Key Investors in IPOs*

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September 8, 2015

Abstract

We statistically identify institutional investors who persistently report holdings of the most underpriced IPOs. As a group, their holdings are strongly related to future IPO underpricing and offer price revisions, more so than any other control variables. The majority of key investors appear to be rewarded for information production, but a minority are more likely associated with laddering. We find no direct evidence that key investor participation is motivated by underwriters' earning kickbacks. However, key investors receive a minority of the economic benefits of underpricing. Greater benefits accrue to non-key investors, supporting agency-based explanations for underpricing.

JEL Classifications: G23, G24, G32

Keywords: IPO Underpricing, Institutional Investors, Underwriters

*We would like to thank Bruno Biais, Andrew Ellul, Jerry Hoberg, Aazam Virani, Bill Wilhelm, and seminar participants at the University of Colorado and the University of Arizona for their helpful insights and suggestions. We would also like to thank Jay Ritter for making his data available.

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Introduction

Investors who participate in initial public offerings (IPOs) often benefit from significant underpricing. The existing theoretical literature proposes a number of explanations for this generosity towards investors, including theories based on information asymmetry and production (Rock, 1986; Benveniste and Spindt, 1989; Sherman and Titman, 2002), optimal post-IPO ownership structure (Brennan and Franks, 1997; Stoughton and Zechner, 1998), and agency concerns (Loughran and Ritter, 2004; Aggarwal et al., 2002b), particularly laddering (Hao, 2007). However, surprisingly little empirical attention has been paid to which institutional investors are most associated with underpriced IPOs. We fill this gap by identifying key institutional investors who were strongly associated with significantly underpriced past offerings and studying their relation to underpricing in future offerings. We find support for both information-based and laddering theories of IPO underpricing related to key investor participation. However, the value of underpricing that can be attributed to key investors is a minority of the total money left on the table in IPOs, suggesting that other motivations, particularly agency concerns, affect the extent of underpricing.

Focusing on investors most associated with underpricing provides a new means of testing a variety of explanations for underpricing.[1] It is not clear *ex-ante* whether a group of investors will persistently be associated with the most underpriced offerings. However, the existence of such a group, whose behaviors, characteristics and associations could be measured, could provide valuable new insight into long-standing debates.

We first identify a group of investors, termed key investors, that are associated with significantly underpriced IPOs. Using investors' 13F filings to proxy for IPO participation, we identify investors that experienced statistically abnormal underpricing over the prior year. Using bootstrapped distributions, we consider a key investor's average underpricing

[1] In reviews of the IPO literature, Ritter and Welch (2002), Ljungqvist (2007) and Ritter (2011) discuss myriad theories of underpricing, many of which are supported by empirical evidence.

as abnormal if it is better than random with 99.9% confidence. About 10% of investors receive abnormal underpricing, and those investors tend to continue doing so in the future: over 43% of key investors in a given year are classified as key investors in the following year. The measure is persistent for 10 years, suggesting that key investors have traits leading to frequent participation in highly-underpriced IPOs.

Our main finding is that the number of key investors participating in an IPO is significantly related to underpricing. In a simple univariate regression, key investor participation explains 42% of the variation in underpricing. Furthermore, a one-standard-deviation increase in key investor participation increases underpricing between 17% and 24% (average underpricing in our sample is 20%). Additionally, measures of underwriter quality are no longer significantly related to underpricing when key investor participation is included. These results establish the importance of key investors in IPOs and stand in contrast to non-key investors whose participation is not related to underpricing.

Examining offer price revisions and future returns help us to distinguish agency-based explanations from other alternatives. Agency-based explanations suggest offer prices will be suppressed when key investors participate in order to maximize rents to those investors. However, information- and value-based theories expect offer prices to increase as more informed or value-adding investors participate. We show a strong relation between key investors and offer price revisions. In fact, key investor participation is the most significant determinant of offer price revisions. Furthermore, key investors appear to add value or be informed, as their post-IPO trades predict next quarters' abnormal returns. Together, these tests are inconsistent with key investors' participation in IPOs being driven by agency concerns, and instead suggest key investors bring information or value-add to the IPO process.

Because we rely on holdings data, our results could be due to key investors' receiving allocations in IPOs, or due to post-IPO, secondary-market purchases. While 13F holdings have been used in prior studies (Reuter, 2006; Binay et al., 2007), we conduct a variety of

tests to justify using 13F holdings as a proxy for key investor participation in IPOs. First, we show that post-IPO buying is not likely to contribute to key investor identification. While both key and non-key investors tend to report more holdings for IPOs earlier in the quarter, the effects are similar for both groups. Second, we show that secondary-market buying is not a profitable trading strategy, suggesting little motive for key investors to buy post-IPO. Third, we predict key investors' IPO participation using only investor and underwriter characteristics. While underwriter-investor relationships and investor traits likely influence IPO participation, it is less likely that these same factors influence secondary-market trading. Predicted participation is highly correlated with realized participation, consistent with the holdings data reflecting IPO participation. While the evidence suggests holdings do reflect allocations, key investors may still impact IPO pricing without receiving allocations. For instance, key investors may attempt to buy shares in the IPO directly, conveying information to the underwriter, or key investors' demand may be anticipated via other channels.

While the bulk of the evidence is consistent with information or value-add influencing IPO pricing, we do find some evidence consistent with laddering, specifically related to key investors who have a history of frequently flipping IPOs. Higher participation by these investors is associated with a higher likelihood of a price reversion following the IPO. In particular, these investors signal positive returns in the first quarter after the IPO, and negative returns the subsequent quarter. Trades by frequently-flipping key investors also show no return predictability. Together, these results suggest that key investors consist of two distinct groups.

The evidence is consistent with key investors' influencing underpricing via information-provision or value-add and to a lesser extent through laddering. However, aggregate participation statistics leave room for many alternative explanations for IPO underpricing. For example, key investors, who make up 10% of all investors and account for the majority of the relation between investor participation and underpricing, only account for 26% of reported

holdings and 45% of the inferred money left on the table in IPOs. The majority of economic benefits accrue to other funds, leaving room for alternative explanation for underpricing. While key investor participation explains a large portion of the cross-sectional variation in underpricing, agency-based motivations likely keep underpricing higher than is necessary to secure key investors' participation. Overall, these statistics are consistent with a significant part of the economic value of underpricing being unrelated to key investors' information production and value-add for firms.

Our paper makes a number of contributions to the IPO literature. First, we show the importance of key institutional investors to underpricing and offer price revisions. Cornelli and Goldreich (2001) documents that investors that submit informative bids are treated favorably by the underwriter, while Jenkinson and Jones (2004) find little evidence that informative bids are favored and suggest that underwriter tends to favor long-term investors in its allocations. The mixed results may be due to limited samples from two different European investment banks. Our paper uses a larger sample to follow investors across underwriters and over time, and supports information and value-based theories of underpricing. Field and Lowry (2009) and Chemmanur et al. (2010) document that high institutional ownership after the IPO is positively associated with post-IPO returns. Consistent with these studies, our evidence suggests that key investors are informed, and that classification as a key investor is persistent. Sibo (2014) also studies the persistence of institutional investors' performance in IPOs, finding that institutional investors that performed well in the past tend to perform well in the future. Aggarwal et al. (2002a) also show evidence of institutional investors affecting IPO pricing. While their study focuses on differences between institutional and retail investors, we focus on identifying a sub-group of institutional investors who most affect IPO pricing.

While our main findings support non-agency-based theories of underpricing, we present some evidence consistent with agency-based theories. Key investors who frequently flip are

associated with return patterns consistent with laddering. This finding complements Fjesme (2015), which finds that some institutional investors in Norwegian IPOs engage in post-IPO price support and that these investors are treated favorably in subsequent allocations. Flipping key investors are also present in higher number for IPOs with large offer price revisions, consistent with these investors' benefiting from agency-based motivations. These results are consistent with a number of studies, including Goldstein et al. (2011), Kang and Lowery (2014), Nimalendran et al. (2007), Reuter (2006), Ritter and Zhang (2007), among others.

Finally, we contribute to a broader literature studying the effects of institutional investors on firms. We show that investors impact firms' IPOs through initial pricing and underpricing, and that the effects are likely related to information-production or value-adding activities such as monitoring, long-term holding or increasing price informativeness. An IPO is one example of a setting in which who owns a firm matters.

1 Exisiting theories and hypothesis development

A vast theoretical literature proposes several explanations for certain investors' favorable treatment in IPOs. In this section, we review several theories and relate their predictions to key investors.

1.1 Information Asymmetry

A large class of explanations is based on the assumption that some investors have superior information about the firm going public. We refer to this broad class of explanations as information-based theories of IPOs. These theories commonly lead to several predictions. First, a key investor who is privately informed is more likely to buy IPO shares if his private information indicates firm value is high (Rock, 1986), hence participation of key investors

in IPOs is positively correlated with firms' post-IPO share prices and underpricing. Second, underwriters deliberately underprice shares if key investors agree to participate and reveal their private information during bookbuilding (Benveniste and Spindt, 1989). Similarly, the underwriter may underprice shares in order to compensate key investors for costly information acquisition (Sherman and Titman, 2002). These theories predict:

Participation of key investors in IPOs is positively correlated with IPO underpricing.

