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Order Flow Patterns around Seasoned Equity Offerings and their Implications for Stock Price Movements

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Abstract

Order Flow Patterns around Seasoned Equity Offerings and their Implications for Stock Price Movements

In this study, we employ order imbalance measures to provide evidence that there exists an individual/institutional dichotomy in reactions to seasoned equity offerings (SEOs). The evidence supports the notion that small, possibly naïve, individual investors keep trading SEO stocks aggressively while the returns of these stocks reverse in the post-issue period. Investors appear to be tardy in adjusting their overoptimism, and their trades systematically lag the return response. It appears to take more than two years for small individual investors to adequately revise their overoptimistic views. Consequently, the SEO portfolios that individual investors buy on net strongly underperform relative to the size-matching nonissuer portfolios as well as to the SEO portfolios that institutional investors buy on net in the post-issue period.

I. INTRODUCTION

The issue of underperformance in stock returns and operating profits after initial public offerings (IPOs) or seasoned equity offerings (SEOs) has been the focus of several well-known papers [see Ritter (1991), Loughran and Ritter (1995), Spiess and Affleck-Graves (1995), Lee (1997), and Loughran and Ritter (1997)]. For example, Loughran and Ritter (1995) find that companies issuing stock (both IPOs and SEOs) during 1970-1990 significantly underperform relative to nonissuing firms for 5 years after the offerings. These studies all suggest that managers take advantage of overvaluation in the IPO and SEO markets. Brav and Gompers (1997) raise an issue about IPO underperformance, arguing that the underperformance is not an IPO effect but a characteristic of small, low book-to-market firms. Schultz (2003) shows that if more firms go public after stock prices have risen, event-time analyses are likely to exhibit poor performance of IPO firms, suggesting that the underperformance is not surprising. Gompers and Lerner (2003) document by using a pre-Nasdaq IPO sample that the underperformance of IPOs is sensitive to the method of return measurement.

In the literature on performance after IPOs or SEOs mentioned above, however, the debate has naturally focused on returns or accounting performance, while trading activity around these events has not been examined. As argued in Chordia, Huh, and Subrahmanyam (2003), studies on trading activity are essential to a deeper understanding of economic interactions in financial markets. By exploring the behavior of trading activity measures around corporate events, we can potentially obtain a better understanding of sources of return dynamics around the events.

Within a broader context, voluminous research has been devoted to understanding the association between stock returns and trading activity [e.g., Karpoff (1987), Gallant, Rossi, Tauchen (1992), Hiemstra and Jones (1994), and Lo and Wang (2000)]. In this literature, trading activity has been mostly proxied by an unsigned activity measure, or volume. However, signed returns are more closely linked to trading activity through a signed measure (order imbalances), rather than an unsigned measure (volume).

Order imbalance has recently caught many researchers' attention as one of the most important variables in explaining exchange rate movements. For example, Evans and Lyons (2002) show that daily DM/\$ exchange rate changes are surprisingly well explained by order imbalances, with the R^2 reaching as high as 60% in the regressions. In stock

markets, however, there have been relatively fewer lines of research using order imbalances. Obviously, it is a formidable task to assign hundreds of millions of transactions to either buyer-initiated or seller-initiated categories. For this reason, the scope of existing literature analyzing order imbalances is limited only to specific agents, a narrow range of stocks, OTC markets, or a short period of time [for various aspects relating to institutional investors, see Kraus and Stoll (1972), Lakonishok, Shleifer, and Vishny (1992), Wermers (1999), and Sias (1997); for studies using 20-30 stocks, see Brown et al. (1997), and Hasbrouck and Seppi (2001); for a study on the NASDAQ, see Griffin et al. (2003); and for analyses over a short periods of time, see Lauterbach and Ben-Zion (1993), Blume, MacKinlay, and Terker (1989), Stoll (2000), and Chan and Fong (2000)]. Only recently have studies investigating aggregate and individual order imbalances using broader and longer series of data appeared. Among them are: Chordia, Roll, and Subrahmanyam (2002), Chordia and Subrahmanyam (2003), and Subrahmanyam (2003).

With regard to corporate events, Lee (1992) investigates order imbalances around earnings announcements for 230 NYSE firms during the 253 trading days of 1988. He finds that individual investors differ from institutional investors in their reactions to the same earnings news. Other than his short-horizon study, however, there appears to be a dearth of literature on how order flows react to corporate events such as initial public offerings, seasoned equity offerings, M&As, earnings announcements, stock splits, repurchases, and so on.

