

Quid Pro Quo? What Factors Influence IPO Allocations to Investors?

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ABSTRACT

Using detailed information from a large sample of investment banks we test the determinants of IPO allocations. This research draws on data gathered by the UK Financial Conduct Authority, and covers 220 IPOs managed from the UK raising around \$160bn. Detailed information on book-building is combined with data on revenues generated (from trading and other activities) by investment banks' buy-side clients, and data on post-IPO trading. We find evidence that informative bids are rewarded. However, we also find strong evidence that most, but not all, of the major investment banks favor the buy-side clients that produce the most revenue.

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1. 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 IPO market operates for issuing companies. The IPO boom in the U.S. during the dot-com period – in particular 1999-2000 – witnessed several scandals, including laddering, spinning¹, analysts' conflicts 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 U.S., 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 U.K., the Financial Conduct Authority (FCA) began a review of wholesale financial markets in 2014.³ 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. The research in this paper was conducted alongside this market study, and benefits from the sort of data that has not previously been available to researchers. All banks with operations in the

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. The interim report of the market study was published in April 2016 (FCA, 2016).

U.K., which includes all the leading investment banks, are subject to regulation by the FCA. The FCA used its powers to gather detailed information on bids, allocations, fees, the economic relationship between investment banks and their buy-side clients, trading in the after-market and various other data for all IPOs conducted from the U.K. between January 2010 and May 2015.⁴ 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. This results in a sample comprising 220 IPOs raising \$160 billion, representing around three-quarters of the EMEA market, by value, over this period.⁵

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.⁶ That money is picked up by those who are allocated shares at the IPO that immediately trade higher than the offer price. But the causes and effects of this underpricing remain the subject of debate.

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 favor long-term holders of the shares over those who are likely to immediately sell (often referred to as ‘flippers’) in the after-market. This favoritism may well be

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

⁵ IPOs on the U.K. exchange constitute around one-quarter of our sample, by value.

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/>.

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 favored. 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 favored. 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 U.S.-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 behavior 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,

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.

for example, expects banks to manage potential conflicts by implementing appropriate internal allocation policies and by operating effective systems and controls. 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 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 behavior consistent with *quid pro quo* arrangements. Goldstein, Irvine and Puckett (2011) find evidence that investors increase round-trip stock trades 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.⁸ 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

⁸ 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.

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, a significant number of investment banks were required to provide information, including the leading global investment banks. For the more active book-runners we are able to estimate our models by bank, and therefore compare and contrast the factors that influence allocation. For each deal we have information on bids, investor participation in meetings, pricing, allocation, as well as syndicate structure, fees etc. No previous study has benefited from such data.

Second, banks were asked to provide information on the revenues they made each year from their investor clients. This enables us to conduct the first 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 detailed book-building data with investor revenues to investigate whether the allocations are skewed towards certain types of investors.

Third, as part of its 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. 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 (sometimes called 'independent IPO advisors') can 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 U.S. 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 U.K., we combine our allocation data with detailed trading data – which the FCA gathers for monitoring and compliance purposes – to analyze the extent to which investors sell their shares quickly once trading starts, and whether allocations are related to post-IPO trading. 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 U.S. 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 U.S. finding, to see how successful investment banks are at avoiding allocating shares to flippers.

Our main results are as follows. First, we find evidence that the way investors bid influences allocations. We analyze 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.⁹ 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 book-building has any significant impact on allocations. We also we find, in line with previous research, that large bids consistently get higher proportionate allocations.

⁹ Following the existing literature, we focus on allocations relative to bids, or ‘normalized rationing’ – the ratio of the proportionate allocation relative to the proportionate quantity bid for (at the issue price); see Cornelli and Goldreich (2001).

Second, we analyze 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 (for revenue generation) receive allocations, relative to the amount they bid, that are around 60% higher than those received by investors who are not revenue-generating clients of the book-runner. We find that this effect is largely driven by preferential allocations in hot IPOs.¹⁰ 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. Therefore, 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

¹⁰ We designate IPOs as hot when the time taken for the book to be covered (i.e. demand equals supply at the bottom on the price range) is quicker than the median.

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 penalized 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 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 favor liquidity providers when they make 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 that provide some liquidity are given favorable IPO allocations.

The remainder of the paper is organized 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 third section we analyze 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 four we analyze investors' trading activity in the IPO aftermarket and whether IPO shares are allocated depending on how investors behave in the aftermarket. Section five concludes.