Information acquired through bookbuilding allows the underwriter to update the offer price. Because informed investors likely participate when they have good information, upward revisions are likely when key investors participate in the IPO:

Participation of key investors in IPOs is positively correlated with offer price revisions.

When key investors reveal information during bookbuilding it affects short-run performance (underpricing). On the one hand, if the information is not fully revealed or incorporated into the price initially, it can also affect the longer-term performance of shares in a similar manner. On the other hand, once information is fully incorporated it has no bearing on future performance. As a result:

Short-run and long-run stock performance should be non-negatively correlated.

Finally, if key investors possess superior information prior to an IPO, this advantage may persist (either via retained information or new information production) leading to informative post-IPO trades, especially relative to less-informed investors' trades.

Changes in post-IPO shareholdings by key investors should predict returns better than changes in shareholdings of non-key investors.

1.2 Value-Add

An alternative class of theories posits that key investors engage in value-adding activities. For instance, Mello and Parsons (1998) and Stoughton and Zechner (1998) propose that investors increase firm values through monitoring, and therefore these investors should receive favorable allocations and prices in an efficient IPO.[2] Along similar lines outside the IPO literature, Holmstrom and Tirole (1993) argues that investors can discipline management and increase firm value by collecting firm-specific information and trading on it, making the firm's price more informative. Alternatively, trading can improve firm value by improving future investment decisions as in Brown (2015). Banerjee et al. (2009) argues that underpricing may be used to secure valuable, long-term holding. All of these theories generate empirical predictions similar to those from information-based theories. We do not distinguish between information-based and value-add theories, and refer to them as information/value theories hereafter.

1.3 Laddering

The laddering theory is based on the idea that key investors may promise to buy shares in the secondary market in exchange for an allocation of underpriced shares. Hao (2007) argues that underwriters may favor institutional investors that engage in laddering in order to ease their own price-support activities. Such behavior generally creates upward pressure on shares prices for some time after the IPO which is eventually reversed.[3] If key investors engage in laddering, their IPO participation can be associated with positive offer price revisions and positive first day returns, which are also predicted by information/value theories. The distinguishing feature of laddering is that the price effect is temporary. The short-term

[2]Zingales (1995) and Booth and Chua (1996) also present non-booking-building, value-maximization-based explanations for underpricing.

[3]Aggarwal (2000) finds price support activities by underwriters conclude within a month of the IPO for 93% of firms.

post-IPO returns should be positive due to post-IPO buying, while long-term returns should be negative as positions are unwound. When key investors sell their shares, the share price performance should deteriorate, and:

Post-IPO short-run and long-run performance of shares should be negatively correlated.

Lastly, if key investors do not possess superior information and instead engage in programmatic buying and selling via laddering, their trades should not predict share prices more than those of other investors:

Changes in post-IPO holdings of key investors should affect the share price to the same extent as changes in holdings of non-key investors.

1.4 Cronyism

There is a common argument in the IPO literature that key investors get special treatment in IPOs because they have a relationship with the underwriter.[4] For instance, underwriters may want to please key investors in hopes of securing future, unrelated business (i.e. earn kickbacks). In particular, new funds that have yet to establish business relationships may be particularly enticing to underwriters. In essence, repeated interaction of investors and underwriters give rise to an agency conflict, and allocations of underpriced IPO shares is one way for underwriters to reward regular clients. While many of the empirical implications are similar to those previously developed, we stress a few differences.[5]

If key investors have no superior information, do not add value, and do not engage in laddering, their IPO participation should not be related to firm value. Yet, if the underwriter does underprice the shares to transfer rents to the key investors (and subsequently receive kickbacks), then the offer price should not be revised upward relative to the initial price range.

[4]For examples, see Reuter (2006), Ritter and Zhang (2007), Ritter (2011) and Kang and Lowery (2014)
[5]Laddering could be considered a form of cronyism, but we separate it due to its distinct predictions.

Participation of key investors in IPOs is non-positively correlated with offer price revisions.

If cronyism drives underpricing, then key investors likely lack information and their trades should not predict returns more than the trades of other investors:

Changes in post-IPO holdings of key investors should predict returns to the same extent as changes in holdings of non-key investors.

Table 1 summarizes the implications of the various theories. While information/value theories for underpricing are difficult to distinguish, we can test these together against laddering and cronyism alternative. For example, if key investors are associated with underpricing but not offer price revisions, then it is likely that cronyism drives key investors' participating in highly-underpriced IPOs. However, finding a positive associated among key investor participation, underpricing and offer price revisions does not rule out cronyism as a contributing factor. Rather, it would only suggest that cronyism is not likely to be the motivation leading to *key investors'* participating in highly-underpriced IPOs.

1.5 Post IPO buying

In our analysis we do not observe directly the participation of investors in an IPO, instead we use the reported share holdings by investors in the quarter when the IPO took place as a proxy for investors participation. The delay between the date of the IPO and the reporting date gives scope for the possibility that investors do not order shares in the IPO but buy them immediately after the company is listed in the secondary market. Given that on average IPOs are underpriced one needs to argue that for some reason some investors do not try to buy shares in the IPO but do so after the shares are traded.

One rationale for such a behaviour would be the anonymity of secondary market purchases compared with direct participation in the IPO. Some investors may not be willing to

reveal their interest to the underwriter during Book-building and may prefer buying in the open market. For instance some of the underwriter's competitors and funds affiliated with them may prefer not to reveal positive information during book-building thus forcing the underwriter to set a low price and upset the issuing firm. Presumably, these key investors should be informed about the share value as they must be confident to buy in the volatile early market and we get first two predictions:

Underpricing and post IPO holdings by key investors should be positively related.

Changes in post-IPO shareholdings by key investors should predict returns better than changes in shareholdings of non-key investors.

If key investors posses private information but choose not to reveal it to the underwriter but rather to buy shares in the secondary market we expect that key investors are more likely to buy shares when the underwriter does not have some favourable information about the firm and the offer price revision is small:

Offer price revision and post IPO holdings by key investors should not be positively related.

Alternatively, key investors may simply follow a behavioural strategy of buying shares that experience significant underpricing. As our tests show such a strategy does not generate abnormal returns. The funds that we identify as key investors listed in Table 4 include many well established and reputable institutions that in our view are unlikely to follow this behavioural strategy. Therefore, in the subsequent analysis we do not consider this alternative.

Table 1: Emprical predictions of alternative IPO theories

Relationship	**Information / Value-Add**	**Laddering**	**Cronyism**	**Post IPO buying**
Underpricing and Key Investor Participation	+	+	+	+
Offer Price Revision and Key Investor Participation	+	+	0/-	0/-
Short and Long-Run Return Correlation	0	-	0	0
Predictive Power of Key Investors' Trades	+	0	0	+

2 Data and Sample

We identify IPOs using the Thomson Securities Data Corporation (SDC) Platinum Global New Issues database. The sample includes IPOs of U.S. firms' common stocks completed between 1985 and 2011. As is common in the literature we exclude unit offerings, spinoffs, real estate investment trusts, rights issues, closed-end funds and trusts, and IPOs with an offer price less than five dollars. To be included in the sample, we require that a firm be in the Center for Research in Security Prices (CRSP) database and that at least one institution reports owning shares in the first quarter after the IPO. Holdings data are from Thomson-Reuters 13F Institutional Holdings (13F) database. We supplement data from the SDC, CRSP and 13F databases from several sources. Consumer Price Index (CPI) data from the Bureau of Labor Statistics is used to adjust dollar values to year 2000 dollars. Founding dates, monthly underpricing and issuance activity, and underwriter rankings are taken from Jay Ritter's website.[6] The resulting sample includes 4,938 IPOs.

Lacking direct data on IPO allocations, we follow Binay et al. (2007) and Reuter (2006) and proxy for allocations using the first reported institutional holdings data after issuance.

[6]The data are available at https://site.warrington.ufl.edu/ritter/ipo-data/

While using 13F holdings data to proxy for allocations has several shortcomings (limited and delayed reporting), several studies provide evidence that this proxy is highly correlated with actual IPO allocations. Using proprietary data on a sample of 38 IPOs managed by a single underwriter, Hanley and Wilhelm (1995) finds that the correlation between 13F holdings data and actual allocations is 0.91. Using six of the IPOs with known allocations featured in Ritter and Zhang (2007), we find that 51% of funds holding shares at the end of the quarter received allocations. For key investors (defined shortly) 58% of holdings are associated with IPO allocations.

Our proxy for allocations helps to overcome one limitation in the IPO literature, but allows for alternative interpretations of our results. The limitation, which is common in the literature, is due to a lack of data on allocations in IPOs.[7] While 13F data noisily identifies true allocations, the holdings originating from post-IPO buying may be a significant factor. In fact, *a priori*, the role of investors buying shares after the IPO may be as important for determining the offer price as the role of investors participating in the offering. While we attempt to distinguish whether 13F holdings are more driven by allocations or post-IPO buying, we acknowledge that our measure cannot definitively separate the two.

