try to control for many bid and bidder characteristics it is possible that some omitted and/or unobservable investor characteristic drives normalised rationing and is at the same time positively correlated with high investor revenues. For example, large asset managers may be desirable investors who provide input on pricing during the IPO process (in ways not captured by the information production proxies we include) but also have high revenues with multiple investment banks. To address these potential concerns we run two robustness tests: including investor fixed effects and bank-investor fixed effects.

Investor fixed effects

Investor fixed effects control for any drivers of normalised rationing that are constant for a given investor across different IPOs and banks. Examples might include providing particularly useful views on valuation on all IPOs, or being a large investor. The investor fixed effects filter out this investor-specific effect, and so the coefficients capture only the characteristics that differ for the same investor from one IPO to another. For instance, having included investor fixed effects, the revenue variables will only capture the impact of variations in revenue quartiles across IPOs. If an investor is in the top revenue quartile for every IPO, this characteristic will be filtered out by the fixed effect. Therefore, the results need to be interpreted carefully.

The results for models including investor fixed effects are shown in column one of Table 8. The R-squared of the regression increases by about 40 percentage points compared with baseline regression, ie 40% of the variation in normalised rationing is driven by characteristics specific to an investor.⁵⁴ The bid-size quartile dummies are negative in contrast to the regressions without investor fixed effects, but only the coefficient for the largest bid-size quartile is statistically significant. This can be interpreted as follows: holding investor size constant (using the fixed effects) the additional impact of putting in a very large bid is actually negative and such large bids (by that investor) are penalised.

Turning to the investor revenue variables, we still see a positive and, except for the third quartile, significant relationship with normalised rationing when including investor fixed effects. The size of the coefficients declines by revenue quartile which is again consistent with larger revenues being associated with more favourable allocation. Overall the effects are smaller than in the regressions without fixed effects, which is to be expected since the revenue coefficients in this specification only capture the variation in revenue quartiles across IPOs. These results reinforce the earlier findings, as they demonstrate that for a given investor (whether helpful, coy, large, small, long-only or renowned flipper) their varying revenue relationships across IPOs affects their allocation.

Bank-investor fixed effects

While investor fixed effects control for investor characteristics that are common to one investor across multiple IPOs with different banks, they do not control for characteristics which are peculiar to the relationship between one investor and one

⁵⁴ Note however that investor fixed effects also capture investor characteristics like being an informative investor or a high revenue investor.

particular bank. For example an investment bank which has a good relationship with an investor may be better able to predict whether that investor will be a long-term holder of the stock in a given IPO and therefore decide to allocate more shares to such an investor. One reason for that relationship could be that the investor is a long-standing, active broking client of the bank.

If this were the case our regressions would lack a variable that measures the depth of the relationship and we could interpret the correlation between revenues and normalised rationing as evidence for banks favouring clients with whom they have a deep relationship. We already include some variables that may proxy for this investor-bank relationship and its outcomes, eg whether the investor is a frequent participant⁵⁵ in the IPO market, participates in meetings, or submits informative bids. However, as a further robustness check we re-run our baseline regressions including bank-investor fixed effects, ie we restrict the regression model to variation within investor-bank pairs. That means that the coefficient will capture only the different revenue quartile position of an investor in different IPOs run by the same bank. For example, an investor that is active in two IPOs run by the same bank may be in the top revenue quartile in the first IPO (alongside many low revenue investors) but in the bottom quartile in the second IPO (alongside many other high revenue investors).

The results of this regression are shown in column four of Table 8. Even under this very demanding test the top two revenue quartile variables are still significant, positive, and increasing in revenues, implying that an investor who participates in different IPOs with one bank will receive a higher allocation in the IPO in which it is more important to the bank in revenue terms.

To conclude, even after controlling for any omitted investor-specific and investor-bank-specific effects, higher revenues are associated with higher normalised rationing.

Timing of investor revenues relative to the IPO

A further issue we explore is the temporal relationship between revenues and allocations. Banks supplied revenues from investors on a calendar year basis, and our empirical specifications to this point have used revenues in the calendar year of the IPO. In this section we explore how the results vary when we include investor revenues in the year before and the year after the IPO.⁵⁶ If banks and investors see IPO allocations and broking revenues during a short period around the IPO as a single quid pro quo, revenues closer to the time of the IPO (as in our baseline regressions) could be more important than those further away. Moreover, if the relationship between IPO allocations and previous broking revenues is different from the relationship between IPO allocations and subsequent broking revenues, this might inform us about whether revenues or allocations are the trigger in such a quid pro quo.

The results from varying the timing of the revenue variable are shown in columns two and three of Table 8. They show that revenues are significant for all years, even though the coefficients are slightly smaller in the years after the IPO than for the year of the IPO and the year before. Considering the long-term relationships that

⁵⁵ We also checked whether loyal investors, ie investors who participate in most of a bank's IPOs, receive favourable treatment. See Annex 2.

⁵⁶ See Reuter (2006) for evidence consistent with investors increasing commissions paid to underwriters after profitable IPOs; see Nimalendran et al. (2007) and Goldstein et al (2011) whose findings suggest that investors increase trading volumes with book-runners before IPOs.

exist between many investors and investment banks, which result in quite stable revenue flows over time, it is perhaps unsurprising that the precise timing of the revenues relative to the IPO makes little difference to the results.

Table 8: The determinants of allocation, timing of investor revenues, investor fixed effects and bank-investor fixed effects

VARIABLES	Normalised rationing			
	(1)	(2)	(3)	(4)
Largest	-0.138*** (-2.665)	-0.0650* (-1.824)	-0.198** (-2.509)	-0.174** (-2.597)
Large	-0.0529 (-1.524)	-0.0211 (-0.758)	-0.119** (-2.446)	-0.0720* (-1.672)
Price sensitive bid	0.0529* (1.837)	0.0466 (1.528)	-0.00569 (-0.164)	0.0515 (1.366)
Money bid	-0.0224 (-0.679)	-0.0312 (-0.878)	-0.0841** (-2.479)	-0.0305 (-0.717)
Early	0.0685*** (3.488)	0.0717*** (3.594)	0.0760*** (2.970)	0.0671*** (2.642)
Revised bid	0.0115 (0.417)	0.00607 (0.201)	0.0407** (2.415)	0.00859 (0.248)
Meeting	0.106*** (5.773)	0.135*** (6.539)	0.0896*** (3.279)	0.142*** (5.638)
Pilot fishing	0.0928*** (2.758)	0.144*** (4.824)	0.0340 (0.824)	0.0904** (2.186)
1 st revenue quartile (IPO year)	0.133*** (5.093)			0.179*** (3.243)
2 nd revenue quartile (IPO year)	0.0677*** (2.955)			0.0953** (2.104)
3 rd revenue quartile (IPO year)	0.0236 (1.409)			0.0327 (0.764)
4 th revenue quartile (IPO year)	0.0347* (1.859)			0.0376 (0.658)
1 st revenue quartile (IPO year-1)		0.141*** (3.082)		
2 nd revenue quartile (IPO year-1)		0.0598*** (2.920)		
3 rd revenue quartile (IPO year-1)		0.0274 (1.245)		
4 th revenue quartile (IPO year-1)		0.0413* (1.969)		
1 st revenue quartile (IPO year+1)			0.125*** (4.759)	
2 nd revenue quartile (IPO year+1)			0.0602*** (2.913)	
3 rd revenue quartile (IPO year+1)			0.0144	

			(0.765)	
4 th revenue quartile (IPO year+1)			0.0263	
			(1.467)	
Constant	1.079***	1.003***	1.190***	0.961***
	(22.13)	(22.27)	(18.36)	(16.04)
Observations	52,199	48,704	33,715	52,199
R-squared	0.498	0.498	0.551	0.612
Bank fixed effects	yes	yes	yes	no
IPO fixed effects	yes	yes	yes	no
investor fixed effects	yes	yes	yes	yes
investor-bank fixed effects	no	no	no	yes

The dependent variable is normalised rationing, ie the ratio of percent allotted to percent bid. Largest (large) bids are in the top (second) quartile of the bid size distribution. Price sensitive bids are limit bids or step bids. Money bids are bids expressed in currency which are not price sensitive bids. We construct the revenue quartiles by ranking, for each book-runner and for each IPO, all investors by the revenues they have had with the book-runner in the year of the IPO, in the year before the IPO or in the year after the IPO. The revenue dummies need to be interpreted relative to the investors who did not have any revenues with that book-runner. Meeting is a dummy that takes value one if investor participated in a meeting with the issuer. Pilot fishing refers to meetings that took place before the announcement date or which were labelled as pilot fishing meetings by the investment banks. One-time bidders are bidders that participated in only one IPO. Investor fixed effects and investor-bank fixed effects are defined using the 'wide' matching algorithm. T-stats are given in parentheses based on robust standard errors clustered at the IPO level.