2. 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 U.S. 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. 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.

A. 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). As a generalization, 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 (i.e. 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.¹¹

All banks operating in the U.K. were required to provide information on IPOs managed from their U.K. offices between January 2010 and May 2015, regardless of the location of issuer, listing authority, or target investors. In total, 32 banks provided 801 books (of orders and allocations) on 410 IPOs over the sample period. 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 on the same IPO.

¹¹ Industry participants make a distinction between book-runners who are ‘active book-runners’ (who in many IPOs are also given the title ‘global coordinators’) 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.

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 the publicly available Dealogic database) were sold in the IPO, on the grounds that these books were incomplete.¹² The final sample comprises 372 books from 19 banks on 220 IPOs.

Table 1 provides information on 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 U.K., 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.¹³

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 U.K. has the highest number of IPOs, but under one-quarter of the IPOs are for U.K. firms – which reflects the fact that many non-U.K. companies choose to list in London. 20 companies in our sample listed on multiple exchanges.

¹² We also dropped one unusual IPO for which only three distinct investors were recorded.

¹³ The proportion by value varies by year from a low of 65% in 2012 to 83% in 2015. Given that we focus on book-built 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.

B. Fees, Syndicate Structure and the Role of Corporate Finance Advisors

The explicit remuneration received by banks for participating in IPOs is the fee paid by the issuer,¹⁴ 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 U.S. 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.

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 before the launch of the IPO 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 guides 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, they 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.

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

¹⁴ We use the term ‘issuer’ indifferently both for firms issuing new shares and for pre-IPO owners selling existing shares.

have the most complete information (i.e. are ‘active book-runners’); 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.

We obtain 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. 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. IPOs with corporate finance advisers have on average slightly lower average fees, although given their larger average deal size this is to be expected. 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 IPOs without a corporate finance adviser.

C. Investors and Bidding Behavior

Investor demand in our sample of book-built 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. A strength of our dataset is that it is derived from a large number of banks; however this also creates challenges when analyzing 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’, ‘U.K.’, 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.¹⁵

Across the 220 IPOs in our sample we identify about 20,000 distinct investors,¹⁶ who submitted around 41,000 bids. In Table 3 we present summary information on these bids. Bidding behavior 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 that 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, can be considered 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, 46.6% 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.¹⁷ The incidence of price-sensitive bids varies sharply according to the

¹⁵ In the Internet Appendix we provide more information on the matching procedure and check our main results for robustness with respect to the way we match investors.

¹⁶ About 9,000 when aggregating investors using the ‘wide’ match and about 16,000 using the ‘narrow’ match

¹⁷ 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 (i.e. the ratio of demand to supply). However, this is an ex-post

hotness of the IPO, with an average of 30.0% of bids being price-sensitive in hotter IPOs versus 55.6% in colder IPOs.¹⁸

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 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 leading corporate finance adviser.¹⁹ 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, we have information on the meetings held between the issuing firm and potential investors before and during the IPO. 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)

measure that is not known for certain until after the end of the book-building (order-taking) period. We present results using this latter measure in the Internet Appendix.

¹⁸ 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.

¹⁹ 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.

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.

D. Investor Broking Business with Book-Runners

A number of studies have argued that book-runners make preferential allocations to investors with whom they do broking business (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 favored 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. The responses indicate a sharp difference of opinions between these two groups of respondents.²⁰ On the whole, banks considered that their business 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 guidance 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 link between their business relationship with the book-runner and IPO allocations. The difference between the

²⁰ See Figure IA.1 in the Internet Appendix.

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.

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.²¹ 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. Information 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 revenues generated (outside IPOs) by investors.

E. 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 on average 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 3 we explore the ‘normalized rationing’ (i.e. 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 1 illustrates, all but nine IPOs in our sample were priced within the indicative

²¹ The data request was not limited to revenues from brokerage business but included all services provided to an investor.

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 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.²² 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. It is noteworthy that the initial returns on IPOs in EMEA during the sample period were low by historical standards,²³ and lower than first-day returns for U.S. IPOs during the same period (which averaged 12.6% for 2010-2014).²⁴ 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.

F. Trade Data

We used the FCA’s transaction reporting dataset ZEN 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. The data includes all trades, on-exchange or off-exchange, which involve at least one counter-party based in the European Economic Area. Table 8 summarizes 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 8 shows, around

²² In a sample of European IPOs analyzed 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.