3 Defining Key Investors

Key investors are those that are likely to influence price setting and allocations in IPOs. If such a group of investors exists, and has traits of particular value to firms or underwriters, it is likely that those investors will continue to influence pricing in future offerings. Therefore, we hypothesize that investors who have experienced abnormal underpricing in past offerings are likely to predict underpricing in future IPOs.

[7] Jenkinson and Jones (2004) and Cornelli and Goldreich (2001) overcome this limitation by using detailed, proprietary underwriters' data about bids and allocations. In both cases, the data are from a single underwriter. However, the papers find mixed results, possibly due to differences between the underwriters that supplied the data.

To determine those funds that have received abnormal underpricing, we begin by constructing, on a quarterly basis, a measure reflecting the average adjusted underpricing of the funds' recently reported holdings. For each quarter, we consider IPOs over the past year, excluding any funds that did not report holdings in at least 4 IPOs. For each IPO, we adjust realized underpricing by subtracting the month's average underpricing:

$$AdjUnderpricing_i = Underpricing_i - \frac{\sum_{j=1}^{J(i)} Underpricing_j}{J(i)} \tag{1}$$

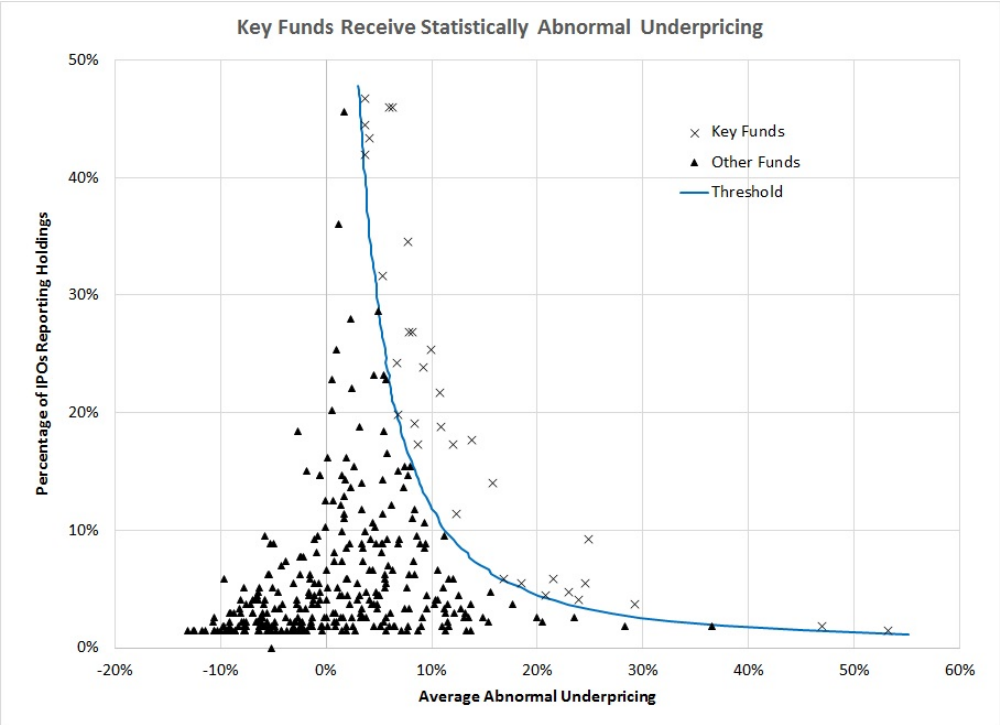
where $J(i)$ is the set of IPOs completed in the same month as IPO i. A fund's average adjusted underpricing is then the simple average of the adjusted underpricing for the IPOs, over the last year, in which the fund reported holdings:

$$AvgAdjUnderpricing_k = \frac{\sum_i^I AdjUnderpricing_i \times \mathbb{1}_{i,k}}{\sum_i^I \mathbb{1}_{i,k}} \tag{2}$$

where k indexes funds and $\mathbb{1}_{i,k}$ equals 1 if fund k held shares in IPO i and I is the set of IPOs over the past year.

We rely on statistical methods to determine which of the funds received abnormal underpricing. For each quarter, and for each possible number of IPOs received by a fund, we construct bootstrapped distributions of average adjusted underpricing. For example, for a fund who received 10 IPOs in 2005, we would sample, with replacement, 10 IPOs from those that occurred in 2005. We then calculate average adjusted underpricing for the random sample. We repeat this process 100,000 times for each date and for each number of potential IPOs received over the prior year. Therefore, for each realized value of average adjusted underpricing, we have a corresponding distribution of random outcomes with the same number of IPOs, drawn from the IPOs available over the same time period. We then compare the realized values to the distribution. Key investors ($KeyInvestor = 1$) as those having realized values greater than at least 99,900 of the random draws, equivalent to a

Figure 1: Scatter-plot of key funds and other funds in 1994, as an example. The solid line represents the threshold at which we are 99.9% confident (generated from 100,000 random sample portfolios) that the average adjusted underpricing is significantly different from zero.



statistical threshold of 0.1%. While this is a strict statistical threshold, 10.9% of fund-year observations meet this criterion.

Figure 1 provides an example for the start of 1994. The x-axis displays average abnormal underpricing, while the y-axis displays the percentage of the IPOs over the past year in which a fund reported holdings. The solid line represents the bootstrapped threshold, while the X's, which lie to the right of the threshold, represent key investors. Those investors have average abnormal underpricing which is statistically greater than zero at the 0.1% confidence level. The triangles represent other investors, and all lie to the left of the threshold. Using our key investor definition applied to each fund-quarter, for each IPO we count the number

of key investors who hold the firm's stock at the end of the first quarter following the IPO.

$$NumKeyInvestors = \sum_{k \in K} KeyInvestor_k \tag{3}$$

where K is the set of investors who hold shares at the end of the first quarter following the IPO. $NumKeyInvestors$ is our main variable of interest.

Table 2 shows that our key investor measure is persistent. 42% of key investors at the beginning of one year are classified as key investors at the beginning of the following year. This is a significant portion as random assignment would suggest only 11% overlap. Furthermore, this persistence continues for 10 years. In each subsequent year, the excess proportion of original key investors classified as key investors remains significant. Even for those who are no longer key investors, their average adjusted underpricing is statistically significant at common thresholds. In each of the subsequent 10 years, over 60% of the key investors receive abnormal underpricing based on a 5% significance threshold, and usually 75% do so based on a 10% threshold.

In an attempt to distinguish agency-based and information-based theories of underpricing, we measure investors' past IPO-selling behavior. Investors who receive allocations in exchange for other business with underwriters, or for price-support as in the laddering theory, are likely to sell their shares quickly to lock in their underpricing-related gains. We measure this flipping activity based on the frequency with which investors sell all of their holdings by the end of the second quarter following the IPO. *Flipped* is equal to the proportion of an investor's IPOs in which the investor reports holdings in the IPO stock at the end of the first quarter, but reports no holdings at the end of the second quarter. Investors are ranked quarterly based on *Flipped*, and those in the top third are *Flippers*. Key investors who are also flippers make up 11% of all key investors.

Table 3 shows summary statistics of key and non-key investors. Key investors are larger

and older than non-key investors, and more actively churn their portfolios. Additionally, key investors tend to hold IPOs longer, more actively trade IPOs holdings and are less likely to flip their holdings quickly. Finally, hedge funds are under-represented in the key investor population.[8]

Table 4 summarizes the most common key investors throughout our sample period (measured at the beginning of each year). The summary statistics indicate that most key investors receive many allocations and that a broad range of fund sizes are included as key investors. For example, Essex Investment Management Company, the most frequent key investor, manages a little over $1 billion in assets, while Fidelity is ranked second and manages over $400 billion.[9] In general, the funds represented are heterogeneous, including the largest and most prominent funds, large banks, and many smaller and lesser-known funds.

4 Main Results

4.1 Underpricing

Table 5 shows our main result: $NumKeyInvestors$ is strongly related to IPO underpricing.[10] Column (1) highlights that $NumKeyInvestors$, by itself, explains almost 40% of underpricing variation. In the univariate regression, a one-standard-deviation increase in $NumKeyInvestors$ is associated with 24% higher underpricing. Column (2) provides a baseline regression using control variables common to the IPO literature, and Column (3) adds $NumKeyInvestors$ alongside those controls. Even in the presence of controls, $NumKeyInvestors$ is the most significant determinant of underpricing. Economically, increasing $NumKeyInvestors$ by one standard deviations increases underpricing by 17%. For comparison, a one-standard-deviation increase in $OfferPriceRevision$ increases underpric-

[8] We use the hedge fund classifications introduced in Agarwal et al. (2013a) and Agarwal et al. (2013b).
[9] Dollar figures are based on reported 13F holdings.
[10] Our main result is robust to separate analysis of the periods 1985 - 1997, 1998 - 2000 and 2001 - 2011.

ing by 11%. Column (4) shows there is no differential relation between underpricing and participation by key investors who frequently flip. Non-key investor participation is not related to underpricing, suggesting that these other investors do not contribute significantly to the pricing process.