Profitability of orders

Our earlier results established that high revenue clients receive higher relative allocations in the (ex-ante) hot IPOs. A final issue we investigate is whether high revenues are also associated with bids that are ex-post profitable for investors. To do this we switch the dependent variable in our regressions from normalised rationing to profitability. Following earlier studies, we define bid profitability as the return to an investor's bidding strategy, ie the value of the allocated shares after one day minus the costs of the shares allotted at offer price, divided by the cost of the bid at offer price.

Table 9 shows the results of a regression of bid profitability on control variables and the investor revenue variables. The first column, the baseline regression with bank and IPO fixed effects, shows that high revenue investors make more profitable bidding decisions. The only other significant variable is bid size, ie those clients who have a lot of broking revenue with the book-runners and those who place large bids make the most profitable bids.

When we introduce investor fixed effects in the second column of Table 9 the revenue variables turn insignificant, ie while investors with high broking revenues receive more profitable bids than others, this relationship seems to be specific to some investors rather than applying to all investors. In column three we try to understand better which investor types place the more profitable bids. Bids by hedge funds are less profitable than bids by long-only investors or other types of investors, reflecting the higher scale back that hedge funds receive compared to long-only investors (Table 5). However, the revenue variables remain positive and significant, ie our results are not driven by one of the investor types having high revenues with banks and receiving the most profitable bids.

To sum up, it seems that some investors are consistently able to place profitable bids and that these investors also generate high brokerage revenues for the banks. It is important to note that profitability of bids does not only depend on the scale-back an investor receives but also on the investor's ability to predict the market price of the IPO shares, a variable that is unknown to all participants.

Table 9: Bid profitability

VARIABLES	Bid profitability		
	(1)	(2)	(3)
Largest	0.235*** (2.706)	-0.141 (-1.186)	0.283*** (2.996)
Large	0.0983 (1.476)	-0.137* (-1.824)	0.120* (1.727)
Price sensitive bid	-0.0926 (-0.616)	-0.251* (-1.672)	-0.0681 (-0.448)
Money bid	-0.101 (-1.487)	-0.0735 (-1.039)	-0.0608 (-0.846)
Early	0.00342 (0.0840)	0.123** (2.197)	0.0216 (0.531)
Revised bid	0.0701 (0.859)	0.130 (1.599)	0.0322 (0.419)
Meeting	0.125 (1.199)	-0.0467 (-0.447)	0.120 (1.151)
Pilot fishing	0.156 (0.824)	0.0352 (0.181)	0.132 (0.696)
Frequent bidder	-0.0130 (-0.239)		0.00369 (0.0695)
Hedge fund			-0.190*** (-2.923)
Long only			0.407** (2.607)
Coalition			
1 st revenue quartile	0.376*** (3.613)	0.0686 (0.609)	0.343*** (3.251)
2 nd revenue quartile	0.212*** (2.634)	0.0414 (0.534)	0.202** (2.480)
3 rd revenue quartile	-0.0423 (-0.616)	-0.0565 (-0.914)	-0.0272 (-0.399)
4 th revenue quartile	-0.140** (-2.067)	-0.0775 (-1.330)	-0.107* (-1.699)
Constant	-2.145* (-1.892)	-2.195*** (-4.671)	-2.224* (-1.958)
Observations	44,437	44,437	44,437
R-squared	0.049	0.356	0.055
Bank fixed effects	yes	yes	yes

IPO fixed effects	no	no	no
Investor fixed effects	no	yes	no

The dependent variable is bid profitability, ie the ratio of shares allocated to shares bid for times the return in the first day of trading compared to the offer price. Largest (large) bids are in the top (second) quartile of the bid size distribution. Price sensitive bids are limit bids or step bids. Money bids are bids expressed in currency which are not price sensitive bids. We construct the revenue quartiles by ranking, for each book-runner and for each IPO, all investors by the revenues they have had with the book-runner in the year of the IPO. The revenue dummies need to be interpreted relative to the investors who did not have any revenues with that book-runner. Meeting is a dummy that takes value one if investor participated in a meeting with the issuer. Pilot fishing refer to meetings that took place before the announcement date or which were labelled as pilot fishing meetings by the investment banks. Frequent is a dummy with value one for investors that participated in at least 50 IPOs. One time bidders are bidders that participated in only one IPO. Investor fixed effects are defined using the 'wide' matching algorithm. T-stats are given in parentheses based on robust standard errors clustered at the IPO level.

Conclusion

We find evidence that revenues from investors influence the allocation decision of investment banks. Investors who generate the highest revenues for the book-runners receive significantly higher allocations relative to the amount they bid. These preferential allocations are strongest in hot IPOs. These results hold in the overall sample of IPOs, and for the majority of individual banks. However, for one major bank we find that investor revenues have no impact on allocations.

5 Are the allocated investors long-term holders?

The final issue we explore is how trading evolves after the IPO. For a subset of 65 stocks we have data on all transactions that took place in the month after the IPO. For any trade involving at least one EEA counterparty we have full information on counterparties, time and date and place of trade, quantity, and price.⁵⁷ We use this dataset to analyse the extent to which allotted investors add to, or reduce, their holdings, and the extent to which they trade actively in the aftermarket.

Issuers and investment banks have expressed the view, both through the FCA's information request (see Figure 1) and through bilateral meetings, that an important objective of the allocation process was to place the shares in the hands of long-term investors. Whatever the objectives of the book-runner and issuer regarding allocating shares, it is clearly difficult to condition allocations on particular after-market behaviour. It is true that investors may, over time, develop reputations for topping up, holding, or flipping shares and it is one of the roles of investment banks as intermediaries in matching issuers and investors to know their clients. However, they cannot enter into contracts with investors to act in a particular way (for instance, not to flip the shares), nor will they have perfect information on subsequent trades. While book-runners may accumulate information on flippers from past IPOs, they do not have access, within Europe, to any systematic tracking of aftermarket trading like the Depository Trust and Clearing Corporation's IPO Tracking System in the US. This facility allows book-runners to track how ownership evolves in the first few weeks after the IPO and provides the opportunity for book-runners to penalise syndicate members whose clients subsequently flip the share (see Aggarwal (2003)).⁵⁸

With these caveats in mind, we explore whether investors' allocations depend on the extent to which they add to or reduce the shares they are allocated. First we analyse the relationship between the allocation to an investor in a given IPO and the extent to which that investor tops up or flips its allocation in the same shares. We thereby test whether investment banks correctly anticipate trading behaviour. Second, we analyse the relationship between the allocation to an investor in a given IPO and the extent to which that investor topped up or flipped shares in previous IPOs, thereby testing the investment banks' response to prior trading activity.

Some investment banks have mentioned an additional objective in making allocations, which is to ensure that there is sufficient liquidity in the newly issued security. The concern seems to be that placing too many shares with long-term holders may limit the liquidity of the share and may therefore not be in the issuers' best interests. This argument is at least debatable. Only a subset of potential investors bid in the IPO, and many investors receive no allocation or have their bids heavily scaled back. At the same time, IPOs tend to trade at an immediate premium

⁵⁷ We remove duplicate transaction reports whenever a transaction is reported with identical buyer, seller, trade date, quantity and price information. While ZEN transaction data should only include secondary market transactions we do find a number misreported primary market transactions which we drop from the dataset: 1) We drop all transactions recorded before the IPO date, 2) We drop all transactions reported with a transaction price of zero, and 3) we drop transactions where the number of shares allocated equals the number of shares reported as being bought in the IPO on the IPO date.

⁵⁸ See <https://dtcclearning.com/learning/settlement/products/settlement/business-information/ipo-tracking.html>

to their issue price, presenting allocated investors with a realisable gain. In between these groups of buyers and sellers the book-runner or book-runners commit to provide liquidity in the aftermarket.

When we examine trading in the immediate aftermarket for this subsample of IPOs, there appears to be an abundance of liquidity compared to later periods. We measure turnover and the bid-ask spread as proxies for trading activity and liquidity.⁵⁹ Turnover tends to spike on the first day and then drastically decrease over time: the median turnover drops from 6.7% (of total shares outstanding) on the first trading day after the IPO to 4.4% per day after one week and 0.49% per day after one year (Figure 3 and Appendix 3). Bid-ask spreads are relatively stable but on average wider after one year of trading than on the first day, week, or month after the IPO. This is consistent with investors adjusting their portfolios right after the IPO and liquidity then dropping to its natural level.

On the face of it, therefore, there seems little reason for book-runners to make preferential allocations to investors expected to provide aftermarket liquidity. Nonetheless, we explore below whether they do.

Analysis of investor behaviour

We classify investors into three different categories: investors who flip their shares, those who top up the holding they received at the IPO with additional purchases, and those who provide liquidity. We explain below how we define each of these groups.

Investors are classified as 'flippers' if they sell at least 50% of allocated shares in the first week after the IPO date. Investors are defined as 'toppers-up' if they were allocated shares in an IPO and bought more shares in the first week after the IPO. To limit the analysis to those investors who bought a sizeable number of shares relative to their size we require at least 10% of the allocated amount to be bought in the aftermarket. Investors are classified as 'liquidity providers' in a given IPO if they are in the top decile of investors by numbers of shares bought/sold in the first month after the IPO.⁶⁰ To keep these categories complementary, we exclude liquidity providers from also being toppers-up or flippers.