²³ According to Chambers and Dimson (2009) average underpricing of IPOs on the LSE for 2000-2007 was 19.86%, median underpricing was 8.5%.

²⁴ Average underpricing in the US was 12.6% in 2010-2014 (Jay Ritter, <https://site.warrington.ufl.edu/ritter/ipo-data/>, February 2016).

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.

3. 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. Underpricing of IPO shares makes them desirable for the buy-side investor clients from whom investment banks earn significant revenues. 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 favorable allocation we calculate the normalized rationing of investors. This allows our results to be compared to earlier analyses by Cornelli and Goldreich (2001) and Jenkinson and Jones (2004). Normalized 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 normalized rationing variable for an investor, the less that investor's demand is scaled back compared with other investors in the IPO. For example, normalized rationing of one means that an investor is scaled back in line with the scaling back in that IPO as a whole, and normalized rationing of 0.5 means that an investor is scaled back twice as much as the scaling back in the IPO as a whole.

Table 5 (panel C) shows normalized rationing for different investor types and IPOs. The average normalized rationing per investor is 0.78. Investors who have high revenues with banks have on average higher values, i.e. are scaled back less than other investors. We also see that long-only funds are treated more favorably 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 favor 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.

A. *Econometric Approach*

We follow earlier studies and regress normalized 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 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, normalized 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:

Normalized rationing $_{i,j,k}$

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

We include IPO fixed effects to control for any unobserved drivers of normalized 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.²⁵ Because our dataset contains more than one book per IPO for some IPOs, we cluster standard errors at the IPO level.²⁶

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

²⁵ As robustness checks we also include investor and bank-investor fixed effects, see the Internet Appendix.

²⁶ We cluster standard errors at the IPO level to account for the fact that books for the same IPO are not independent observations. The results are qualitatively unchanged if we only include one book per IPO, using the book that includes the largest number of bids.

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. 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.²⁷

Regarding bidder characteristics, investors may express information on pricing not only through their bidding behavior 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 takes part in ‘pilot fishing’ meetings, that is, meetings held before the intention to float is announced which are used by investment banks and issuers as an early gauge of demand for the IPO.

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, e.g. ‘family and friends’.

To test whether revenues generated by investors for the book-runner are associated with normalized rationing, for each IPO we group investors in quartiles according to the broking (and any other) revenues they generate for the book-runner in the year of the IPO. We then include revenue quartile dummy variables in the regression. Those investors who have no revenues with the book-runner are the omitted control group. We use revenue quartiles, rather than the absolute

²⁷ 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.

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. 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 understate the results.²⁸

B. Results

The first column of Table 6 shows the results of our baseline regression. Looking across the columns in Table 6 we test 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. The reason is that, as we show in Figure 1, very few IPOs in our sample 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 hot IPOs is 9.3% compared with 2.1% for the cold IPOs. 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.²⁹ We also analyze 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.

²⁸ We show results with alternative specifications of the revenue variable in the Internet Appendix.

²⁹ 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 the Internet Appendix.

Starting with bid characteristics, we find that the largest quartile of bids receives nearly a 20% higher allocation (after normalizing 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 normalized rationing in a consistent way. In most specifications the impact of bidding early appears to be negative on normalized 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, e.g. 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 normalized 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 producing any revenues for the investment bank. The coefficients are consistently significant and increasing in the investor's revenue position, i.e. the more important an investor is in revenue terms for the book-runner of a given IPO, the higher the relative allocation they receive. The preferential allocations are sizeable: being in the top revenue quartile increases the relative allocation by 0.51, which is a large impact given that the sample average normalized 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 preferential allocations by 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. 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 normalized 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.

C. Bank-by-Bank Regressions

Up to this point, the results have been based on all IPOs. While we have included bank fixed effects, these only allow for differences in the average level of normalized 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.³⁰ 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.

³⁰ The number of bids per bank varies from just under 3,000 to over 11,000, and the 'other' group of smaller banks includes around 5,500 observations.

D. Robustness Checks and Extensions

Although we control for many bid and bidder characteristics it is possible that some omitted and/or unobservable investor characteristic drives normalized 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. We summarize below the results of these two tests, which are presented in full in the Internet Appendix.