Comparing Columns (2) and (3) highlights an additional finding: key investor participation removes the significance of underwriter measures. In particular, $UnderwriterRank$ (Carter and Manaster, 1990; Carter et al., 1998) and $UWpremium$ (Hoberg, 2007) both lose significance in explaining underpricing, suggesting that underwriters may be valuable in the IPO process because they connect firms with key institutional investors.

Either through allocations or post-IPO buying, key investors' participation in IPOs is strongly related to underpricing. To differentiate among theories of underpricing we next consider the relations between $NumKeyInvestors$ and offer price revisions.

4.2 Offer Price Revisions

Offer price revisions allow us to distinguish information-based explanations for underpricing from value-destroying, agency-based explanations. Were underpricing entirely motivated by agency-based explanations, it is likely that key investors would experience less positive or even negative revisions as underwriters set offer prices lower to transfer more rents to those investors (and subsequently recapture those rents through other lines of business). While that broadly applies to agency-based explanations, it is important to note that laddering can generate the opposite prediction. As shown by Hao (2007), laddering should be associated with positive offer price revisions and positive underpricing when underwriters do not receive kickbacks from investors. However, profit-sharing via kickbacks can motivate underwriters to lower offer prices as in some agency-based explanations. Therefore, we expect that non-agency-based motivations for underpricing lead to a positive relation between key investors and offer price revisions.

Table 6 shows that $NumKeyInvestors$ is positively related to offer price revisions. By itself, Column (1) shows that $NumKeyInvestors$ explains 29% of variation in offer price revisions. Column (2) provides a baseline specification with controls, and Column (3) shows that $NumKeyInvestors$ maintains as an important explanatory variable in the presence of controls. Notably, including $NumKeyInvestors$ increases the explanatory power of the regression by 4%.

Interestingly, Column (4) shows that participation by key investors who flip is positively related to offer price revisions. This may be due to selection. Assuming underwriters recognize the strong relation between offer price revisions and underpricing, they may be particularly apt to allocate highly-revised IPOs to flippers in order to be most effective in transferring rents. While non-flipping key investors participate in a wide range of IPOs, and the extent of their participation helps to determine initial pricing and underpricing, flipping key investors may simply be invited to participate in the most promising IPOs. This is consistent with flippers not driving pricing, and instead being a beneficiary of pricing. While allocations to flippers are symptomatic of agency concerns, the evidence does not suggest that agency-based motivations determine underpricing; underwriters would rather lower offer prices to maximize flippers' profits. Instead, agency concerns may exacerbate average underpricing by reducing the size of allocations to investors who add value to the IPO process.

The results for offer price revisions are consistent with an information-based motivation for key investors' post-IPO holdings.[11] Offer prices adjust to key investors' future holdings and key investors' holdings strongly correlate with realized underpricing. Bookbuilding and information-revelation theories of underpricing rely on well-informed investors, and the data are consistent with key investors' possessing information that is valuable to the pricing

[11]Bubna and Prabhala (2011), Chiang et al. (2010) and Ljungqvist and Wilhelm (2002) also provide evidence consistent with investors' receiving rewards for information revelation during bookbuilding.

process. While these results are inconsistent with primarily agency-based motivations driving key investor allocations, they do not allow us to distinguish strongly between information production, value-add and laddering theories.

4.3 Post-IPO Abnormal Returns

The information-production hypothesis relies on key investors being informed prior to the IPO and being rewarded for revealing their information during bookbuilding. If key investors have valuable information, then it is likely they may continue to possess or generate information after the IPO. If this is the case, then their trading activity after the IPO may predict future returns. Finding a positive relation between future abnormal returns and trading would be consistent with the information-production hypothesis. A positive relation is also predicted by theories in which investors add value to the firm through their ownership. Whatever the value-proposition, investors' selling will be associated with the loss of value and possibly negative future returns.[12] While we cannot distinguish the information and value theories, the other hypotheses do predict abnormal returns following funds' trades.

To test for informed trading, we regress quarterly returns on investors' net trading in the prior quarter. Specifically, we measure the change in the number of initial investors (key and otherwise) who own the stock at the end of the quarter.[13] As the group of initial investors who received allocations does not change, the change in investors will be non-positive. Therefore, we expect that those firms who are sold by the most investors in the prior quarter will have worse abnormal returns going forward. Furthmore, we expect key investors' selling to be incrementally informative, so more sales by key investors are likely to lead to worse returns. We measure abnormal returns using cumulative abnormal returns and buy-and-hold abnormal returns using either a market-model or a four-factor model for

[12]The timing of the negative returns depends on when markets learn about value-adding investors' selling.

[13]Sias et al. (2006) shows that the change in number of institutions holding a stock are more related to contemporaneous returns than changes in the fraction of shares held by those institutions.

risk-adjustment. Table 7 presents the results.

Panels A and B of Table 7 show results using different measurements of abnormal returns. The results are generally consistent in the panels, so we focus on the results in Panel A. Column (1) shows that overall institutional selling is predictive of future abnormal returns, although the economic significance is small. For each investor who sells, the following quarter's return falls by 10 bps. Column (2) shows that the effect is concentrated with key investors, where per-investor-selling lowers quarterly returns by 70 bps. When key investors' selling is taken into account, other investors' selling is no longer predictive of returns. Columns (3) shows that key-investor flippers' sells are not related to future returns, while key-investor non-flippers' selling is associated with 120 bps lower returns.

The predictability of key investors' trades is suggestive of these investors' being informed. If key investors do have better information about IPO pricing, the strong relation to underpricing could be due to either allocations or post-IPO buying. In the case of allocations, underwriters may be using that information to price the offerings. For post-IPO buying, investors may be buying the IPOs that were underpriced and are expected to continue to outperform. If the later explanation is most relevant, we would expect to see that key investors' participation is positively related to first-quarter returns. To test this hypothesis, we consider a trading strategy that buys on the first-day of an IPO (at the close) and holds until the end of the quarter. If this is profitable, then key investors may simply be those who engage in this post-IPO, buy-and-hold strategy. Column (1) of Table 8 shows that such a strategy is not generally profitable. Column (2) shows that conditioning on underpricing does not improve the strategy's profitability. Moreover, Column (3) shows returns are not higher when more investors participate. However, if key investors have more information, they may be skilled at identifying the best stocks to buy after the IPO. Column (4) suggests this is not the case. First-quarter returns do not depend on the number of key investors participating. While not conclusive, this test suggests that the relation between key investors

and both underpricing and offer price revisions is due to their information being incorporated during bookbuilding.

4.4 13F Holdings as a Proxy for Allocations

The preceding results are consistent with key investors' providing information during bookbuilding or adding value to firms. Information-based theories of underpricing then predict that key investors are compensated for this information via underpriced shares. Because we do not observe allocations, we conduct several tests of the 13F holdings data. The tests are generally consistent with holdings' representing allocations, although we cannot rule out that our results are driven by post-IPO buying. We begin by comparing a limited sample of actual allocations to 13F holdings.

Ritter and Zhang (2007) analyze allocations data from 11 IPOs acquired through a Freedom of Information Act request.[14] Using the overlap between their allocations data and our sample, we compare 6 IPOs' actual allocations to reported 13F holdings at the end of the quarter. Table 9 provides summary statistics. Many allocations were made to individuals or foreign holders who do not report in 13F holdings. Despite this, 48% (64%) of the allocations (shares) match to funds that report in the 13F holdings data. However, only 19% (9.3% of all allocations) of those matches were also reported as holdings in the 13F data. The other 81% had apparently sold their shares by the end of the quarter. Selling is particularly prominent for new investors: key investors retain 44% of their allocations, non-key investors retain 13%, and new investors retain only 2%.

Another source of mis-attribution comes from funds that buy after the IPO and do not receive allocations. In the 6 IPOs, 42% of key investor allocations are added after the IPO, while 49% of total allocations are added after the IPO. For new investors, the vast majority (78%) are added after the IPO. While based on a small sample, this data suggests that we

[14]The data are available at https://site.warrington.ufl.edu/ritter/ipo-data/.

underestimate the number of each type of investor. Combining the measurement errors due to flipping and secondary-marketing buying, 13F holdings data underestimates the number of key investors by 23%, the number of non-key investors by 71% and the number of new investors by 93%. However, the correlations between the number of investors in the 13F holdings and the number receiving actual allocations are high. For all investors over the 6 IPOs, the series are 79% correlated. For key investors, the series are 85% correlated. These strong correlations suggests 13F holdings are picking up meaningful variation in investors' and key investors' allocations.

The allocations data also shows that key investors receive more shares and tend to buy additional shares after the IPO. Key investors on average receive 72K shares, while non-key investors receive 43K shares and new investors receive 20K shares. Both key and non-key investors tend to add to their positions after the IPO, doubling their holdings by the end of the year.

While our comparison suggests 13F holdings are a good proxy for allocations, several alternative explanations may result in key investors' being associated with underpriced IPOs. It is possible that holdings reflect systematic, secondary-market purchases of IPOs, particularly of hot IPOs. If key investors engage in this behavior more so than non-key investors, they would be associated with substantial underpricing due to their propensity to buy very underpriced stocks after the IPO and hold them until at least the end of the quarter. To test this possibility, we examine the relation between the number of investors and key investors holding shares at the end of the quarter and the time period between the IPO and the end of the quarter. IPOs that occur earlier in the quarter have more time for investors to purchase shares in the secondary market. Therefore, if key investors' post-IPO buying is driving our results, we would expect higher numbers of key investors for earlier IPOs relative to the number of non-key investors.