Table 11 provides summary statistics of investor behaviour in the IPO aftermarket. Across the 65 IPOs for which we have detailed trading data, the mean (median) flipping rate is 3.8% (3.4%). The flipping rate is only slightly higher for hedge funds than for long-only investors. Moreover it does not vary systematically across investor revenue quartiles. Flipping frequencies are shown in Figure A1 in Annex 3. These results suggest that while few investors flip, investment banks are not entirely successful in anticipating which investors will flip, although we analyse this in more detail in our regression framework.

The mean (median) proportion of investors who satisfy our topping up criteria is 8.4% (7.8%). In this case, there is a noticeable difference between investor types: the incidence of topping up is much higher by long-only funds. At the IPO, those investors who have been identified as long-only⁶¹ received in aggregate a median

⁵⁹ Turnover is the number of shares traded on a given day divided the number of shares outstanding times 100. The bid ask spread is the difference between end of day ask and bid prices divided by the end of day ask price times 100. The underlying data is from Thomson Reuters' Datastream.

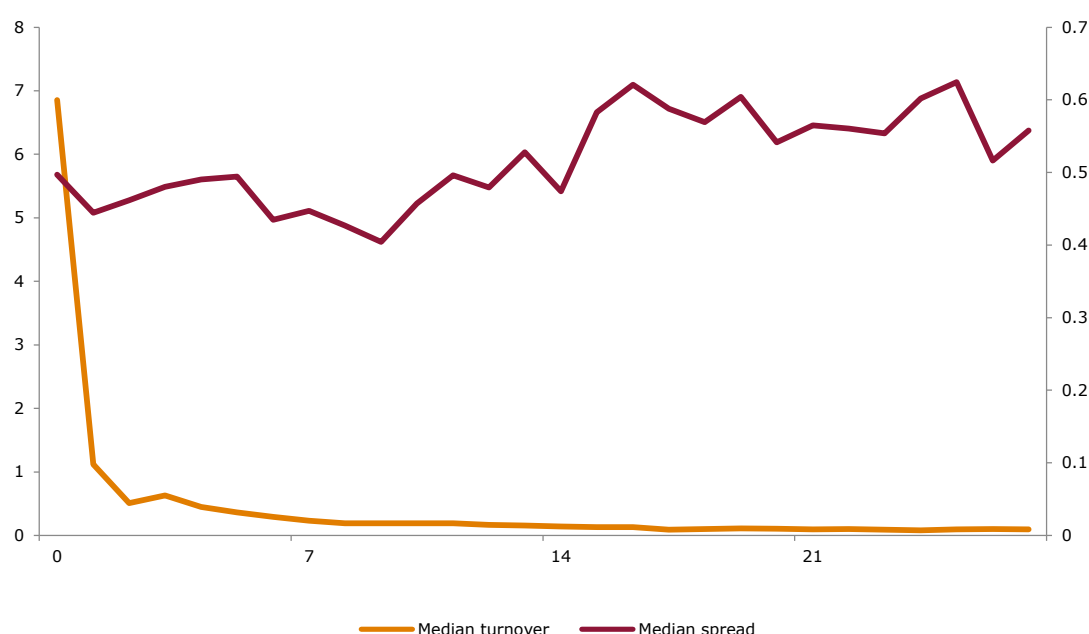
⁶⁰ Results are qualitatively similar if we are limit our definition of liquidity providers to the top 5% or the top 1% of investors. We exclude syndicate banks from consideration as they are often expected to provide liquidity in the immediate after-market.

⁶¹ Recall that we rely for this classification on the ranking produced by a corporate finance advisers, who did not classify about half of the investors in our sample.

allocation of 28.8% of the shares, but by the end of the first week their holdings had increased to 42.3%. Median hedge fund holdings decreased from 11.6% to 11.0%.⁶²

Turning to post-IPO liquidity, we start, in Figure 3, by plotting how the turnover of shares and the bid-ask spread evolve over the first month of trading. As can be seen, daily turnover, as a proportion of the shares outstanding, is initially high – the median daily turnover is nearly 7% on the first day – but this falls quickly over the first week and stabilises at less than 0.5% per day. Bid-ask spreads rise marginally over the first month. This pattern of trading suggests that investors are adjusting to their desired holdings quite rapidly – within the first trading week – and that thereafter trading stabilises at its equilibrium level.

Figure 3: Turnover and bid-ask spreads in the month after the IPO



Source: Thomson Reuters Datastream. Turnover (left axis) is the number of shares traded divided by the total number of shares outstanding times 100. The bid-ask spread (right axis) is the end of day ask price minus the end of day bid price divided by the end of day ask price times 100.

Overall, on average about 85% of trades in the IPO shares in the month after the IPO are carried out by entities which were not allocated shares. Long-only funds who also received shares in an IPO were on average responsible for about 3.6% of total trading activity while those hedge funds that received shares were responsible for on average only 0.7% of trades (panel A Table 11). Of the allocated investors who are also liquidity providers, we find very few hedge funds (panel B Table 11).⁶³

Having summarized the evidence on post-IPO trading, we now explore whether IPO allocations are related to investors' aftermarket trading behaviour. To do this, we introduce in Table 10 new variables capturing whether investors are flippers, toppers up, or liquidity providers to our econometric models of allocation.

The first column of Table 10 shows that both flippers and toppers-up in the week following the IPO are allocated more favourably (as measured by normalised

⁶² Untabulated results based on FCA transaction reporting data.

⁶³ The designation of 'liquidity provider' refers to trading activity in general, and makes no distinction between those who offer liquidity by posting bids/offers and those who take liquidity by trading on the bids/offers of others.

rationing) than other investors. Investors who subsequently provide liquidity do not receive a significantly more or less favourable allocation. As noted above, the ability of the book-runner to anticipate the aftermarket behaviour of investors will be limited, but over time investors are likely to develop reputations through their repeated interaction with book-runners. For example, particular investors may be known to be of a certain type, eg a regular flipper of IPOs. By introducing investor fixed effects we filter out such consistent behaviour and test if allocation is driven by aftermarket trading beyond the investor's average behaviour. Column two includes investor fixed effects and the dummy for topping up becomes insignificant in this specification, whereas the flipping dummy remains positive and significant. In other words investors topping up do so consistently across IPOs, whereas investors who flip seem to vary their behaviour.

Finally, to explore whether banks learn how investors behave and use subsequent IPOs to reward or punish them, we include dummies for investors who have flipped (topped up) at least once and at least twice in the past in IPOs run by the same book-runner. We find that past flipping partially reverses the positive effect of concurrent flipping and that this effect is increasing when investors have flipped multiple times. This is consistent with investment banks learning about investors' trading behaviour and adjusting their future allocations.

The evidence in this section is consistent with either the limited ability of book-runners to anticipate which investors will be flippers and/or unwillingness to bias allocations away from such investors. Another possible interpretation of our findings is that some of the investors who received relatively high allocations then adjusted their positions. However, given that our flipping variable requires at least 50% of allocated shares to be sold, such reverse causality seems unlikely to be the main driver. Our findings suggest banks do learn over time and try to avoid flippers, since the allocation rate for consistent flippers is lower. It also seems that banks are able to anticipate investors likely to top up their holdings and that such investors are rewarded with better allocations. However, it should be recalled that this part of the analysis is based on a relatively small sample of IPOs, and a larger sample of IPOs would be useful to analyse the extent of learning about investor behaviour.

When looking at liquidity provision we observe high levels of turnover in the first days of trading, which suggests that allocating to liquidity providers is unnecessary for this period. As for longer-term liquidity provision, we do not find evidence that liquidity providers (as we define them) are favoured in allocations. This finding, together with the low levels of aftermarket liquidity provided by hedge funds which are allocated IPO shares, casts doubt on the justification advanced by some investment banks' that hedge funds should be allocated shares in IPOs because they provide valuable aftermarket liquidity.

Table 10: Does aftermarket behaviour determine allocation?