Recently, Chordia, Huh, and Subrahmanyam (2003) analyze the cross-sectional aspects of trading activity for NYSE/AMEX and NASDAQ firms using comprehensive datasets over a 38-year period (1964-2001). Their study focuses more on three unsigned trading activity measures (turnover, share volume, and dollar volume), although the determinants of order imbalances are also discussed. The present study focuses more on signed activity measures and their association with price movements, specifically in relation to a significant corporate event in capital markets: seasoned equity offerings (SEOs). Our primary goal in this study is to shed some light on how order imbalances and returns are characterized around SEOs.

We attempt to answer the following questions in this study: What are the typical patterns of order imbalances around SEOs? Are patterns in the SEO portfolio different from those of a benchmark portfolio? Do order imbalances necessarily represent price pressure in both the time series and the cross section around SEOs? Is there any difference

in the OIMB-return relations caused by new equity offerings? If different, who induces the deviation and why does it occur? Given the return reversal after SEOs, who causes the correction in returns in the post-issue period? And, is there any difference in return performance between the SEO portfolios that individual investors aggressively buy and the SEO portfolios that institutions aggressively buy in the post-SEO period?

To our knowledge, this is the first study to investigate patterns of daily/monthly order imbalances around SEOs and their concomitant return implications using a long time-series (1988-1998). There are a few reasons for why there is merit to investigating the order flow-return relation specifically in the context of SEOs. For example, if the relation in this setting is very different from that in a general setting, it could imply the existence of informational asymmetry or behavioral biases among investors. Thus, if high levels of order imbalances are observed immediately *before* any corporate news announcements, this provides evidence of information leakage or insider trading. Similarly, if high levels of imbalances emerge *after* the event, this enables us to gain some insights into how quickly traders adjust to new equilibrium prices. In case of IPOs, we cannot examine the trading activity before the event. In addition, trading activity after IPOs is affected by the first-time listing issues, for example, a lockup period. SEOs allow us to compare the investor reactions before the event with those after the event. Moreover, to minimize dilution effects, managers have greater incentives to time SEOs than to time other corporate events such as stock splits. Stock splits also are likely to be contaminated by liquidity-related issues. In this sense, SEOs are the best corporate event around which order flow patterns might reveal some interesting features of investor reactions.

In this study, we uncover some interesting features regarding trading activity in the portfolio of stocks experiencing an SEO. In particular, we find that there exists an individual/institutional dichotomy in reactions to seasoned equity offerings. The evidence supports the notion that small, possibly naïve, individual investors keep trading SEO stocks aggressively while their returns reverse in the post-issue period. The results also indicate that it is the large, more sophisticated institutional investors that cause the correction in returns after the offerings. Small individual investors appear to be tardy in adjusting their overoptimism, and systematically lag the return response. Consequently, the SEO portfolios which individual investors aggressively buy on net strongly underperform relative to the size-matching nonissuer portfolios as well as to the SEO portfolios which institutional investors buy on net in the post-issue period. This evidence indi-

cates that individual investors on average adopt strategies that are dominated by those of institutional investors in SEO stocks following the offerings.

The remainder of this paper is organized as follows. In the next section, the data, sample selection, and definitions of variables are described. In Section III, we examine the patterns of order flows and other key variables around SEOs. Section IV investigates how order imbalances and returns are related around SEOs, providing evidence of a “delink” between trade-number imbalances and returns in the post-SEO period. In Section V, we explore who induces the delink (institutions vs. individuals). Section VI provides possible explanations why the individual/institutional dichotomy exists in their reactions to SEOs. Section VII summarizes and concludes.

II. DATA, SAMPLE SELECTION, AND DEFINITIONS

A. Order Imbalance Data

For this study, we use an extensive range of databases. First, order imbalance (OIMBs) data are used for NYSE-listed stocks over the sample period of 11 years (1988-1998).¹ The data are originally estimated by the Lee and Ready (1991) algorithm using transactions data from the Institute for the Study of Securities Markets (ISSM) and the NYSE Trades and Automated Quotations (TAQ) databases. Only NYSE stocks are included in the sample. Following Lee and Ready (1991), any quote less than five seconds prior to the trade is ignored and the first one at least five seconds prior to the trade is retained. Then the transactions data are signed as follows. If a transaction occurs above the prevailing quote mid-point, it is regarded as buyer-initiated and *vice versa*. If a transaction occurs exactly at the quote mid-point, it is signed using the previous transaction price according to the tick test: buyer-initiated if the sign of the last non-zero price change is positive, and *vice versa*. One noteworthy point is that generally, only market orders are signed in the sample. Therefore, order imbalances measure the aggregate demand of agents who require immediacy in trading. That is, any imbalances caused by submitters of market orders who have relatively urgent needs are accommodated by more patient market makers, who

¹For details on the OIMB data, see Chordia, Roll, and Subrahmanyam (2001).

include standing order traders, limit order traders, and specialists.²

With the signed transaction database available, now we define two order imbalance measures as follows:

NOIMB: A scaled measure of order imbalances in the number of trades. That is, buyer-initiated trades minus seller-initiated trades divided by the sum of the two types of trades. Since this metric counts only the frequency of trades, it ignores the information content of the trade size, leading to the effect of weighting smaller trades more heavily than it would otherwise do. Therefore, NOIMB is more likely to pick up the trading behavior of small traders.