Table 10 shows that both the number of non-key investors and key investors increases

with the number of days remaining in the quarter. This is consistent with the allocations data in Table 9 showing a significant number of non-allocation, end-of-quarter holdings. Importantly, the number of key investors does not increase faster than the number of non-key investors. This is inconsistent with key investors' identification being due to post-IPO buying of hot IPOs. However, it does not rule out the possibility as key investors may be purchasing on the first day of the IPO, making within-quarter-timing irrelevant. Given our complimentary evidence, we believe it is more likely that key investors' holdings reflect allocations rather than post-IPO buying.

In IPO allocations, underwriters often favor past participants and may be attracted to certain investors based on fund characteristics (Binay et al., 2007). However, these same traits are less likely to influence secondary-market purchase decisions. Given that post-IPO buying is not a profitable strategy, it seems unlikely that key investors are clustering secondary-market purchases with specific underwriters and thereby establishing "relationships" where none exist. Based on this intuition, if past relationships in the holdings data and fund characteristics predict future holdings, then this is consistent with those holdings reflecting allocations. To test this hypothesis, we follow Brown (2015) in estimating a probit model of funds' end-of-quarter holdings. Using underwriter-investor relationship measures and fund-level controls, we estimate the probability that each investor reports holdings after each IPO. Table 11 reports marginal effects from the estimation results which are divided between new funds (who do not have history necessary for several variables) and established funds.

The results demonstrate the importance of underwriter-investor relationships in determining holdings. Interacting with the underwriter once or multiple times within the underwriters' last 10 IPOs leads to much higher probabilities of holdings, particularly for established funds.[15] Larger, older and more-frequently trading funds are also more likely to

[15]A similar measure is used in Gondat-Larralde and James (2008).

report holdings, as are key investors. Flippers are less likely to receive allocations, while key investors who are long-term holders are relatively likely to report holdings. This is consistent with underwriters' having distinct motivations for providing certain investors with allocations. Overall, that past holdings and fund characteristics predict investors' future holdings is consistent with allocations driving end-of-quarter holdings.

As a final test of holdings' ability to proxy for allocations, we compare expected levels of investor and key investor participation (based on the probit analysis) to realized levels. If holdings proxy for allocations, then we would expect a positive relation between the expected and realized levels of participation. However, if secondary-market buying is driving holdings, no particular relationship is clearly expected. We construct expectations using the probit estimation to form predicted probabilities of receiving allocations for each investor in each IPO. These probabilities are summed for each IPO, with separate sums for all investors and for key investors, giving $E[NumInstInvestors]$ and $E[NumKeyInvestors]$. The predicted values are correlated 61% and 69% with realized values. Regressing the realized values on predicted values also gives coefficient estimates near one and R^2 values of 36% and 47%, indicating that the constructed estimates are good predictors of the realized values.

Several other points are worth making. We may be failing to identify the most important key investors if they flip their most underpriced IPOs before the end of the quarter, leaving them identified as non-key investors. If this is the case, then in future IPOs, those investors should be associated with even more underpricing if they are the true information providers. This would increase the effect for all investors and diminish the relative effect for key investors, biasing tests against finding a difference. Therefore, this source of bias does not challenge our conclusions.

If key investors are conveying information to underwriters during bookbuilding, then it is likely that those investors are receiving allocations. For key investors to affect pricing, this need not be the case. For example, expressing interest to an underwriter may convey

information, but underwriters do not reward all who express interest with allocations. This expression of interest may also correlate with post-IPO buying, so again, we cannot conclude that our measure only represents allocations. However, it is unlikely that funds would continue to provide information were they not awarded with allocations from time to time. Given the theory and evidence, we believe it is more likely than not that our results are driven by allocations and not post-IPO buying.

4.5 Laddering

Post-IPO return patterns distinguish the laddering hypothesis from other hypotheses. In the laddering hypothesis, investors commit to purchase additional shares following the IPO as a condition for receiving an underpriced allocation. Therefore, laddering induces additional buying soon after the IPO, which is likely to add upward pressure on the price. However, after the underwriter's price support activities have ceased, investors can typically sell their entire position. This creates negative price pressure and laddering results in price reversion (negative correlation) in the months following the IPO.

To test for price reversion, we examine the frequency of IPOs that experience positive returns in the first quarter, which are subsequently reversed in the second quarter. If laddering is a major motivation for allocations or key investor allocations, then we would expect to see that investor participation or key investor participation is associated with a greater likelihood of price reversion. Table 12 shows that this is indeed the case. First, as predicted by Hao (2007), Column (1) shows that higher underpricing is associated with higher likelihoods of price reversions. Column (2) shows that much of this effect is explained by overall investor participation. However, including total investor participation and key investor participation, Column (3) shows that key investors drive the relation.

Laddering predicts a subsequent negative return due to selling after initially buying following the IPO. To further refine our tests, we use our classification of flipping and non-

flipping investors to compare those key investors who are *Flippers* to other key investors. We expect that any evidence of laddering will be strongest in the flipping sub-sample of key investors. Column (4) shows participation by key investor flippers is strongly related to price reversions. This result highlights the complexity of explaining underpricing. While the majority of key investors do not appear to engage in laddering, a subset does show evidence of laddering-related behavior. So while laddering is likely a factor in underpricing, we do not expect that it drives the majority of the relation between underpricing and key investor participation.

4.6 Economic Significance

Our prior analysis shows that key investors are an important part of the IPO pricing process. Table 13 shows that key investors are rewarded substantially for the role they play, receiving 45% of the total money left on the table in IPOs. Of this, only 5% accrues to key investors who frequently flip, consistent with the relative proportion of flippers in the group.

Interestingly, non-key investors make up the majority of allocations and receive the majority of money left on the table, despite the relatively minor effects they have on IPO pricing. If underpricing is being used to compensate key investors who provide information, why are non-key investors compensated? Given the existing evidence that underpricing benefits underwriters and investors at the expense of firms (e.g. Goldstein et al. (2011), Nimalendran et al. (2007), Reuter (2006), Ritter and Zhang (2007)), this result is unsurprising and confirms earlier findings. While key investors are important for determining IPO pricing, it appears a large portion of the economic value of underpricing goes to other investors. As a result, our analysis supports the role of information in determining underpricing, but does not rule out other explanations for underpricing, particularly those related to agency concerns.

5 Conclusion

We identify key investors based on their past IPO participation and show that their participation in future IPOs is highly predictive of underpricing and offer price revisions. A majority of key investors are likely compensated for information production or value-adding activities, and a minority are likely compensated for laddering. However, a majority of investors' benefits from underpricing accrue to non-key investors, leaving room for alternative theories of IPO underpricing.

Our analysis highlights the importance of a small group of institutional investors to the IPO process. These investors appear to aid in the price-formation process during and after the IPO, and may be beneficial to firms as part of their continuing ownership structure. Future research may identify other ways in which specific institutional investors add value to firms.

References

Agarwal, V., V. Fos, and W. Jiang (2013a): "Inferring Reporting-Related Biases in Hedge Fund Database from Hedge Fund Equity Holdings," *Management Science*, 59, 1271–1289.

Agarwal, V., W. Jiang, Y. Tang, and B. Yang (2013b): "Uncovering Hedge Fund Skill from the Portfolio Holdings They Hide," *Journal of Finance*, 68, 739–783.

Aggarwal, R. (2000): "Stabilization Activities by Underwriters after Initial Public Offerings," *Journal of Finance*, 55, 1075–1103.

Aggarwal, R., N. R. Prabhala, and M. Puri (2002a): "Institutional Allocation in Initial Public Offerings: Empirical Evidence," *The Journal of Finance*, 57, 1421–1442.

Aggarwal, R. K., L. Krigman, and K. L. Womack (2002b): "Strategic IPO Underpricing, Information Momentum, and Lockup Expiration Selling," *Journal of Financial Economics*, 66, 105–137.

Banerjee, S., R. S. Hansen, and E. Hrnjić (2009): "IPO Underpricing to Attract Buy-and-Hold Investors," *Working Paper*.

Benveniste, L. M. and P. A. Spindt (1989): "How Investment Bankers Determine the Offer Price and Allocation of New Issues," *Journal of Financial Economics*, 24, 343–361.

Binay, M. M., V. A. Gatchev, and C. A. Pirinsky (2007): "The Role of Underwriter-Investor Relationships in the IPO Process," *Journal of Financial and Quantitative Analysis*, 42, 785–810.

Booth, J. R. and L. Chua (1996): "Ownership Dispersion, Costly Information, and IPO Underpricing," *Journal of Financial Economics*, 41, 291–310.

Bradley, D. J. and B. D. Jordan (2002): "Partial Adjustment to Public Information and IPO Underpricing," *Journal of Financial and Quantitative Analysis*, 37, 595–616.

Brennan, M. and J. Franks (1997): "Underpricing, Ownership and Control in Initial Public Offerings of Equity Securities in the UK," *Journal of Financial Economics*, 45, 391–413.