VARIABLES	Normalised rationing			
	(1)	(2)	(3)	(4)
Largest	0.178*** (2.696)	-0.172* (-1.717)	0.184*** (2.776)	0.180*** (2.715)
Large	0.0544 (0.900)	-0.130 (-1.646)	0.0552 (0.913)	0.0553 (0.918)
Price sensitive bid	0.0425	-0.0233	0.0416	0.0432

	(0.843)	(-0.282)	(0.831)	(0.858)
Money bid	-0.0929**	-0.111	-0.0929**	-0.0944**
	(-2.124)	(-1.354)	(-2.118)	(-2.154)
Early	-0.0881**	0.0581	-0.0846**	-0.0863**
	(-2.422)	(1.516)	(-2.298)	(-2.394)
Revised bid	0.0430	0.0725	0.0410	0.0427
	(1.127)	(1.627)	(1.077)	(1.125)
Meeting	0.230***	0.0121	0.227***	0.226***
	(5.118)	(0.242)	(4.980)	(5.026)
Pilot fishing	0.166**	-0.0346	0.168**	0.160**
	(2.436)	(-0.609)	(2.441)	(2.375)
Frequent bidder	0.0136		0.0152	0.0150
	(0.538)		(0.568)	(0.571)
One-time bidder	0.152**		0.153**	0.153**
	(2.199)		(2.220)	(2.210)
1 st revenue percentile	0.573***	0.135***	0.569***	0.571***
	(6.650)	(2.867)	(6.593)	(6.647)
2 nd revenue percentile	0.340***	0.0828**	0.336***	0.340***
	(5.210)	(2.185)	(5.148)	(5.223)
3 rd revenue percentile	0.0915	0.0192	0.0911	0.0918
	(1.543)	(0.699)	(1.539)	(1.548)
4 th revenue percentile	-0.0394	0.0353	-0.0375	-0.0398
	(-0.903)	(1.581)	(-0.852)	(-0.919)
Flipped	0.106*	0.174***	0.202***	0.126**
	(1.935)	(3.051)	(3.122)	(2.182)
Liquidity provision	0.0881	0.161*	0.0797	0.0847
	(1.166)	(1.804)	(1.009)	(1.125)
Topped up	0.251***	0.0675	0.113	0.215***
	(4.730)	(1.160)	(1.427)	(3.851)
Flipped once			-0.127***	
			(-4.943)	
Topped up once			0.159***	
			(2.917)	
Flipped twice				-0.143***
				(-2.723)
Topped up twice				0.160***
				(2.692)
Constant	0.580***	0.516***	0.577***	0.586***
	(9.401)	(6.996)	(9.319)	(9.163)
Observations	12,393	12,393	12,393	12,393
R-squared	0.112	0.576	0.113	0.113
Bank fixed effects	yes	yes	yes	yes
IPO fixed effects	yes	yes	yes	yes
Investor fixed effects	no	yes	no	no

The dependent variable is normalised rationing, ie the ratio of percent allotted to percent bid. Largest (large) bids are in the top (second) quartile of the bid size distribution. Price sensitive bids are limit bids or step bids. Money bids are bids

expressed in currency which are not price sensitive bids. We construct the revenue quartiles by ranking, for each book-runner and for each IPO, all investors by the revenues they have had with the book-runner in the year of the IPO. The revenue dummies need to be interpreted relative to the investors who did not have any revenues with that book-runner. Meetings is a dummy that takes value one if investor participated in a meeting with the issuer. Pilot fishing refers to meetings that took place before the announcement date or which were labelled as pilot fishing meetings by the investment banks. Frequent bidder is a dummy with value one for investors that participated in at least 50 IPOs. One-time bidders are bidders that participated in only one IPO. Flippers are investors that flipped at least 50% of allocated shares in the first week after the IPO. An investor tops up if he/she increased their holdings by at least 10% of shares initially allocated in the first week after the IPO date. Liquidity providers are investors that are in the 90th percentile of investors by number of trades in the first month after the IPO. Flipped (topped up) once (twice) are investors that flipped (topped up) at least once (twice) with the same investment bank in a previous IPO. Investor fixed effects are defined using the 'wide' matching algorithm. T-stats are given in parentheses based on robust standard errors clustered at the IPO level.

Table 11: Aftermarket

Panel A: Trading activity				
	Mean number of trades	Mean % of total number of trades	Median number of trades	Median % of total number of trades
Investor types				
- Hedge fund	758	0.66	120	0.23
- Long only	4129	3.57	300	1.48
- Unclassified	26523	9.85	1167	4.26
Panel B: Investor behaviour				
	Mean % of investor	Median % of investors		
Flipping	3.81	3.36		
% of hedge funds	5.16	4.48		
% of long only	3.43	2.17		
% of others	3.44	3.45		
Topping up	8.41	7.82		
% of hedge funds	4.98	3.39		
% of long only	13.96	12.5		
% of others	8.46	6.90		
Liquidity provision	2.82	2.5		
% of hedge funds	1.57	0		
% of long only	3.62	3.39		
% of others	3.17	2.94		
Flipping				
% of no revenues	3.07	1.56		

% of bottom quartile	5.95	4.41		
% of 25-50	5.14	3.58		
% of 50-75	4.31	4.17		
% of top 25	2.46	0		

The table shows aftermarket behaviour of IPO investors based on FCA transaction data of 65 stocks. Panel A shows positions by investor type and revenue type at issue, after one day, after one week, and after one month. Panel B shows the number of trades as a percentage of all trades in a given stock by investor type. Panel C shows the percentage of investors that flipped, topped up, or provided liquidity and is broken down by investor type and by revenue quartile. Flippers are investors that flipped at least 50% of allocated shares in the first week after the IPO. Investors are 'topping up' if they increased their holdings by at least 10% of shares initially allocated in the first week after the IPO date. Liquidity providers are investors that are in the 90th percentile of investors by number of trades in the first month after the IPO.

6 Conclusion

As part of the FCA's market study of investment and corporate banking we provide a comprehensive review of allocations in IPOs. The data collected through the market study has allowed us to provide a more complete picture of the drivers of IPO allocations than has been possible to date. We have investigated the IPOs run out of the UK by all banks over the period January 2010 to May 2015. The IPOs in our study represent some three-quarters of total IPO volumes for issuers in Europe, the Middle East, and Africa over this period.

Because we have access, not only to the complete books of demand and allocation in IPOs, but also to details of revenues, notably broking revenues, earned by IPO syndicate banks from the investors allotted in IPOs we were able to investigate directly the link between IPO allocations and revenues for which the evidence has up to now been only indirect. As for the post-IPO period, we have used data gathered by the FCA for monitoring and compliance purposes to analyse the aftermarket trading activity of investors allocated shares in the IPO. In addition to all this quantitative data, we have drawn on responses to a qualitative survey of syndicate banks and investors, which also formed part of the FCA's market study.

We find evidence consistent with syndicate banks making favourable allocations to investors who provide them with information likely to be useful in pricing the IPO. In particular, investors who submit price-sensitive bids, and those who attend meetings with the issuer before the IPO, are favoured in allocations. While both these variables are only indirect evidence of information revelation, our findings lend support to an account in which book-runners are using the 'currency' of underpriced shares in exchange for information which is valuable for the pricing of those shares.

At the same time, book-runners make favourable allocations to investors from whom they generate the greatest revenues elsewhere in their business, notably through brokerage commissions. Thus, investors in the top quartile of the book-runners' clients by revenues receive allocations, relative to the amount they bid, around 60% higher than those received by investors who are not clients of the book-runner. This result is driven primarily by allocations in 'hot' IPOs, ie those which are quickest to be fully subscribed. The close relationship between the IPO allocation rate received by an investor and that investor's revenues with the book-runner is common to most leading IPO book-runners, but not all. The evidence points to book-runners choosing to make preferential IPO allocations to their highest-revenue clients, and is consistent with their using the currency of allocations in return for revenues generated elsewhere.

We cannot tell whether preferential allocations to the book-runners' high-revenue clients are sub-optimal for issuers: even if high revenues in investors are not a proxy for some quality which an issuer might find desirable, it is possible that such investors are not actually detrimental. Even so, since the non-IPO revenues which book-runners earn from allocated investors dwarf the revenues which they make in IPO fees from issuers, there is a risk that book-runners will resolve the conflict in another way which *is* detrimental to issuers, namely by favouring their own high-

revenue clients with allocations and by underpricing IPO shares more than is optimal for the issuer.

Our investigation of the aftermarket activity of investors allocated shares in IPOs points to book-runners making more favourable allocations to both investors who flip shares and to those who add to their holdings in the immediate aftermarket. The inability of book-runners to ration future flippers may reflect the fact that flippers vary their flipping behaviour more from one IPO to another than toppers-up. However, book-runners appear to penalise investors who have been consistent flippers in past IPOs. We find no evidence that book-runners favour liquidity providers in allocations, that is, investors who turn out to become active traders in the IPO shares.

We break down our data set into IPOs in which there was or was not a corporate finance adviser. We find that IPOs with corporate finance advisers have lower fees than others and that, in such IPOs, price-sensitive bids are more favourably allocated. We do not find that the presence of IPO advisers affects the extent to which high-revenue clients of the book-runner are favoured in allocations.

We also split a subset of the investors in our sample by category; in particular, we create separate categories for long-only investors and hedge funds. We find, on average, that hedge funds are allocated a lower fraction of IPOs than long-only investors and that they are rationed more severely. Some investment banks argue that they allocate to hedge funds because they are valuable liquidity providers. This claim is unsupported by our analysis, as we find that hedge funds allocated in IPOs provide negligible liquidity in the aftermarket, and those which do provide liquidity are not favoured in allocations.

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Annex 2: Robustness checks

Matching procedures

For our analysis we need to name-match investors across our different datasets and across IPO allocation books. To do this we use a two stage matching process.

In the first stage we remove all special characters and correct obvious misspellings. The first stage is likely to match investors on an individual entity level and we refer to it as the 'narrow' match. In the second stage we first remove legal terms and geographic references and then manually match investor names. We refer to the second stage matching as the 'wide' match that will capture unique investors at a group level. Table A1 shows how many investors we match across the different datasets.