With investor fixed effects, the revenue variables will only capture the impact of variations in revenue quartiles across IPOs, so that if an investor is in the top revenue quartile for every IPO, this characteristic will be filtered out by the fixed effect. Bank-investor fixed effects are even more exacting, in that they 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). Under these two robustness checks we find that the coefficient on the revenue variable declines, meaning that some of the dependency of allocations on revenues is specific to an investor or, in the second of the tests, specific to a bank-investor pair. However, even under these highly demanding tests, the top revenue quartiles are still significant drivers of allocations. Thus, even after applying bank-investor fixed effects, the top two revenue quartiles are significant at the 1% level as determinants of normalized rationing (see Table IA.4 in the Internet Appendix)

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. 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.³¹ When we vary the timing of the revenue variable the coefficients are significant for all years, although they 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 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 (see Table IA.4 in the Internet Appendix).

A final issue we investigate is whether high revenues are also associated with bids that are ex-post profitable for investors. Our earlier results established that high revenue clients receive higher relative allocations in the (ex-ante) hot IPOs. To do this we switch the dependent variable in our regressions from normalized rationing to profitability. Following earlier studies, we define bid profitability as the return to an investor's bidding strategy, i.e. 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. We find that higher-revenue investors make more profitable bidding decisions, that is, higher revenues drive the profitability of orders as well as the normalized rationing of those orders (see Table IA.5 in the Internet Appendix). However, when we introduce investor fixed effects, the revenue variables turn insignificant. This suggests that, 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. This is unsurprising, since the profitability of bids depends not only on the extent to which an investor is scaled back in allocations, but also on the investor's ability to predict the market price of the IPO shares, a variable that is unknown to all participants.

In summary, we find strong 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

³¹ 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.

majority of individual banks. However, for one major bank we find that investor revenues have no impact on allocations, and for another bank the effect is marginal.

4. Are the Allocated Investors Long-Term Holders?

The final issue we explore is how trading evolves after the IPO. For a subset of 65 companies 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. We use this dataset to analyze 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 often express the view that an important objective of the allocation process is 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 behavior. 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 penalize syndicate members whose clients subsequently flip the share (see Aggarwal (2003)).³²

With these caveats in mind, we explore whether investors' allocations depend on the extent to which they add to, or sell, the shares they are allocated. First we analyze 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

³² See <https://dtcclearing.com/learning/settlement/products/settlement/business-information/ipo-tracking.html>

anticipate trading behavior. Second, we analyze 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 to their issue price, presenting allocated investors with a realizable gain. In between these groups of buyers and sellers the book-runner(s) 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.³³ Turnover tends to spike on the first day and then drastically decreases 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 0.5% per day after one year; see Figure 2. 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, the case for book-runners to make preferential allocations to investors expected to provide aftermarket liquidity seems weak. Nonetheless, we explore below whether they do. 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.

³³ 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.

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.³⁴ To keep these categories complementary, we exclude liquidity providers from also being toppers-up or flippers.

Table 8 provides summary statistics of investor behavior 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. We analyze in our regression framework below how successful the bookrunners are at anticipating which investors will flip and reflecting this in their allocations to these investors.

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-only³⁵ received in aggregate a median 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%.

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 8).

³⁴ Results are qualitatively similar if we 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.

³⁵ Recall that we rely for this classification on the ranking produced by corporate finance advisers, who did not classify about half of the investors in our sample.

Of the allocated investors who are also liquidity providers, we find very few hedge funds (panel B Table 8).³⁶

Having summarized the evidence on post-IPO trading, we now explore whether IPO allocations are related to investors' aftermarket trading behavior. To do this, we introduce in Table 9 new variables capturing whether investors are flippers, toppers up, or liquidity providers to our econometric models of allocation.

The first column of Table 9 shows that both flippers and toppers-up in the week following the IPO are allocated more favorably than other investors. Investors who subsequently provide liquidity do not receive a significantly more or less favorable allocation. As noted above, the ability of the book-runner to anticipate the aftermarket behavior 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, e.g. a regular flipper of IPOs. By introducing investor fixed effects we filter out such consistent behavior and test if allocation is driven by aftermarket trading beyond the investor's average behavior. 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 behavior.

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 behavior 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

³⁶ 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.

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 are consistent with banks learning over time and trying 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 analyze the extent of learning about investor behavior.

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 favored 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.

5. Conclusions

This paper draws on a unique set of data on IPO bids, allocations, and the economic relationship between investors and the investment banks that act as book-runners, to analyze the determinants of IPO allocations. This data was gathered as part of an investigation by the UK financial regulator, and covers all investment banks operating in the UK – which includes all the major international banks – and all IPOs managed from the UK 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 earned by IPO syndicate banks from the investors allocated shares 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 UK financial regulator for monitoring and compliance purposes to analyze the aftermarket trading activity of investors allocated shares in the IPO.