Brown, D. (2015): "Investing in Security Price Informativeness: The Role of IPO Underpricing," *Working Paper*.

Bubna, A. and N. R. Prabhala (2011): "IPOs with and without Allocation Discretion: Empirical Evidence," *Journal of Financial Intermediation*, 20, 530–561.

Carter, R. and S. Manaster (1990): "Initial Public Offerings and Underwriter Reputation," *The Journal of Finance*, 45, 1045–1067.

Carter, R. B., F. H. Dark, and A. K. Singh (1998): "Underwriter Reputation, Initial Returns, and the Long-Run Performance of IPO Stocks," *The Journal of Finance*, 53, 285–311.

Chemmanur, T. J., G. Hu, and J. Huang (2010): "The Role of Institutional Investors in Initial Public Offerings," *The Review of Financial Studies*, 23, 4496–4540.

Chiang, Y.-M., Y. Qian, and A. E. Sherman (2010): "Endogenous Entry and Partial Adjustment in IPO Auctions: Are Institutional Investors Better Informed?" *The Review of Financial Studies*, 23, 1200–1230.

Cliff, M. T. and D. J. Denis (2004): "Do Initial Public Offering Firms Purchase Analyst Coverage with Underpricing?" *The Journal of Finance*, 59, 2871–2901.

Cornelli, F. and D. Goldreich (2001): "Bookbuilding and Strategic Allocation," *The Journal of Finance*, 56, 2337–2369.

Field, L. C. and J. M. Karpoff (2002): "Takeover Defenses of IPO Firms," *Journal of Finance*, 57, 1857–1889.

Field, L. C. and M. Lowry (2009): "Institutional versus Individual Investment in IPOs: The Importance of Firm Fundamentals," *Journal of Finanacial and Quantitative Analysis*, 44, 489–516.

Fjesme, S. L. (2015): "Initial Public Offering Allocations, Price Support, and Secondary Investors," *Working Paper*.

Goldstein, M. A., P. Irvine, and A. Puckett (2011): "Purchasing IPOs with Commissions," *Journal of Financial and Quantitative Analysis*, 46, 1193–1225.

Gondat-Larralde, C. and K. R. James (2008): "IPO Pricing and Share Allocation: The Importance of Being Ignorant," *The Journal of Finance*, 63, 449–478.

Hanley, K. W. (1993): "The Underpricing of Initial Public Offerings and the Partial Adjustment Phenomenon," *Journal of Financial Economics*, 34, 231–250.

Hanley, K. W. and W. J. Wilhelm, Jr. (1995): "Evidence on the Strategic Allocation of Initial Public Offerings," *Journal of Financial Economics*, 37, 239–257.

Hao, Q. (2007): "Laddering in initial public offerings," *Journal of Financial Economics*, 85, 102 – 122.

Hoberg, G. (2007): "The Underwriter Persistence Phenomenon," *The Journal of Finance*, 62, 1169–1206.

Holmstrom, B. and J. Tirole (1993): "Market Liquidity and Performance Monitoring," *Journal of Political Economy*, 101, 678–709.

Ibbotson, R. G., J. L. Sindelar, and J. R. Ritter (1975): "The Market's Problems with the Pricing of Initial Public Offerings," *Journal of Applied Corporate Finance*, 7, 66–74.

Jenkinson, T. and H. Jones (2004): "Bids and Allocations in European IPO Bookbuilding," *The Journal of Finance*, 59, 2309–2338.

Kang, A. and R. Lowery (2014): "The Pricing of IPO Services and Issues: Theory and Estimation," *Review of Corporate Finance Studies*, 2, 188–234.

Ljungqvist, A. P. (2007): *IPO underpricing in: Eckbo, B.E. (Ed.), Handbook of Corporate Finance: Empirical Corporate Finance*, North Holland.

Ljungqvist, A. P. and W. J. Wilhelm, Jr. (2002): "IPO Allocations: Discriminatory or Discretionary?" *Journal of Financial Economics*, 65, 167–201.

Loughran, T. and J. R. Ritter (2004): "Why Has IPO Underpricing Changed Over Time?" *Financial Management*, 15, 5–37.

Mello, A. S. and J. E. Parsons (1998): "Going Public and The Ownership Structure of The Firm," *Journal of Financial Economics*, 49, 79–109.

Nimalendran, M., J. R. Ritter, and D. Zhang (2007): "Do Today's Trades Affect Tomorrow's IPO Allocations?" *Journal of Financial Economics*, 84, 87–109.

Reuter, J. (2006): "Are IPO Allocations for Sale? Evidence from Mutual Funds," *The Journal of Finance*, 56, 2289–2324.

Ritter, J. R. (2011): "Equilibrium in the Initial Public Offerings Market," *Annual Review of Financial Economics*, 3, 347–374.

Ritter, J. R. and I. Welch (2002): "A Review of IPO Activity, Pricing, and Allocations," *The Journal of Finance*, 57, 1795–1828.

Ritter, J. R. and D. Zhang (2007): "Affiliated Mutual Funds and the Allocation of Initial Public Offerings," *Journal of Financial Economics*, 86, 337–368.

Rock, K. (1986): "Why New Issues Are Underpriced," *Journal of Financial Economics*, 15, 187–212.

Sherman, A. E. and S. Titman (2002): "Building the IPO Order Book: Underpricing and Participation Limits with Costly Information," *Journal of Financial Economics*, 65, 3–29.

Sias, R. W., L. T. Starks, and S. Titman (2006): "Changes in Institutional Ownership and Stock Returns: Assessment and Methodology," *The Journal of Business*, 79, 2869–2910.

Sibo, L. (2014): "Performance Persistence of Institutional Investors in IPO Market: Evidence from China," *Working Paper*.

Stoughton, N. M. and J. Zechner (1998): "IPO-mechanisms, Monitoring and Ownership Structure," *Journal of Financial Economics*, 49, 45–77.

Yan, X. S. and Z. Zhang (2009): "Institutional Investors and Equity Returns: Are Short-term Institutions Better Informed?" *The Review of Financial Studies*, 22, 893–924.

Zingales, L. (1995): "Insider Ownership and the Decision To Go Public," *The Review of Economic Studies*, 62, 425–448.

Appendix: Variable Definitions

AUM: Total dollar value of a fund's positions reported in the 13F filings data.

Churn: Measure of trading activity calculated following Yan and Zhang (2009).

ConcurrentIPOs: Number of IPOs issued in the same month as the IPO, as used in Ibbotson et al. (1975).

ConcurrentUnderpricing: Average underpricing of IPOs issued in the same month as the IPO, as used in Ibbotson et al. (1975).

DaysToQuarterEnd: The number of days between the IPO and the last day of the quarter.

Flipper: An indicator equal to one if an investor is in the top third of investors in the past year based on selling allocations in the quarter following the IPO.

FundAge: Number of years a fund has reported in the 13F filings data, starting in 1980.

LogAge: Natural logarithm of the firm's age at the time of the IPO based on founding dates from the Field-Ritter dataset used in Field and Karpoff (2002) and Loughran and Ritter (2004).

LogSize: Total dollar value of a fund's positions reported in the 13F filings data.

Holder: An indicator equal to one if an investor is in the top third of investors in the past year based on holding IPOs through the end of the fourth quarter following the IPO.

InvPrice: The inverse of the filing-range midpoint.

AvgIPOHoldTime: The average number of quarters before a fund reports no holdings in a firm for which it reported holdings in the quarter following the IPO.

KeyInvestor: An indicator variable equal to one if a fund reported holdings over the last year representing statistically abnormal underpricing.

MktReturn: Market return (CRSP value-weighted return) over the 15 trading days prior to the issue date.

MktStdDev: Standard deviation of market returns (CRSP value-weighted returns) over the

15 trading days prior to the issue date.

$MoneyLeft$: $Shares \times OfferPrice \times Underpricing$

$MultipleTimesRelationship$: An indicator variable equal to one if an investor participated in more than one of an underwriter's last ten offerings.

$NumInstInvestors$: The number of institutional investors participating in an offering.

E[$NumInstInvestors$]: The estimated number of institutional investors participating in an offering based on a probit estimation of allocation probabilities.

$\widehat{NumInstInvestors}$: Instrumented version of $NumInstInvestors$.

$NumKeyInvestors$: The number of institutional investors participating in an offering with $KeyInvestor = 1$.

$\widehat{NumKeyInvestors}$: Instrumented version of $NumKeyInvestors$.

E[$NumKeyInvestors$]: The estimated number of key institutional investors participating in an offering based on a probit estimation of allocation probabilities.

$NumKeyFlippers$: The number of key investors participating in an offering who are also classified as $Flippers$.

$NumKeyHolders$: The number of key investors participating in an offering who are also classified as $Holders$.

$NumKeyProducers$: The number of key investors participating in an offering who are also classified as $Producers$.

$OfferPriceRevision$: Percentage change from the midpoint of the first offer price range to the final offering price. The positive relationship between underpricing and offer price revisions was first documented by Hanley (1993).

$OneTimeRelationship$: An indicator variable equal to one if an investor participated in at least one of an underwriter's last ten offerings.