DOIMB: A scaled measure of order imbalances in dollar value, similarly defined as buyer-initiated dollar volume minus seller-initiated dollar volume divided by the sum of the two. This metric measures the information content of the size of trades as well as of the frequency of trades. Thus DOIMB is more likely to reflect the trading behavior of large traders.

Order imbalances are scaled by the total number of trades or by the total dollar volume to eliminate the impact of total unsigned trading activity, since more actively traded stocks in terms of the number of trades or dollar trading volume are likely to have higher order imbalances. By defining the different measures as above and comparing the two results from them, we expect to garner more insights on the differential behavior of small vs. large traders.

B. SEO Data

Next, the seasoned equity offerings (SEOs) data are extracted from the SDC Platinum database. In the sample, SEOs conducted by closed-end funds and REITs are excluded.³ To survive in our sample, SEOs are required to overlap with the OIMB data. Moreover, because the event window at a daily horizon is 120 trading days and that at a monthly

²Assuming that specialists maintain on average constant inventories, the excess of buyer-initiated market orders over seller-initiated market orders is absorbed by standing-order and limit-order traders.

³In some studies on the return underperformance after IPOs or SEOs, utility companies are excluded from the consideration that the utility industry is heavily regulated and so SEOs by utility firms are not assumed to have typical informational asymmetry problems existent in other operating companies. Since our primary concern is trading activity (order flow patterns) around SEOs, in our sample we retain SEOs conducted by utility companies.

horizon is 36 months surrounding the event date,⁴ We use only the sample of SEOs issued by NYSE-listed firms over a subset of the 11-year period: i.e., July 1988 - June 1998 for the daily sample, and January 1989 - December 1997 for the monthly sample. For the analysis at a monthly horizon, SEOs issued during the 3 years at each end of the whole sample period (1988-1998) were initially intended to be expunged from the sample. In that case, however, our sample size at a monthly horizon is significantly reduced. Therefore, SEOs offered during 1989-1990 and 1996-1997 are retained. This means that when the OIMB and other datasets are aligned around the event dates, part of the time series associated with such SEOs are truncated in the monthly event window. SEOs repeated by the same firm within the monthly event window are eliminated to minimize potentially misleading effects on our results.

In the end, 521 SEOs in the daily sample and 408 SEOs in the monthly sample remain, as shown in Panel A of Table I.⁵ In our daily sample, the average amount of proceeds and the mean number of issues from SEOs are \$139.27 million and 4.71 million shares, respectively [see Panel B of Table I]. The mean size of SEOs defined by the ratio of proceeds to the market value at day -1 (SSEO1) is 15.69% and that defined by a ratio of new issues to the total number of shares outstanding at day -1 (SSEO2) is 16.05%. Panel C in the table also shows that equity offerings are from a broad range of industries, with SEOs issued by electric, gas, water, and sanitary services (14.0%), financial and holding companies (11.5%), advertising, business services, and other services (9.4%), and retail (8.8%) being the ones most frequently observed in our sample.

C. Other Data

In addition to the two databases above, we use the CRSP daily and monthly files to obtain turnover (TURN), returns (RET), split- and stock dividend-adjusted prices (ADJP),⁶ and market values (MV: price times the number of shares outstanding). The book-to-market ratio (BTM) is constructed by dividing the book value by the market value, where the

⁴In this study, the *event date* means the “issue date” in the SDC Platinum database, which is also the same as the *offer date*, as opposed to the *announcement date* or *filing date* of an SEO.

⁵Note that the numbers of observations used in various computations are smaller than the total number of SEOs (daily 521, and monthly 408) because of missing values in the datasets as well as the truncation in the monthly event window.

⁶To calculate the split- and stock dividend-adjusted price (ADJP) from the CRSP, price (PRC) is divided by CFACPR (cumulative factor to adjust price).

book value is the sum of common equity, deferred tax, and investment tax credit from the CRSP/Compustat Merged (CCM) file. The institutional ownership (IO) data comes from Standard & Poor's. This IO variable is available for 1980-1998, but only on an annual basis. The number of analysts following a firm (NOANA) is extracted from the I/B/E/S database through the Wharton Research Data Services (WRDS).