We find evidence consistent with syndicate banks making favorable 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 favored 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 favorable 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. 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 also investigate the impact of the relatively new phenomenon of corporate finance advisers – who guide the issuer through the IPO process and may help to mitigate conflicts of interest facing the book-runner. We find that IPOs with corporate finance advisers have lower fees than others and that, in such IPOs, price-sensitive bids are more favorably allocated. We do not find that the presence of IPO advisers affects the extent to which high-revenue clients of the book-runner are favored in allocations. Regarding investor types, we find that hedge funds and long-only investors are treated differently: on average, hedge funds are rationed more severely than long-only investors.

Nonetheless, a significant proportion of IPOs are allocated to hedge funds, and some investment banks argue that this reflects their valuable role as liquidity providers, that is, investors who turn out to become active traders in the IPO shares. Our investigation of the aftermarket activity of investors allocated shares in IPOs does not support this claim. We find that hedge funds receiving IPO allocations provide negligible liquidity in the aftermarket, and those which do provide liquidity are not favored in allocations. In general, we find no evidence that book-runners favor liquidity providers in allocations. We do find, however, that book-runners make more favorable allocations not only to those investors who add to their holdings in the immediate aftermarket, but also to investors who flip shares. The inability of book-runners to

ration flippers may reflect the fact that investors vary their flipping behavior more from one IPO to another than toppers-up. However, book-runners penalize investors who have been consistent flippers in past IPOs.

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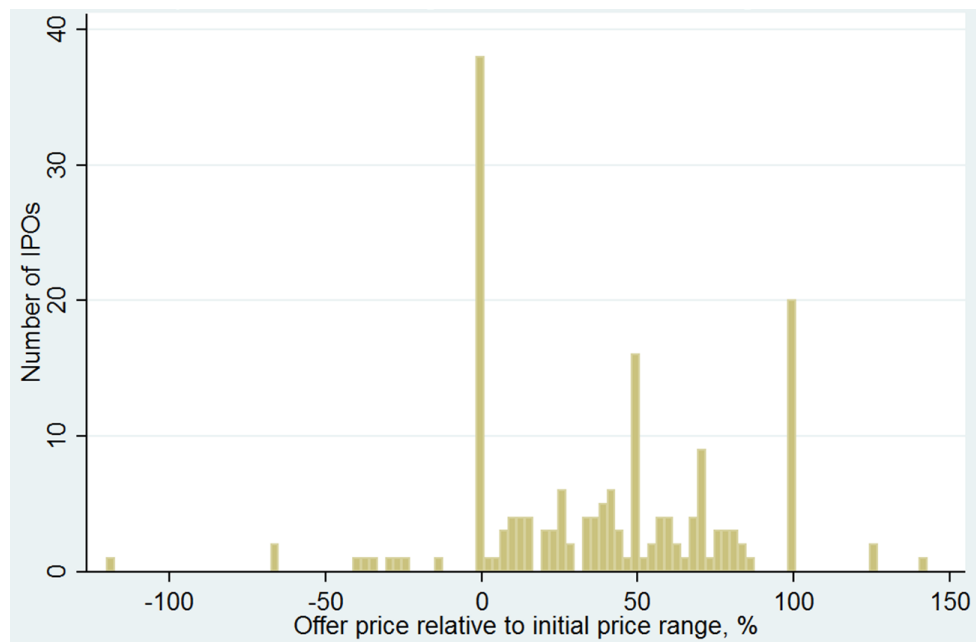


Figure 1. Number of IPOs by ratio of offer price to initial price range. Source: Dealogic database and bank responses to the Investment and Corporate Banking Market Study.