$OPR - Residuals$: The unexplained portion of offer price revision when regressing offer price revision on the other independent variables used to predict $Underpricing$.

Overhang: Shares held by the firm's initial investors divided by the shares issued in the IPO. Bradley and Jordan (2002) documents the importance of this measure.

PercentInst: Total holdings of institutions in the first reporting quarter divided by the number of shares issued. A similar measure (using more precise allocations data) is used in Ljungqvist and Wilhelm (2002).

Proceeds: Natural logarithm of the total IPO proceeds adjusted to year 2000 dollars.

Producer: An indicator equal to one if an investor is in the top third of investors in the past year based on significant position increases in the three quarters following the IPO.

Q1Return: The return from the closing price on the first day to the last day of the quarter of the IPO.

Q2Return: The return from the closing price on the last day of the quarter of the IPO to the closing price on the last day of the following quarter.

Shares: The number of shares reported by a fund in the 13F filings in the quarter following the IPO (proxy for allocations).

TechFirm: Indicator variable equal to one if the firm's SIC code is in a technology sector as defined by Cliff and Denis (2004).

Underpricing: The return from the IPO offer price to the price at the end of the first day of trading.

UnderwriterRank: Carter Manaster rank originated in Carter and Manaster (1990), and further updated in Carter et al. (1998) and Loughran and Ritter (2004). The data is taken from Jay Ritter's website.

UWshare: Market share of underwriters in past offerings.

UWpremium: Average abnormal underpricing for an underwriter over the five years preceding an IPO. This measure was first used by Hoberg (2007) as *UnderwriterPersistence*.

$VC-Backed$: Indicator variable equal to one if the firm is backed by a venture capital firm.

Table 2: Persistence of Key Investors. Key investors are in the top 10% of funds based on the average abnormal underpricing (relative to monthly averages) of IPOs they have participated in over the past year. Columns track years since an investor was classified as a key investor, and the rows track the percentage of investors classified in each decile in subsequent years. A lack of persistence would imply 11% of investors in each decile-year. The percentages of key investors in each year are significantly different (p-values less than 1%) from 11% for all ten years after initial classification.

	Years Since Initial Classification as Key Investor ($p < 0.001$)									
Thresholds	1	2	3	4	5	6	7	8	9	10
$p < 0.001$	43	28	26	26	28	29	31	24	17	21
$0.001 < p \leq 0.01$	18	17	17	19	19	20	16	11	14	20
$0.01 < p \leq 0.05$	19	23	23	22	26	23	25	24	29	28
$0.05 < p \leq 0.1$	6	11	12	10	8	8	7	11	9	9
$p \geq 0.1$	14	21	22	22	19	20	21	30	31	21
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 3: Fund Characteristics. Variable definitions are provided in the appendix. Robust t-statistics are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels.

	Key Investors	Non-Key Investors	Differences
AUM (billions)	\$33.3	\$11.5	\$21.8***
FundAge	50.4	39.5	10.9***
Churn	0.170	0.158	0.012*
Average *IPOHoldTime*	5.605	5.039	0.566***
Average *Held*	0.608	0.581	0.027***
Average *Produced*	0.276	0.236	0.04***
Average *Flipped*	0.194	0.208	-0.014***
Percent *Holder*	37.4%	33.3%	4.1%**
Percent *Producer*	43.3%	32.1%	11.2%***
Percent *Flipper*	18.8%	33.3%	-14.5%***
Percent Hedge Funds	17.4%	21.8%	-4.4%***
Observations	667	6,219	

Table 4: Key investor summary data. Investors are ranked based on the number of years, at the beginning of which, they are identified as being a key investor. AUM represents assets under management. The final column, average percentile, gives the average value of the abnormal underpricing percentile calculated as of the beginning of each year. Only funds identified as key investors for at least 6 years are provided in the main body of the table.

Fund Name	Num Years $KeyInv = 1$	Num Years in Sample	Number of Allocations	AUM (billions)
Most Frequent Key Investors:				
ESSEX INVESTMENT MANAGEMENT CO	16	29	1,213	$1.5
FIDELITY MANAGEMENT & RESEARCH	13	20	1,958	$418.0
PUTNAM INVESTMENT MANAGEMENT	12	29	1,404	$33.0
TURNER INVESTMENT PARTNERS, IN	10	19	618	$15.8
JANUS CAPITAL CORP	9	24	834	$99.2
MASS FINANCIAL SERV CO	9	28	1,444	$87.7
TCW ASSET MANAGEMENT COMPANY	9	24	914	$22.7
DEUTSCHE BANK	8	30	1,721	$153.0
DENVER INVESTMENT ADVR LLC	8	14	820	$3.8
AXA FINANCIAL, INC.	8	30	1,296	$146.0
PROVIDENT INV COUNSEL	8	26	659	$2.9
AMERINDO INVESTMENT ADVR	7	11	169	$6.6
DUNCAN-HURST CAP MGMT	7	16	602	$0.7
AMERICAN EXP FINANCIAL ADVR	7	25	1,154	$130.0
MELLON BANK CORPORATION	7	28	1,465	$179.0
MORGAN STANLEY D WITTER	7	24	1,199	$140.0
NICHOLAS-APPLEGATE CAP MGMT	7	17	1,256	$16.4
DRIEHAUS CAPITAL MANAGEMENT, I	6	18	280	$1.6
AMERICAN CENT COS	6	23	586	$47.9
NORTHERN TRUST CO	6	26	774	$189.0
OPPENHEIMER MGMT CORP	6	21	1,067	$49.3
LIBERTY RIDGE CAPITAL, INC.	6	18	376	$0.5
BLACKROCK FINL MGMT (SSR&M)	6	22	1,069	$17.8
STRONG CAPITAL MANAGEMENT, INC	6	21	901	$15.0
CITIGROUP INC	6	17	1,136	$37.7
THE VANGUARD GROUP	6	14	1,015	$502.0
WADDELL & REED FINANCIAL, INC.	6	23	570	$34.4
A I M MGMT GROUP INC	5	12	931	$58.6
FRED ALGER MANAGEMENT, INC.	5	19	379	$13.7
BERGER ASSOCIATES INC	5	11	351	$8.1
DREYFUS CORP	5	14	357	$4.6
FORTIS ADVISERS INC	5	9	238	$6.2
FRANKLIN RESOURCES INC	5	19	691	$136.0
GILDER GAGNON HOWE & CO LLC	5	11	252	$4.9
HUSIC CAPITAL MANAGEMENT	5	17	518	$0.4
INVESTMENT ADVISERS INC	5	18	420	$0.3
JUNDT ASSOCIATES INC.	5	16	189	$0.1
LORD ABBETT & CO	5	23	457	$43.4
J. P. MORGAN INVT MGMT (US)	5	30	1,509	$200.0
PRICE T ROWE ASSOCIATE	5	28	834	$222.0

Table 5: Regressions of underpricing on the number of participating key investors and control variables common to the IPO literature. Variable definitions are provided in the appendix. Robust t-statistics are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels.

	Underpricing			
	(1)	(2)	(3)	(4)
NumKeyInvestors	0.029***		0.021***	0.021***
	(30.299)		(17.988)	(13.639)
NumKeyFlippers				0.000
				(0.040)
LogAge		-0.015***	-0.010***	-0.010***
		(-4.857)	(-3.522)	(-3.522)
LogSize		-0.083***	-0.055***	-0.055***
		(-9.839)	(-7.249)	(-7.249)
VC-Backed		0.026***	0.016**	0.016**
		(3.254)	(2.150)	(2.152)
TechFirm		0.021**	0.015*	0.015*
		(2.371)	(1.715)	(1.702)
InvPrice		0.484***	0.522***	0.522***
		(2.672)	(3.091)	(3.088)
Overhang		0.026***	0.021***	0.021***
		(9.752)	(8.382)	(8.383)
UWpremium		0.094*	0.036	0.036
		(1.822)	(0.739)	(0.739)
UnderwriterRank		0.008***	0.000	0.000
		(2.804)	(0.014)	(0.012)
UWshare		0.132	0.098	0.098
		(1.596)	(1.278)	(1.281)
ConcurrentIPOs		-0.000	-0.001***	-0.001***
		(-0.760)	(-3.472)	(-3.466)
ConcurrentUnderpricing		0.004***	0.004***	0.004***
		(6.838)	(6.466)	(6.463)
MarketReturn		4.966**	5.230**	5.225**
		(2.102)	(2.353)	(2.350)
MarketStdDev		1.657	1.898	1.900
		(1.095)	(1.322)	(1.319)
PercentInst		-0.010	-0.029	-0.029
		(-0.524)	(-1.615)	(-1.607)
NumInstInvestors		0.005***	0.000	0.000
		(10.939)	(0.651)	(0.651)
OfferPriceRevision		0.732***	0.559***	0.559***
		(19.863)	(15.068)	(15.046)
Year Dummies	No	Yes	Yes	Yes
R^2	0.417	0.558	0.608	0.608
Observations	4,938	4,938	4,938	4,938

Table 6: Regressions of offer price revisions on the number of participating key investors and control variables common to the IPO literature. Variable definitions are provided in the appendix. Robust t-statistics are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels.