III. PATTERNS OF ORDER FLOWS, TURNOVER, AND PRICE MOVEMENTS AROUND SEO'S

For this study, we match the datasets of the chosen variables (i.e., NOIMB, DOIMB, RET, TURN, ADJP, MV, IO, and NOANA) with the SEO dataset using the company identification numbers as well as the offer dates. The process of assigning the values of those variables to our SEO sample firms is as follows.

For each SEO firm, its values of each variable at daily or monthly levels are aligned around the offer (issue) date of the SEO over the two event windows of 241 trading days and 73 months.⁷ Having assigned the values of each variable around the offer dates for the issuer firms (SEO portfolio), we then form two benchmark portfolios for comparison purposes: one based on size (MV), and the other based on the book-to-market ratio (BTM). That is, for each SEO firm, one firm with a similar market value is selected from the set of non-issuer firms by comparing the market values as of the year-end prior to the offer date. If a non-issuer firm that has the identical MV is not found, which is mostly the case, then a firm with an MV closest to but slightly *higher* than that of the issuer is picked. As indicated, for a firm to be eligible as an MV-matching firm, first it should not offer equity issues within the event window *and* then should have the OIMB data over the event window. If a non-issuer candidate as a size-matching firm with a slightly higher MV does not happen to have the OIMB data, then a firm with the closest but slightly

⁷That is, the daily event window includes 120 trading days before and after the offer date, and the monthly window includes 36 months before and after the event month. The reason that we use two types of event windows is the following. First, we wish to take a close look at the patterns of trading activity in a higher frequency setting on the occasion of the corporate events (SEOs). Therefore, an interval of 120 trading days (equivalent to about 6 months) around the event is adopted. Second, return performance associated with SEOs is of interest, and most existing literature examines it at 3-5 year horizons. Thus, we choose 36 months (3 years) before and after the event for comparison purposes with existing results. Also note that for IO and NOANA, a 7-year window (3 years before and after the SEO year) is used because those data are available on an annual basis.

lower MV is chosen. The same process is applied to the formation of a BTM-matching benchmark portfolio. Once the MV- and BTM-matching firms are selected, then their own values for the above key variables (NOIMB, DOIMB, RET, TURN, ADJP, MV, IO, and NOANA) are obtained from relevant databases at daily and monthly levels. These values are again assigned to each firm of these two benchmark portfolios around the same offer date as in the SEO portfolio.

A. Descriptive Statistics for the SEO Firms

The above processes enable us to examine how our key variables for the SEO firms are characterized. For comparison purposes, we check the descriptive statistics by (sub)period. The results are exhibited in Table II. (More detailed statistics are also presented in Panel A of Tables IIIa and IIIb.) To obtain the values of each variable in Table II (and Table III), equally weighted averages across all the sample SEOs are calculated at each day or month. Then, if an interval includes more than a single trading day or month, the mean value of those averages are computed over the interval.

First, we look at the two variables of special interest at a daily horizon: NOIMB and DOIMB. In Panel A, the average values of daily NOIMB and DOIMB over the whole period are 2.69% and 2.76%, respectively. The values in the pre- and post-event periods are different but still both remain highly positive, while those values at the event day are highly negative (−4.81% and −2.36%). Chordia and Subrahmanyam (2003) document that for the sample of 1,322 NYSE stocks over the 11-year period, the average of daily NOIMB is −1.72% and that of daily DOIMB is −0.54%.⁸ That is, on average there are more trading days with large seller-initiated trades than with large buyer-initiated trades. A simple comparison of the sign and magnitude of these values with our results suggests that on the occasion of a corporate event (SEOs), trades continue to be strongly buyer-initiated for a certain period of time even after equity offerings, except that trading days near the offer date face large seller-initiated trades. Also noticeable is that NOIMB is less volatile over time but remains at a far higher level in the post-event period.

To visualize these features, we plot the daily time series in Figures 1(A), and 2(A). Figure 1(A), for example, confirms the above observations: both imbalance measures are well above the x-axis; NOIMB, albeit less volatile, remains much higher after day 30

⁸In their paper, the same OIMB database is used as in this study.

than DOIMB; in the period of day 0 to day 10, the SEO firms experience huge seller-initiated trades. In particular, NOIMB and DOIMB at day 1 are -19.02% and -11.72% , respectively [see Panel A of Table IIIa]. These highly negative OIMBs, albeit dramatic, seem natural, considering large selling activities at day 1.⁹

Next, we consider other variables of interest in Table II. The average daily return (RET) in the pre-event period is 0.20% , but that in the post-event period is only 0.05% . This fact is consistent with the extant literature on the return outperformance before SEOs and underperformance after the issuance. We observe an interesting feature in Figure 1(A) and Panel A of Table IIIa. Daily returns turn lower from about day -35 . We interpret this as an announcement effect.¹⁰ But returns are highly positive immediately after the event, e.g., at days 1 and 2, where order imbalances are most negative. It is interesting that the daily return is highest at day 1, exactly when there is a largest selling spree. Especially, Figure 1(A) suggests that order imbalances and returns may be negatively related in the post-event period.