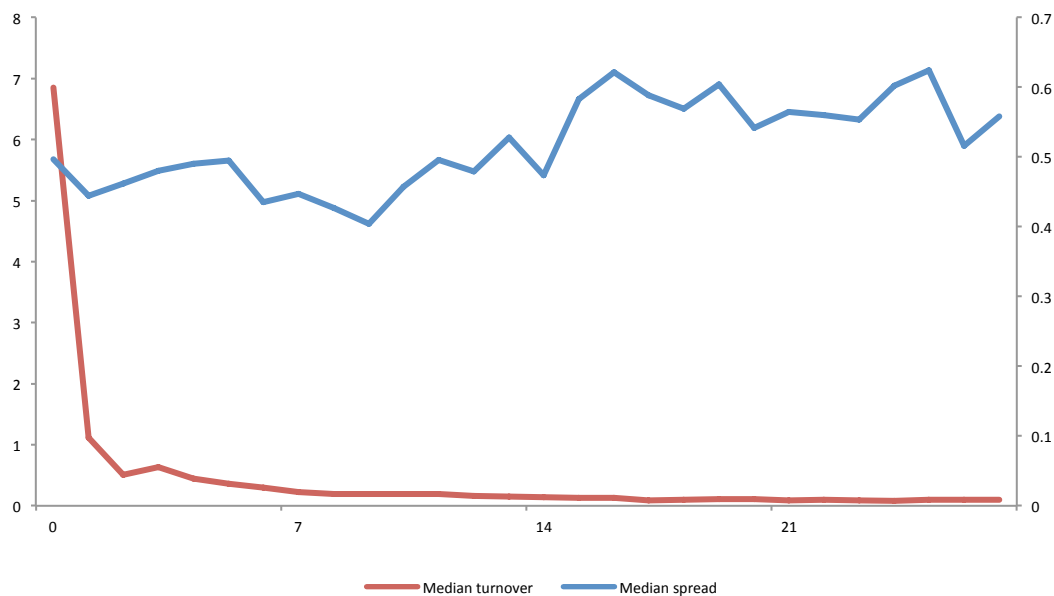


Figure 2. Turnover and bid-ask spreads in the month after the IPO. Turnover (left axis) is the number of shares traded divided by the total number of shares outstanding times 100. The bid-ask spread (right axis) is the end of day ask price minus the end of day bid price divided by the end of day ask price times 100. Source: Thomson Reuters Datastream.

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

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.

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			
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

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

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.

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	5.6	5	1	19	650	71
- IPOs without corporate finance	4.9	4	1	19	392	149
Book-runners, whole sample	3.38	3	1	11		
- IPOs with corporate finance	3.68	3	1	9		
- IPOs without corporate finance	3.24	3	1	11		
Active book-runners, whole sample	1.69	2	1	4		
- IPOs with corporate finance	1.83	2	1	3		
- IPOs without corporate finance	1.62	2	1	4		
Panel B: Fees						
	Mean total fee	... of which discret- ionary	Median total fee	.. of which discret- ionary	Median IPO proceeds USD m	Number of IPOs
All IPOs with fee information	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

Table 3: Investors' bidding behavior

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.

	All issues		Hot issues		Cold issues	
	Mean	Median	Mean	Median	Mean	Median
Price sensitive	46.6%	48.7%	30.0%	23.1%	55.6%	57.5%
... step bids	9.6%	8.9%	7.1%	5.3%	10.7%	9.8%
Strike bids	54.3%	51.5%	71.2%	77.1%	45.0%	42.7%
... money bids	36.1%	31.2%	50.1%	55.5%	33.1%	28.2%
Median number of bids		140		363		97
Revised bids	42.0%	42.2%	39.2%	40.1%	44.3%	44.6%
Attended at least one meeting	20.4%	18.9%	21.9%	20.1%	20.6%	21.5%
Attended pilot fishing	6.4%	4.2%	6.1%	4.7%	7.2%	5.8%

Table 4: Investment bank revenues from investors

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. The revenue and number of clients by individual bank are presented in ranges to preserve anonymity.

	2010	2011	2012	2013	2014	Average	2010-2014 Total
Total revenue (\$bn)	31.7	41.0	37.7	38.2	38.5	37.4	187.1
Top five banks by revenue (\$bn)	2010	2011	2012	2013	2014	Total	Revenue clients
Bank A	9-10	8-9	7-8	7-8	7-8	39-40	1400-1500
Bank B	n.a.	8-9	7-8	8-9	8-9	32-33	500-600
Bank C	6-7	6-7	5-6	5-6	5-6	29-30	2700-2800
Bank D	5-6	4-5	4-5	4-5	4-5	23-24	500-600
Bank E	3-4	4-5	3-4	3-4	3-4	17-18	1600-1700

Table 5: Investors' outcomes

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.