Table A1: Matches across datasets

Dataset	Narrow match	Wide match
Revenue data	38.89%	57.54%
Trade data	11.65%	29.75%
Meetings data	3.27%	12.66%
Investor type data	44.75%	69.30%

Percentage of investors matched across databases. Narrow and wide matches are based on investor names. Under the narrow match special characters are removed and typos, abbreviations and capital letters changed. Under the wide match legal terms and location information are removed. Additionally wide matches have been individually checked by FCA supervisors. Trade data is only available for 65 IPOs with 27,000 combined investor names. The percentage shown reflects this smaller sample. When there is more than one book per IPO in the sample there can be double counting.

When matching investors across the different datasets, ie between IPO allocation books, investor revenue data, meetings data, investor type data, transaction data, we use first the narrow match and then the wide match for all investors that have not been matched using the narrow match only.

The reason for this procedure is the following. If we used only the narrow match we would most likely miss matches that are economically important. For example, if Fund A of Asset Manager X is recorded in a book but the revenue data only record data of Asset Manager X, the narrow match would not capture this relationship even though it might be economically important. Similarly if we used only the wide match Fund B of Asset Manager X in the allocations book would not be matched to Fund B in the revenues data but to its parent company Asset Manager X. Our two stage matching procedure is therefore a compromise between matching accurately the different investors and capturing the most important economic relationships.

To explore the robustness of our results to the way we match we rerun our analyses using only the narrow match and, separately, using only the wide match (Tables A2 and A3).

Our analysis requires us not only to match investors from different datasets but also to identify investors across the allocation books. In our main analysis we do this with

the wide match. Whenever this wide match identifies multiple investors in one book as identical we do not drop or consolidate them, ie if two investors appear as separate investors in one book but have the same name according to our matching algorithm we keep those investors as separate entities. We think that this procedure is most likely to reflect the way banks see their own investor clients (since they included them as separate investors in the first place). To check the robustness of our analysis to this assumption we consolidate bids from (wide and, separately, narrow) matched investors when replicating the analysis in this section.

Table A2 shows the baseline regressions with a sample constructed using the narrow matching algorithm only, ie allocation books, investor revenues, meetings, and trade data are matched by names without trying to match at a wider group level. When we match investors across the books of different banks for the investor fixed effects and the investor-bank fixed effects specifications we also use the narrow matching algorithm only. If our matching algorithm identifies more than one investor per book as the same investor we aggregate these investors by adding up their demand and final allocation.

The results are similar to those presented in the main text even though we match a much smaller number of investors. Signs of the investor revenue variables remain positive and declining in the revenue quartiles. However, significance levels are slightly lower, and the variables in the regression using investor-bank fixed effects are no longer significant at the 10% level.

In the same way Table A3 shows the same regressions based on the wide matching algorithm only, ie we match investors across books and from books to revenue data using the wide match. If investors are identified as the same entity under this matching algorithm we aggregate their bids and allocations. Results are qualitatively unchanged from our baseline regressions.

Multiple books per IPO

Our baseline analysis allows for more than one book per IPO, the reason being that we do not know exactly how the different lead banks drive the allocation decision. We include IPO fixed effects and cluster standard errors at the IPO level to account for this in our regression setup. As a further robustness test we select only one book per IPO, namely the largest book. Results are very similar to the baseline results presented in the main part of this paper (Table A4).

Regression specifications

In this subsection we show alternative specifications of the regressions and of the variables we use in order to test the robustness of our main results.

Investors who participate in meetings and who are frequently active in the IPO market may also be investors who have high revenues with investment banks (Table A7), which may cause concerns about multicollinearity. Columns one to three of Table A5 show that the coefficients of the revenue variables do not change materially when excluding these variables.

In line with the earlier literature, we measured investors' experience in the IPO market by including a dummy variable that takes value one if the investor is a frequent participant in the IPO market. Some theories of the IPO market (see Ritter

and Welch (2002) and Gondat-Larralde and James (2008)) predict that banks allocate favourably to coalitions of investors in exchange for either information (the information extraction hypothesis) or participation in both hot and cold IPOs (the block-booking hypothesis). Under either hypothesis coalition investors would receive preferential treatment compared to non-coalition investors, although it is worth noting that this is often ruled out according to banks' own allocation policies. While a full analysis of coalition investors is beyond the scope of this paper, we conduct some additional tests to explore whether these theories are consistent with our data.⁶⁴ As a proxy for investor coalitions we define coalition investors as those who participate in at least two thirds of the IPOs of a given bank.⁶⁵ Column four of Table A5 shows that coalition investors do not receive better allocations than non-coalition members; on the contrary they seem to be receiving slightly less allocation. As we have shown in Section 3, revenues drive the allocation decision even when taking into account the bank-investor relationship (which includes being part of a coalition). Therefore, while investor coalitions cannot be the sole driver of allocation, it is possible that some of the allocations that are made to high revenue investors are made because investors are part of a bank's coalition.

We defined ex-ante 'hot' and 'cold' IPOs according to whether full subscription at the lower end of the initial price range was achieved more quickly or more slowly than the median (in terms of days). In columns five to eight of Table A5 we explore alternative definitions of 'hot' and 'cold' IPOs: by segmenting the sample by the (ultimate) level of oversubscription, and by the level of ex-post IPO performance. Oversubscription is the level of subscription at the offer price and IPO performance is the return compared to the offer price after one week of trading. We split the sample at the median. Results are qualitatively similar to those using our 'time to full subscription'.

In Table A6 we test the robustness of our results to different specifications of the investor revenue variables. Columns one and two show results with dummy variables which take the value one if the investor is in the first to fourth quartile of revenues of all investors of a bank. That is, we sort investor revenues by bank and not by IPO since banks may only favour investors who are important to them in general, not just relative to the other investors in a given IPO. The results are very similar to those in our main analysis. In columns three and four we use continuous revenue variables, rather than our quartile rankings. In column three we use the share of revenues an investor had with an investment bank in the year of the IPO. In column four we use instead the total share of revenues of an investor with a bank over the full sample period. Both variables are significant and positive confirming our results in the main text. Throughout Table A6 we cluster standard errors at the investor level compared to clustering them at the IPO level as in the main analysis.⁶⁶

⁶⁴ Table 6 and Table 7 show that at least for a subset of IPOs and banks information revelation may play a role when allocating shares, consistent with the information extraction hypothesis but less so with the block-booking hypothesis. Under either hypothesis coalition investors are expected to earn higher profits from placing bids than non-coalition investors. Table 9 in Section 3 shows that this is not the case; coalition investors do not make more profitable bids than non-coalition investors.

⁶⁵ We also require investors to have participated in at least three IPOs with that bank.

⁶⁶ We did run robustness checks on all regressions in this paper clustering standard errors at the investor level and the results remained mostly unchanged.

Table A2: Regression results using the 'narrow' matching algorithm only.

VARIABLES	Normalised rationing						
	(1)	Hot (2)	Cold (3)	(4)	(5)	(6)	(7)
Largest	0.325*** (10.74)	0.378*** (4.775)	0.289*** (11.09)	-0.152*** (-3.069)	-0.216*** (-3.414)	0.268*** (5.000)	-0.178*** (-3.324)
Large	0.170*** (6.116)	0.168** (2.177)	0.164*** (7.322)	-0.0606** (-1.988)	-0.0926** (-2.286)	0.0970* (1.960)	-0.110** (-2.316)
Price sensitive bid	0.105*** (4.675)	0.136** (2.679)	0.0771** (2.394)	0.0625*** (2.869)	0.0576* (1.854)	0.0949* (1.877)	-0.000837 (-0.0174)
Money bid	-0.0408** (-1.980)	-0.0257 (-0.661)	-0.0421 (-1.533)	-0.00139 (-0.0666)	-0.0126 (-0.409)	-0.0780* (-1.785)	-0.0560 (-1.366)
Early	-0.0477*** (-2.898)	-0.0710 (-1.658)	-0.0165 (-1.249)	0.0912*** (5.591)	0.0939*** (4.686)	-0.0804** (-2.381)	0.0566 (1.600)
Revised bid	0.0562*** (3.308)		0.0434*** (2.873)	0.0170 (1.015)	0.0217 (1.024)	0.0767* (1.845)	0.0526 (1.626)
Meeting	0.212*** (6.174)	0.212** (2.186)	0.182*** (4.151)	0.109*** (3.785)	0.140*** (3.526)	0.294*** (3.556)	0.127* (1.936)
Pilot fishing	0.343*** (3.711)	0.428** (2.629)	0.284*** (4.463)	0.129 (1.635)	0.139 (1.476)	0.291** (2.329)	-0.0534 (-0.470)
Frequent bidder	-0.208*** (-11.39)	-0.295*** (-7.291)	-0.187*** (-7.988)			-0.252*** (-7.695)	
One-time bidder	0.0831*** (2.710)	0.182** (2.388)	0.0202 (0.810)			0.126 (1.434)	
1 st revenue quartile	0.508*** (12.87)	0.712*** (7.446)	0.365*** (10.69)	0.110*** (5.100)	0.0997 (1.282)	0.592*** (7.282)	0.108* (1.812)
2 nd revenue quartile	0.237***	0.286***	0.227***	0.0417**	0.0154	0.327***	0.0378