The behavior of an unsigned trading activity measure, turnover (TURN), is also of interest: daily average turnover of 0.33% in the pre-event period increases to 0.44% in the post-event period, with a big spike in the middle (day 0-day 7). Figure A1(A) in the Appendix demonstrates this pattern of TURN around SEOs. To be specific, turnover at day 1 is as large as 3.78% and it remains high until day 7. The large turnover coupled with large negative imbalances in this interval reflects the large-scale selling activities surrounding new issues on the NYSE. Except for several trading days around the offer date, however, we see that turnover is quite stable over each subperiod. Considering that a new equity offering to finance new investment may result in a larger-sized firm, which in turn, may attract more analysts and diverse investor groups, our observation of increased liquidity after SEOs is reasonable.

⁹Conversations with Mr. Alexander Cruz at Thomson Financial confirmed that the shares of new offerings start to trade on the exchange market from the next business day (day 1) after the offer date.

¹⁰Because our primary concern is to examine the movements of order imbalances around the issue (offer) date, the variables are aligned around the *issue date*, not around the *announcement* or *filing date*. But our calculation using the sample SEOs shows that the filing dates occur on average 58.4 calendar days or 8.4 weeks prior to the issue date. This translates to 35-40 trading days prior to the issue date in the daily event window, and 1.5-2 months prior to the issue month in the monthly event window. The “announcement date” of an SEO can be different from the “filing date” in the SDC Platinum database. Some firms first announce and then file with the SEC on the same day or several weeks/months later. Some first file and then announce the offerings. Others just file and do not announce it at all. We assume that on average the gap between the two dates is not large. I thank Dennis Sheehan for confirmation regarding this issue.

The movements of the price level have implications for the relationship between returns and order imbalances (examined later in more detail). As Panel A of Table II shows, the average level of split- and stock dividend-adjusted prices (ADJP) is \$18.97 in the pre-event period, and this level rises up to \$20.45 at day 0. Contrary to this trend, ADJP does not move very much in the post-event period. Figure 2(A) exhibits this price run-up in the first half as well as its tardiness in the second half of the event window.

At a monthly horizon, the results are qualitatively similar, but it is worthwhile to mention some of the distinct features. As shown in Panel A of Table IIIb and in Figure 1(B), monthly NOIMB starts to rise from month -8 , remaining at its peak near 6% for a long time (month 3-month 16) *after* the event, and yet hovering above 2% until month 28 (except for the 2 middle months). However, monthly DOIMB starts to go up from earlier (month -18), reaching beyond 6% a couple of months immediately *before* the event, but then oscillating around a modest level in the post-event period.

Panel B of Table II as well as Figure 1(B) contrasts the monthly average return before the event (2.32%) with that after the event (0.93%). Given that the monthly average return of NYSE firms during the sample period (1988-1998) is 1.28% as shown in Subrahmanyam (2003),¹¹ we observe that the SEO firms substantially outperform in the pre-event period but underperform in the post-event period. At a monthly horizon, the relations between OIMBs and returns are also discernible. In particular, notice in Figure 1(B) that NOIMB seems to be negatively related to returns in the post-SEO period, while DOIMB does not. This is counterintuitive in that most existing studies imply close relations between OIMBs (both NOIMB and DOIMB) and returns. This issue will be explored in more detail later in this study.

Another noteworthy aspect in Figure 2(B) is that monthly prices (ADJP) begin to run up from month -16 , experience the steepest hike in the monthly interval $[-12, -2]$, but show no discernible move afterwards. This pattern suggests that DOIMB may be more tightly related to returns than NOIMB over the post-issue period. Lastly, Panel B of Table II and Figure A1(B) confirm that monthly turnover significantly increases to 8.29% on average after new equity offerings, relative to the monthly average turnover of 5.5% for the 1,264 NYSE/AMEX firms over the sample period (1982-2001) as documented by

¹¹In Subrahmanyam (2003), the same OIMB database is used, but bid-ask midpoint returns are employed. We expect that the difference between CRSP and mid-point returns to be marginal at a monthly level. See Table 1 in the paper for details.

Chordia, Huh, and Subrahmanyam (2003).¹²

B. Comparison with the Size-matching Portfolio

Are the features explored above general characteristics of any firm or specific to SEO firms? To examine this aspect, we need to compare the features of our SEO portfolio to those of a nonissuer benchmark portfolio. For this purpose, we form two types of control groups based on size (MV) and book-to-market (BTM) as already described.