Panel A: Outcomes						
	Mean		Median		Min	Max
Subscription	4.5		2.6		1	28
Offer price relative to initial	40%		40%		-120%	140%
Offer price relative to revised	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	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	5.6%		3.9%		-18.61	51.7%
Panel B: Total % of allocation						
	Hot		Cold		Full sample	
	Mean	Median	Mean	Median	Mean	Obs.
- Hedge fund	14.9%	13.5%	18.6%	17.0%	17.9%	8568
- Long only	32.9%	34.4%	26.1%	24.9%	27.6%	8414
- Others	52.1%	47.4%	55.8%	51.6%	54.9%	41321
Revenue quartile						
- no revenues	43.2%	29.4%	48.3%	39.4%	45.9%	
- bottom quartile	8.7%	5.9%	9.2%	7.6%	9.1%	
- 25-50	15.2%	14.2%	11.5%	11.3%	12.9%	
- 50-75	18.3%	18.0%	18.6%	18.1%	18.7%	
- top 25	33.0%	32.4%	23.7%	22.2%	27.0%	
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	Q2	Q3	Q4 – highest	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	

Table 6: Determinants of allocation

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. IPO and bank fixed effects are included. 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.

Explanatory variables	Dependent variable: 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*** (7.312)	0.333*** (6.319)	0.168*** (4.360)	0.269*** (7.259)	0.274*** (4.513)	0.390*** (7.529)	0.167*** (6.299)
3 rd revenue quartile	0.0946*** (3.567)	0.127*** (3.588)	0.0482* (1.671)	0.0848** (2.517)	0.102*** (2.640)	0.202*** (3.236)	0.0858*** (3.475)
4 th revenue quartile	-0.0169 (-0.716)	-0.0176 (-0.553)	-0.00854 (-0.315)	-0.0271 (-0.995)	-0.00962 (-0.261)	0.00877 (0.174)	0.0355** (2.061)
Constant	0.578*** (15.91)	0.572*** (10.49)	0.640*** (30.56)	0.572*** (15.80)	0.593*** (11.83)	0.696*** (13.82)	0.290*** (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

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

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. IPO fixed effects are included. 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.

Explanatory variables	Dependent variable: normalised rationing									
	Bank 1	Bank 2	Bank 3	Bank 4	Bank 5	Bank 6	Bank 7	Bank 8	Bank 9	others
Largest	0.185** (2.197)	0.205*** (4.003)	0.0268 (0.361)	0.123* (1.991)	0.218*** (4.561)	0.197*** (2.975)	0.371*** (4.450)	0.287* (2.087)	0.522*** (3.406)	0.177*** (3.335)
Large	0.125** (2.154)	0.131*** (3.195)	0.0438 (0.802)	0.132** (2.309)	0.192** (2.320)	0.0774** (2.132)	0.0479 (0.784)	0.138*** (4.810)	0.222*** (3.528)	0.0738* (1.744)
Price sensitive bid	0.0109 (0.192)	0.0882*** (2.938)	0.100** (2.228)	-0.0378 (-0.440)	0.154*** (6.224)	-0.142 (-0.947)	0.459** (2.249)	0.0919 (1.074)	0.0178 (0.260)	0.0810*** (3.284)
Money bid	-0.131** (-2.219)	-0.00307 (-0.109)	0.00468 (0.105)	-0.162 (-1.508)	0.174** (2.259)	-0.411** (-2.285)	0.211** (2.427)	-0.0681* (-2.218)	-0.0291 (-0.793)	0.0106 (0.332)
Early	-0.0753** (-2.627)	-0.00833 (-0.346)	-0.0994*** (-2.898)	0.179 (1.408)	-0.0772** (-2.284)	0.150 (0.712)	0.0518 (1.079)	-0.154* (-2.035)	-0.00619 (-0.0805)	-0.0323 (-0.922)
Revised bid	0.0403 (0.952)	0.0283 (1.228)	0.0368 (0.625)	-0.0339 (-0.693)	-0.0457 (-0.447)	-0.0178 (-0.304)	0.0435 (0.668)	-0.00678 (-0.188)		
Meeting	0.297*** (3.964)	0.157*** (4.181)	0.173*** (4.837)	0.431*** (8.542)	-0.0431 (-0.572)	0.211*** (3.817)		0.380 (1.633)	0.492*** (4.877)	0.338*** (3.287)
Pilot fishing	0.426*** (3.353)	0.206*** (3.750)	0.221* (1.873)	0.152* (1.848)	0.635* (1.990)	-0.336 (-0.843)		0.653*** (4.090)	-0.0901 (-0.627)	0.133 (0.902)
Frequent bidder	0.0550** (2.060)	0.0910* (1.939)	-0.00455 (-0.118)	-0.0591 (-0.694)	0.00494 (0.132)	-0.0119 (-0.189)	0.152*** (3.354)	0.230*** (5.346)	-0.0852*** (-3.742)	0.0851** (2.643)
One-time bidder	0.287** (2.586)	0.240*** (3.593)	0.356*** (3.221)	-0.0710 (-1.329)	0.172 (1.637)	-0.232** (-2.490)	0.0617 (1.591)	-0.0244 (-0.641)	0.299 (1.214)	0.106** (2.212)
1 st revenue quartile	0.626*** (7.412)	0.578*** (10.38)	0.717*** (5.872)	0.449* (1.824)	0.637** (2.683)	-0.0170 (-0.108)	0.573** (2.673)	0.250*** (3.794)	0.563*** (9.172)	0.308*** (2.812)
2 nd revenue quartile	0.380*** (5.159)	0.249*** (6.569)	0.670*** (3.450)	0.0935* (1.727)	0.134*** (2.918)	-0.186 (-0.891)	0.294* (1.953)	0.222** (2.356)	0.123 (1.191)	0.258*** (3.048)
3 rd revenue quartile	0.165*** (3.363)	0.160*** (5.005)	0.344*** (5.624)	-0.0381 (-0.747)	0.0156 (0.178)	-0.442** (-2.483)	-0.203* (-1.918)	0.102 (1.144)	0.00460 (0.0466)	0.0809 (1.548)
4 th revenue quartile	-0.0294 (-0.811)	-0.0263 (-0.581)	0.511*** (5.490)	-0.123*** (-4.634)	-0.144*** (-5.401)	-0.501** (-2.443)	-0.427*** (-5.083)	0.0151 (0.197)	-0.0988 (-1.440)	0.0120 (0.287)
Constant	0.433*** (8.381)	0.365*** (14.22)	0.445*** (11.28)	0.601*** (9.061)	0.438*** (5.723)	1.149*** (4.048)	0.281*** (5.239)	0.587*** (15.05)	0.302*** (6.669)	0.586*** (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