	(8.556)	(3.652)	(6.984)	(2.284)	(0.199)	(5.180)	(1.057)
3 rd revenue quartile	0.0581***	0.0450	0.0605**	0.0338*	0.0493	0.0922	0.0250
	(2.619)	(0.846)	(2.388)	(1.878)	(0.706)	(1.429)	(1.036)
4 th revenue quartile	-0.0909***	-0.187***	-0.0156	0.0325*	0.0532	-0.0901***	0.0698***
	(-4.853)	(-4.411)	(-0.754)	(1.855)	(0.786)	(-2.745)	(3.098)
Flipped						0.0314	0.0428
						(0.527)	(0.774)
Topped up						0.171***	-0.0407
						(3.327)	(-0.440)
Liquidity provision						0.142***	0.164
						(2.701)	(1.543)
Constant	0.516***	0.522***	0.609***	1.076***	0.967***	0.521***	0.637***
	(23.68)	(14.01)	(20.48)	(21.62)	(16.23)	(9.227)	(5.758)
Observations	51,296	15,650	19,202	51,296	51,296	11,991	11,991
R-squared	0.081	0.059	0.155	0.652	0.758	0.104	0.772
Bank fixed effects	yes	yes	yes	yes	no	yes	yes
IPO fixed effects	yes	yes	yes	yes	yes	yes	yes
investor fixed effects	no	no	no	yes	no	no	yes
Investor-bank fixed effects	no	no	no	no	yes	no	no

The dependent variable is normalised rationing, ie the ratio of percent allotted to percent bid. All datasets have been merged using the 'narrow' matching algorithm only. Largest (large) bids are in the top (second) quartile of the bid size distribution. Price sensitive bids are limit bids or step bids. Money bids are bids expressed in currency which are not price sensitive bids. We construct the revenue quartiles by ranking, for each book-runner and for each IPO, all investors by the revenues they have had with the book-runner in the year of the IPO. The revenue dummies need to be interpreted relative to the investors who did not have any revenues with that book-runner. Meeting is a dummy that takes value one if the investor participated in a meeting with the issuer. Pilot fishing are meetings that took place before the announcement date or which were labelled as pilot fishing meetings by the investment banks. Frequent is a dummy with value one for investors that participated in at least 50 IPOs. One-time bidder are bidders that participated in only one IPO. Hot (cold) IPOs are below (above) the median of IPOs in the distribution of days till full subscription at the bottom of the range. Investor fixed effects are defined using the 'narrow' matching algorithm. T-stats are given in parentheses based on robust standard errors clustered at the IPO level.

Table A3: Regression results using the `wide' matching algorithm only.

VARIABLES	Normalised rationing						
	(1)	Hot (2)	Cold (3)	(4)	(5)	(6)	(7)
Largest	0.226*** (7.482)	0.194** (2.437)	0.257*** (9.129)	-0.131*** (-2.686)	-0.167*** (-2.677)	0.193*** (3.826)	-0.150** (-2.659)
Large	0.122*** (4.378)	0.0762 (0.988)	0.155*** (6.587)	-0.0514 (-1.644)	-0.0705* (-1.759)	0.0537 (1.110)	-0.0961* (-1.840)
Price sensitive bid	0.108*** (5.018)	0.136** (2.700)	0.0810*** (2.642)	0.0742*** (3.631)	0.0758*** (2.840)	0.123*** (3.026)	0.0804* (1.969)
Money bid	-0.0132 (-0.646)	0.0158 (0.360)	-0.0262 (-0.958)	0.00327 (0.153)	0.00304 (0.107)	-0.0202 (-0.544)	-0.00641 (-0.184)
Early	-0.0463*** (-2.936)	-0.0891** (-2.561)	-0.0128 (-0.869)	0.0791*** (4.790)	0.0820*** (4.046)	-0.0713** (-2.093)	0.0764** (2.279)
Revised bid	0.0366** (2.590)		0.0365** (2.607)	0.0254* (1.894)	0.0237 (1.423)	0.0343 (1.040)	0.0384 (1.116)
Meeting	0.235*** (10.70)	0.298*** (5.849)	0.155*** (5.665)	0.115*** (6.311)	0.160*** (5.626)	0.240*** (5.309)	0.0359 (0.964)
Pilot fishing	0.255*** (3.528)	0.425*** (2.860)	0.168*** (3.097)	0.101** (2.108)	0.0885* (1.801)	0.182** (2.511)	-0.0294 (-0.509)
Frequent bidder	0.0931*** (5.333)	0.169*** (3.211)	0.0509*** (3.382)			0.0202 (0.781)	
One-time bidder	0.170*** (3.523)	0.287** (2.489)	0.0641** (2.142)			0.162** (2.143)	
1 st revenue quartile	0.372*** (11.57)	0.534*** (8.316)	0.218*** (8.920)	0.0515** (2.596)	0.0943* (1.827)	0.377*** (6.308)	0.0525 (1.544)
2 nd revenue quartile	0.208*** (7.817)	0.306*** (5.268)	0.119*** (4.841)	0.0312* (1.874)	0.0646 (1.269)	0.226*** (4.690)	0.0150 (0.520)

3 rd revenue quartile	0.0619***	0.0648	0.0328	0.0168	0.00518	0.0324	0.0229
	(3.129)	(1.625)	(1.556)	(1.207)	(0.130)	(0.581)	(0.914)
4 th revenue quartile	-0.0257	-0.0331	-0.0372*	0.0211	0.0252	-0.0715*	0.0231
	(-1.314)	(-0.716)	(-1.811)	(1.502)	(0.681)	(-1.880)	(1.095)
Flipped						0.195***	0.121***
						(3.844)	(2.965)
Topped up						0.395***	0.00442
						(8.127)	(0.0944)
Liquidity provision						-0.0212	-0.130
						(-0.401)	(-1.543)
Constant	0.520***	0.493***	0.603***	1.031***	0.923***	0.530***	0.356***
	(21.24)	(10.42)	(20.80)	(23.39)	(16.94)	(10.77)	(4.671)
Observations	49,216	14,918	18,496	49,216	49,216	11,799	11,799
R-squared	0.092	0.070	0.158	0.561	0.690	0.120	0.640
Bank fixed effects	yes	yes	yes	yes	no	yes	yes
IPO fixed effects	yes	yes	yes	yes	yes	yes	yes
investor fixed effects	no	no	no	yes	no	no	yes
Investor-bank fixed effects	no	no	no	no	yes	no	no

The dependent variable is normalised rationing, ie the ratio of percent allotted to percent bid. All datasets have been merged using the 'wide' matching algorithm only. Largest (large) bids are in the top (second) quartile of the bid size distribution. Price sensitive bids are limit bids or step bids. Money bids are bids expressed in currency which are not price sensitive bids. We construct the revenue quartiles by ranking, for each book-runner and for each IPO, all investors by the revenues they have had with the book-runner in the year of the IPO. The revenue dummies need to be interpreted relative to the investors who did not have any revenues with that book-runner. Meeting is a dummy that takes value one if the investor participated in a meeting with the issuer. Pilot fishing are meetings that took place before the announcement date or which were labelled as pilot fishing meetings by the investment banks. Frequent is a dummy with value one for investors that participated in at least 50 IPOs. One time bidder are bidders that participated in only one IPO. Hot (cold) IPOs are below (above) the median of IPOs in the distribution of days till full subscription at the bottom of the range. Investor fixed effects are defined using the 'wide' matching algorithm. T-stats are given in parentheses based on robust standard errors clustered at the IPO level.

Table A4: Regression results using only one book per IPO.