As a preliminary check, we first present graphs using the cross-sectionally averaged time series of our key variables for the size-matching benchmark. As exhibited in Figures 3(A) and 4(A), at a daily horizon, the two order imbalance measures of this control group do not show any specific pattern or salient bias in either direction, although DOIMB seems to be more volatile and slightly tilted upward in the post-event period. To gain a feel for this, one can compare Figure 3(A) with Figure 1(A).

At a monthly horizon [Figure 3(B)], NOIMB of the control group tends to oscillate around the x-axis, while DOIMB is slightly tilted upward in post-SEO period. Consequently, the difference in monthly OIMBs between the two peer groups is very conspicuous for NOIMB [Figure 3(B) vs. Figure 1(B)]. In the case of monthly DOIMB, however, the difference between the two comparison portfolios is rather minimal in the post-event period. To facilitate our understanding of order imbalance differentials between the two groups, the SEO portfolio's abnormal order imbalances relative to those of the nonissuers are computed by subtracting imbalances of the size-matching group from those of the SEO group. The results are presented in Figure 5.

As can be seen in Figure 5(A), the pattern of daily abnormal trade-number imbalances, ANOIMB, of the SEO firms is still upward-tilted (except for daily interval $[0, 18]$). The dollar value counterpart of daily abnormal imbalances, ADOIMB, is more upward-tilted than ANOIMB in the pre-event period, but this feature is weakened in the post-event period. At a monthly horizon, the levels of ANOIMB in Figure 5(B) are far from the x-axis from month -6 on (except for month 0), implying that the distribution of NOIMB from the two comparison groups are very different in the corresponding intervals. For monthly ADOIMB shown in Figure 5(B), the levels are well above zero in the monthly

¹²Chordia, Huh, and Subrahmanyam (2003) show that the annual average turnover in the sample is 66%, which translates to about 5.5% at a monthly level. For details, see Table 1 of that paper.

interval $[-16, -2]$. However, the pattern in the post-event period are obscured, oscillating around the x-axis. This indicates that in the post-event period the distribution of DOIMB, unlike that of NOIMB, from the two comparison portfolios is statistically identical.

Differences in other variables between the two groups are also interesting. First, returns, RET, of the control group have no salient pattern or difference by subperiod over the event window in either daily or monthly levels [see Figure 3(A) vs. Figure 1(A) and Figure 3(B) vs. Figure 1(B)]. Consequently, for the nonissuers we do not observe any steep price run-up prior to the event or tardiness after the event. As drawn in Figures 4(A) and 4(B), ADJP of the control group rises monotonically over time but with a much flatter slope. As one might expect, mean turnover (TURN) of the nonissuers in Figure A2(A) is constant over the 241 trading days, while their monthly counterpart increases monotonically over the 6-year period in Figure A2(B).¹³ Results from the BTM-matching portfolio are qualitatively very similar and thus are not reported to save space.

So far we have gauged the differences in variables of interest for the two portfolios by simply reading the graphs. By using a Wilcoxon test, we now formally investigate how our SEO firms are statistically different relative to the size-matching nonissuer firms.

B.1 The Wilcoxon Test

Since we have the two comparison groups, random samples of matched pairs at each day or month for each of NOIMB, DOIMB, RET, and TURN are available. Thus, we can conduct a nonparametric test, namely, the well-known Wilcoxon test,¹⁴ to examine if each pair of the two values is from the same population or not. Suppose the population distribution of differences $d_i = v_i^{MV} - v_i^{SEO}$ is symmetric, where v_i^{MV} is a value of firm i from the size-matching portfolio and v_i^{SEO} a value of firm i from the SEO portfolio. Then we want to test the null hypothesis, $H_0: d = 0$, against the alternative hypothesis, $H_1: d \neq 0$.

Now, let the Wilcoxon test statistic be W and the number of non-zero differences be N^* . When a sample size is large, the normal distribution provides a good approximation to the distribution of the Wilcoxon test under the null hypothesis. That is, if we define a

¹³Refer to Chordia, Huh, and Subrahmanyam (2003), where trading activity is comprehensively analyzed over a 38-year period (1964-2001) for 1,228 NYSE/AMEX stocks, and an 18-year period (1984-2001) for 1,146 NASDAQ stocks.