Table 8: Aftermarket

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.

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

Table 9: Does aftermarket behaviour determine allocation?

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. IPO and bank fixed effects are included. T-stats are given in parentheses based on robust standard errors clustered at the IPO level.

Explanatory variables	Dependent variable: 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 (0.843)	-0.0233 (-0.282)	0.0416 (0.831)	0.0432 (0.858)
Money bid	-0.0929** (-2.124)	-0.111 (-1.354)	-0.0929** (-2.118)	-0.0944** (-2.154)
Early	-0.0881** (-2.422)	0.0581 (1.516)	-0.0846** (-2.298)	-0.0863** (-2.394)
Revised bid	0.0430 (1.127)	0.0725 (1.627)	0.0410 (1.077)	0.0427 (1.125)
Meeting	0.230*** (5.118)	0.0121 (0.242)	0.227*** (4.980)	0.226*** (5.026)
Pilot fishing	0.166** (2.436)	-0.0346 (-0.609)	0.168** (2.441)	0.160** (2.375)
Frequent bidder	0.0136 (0.538)		0.0152 (0.568)	0.0150 (0.571)
One-time bidder	0.152** (2.199)		0.153** (2.220)	0.153** (2.210)
1 st revenue percentile	0.573*** (6.650)	0.135*** (2.867)	0.569*** (6.593)	0.571*** (6.647)
2 nd revenue percentile	0.340*** (5.210)	0.0828** (2.185)	0.336*** (5.148)	0.340*** (5.223)
3 rd revenue percentile	0.0915 (1.543)	0.0192 (0.699)	0.0911 (1.539)	0.0918 (1.548)
4 th revenue percentile	-0.0394 (-0.903)	0.0353 (1.581)	-0.0375 (-0.852)	-0.0398 (-0.919)
Flipped	0.106* (1.935)	0.174*** (3.051)	0.202*** (3.122)	0.126** (2.182)
Liquidity provision	0.0881 (1.166)	0.161* (1.804)	0.0797 (1.009)	0.0847 (1.125)
Topped up	0.251*** (4.730)	0.0675 (1.160)	0.113 (1.427)	0.215*** (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***
Constant	0.580*** (9.401)	0.516*** (6.996)	0.577*** (9.319)	0.586*** (9.163)
Observations	12,393	12,393	12,393	12,393
R-squared	0.112	0.576	0.113	0.113
Investor fixed effects	no	yes	no	no