VARIABLES	Normalised rationing						
	(1)	Hot (2)	Cold (3)	(4)	(5)	(6)	(7)
Largest	0.209*** (5.590)	0.0901 (1.122)	0.278*** (10.60)	-0.107** (-2.033)	-0.139** (-2.127)	0.199*** (3.233)	-0.0975 (-1.302)
Large	0.111*** (4.324)	0.0409 (0.823)	0.157*** (7.593)	-0.0375 (-1.152)	-0.0464 (-1.181)	0.0585 (1.004)	-0.0765 (-1.137)
Price sensitive bid	0.114*** (3.564)	0.131* (2.016)	0.0989*** (2.922)	0.0836*** (2.615)	0.0992** (2.264)	0.0845 (1.504)	-0.00352 (-0.0335)
Money bid	-0.0228 (-0.700)	-0.0266 (-0.443)	-0.0237 (-0.815)	-0.00980 (-0.338)	-0.00162 (-0.0425)	-0.0483 (-1.040)	-0.0893 (-0.990)
Early	-0.00304 (-0.0989)	0.00945 (0.141)	-0.0158 (-1.100)	0.0789*** (4.054)	0.0740*** (3.007)	-0.0649* (-1.689)	0.0540 (1.356)
Revised bid	0.0119 (0.562)		0.0418** (2.510)	0.0109 (0.505)	0.00674 (0.294)	-0.00533 (-0.146)	0.0251 (0.609)
Meeting	0.183*** (7.000)	0.235*** (5.418)	0.138*** (4.501)	0.0989*** (3.600)	0.148*** (3.836)	0.199*** (3.138)	0.0332 (0.579)
Pilot fishing	0.240*** (2.921)	0.346** (2.158)	0.116*** (3.008)	0.0876 (1.274)	0.0681 (0.975)	0.183** (2.412)	-0.0307 (-0.378)
Frequent bidder	-0.0119 (-0.390)	-0.00815 (-0.110)	-0.00848 (-0.543)			-0.0396 (-1.497)	
One-time bidder	0.162*** (3.777)	0.286*** (3.463)	0.0868** (2.326)			0.201** (2.506)	
1 st revenue quartile	0.563*** (7.987)	0.842*** (6.023)	0.348*** (9.978)	0.142*** (4.090)	0.111** (2.016)	0.616*** (7.319)	0.224*** (2.910)
2 nd revenue quartile	0.278*** (7.462)	0.399*** (5.874)	0.190*** (5.796)	0.0538* (1.834)	0.0455 (0.964)	0.303*** (4.407)	0.0472 (0.590)

3 rd revenue quartile	0.0954***	0.153***	0.0509*	0.0122	-0.00134	0.153**	0.0424
	(3.387)	(2.983)	(1.930)	(0.441)	(-0.0261)	(2.093)	(0.603)
4 th revenue quartile	-0.0538**	-0.0597	-0.0475**	0.00734	-0.00351	-0.0265	0.0342
	(-2.501)	(-1.478)	(-2.289)	(0.335)	(-0.0948)	(-0.627)	(0.592)
Flipped						0.103**	0.160***
						(2.058)	(3.148)
Topped up						0.256***	0.0833
						(3.922)	(1.237)
Liquidity provision						-0.0134	0.0793
						(-0.164)	(0.713)
Constant	0.428***	0.386***	0.459***	0.976***	0.650***	0.436***	0.530***
	(16.27)	(8.381)	(18.98)	(21.15)	(11.52)	(9.401)	(6.152)
Observations	30,059	12,661	17,398	30,059	30,059	6,845	6,845
R-squared	0.097	0.087	0.148	0.539	0.688	0.117	0.596
Bank fixed effects	yes	yes	yes	yes	no	yes	yes
IPO fixed effects	yes	yes	yes	yes	yes	yes	yes
investor fixed effects	no	no	no	yes	no	no	yes
Investor-bank fixed effects	no	no	no	no	yes	no	no

The dependent variable is normalised rationing, ie the ratio of percent allotted to percent bid. We drop duplicate books whenever there are multiple active book-runners by keeping only the largest book by number of bids. Largest (large) bids are in the top (second) quartile of the bid size distribution. Price sensitive bids are limit bids or step bids. Money bids are bids expressed in currency which are not price sensitive bids. We construct the revenue quartiles by ranking, for each book-runner and for each IPO, all investors by the revenues they have had with the book-runner in the year of the IPO. The revenue dummies need to be interpreted relative to the investors who did not have any revenues with that book-runner. Meeting is a dummy that takes value one if the investor participated in a meeting with the issuer. Pilot fishing are meetings that took place before the announcement date or which were labelled as pilot fishing meetings by the investment banks. Frequent is a dummy with value one for investors that participated in at least 50 IPOs. One time bidder are bidders that participated in only one IPO. Hot (cold) IPOs are below (above) the median of IPOs in the distribution of days till full subscription at the bottom of the range. Investor fixed effects are defined using the 'wide' matching algorithm. T-stats are given in parentheses based on robust standard errors clustered at the IPO level.

Table A5: Robustness checks

VARIABLES	Normalised rationing							
	(1)	(2)	(3)	Coalition (4)	Above median oversubscript ion (5)	Below median oversubscript ion (6)	Above median IPO return (7)	Below median IPO return (8)
Largest	0.254*** (8.982)	0.241*** (8.104)	-0.129** (-2.511)	0.209*** (6.542)	0.162*** (3.462)	0.240*** (9.485)	0.189*** (4.087)	0.195*** (5.800)
Large	0.142*** (5.016)	0.134*** (4.817)	-0.0500 (-1.439)	0.125*** (4.520)	0.113*** (2.954)	0.121*** (5.529)	0.116*** (2.968)	0.117*** (4.722)
Price sensitive bid	0.0940*** (3.479)	0.0813*** (2.765)	0.0556* (1.913)	0.0707** (2.462)	0.0903** (2.304)	0.0456** (2.461)	0.0742* (1.829)	0.0686*** (3.115)
Money bid	-0.0362 (-1.033)	-0.0496 (-1.331)	-0.0227 (-0.687)	-0.0530 (-1.450)	-0.0545 (-1.150)	-0.0217 (-1.002)	-0.0540 (-1.045)	-0.0318 (-1.457)
Early	-0.0260 (-0.759)	-0.0280 (-0.804)	0.0710*** (3.565)	-0.0236 (-0.691)	-0.0208 (-0.409)	-0.0460*** (-3.115)	-0.0261 (-0.509)	-0.0252* (-1.705)
Revised bid	0.0123 (0.484)	0.0223 (0.834)	0.0143 (0.518)	0.0245 (0.937)	-0.00662 (-0.170)	0.0399*** (3.625)	-0.00481 (-0.123)	0.0499*** (3.699)
Meeting				0.252*** (12.02)	0.280*** (10.25)	0.125*** (6.364)	0.233*** (8.230)	0.242*** (9.129)
Pilot fishing				0.257*** (4.651)	0.322*** (4.745)	0.0568* (1.795)	0.278*** (3.803)	0.180** (2.127)
Coalition				-0.122***				

				(-5.941)				
One time bidder				0.154***	0.218***	0.0460	0.196***	0.103
				(3.084)	(2.908)	(1.609)	(2.907)	(1.392)
Frequent bidder					0.115***	0.000673	0.0869***	0.0605
					(3.450)	(0.0428)	(2.836)	(1.643)
1 st revenue quartile	0.531***	0.590***	0.136***	0.586***	0.634***	0.202***	0.582***	0.365***
	(9.305)	(9.678)	(5.206)	(9.839)	(9.074)	(6.791)	(8.141)	(5.587)
2 nd revenue quartile	0.266***	0.323***	0.0758***	0.308***	0.335***	0.123***	0.315***	0.177***
	(6.908)	(7.529)	(3.234)	(7.335)	(6.834)	(5.915)	(6.232)	(5.589)
3 rd revenue quartile	0.0699**	0.128***	0.0318*	0.116***	0.117***	0.0424**	0.0927**	0.0963***
	(2.519)	(4.325)	(1.879)	(3.859)	(3.314)	(2.442)	(2.572)	(3.790)
4 th revenue quartile	-0.0545**	0.00253	0.0418**	-0.00896	-0.0182	-0.0103	-0.0233	-0.00499
	(-2.273)	(0.103)	(2.220)	(-0.351)	(-0.587)	(-0.578)	(-0.750)	(-0.202)
Constant	0.521***	0.584***	1.080***	0.587***	0.331***	0.641***	0.400***	0.554***
	(15.86)	(17.27)	(21.98)	(16.72)	(6.030)	(30.84)	(6.489)	(17.50)
Observations	52,199	52,199	52,199	52,199	36,272	15,927	35,073	17,126
R-squared	0.051	0.076	0.497	0.086	0.084	0.216	0.080	0.118
Bank fixed effects	no	yes	yes	yes	yes	yes	yes	yes
IPO fixed effects	no	yes	yes	yes	yes	yes	yes	yes
investor fixed effects	no	no	yes	no	no	no	no	no

The dependent variable is normalised rationing, ie the ratio of percent allotted to percent bid. Largest (large) bids are in the top (second) quartile of the bid size distribution. Price sensitive bids are limit bids or step bids. Money bids are bids expressed in currency which are not price sensitive bids. We construct the revenue quartiles by ranking, for each book-runner and for each IPO, all investors by the revenues they have had with the book-runner in the year of the IPO. The revenue dummies need to be interpreted relative to the investors who did not have any revenues with that book-runner. Meeting is a dummy that takes value one if the investor participated in a meeting with the issuer. Pilot fishing are meetings that took place before the announcement date or which were labelled as pilot fishing meetings by the investment banks. Frequent bidder is a dummy with value one for investors that participated in at least 50 IPOs. One-time bidder are bidders that participated in only one IPO. Hot (cold) IPOs are below (above) the median of IPOs in the distribution of days till full subscription at the bottom of the range. Coalition investors are investors that participate in at least 66% of a book-runner's IPOs. Investor fixed effects are defined using the 'wide' matching algorithm. T-stats are given in parentheses based on robust standard errors clustered at the IPO level.