	OfferPriceRevision			
	(1)	(2)	(3)	(4)
NumKeyInvestors	0.013***		0.009***	0.009***
	(37.302)		(17.509)	(11.709)
NumKeyFlippers				0.004*
				(1.655)
LogAge		-0.015***	-0.012***	-0.012***
		(-8.219)	(-6.650)	(-6.598)
LogSize		-0.081***	-0.063***	-0.063***
		(-18.747)	(-14.719)	(-14.750)
VC-Backed		0.013***	0.008*	0.008*
		(2.842)	(1.770)	(1.755)
TechFirm		0.033***	0.027***	0.027***
		(6.926)	(6.034)	(5.940)
InvPrice		-3.476***	-3.191***	-3.185***
		(-37.052)	(-34.970)	(-34.938)
Overhang		0.004***	0.002	0.002
		(3.374)	(1.585)	(1.581)
UWpremium		0.171***	0.132***	0.130***
		(6.901)	(5.641)	(5.573)
UnderwriterRank		-0.022***	-0.024***	-0.024***
		(-13.292)	(-15.048)	(-15.097)
UWshare		0.229***	0.196***	0.199***
		(4.643)	(4.125)	(4.185)
ConcurrentIPOs		0.000**	-0.000	-0.000
		(2.072)	(-0.271)	(-0.171)
ConcurrentUnderpricing		0.003***	0.002***	0.002***
		(11.423)	(10.240)	(10.185)
MarketReturn		-0.721	-0.548	-0.633
		(-0.604)	(-0.477)	(-0.549)
MarketStdDev		-2.727***	-2.409***	-2.361***
		(-3.017)	(-2.751)	(-2.697)
PercentInst		-0.120***	-0.120***	-0.118***
		(-13.011)	(-13.497)	(-13.377)
NumInstInvestors		0.005***	0.002***	0.002***
		(23.862)	(10.215)	(10.244)
Year Dummies	No	Yes	Yes	Yes
R^2	0.302	0.521	0.558	0.559
Observations	4,938	4,938	4,938	4,938

Table 7: 3-Month Abnormal Returns following quarterly 13F holdings changes. Panel A presents cumulative 4-factor abnormal returns and Panel B presents buy-and-hold 4-factor abnormal returns. ΔX measures the change in the number of investors of type X holding shares over the prior quarter. Returns do not incorporate reporting delays in 13F filings and instead take positions at the beginning of each quarter. Variable definitions are provided in the appendix. Robust t-statistics are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels.

Panel A			
	Four-Factor CARs		
	(1)	(2)	(3)
Δ *NumInstInv*	0.001*	-0.001*	-0.001
	(1.939)	(-1.660)	(-1.522)
Δ *NumKeyInv*		0.007***	0.012***
		(4.312)	(4.139)
Δ *NumKeyFlippers*			-0.010**
			(-1.994)
Observations	4,879	4,879	4,879
Panel B			
	Four-Factor BHARs		
	(1)	(2)	(3)
Δ *NumInstInv*	0.001**	-0.001	-0.001
	(2.074)	(-1.429)	(-1.372)
Δ *NumKeyInv*		0.007***	0.009***
		(4.121)	(3.053)
Δ *NumKeyFlippers*			-0.004
			(-0.795)
Observations	4,879	4,879	4,879

Table 8: First-quarter (from close-of-first-day to end-of-quarter) average-daily returns for IPO stocks. The average daily return is expressed as a percentage. The sample size is reduced due to a number of IPOs that occur on the last day of the quarter. Variable definitions are provided in the appendix. Robust t-statistics are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels.

	% Return From First-Day Close To Quarter End			
	(1)	(2)	(3)	(4)
Underpricing		0.566		
		(1.046)		
NumInstInvestors			0.006	
			(1.061)	
NumKeyInvestors				0.028
				(1.625)
Constant	-0.294**	-0.325**	-0.541**	-0.389**
	(-2.104)	(-2.424)	(-1.991)	(-2.530)
Year Dummies	Yes	Yes	Yes	Yes
R^2	0.024	0.025	0.025	0.025
Observations	4,877	4,877	4,877	4,877

Table 9: Comparison of 13F holdings to actual allocations in 6 IPOs. Non-key investors are those who have had at least 4 IPO allocations in the past year, but without statistically significant average abnormal underpricing. New funds are those with fewer than 4 IPOs over the past year.

	Investors			
	Key	Non-Key	New	Total
Actual Allocations				1,395
Matched to 13F Funds	178	371	122	671
Matched to Holdings	79	49	2	130
13F Holdings				
Non-Allocations	58	59	7	124
Total Reported 13F Holdings	137	108	9	254
Correlations	85%	58%	19%	79%
Avg. Shares Received	70,174	44,521	19,516	
Avg. Post-IPO Trading	100%	100%	0%	

Table 10: Relations between number of days from the IPO to the end of the quarter and the number of key investors and non-key investors reporting holdings in the 13F filings. Robust t-statistics are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels.

	(1) *NumKeyInvestors*	(2) *NumNonKeyInvestors*	(3) $\frac{NumKeyInvestors}{NumNonKeyInvestors}$
DaysToQuarterEnd	0.014***	0.039***	0.036
	(3.863)	(5.336)	(1.318)
Constant	2.553**	37.686***	7.304**
	(2.214)	(6.216)	(2.088)
Year Dummies	Yes	Yes	Yes
R^2	0.387	0.263	0.343
Observations	4,938	4,938	4,938

Table 11: Probit analysis predicing end-of-quarter holdings. Established funds are those having sufficient data over the last five years to calculate post-IPO buying, long-term holding and flipping measures. New funds are those with insufficient data history. Variable definitions are provided in the appendix. Robust t-statistics are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels.

	(1) New Funds	(2) Established Funds
Churn	-0.001*	0.008***
	(-1.686)	(3.624)
AUM	0.000***	0.000***
	(18.942)	(22.800)
FundAge	-0.000***	0.000***
	(-19.626)	(5.786)
NumPositions	0.000***	0.000***
	(36.087)	(43.203)
OneTimeRelationship	0.010***	0.051***
	(45.851)	(61.872)
MultipleTimesRelationship	0.019***	0.098***
	(50.900)	(85.793)
KeyInvestor	0.007***	0.053***
	(8.202)	(13.536)
KeyInv × *Churn*	0.008***	0.017***
	(3.745)	(3.097)
KeyInv × *AUM*	-0.000***	-0.000
	(-4.976)	(-0.748)
KeyInv × *FundAge*	0.000	-0.000***
	(0.398)	(-3.507)
KeyInv × *NumPositions*	-0.000**	-0.000***
	(-1.972)	(-5.033)
KeyInv × *OneTimeRel*	0.000	-0.001
	(0.015)	(-0.895)
KeyInv × *MultTimesRel*	-0.002***	0.004***
	(-3.012)	(2.632)
AvgPostIPOBuying		0.024***
		(14.468)
AvgLongHolder		-0.000
		(-0.271)
AvgFlipper		0.001
		(0.355)
KeyInv × *AvgLongHolder*		0.011**
		(2.460)
KeyInv × *AvgFlipper*		-0.013***
		(-2.804)
KeyInv × *AvgPostIPOBuying*		-0.041***
		(-9.586)
Pseudo-R^2	0.1092	0.1562
Observations	3,527,396	1,188,442

Table 12: Probit analysis predicting positive first quarter returns followed by negative second quarter returns, a return pattern that is consistent with laddering. Variable definitions are provided in the appendix. Robust t-statistics are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% levels.

	$Q1Return > 0$ and $Q2Return < 0$			
	(1)	(2)	(3)	(4)
Underpricing	0.086**	0.024	-0.054	-0.107**
	(2.142)	(0.576)	(-1.052)	(-2.002)
NumInstInvestors		0.004***	0.002*	0.002*
		(4.162)	(1.652)	(1.950)
NumKeyInvestors			0.010***	-0.002
			(2.744)	(-0.370)
NumKeyFlippers				0.073***
				(4.720)
Constant	-0.630***	-0.720***	-0.721***	-0.721***
	(-30.040)	(-23.708)	(-23.639)	(-23.577)
Pseudo-R^2	0.001	0.004	0.005	0.009
Observations	4,938	4,938	4,938	4,938

Table 13: Summary statistics of underpricing, end-of-quarter holdings (our proxy for allocations) and holdings-implied money left on the table to different classifications of investors. Key investors are in the top 10% of funds based on the average abnormal underpricing (relative to monthly averages) of IPOs they have participated in over the past year. Start-of-year measures are used to relate key investors from one year to the next. New funds are those with fewer than 4 IPOs over the past year.

	Key Investors				
	Flippers	Non-Flippers	Total Key Investors	Non-Key Investors	New Investors
Average Underpricing	67%	55%	57%	23%	18%
Average Shares Held	132,134	193,053	186,271	177,379	353,065
Average MoneyLeft	$1,262,091	$1,354,308	$1,344,042	$482,412	$991,599
Observations	3,919	31,284	35,203	86,401	16,168
(percent)	3%	23%	26%	63%	12%
Total Money Left ($B)	$4.9	$42.4	$47.3	$41.7	$16.0
(percent)	5%	40%	45%	40%	15%