¹⁴For additional details about the Wilcoxon test, please see, for example, Newbold (1991).

random variable Z as

$$Z = \frac{W - \mu_w}{\sigma_w}, \quad (1)$$

where $\mu_w = E(W) = \frac{N^*(N^*+1)}{4}$, and $\sigma_w^2 = Var(W) = \frac{N^*(N^*+1)(2N^*+1)}{24}$. Then, equation (1) approximately follows a standard normal distribution for large N^* . Since our sample size is large enough, we can use this Z -statistic to draw statistical inferences.¹⁵

Tables IIIa and IIIb present the results. Panel A in the tables contains the cross-sectional averages of our key variables by subperiod for the SEO firm portfolio, while Panel B does the same for the size-matching portfolio. For the mean values in an interval, the cross-sectional means are computed after the time series of the variables are first averaged over the interval for each firm. Since the characteristics in the days or months immediately before and after the event are of special interest, single-day (or month) values are computed in the subperiods immediately around the event date (or month). Panel C presents Z -statistics for the Wilcoxon test.

Panel C of Tables IIIa and IIIb confirms our presumption based on Figure 5 above. For daily NOIMB in Table IIIa, H_0 is strongly rejected at the 1% significance level in most subperiods over the post-event period, while it is marginally rejected at 10% in some subperiods over the pre-event period. Contrary to the case of NOIMB, H_0 is strongly rejected at 5% for daily DOIMB over the pre-event period (except for the 2 single-day subperiods), but the null hypothesis cannot be rejected even at 10% after day 40. At a monthly horizon in Table IIIb, we can strongly reject the null hypothesis at the 5% significance level from month -4 on for NOIMB. Panel C of Table IIIb also confirms that the distribution of monthly DOIMB for the SEO portfolio is significantly different at 5% from that for the size-matching portfolio in interval $[-16, -2]$. For this monthly DOIMB, however, H_0 cannot be rejected again even at 10% from month 2 on. This in turn demonstrates that the distribution of DOIMB for the SEO portfolio over the post-issue period is identical to that for the size-matching portfolio.

Panel C of the two tables also demonstrates that the differences in turnover (TURN) between the SEO group and the control group are statistically significant at any conventional level from the event day (or month) on. For returns (RET), a quick comparison of the levels in Panel A and Panel B of Table IIIa indicates that at a daily horizon the

¹⁵For a test in which H_1 is two-tailed, we can reject H_0 if $Z = \frac{W - \mu_w}{\sigma_w} < -z_{\alpha/2}$, where α is the significance level.

SEO firms outperform over most part of the pre-event period (interval $[-120, -11]$) as well as in a short interval immediately after the event (interval $[1, 10]$), while they are likely to underperform in other subperiods, especially over most of the post-event period. Similarly, Panels A and B of Table IIIb suggest that the SEO firms consistently outperform over the pre-event period but underperform over the post-event period at a monthly horizon as well.

IV. ORDER IMBALANCES AND PRICE PRESSURE

Do order imbalances cause price pressure that has a direct effect on returns on the occasion of equity offerings? Does a high positive level of a current order imbalance translate to a high rate of a current stock return in both the time series and the cross section around SEOs? Modern finance theories suggest that price movements are tightly associated with order imbalances. For example, Kyle's (1985) model relates price changes to order flows. Dynamic inventory models of Ho and Stoll (1981) and Spiegel and Subrahmanyam (1995) also explore how market makers facing competition accommodate buying and selling pressure from outside investors.

Empirically, Blume, MacKinlay, and Terker (1989) use intradaily dollar-volume imbalances for NYSE stocks to document that there is a strong relation between order imbalances and returns during the 2-day period of the 1987 market crash. They show that the relation between order imbalances and concurrent returns are significant in the time series as well as in the cross section. In a more general setting, recent studies document that order imbalances are significantly positively associated with contemporaneous returns at the aggregate market levels [Chordia, Roll, and Subrahmanyam (2002)] as well as at the individual levels [Chordia and Subrahmanyam (2003)] in the time-series.

However, our observations in the previous section lead us to raise a question whether OIMBs really drive returns in both contexts. The results suggest that there may be some disconnection between order imbalances and returns after equity offerings in the time series. In this section, we examine whether high positive OIMBs represent large buying pressure in both contexts, not in a general setting but in a specific setting of SEOs.

A. Cross-Sectional Analysis

Recent studies by Chordia et al. (2002) and Chordia and Subrahmanyam (2003) focus on the imbalance-return relationship in the time-series context. Given that the present paper concerns an event study, we are also primarily concerned with time-series relations between the two variables. However, the cross-sectional relation is of interest, because it helps us understand the interactions of the two variables in a relative sense among individual stocks. Therefore, we first investigate how returns and OIMBs are cross-sectionally related in our specific setting. But, for brevity, we report the results only for the daily horizon in the main text. The results from the monthly analysis are included in the Appendix.