Table A6: Alternative specification of investor revenue variables

VARIABLES	Normalised rationing			
	(1)	(2)	(3)	(4)
Largest	0.193*** (7.052)	-0.137*** (-4.682)	-0.137*** (-4.655)	0.235*** (8.565)
Large	0.116*** (6.085)	-0.0531** (-2.319)	-0.0527** (-2.311)	0.127*** (6.962)
Price sensitive bid	0.0678* (1.957)	0.0524* (1.671)	0.0534* (1.698)	0.0596* (1.838)
Money bid	-0.0507 (-1.258)	-0.0233 (-0.661)	-0.0224 (-0.634)	-0.0704* (-1.949)
Early	-0.0255 (-0.783)	0.0686*** (3.519)	0.0690*** (3.528)	-0.0302 (-1.022)
Revised bid	0.0147 (0.697)	0.0119 (0.534)	0.0127 (0.571)	0.0295 (1.503)
Meeting	0.235*** (8.832)	0.104*** (5.342)	0.108*** (5.530)	0.281*** (11.45)
Pilot fishing	0.246*** (4.259)	0.0930** (2.431)	0.0940** (2.450)	0.282*** (6.181)
Frequent bidder	0.0817* (1.701)			0.146*** (3.044)
One-time bidder	0.166*** (4.727)			0.162*** (4.922)
1 st revenue quartile	0.475*** (8.640)	0.100*** (3.567)		
2 nd revenue quartile	0.301*** (7.241)	0.0877*** (3.145)		
3 rd revenue quartile	0.115*** (4.144)	0.0406** (2.343)		
4 th revenue quartile	-0.0319 (-1.316)	0.0272* (1.738)		
Revenue share IPO year			0.0349*** (2.636)	
Total revenue share				53.95*** (5.375)
Constant	(13.39)	(18.07)	(17.97)	(13.39)
			0.0349***	
Observations	52,199	52,199	52,199	60,210
R-squared	0.084	0.498	0.498	0.082
Bank fixed effects	yes	yes	yes	Yes
IPO fixed effects	yes	yes	yes	Yes
Investor fixed effects	no	yes	No	yes

The dependent variable is normalised rationing. Largest (large) bids are in the top (second) quartile of the bid size distribution. Price sensitive bids are limit bids or step bids. Money bids are bids expressed in currency which are not price sensitive bids. We construct the revenue quartiles by ranking, for each book-runner, all investors by the revenues they have had with the book-runner in the year of the IPO. The revenue dummies need to be interpreted

relative to the investors who did not have any revenues with that book-runner. Revenue share in the year of the IPO are investor revenues divided by total revenues from all investors in the year of the IPO. Meeting is a dummy that takes value one if the investor participated in a meeting with the issuer. Pilot fishing are meetings that took place before the announcement date or which were labelled as pilot fishing meetings by the investment banks. Frequent bidder is a dummy with value one for investors that participated in at least 50 IPOs. One-time bidder are bidders that participated in only one IPO. Hot (cold) IPOs are below (above) the median of IPOs in the distribution of days till full subscription at the bottom of the range. Investor fixed effects are defined using the 'wide' matching algorithm. T-stats are given in parentheses based on robust standard errors clustered at the IPO level.

Annex 3: Additional descriptive statistics

In this annex we present some additional descriptive statistics about the different datasets that we use.

Investor characteristics

Table A7 shows investor characteristics by revenue quartile.

Table A7: Bidder behaviour by revenue quartile

		No revenues	Q1 – lowest revenue	Q2	Q3	Q4 – highest revenue
Price sensitive bids (%)	Mean	40.34	44.89	47.62	52.86	57.40
	Median	42.73	46.19	53.13	57.14	61.54
Meetings (%)	Mean	8.66	18.97	22.70	25.85	28.32
	Median	2.70	8.40	16.67	20	25
Pilot fishing (%)	Mean	1.95	3.22	4.6	5.38	7.18
	Median	0	0	0	0	0
Frequent investors (%)	Mean	13.69	25.59	38.87	56.96	77.47
	Median	11.11	21.98	36	57.90	79.06

The table shows, for each revenue quartile, the mean (median) percentage of investors that submitted price sensitive bids, attended a meeting, attended the pilot fishing meetings and were classified as frequent investors.

IPO aftermarket

Table A8 provides summary statistics of the aftermarket liquidity on the day of the IPO and after one week, one month and one year. All statistics are calculated over the full sample of IPOs on the last day of the respective period. Turnover decreases rapidly after the first few days of trading while the bid-ask spread increases slightly over time for the average IPO.

Figure A1 shows, for each investor, the percentage of IPOs in which the investors flipped their shares, ie sold at least 50% of shares in the week after the IPO. The chart only covers those investors that flipped their shares at least once.

Table A8: Liquidity in the IPO aftermarket

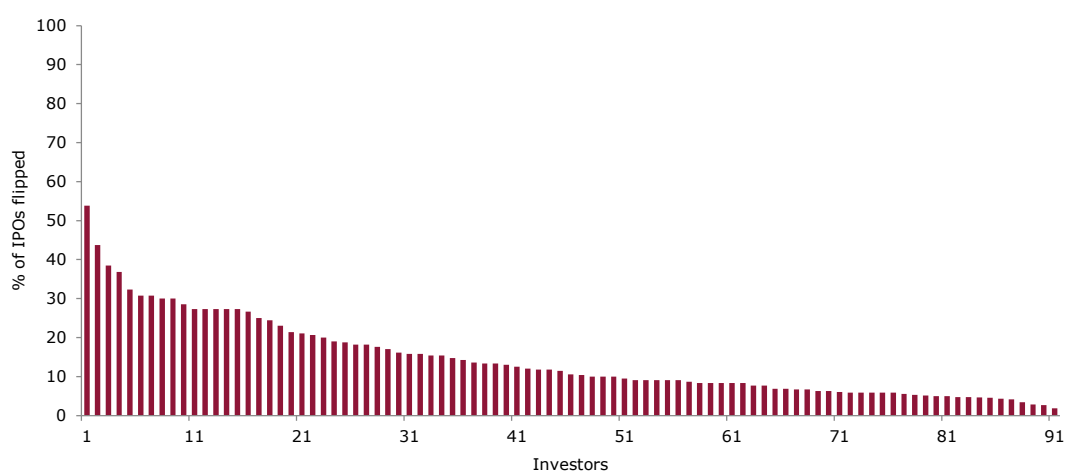
	Daily turnover in percentage of shares outstanding				End of day percentage bid-ask spread			
Time after IPO	Min	Max	Mean	Median	Min	Max	Mean	Median

One day	0	208.61	11.43	6.86	0	5.94	0.73	0.50
One week	0	46.24	0.69	0.23	0	9.09	0.84	0.45
One month	0	4.59	0.22	0.09	0	5.74	0.89	0.61
One year	0	33.34	0.46	0.09	0.03	6.32	0.79	0.46

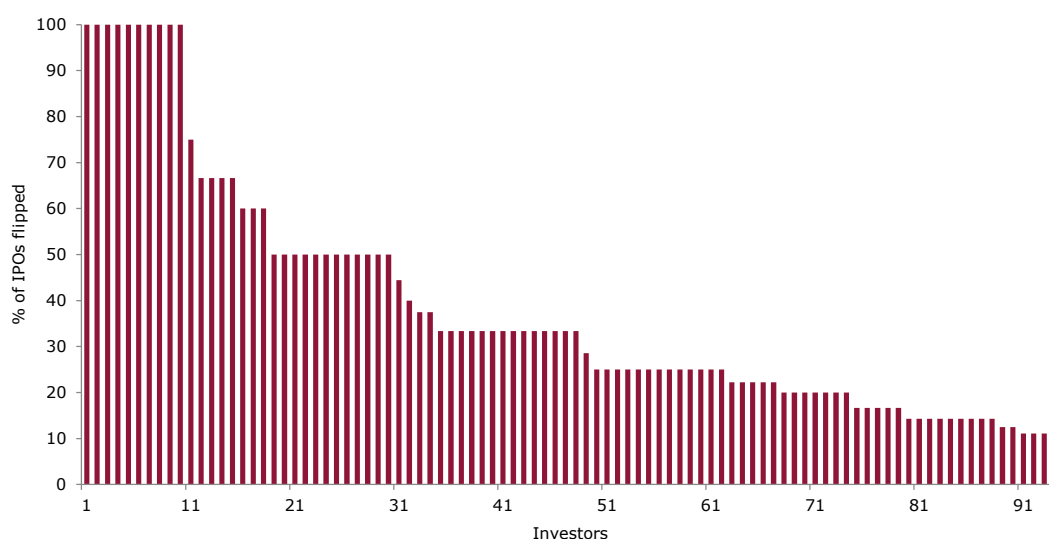
Turnover is the number of shares traded divided by the total number of shares outstanding times 100. The bid-ask spread is the end of day ask price minus the end of day bid price divided by the end of day ask price times 100. Each statistic is calculated on the last day of the respective period and over the full sample of IPOs with price information. Datasource: Thomson Reuters Datastream.

Figure A1: Percentage of IPOs flipped

Panel A: Investors who participated in at least 10 IPOs



Panel B: Investors who participated in less than 10 IPOs



The y-axis shows the percentage of IPOs in which an investor flipped. Each bar represents one investor.