A.1 Rank-Order Correlation Coefficients

Sample correlation coefficients using the actual values of returns and order imbalances can be seriously affected by extreme observations. Moreover, the validity of a test based on them rely on the assumption of normality. To get around this problem, we use Spearman's rank-order correlation coefficients, which are not susceptible to serious influence by extreme values and are feasible for general population distributions. For each pair of our cross-sectional sample $(RET_{i,t}, OIMB_{i,t})$, where $t = -120, -119, \dots, -1, 0, 1, \dots, 119$, and 120 for the daily sample (total 241 pairs), and $t = -36, -35, \dots, -1, 0, 1, \dots, 35$, and 36 for the monthly sample (total 73 pairs), RET_t and $OIMB_t$ are first ranked separately in ascending order to assign ranks for each variable. Then the sample correlation of these ranks is computed at each day or month.

The results are presented in Table IV.¹⁶ For the daily horizon, the correlation coefficients are positive and statistically significant at any conventional significance level in any subperiod. Furthermore, the differences between the coefficients for NOIMB and those for DOIMB are minimal. The size of coefficients is also very stable by subperiod at 30%-40%, regardless of new equity offerings. This relation obtains also at a longer horizon [see Table AI in the Appendix].

Our findings are comparable to the results of Chordia and Subrahmanyam (2003), where the time-series correlation coefficient of returns with NOIMB is 0.343 and that with DOIMB is 0.373. On balance, both measures of order imbalances are strongly positively

¹⁶Note that *Rank-order Correlation* in the table is the *average* of the rank-order correlation coefficients in a subperiod when the subperiod has more than one trading day.

correlated with returns in the cross section, without being affected by the corporate event.

A.2 2SLS Regressions

To see further how OIMBs are tied to returns and whether the patterns are different before and after SEOs, we cross-sectionally regress returns on the contemporaneous levels of order imbalances. To be specific, the equation under consideration is

$$RET_{i,t} = \phi_0 + \phi_1 OIMB_{i,t} + \phi_2 LN(MV)_{i,t} + \epsilon_{i,t}, \quad (2)$$

where current levels of a firm size variable, $LN(MV)$, are included as a control variable. After running regressions corresponding to equation (2), it is possible to examine the usual statistics along the lines of Fama and MacBeth (1973). However, reverse causality is an issue to be resolved for proper statistical inference from equation (2). High same-day (or month) returns can encourage investors to trade aggressively, which results in high positive order imbalances on that day (or in that month). Thus, inferences from simple OLS regressions about whether order imbalances drive returns may be biased.¹⁷ To avoid the possible endogeneity problem and obtain consistent estimators, we use the 2SLS method in the cross-sectional analysis.¹⁸

In the first stage, we model the order imbalance of stock i at day (or month) t using instrumental variables (IVs) to make sure that the predicted order imbalance are not subject to the simultaneous equations bias. Chordia, Huh, and Subrahmanyam (2003) show that order imbalances are cross-sectionally predicted by past levels of returns (RET), firm size ($LN(MV)$), prices ($LN(P)$), institutional ownership (IO), and the number of analysts (NOANA). Thus, in the first stage, we include past levels of the above three variables and current levels of firm size in the set of IVs. In addition, we use 3 more types of instruments: past turnover ratios (TURN), size of an SEO (SSEO2), and a primary/secondary

¹⁷Evans and Lyons (2002) maintain that an unsigned trading activity measure (volume) and a signed activity measure (order flows) are fundamentally different, and that a causal relation runs from order flows to exchange rate changes, despite that prices and order flows are determined simultaneously. According to them, the endogeneity bias is not an issue in the ordinary least squares (OLS) regression of exchange rate changes on contemporaneous order flows. However, it seems that this argument has not been firmly proved yet in stock markets.

¹⁸For equation $RET_{i,t} = \phi_0 + \phi_1 OIMB_{i,t} + \phi_2 LN(MV)_{i,t} + \epsilon_{i,t}$, the endogeneity of OIMB was tested in a similar way as in footnote 22 in the next subsection by the regression-based Hausman test. In some cases, we could not reject the null hypothesis of no endogeneity. To avoid the probable overstatements of statistical significance by OLS, however, we report the 2SLS results in the cross-sectional analysis.

dummy variable (PRIM: 1 if the issue is purely primary, and 0 otherwise). That is, the first stage regression is specified as follows:

$$\begin{aligned}
OIMB_{i,t} = & \beta_0 + \sum_{k=1}^m \beta_{1k} RET_{i,t-k} + \sum_{k=1}^m \beta_{2k} TURN_{i,t-k} + \sum_{k=1}^m \beta_{3k} LN(P)_{i,t-k} \\
& + \beta_4 LN(MV)_{i,t} + \beta_5 IO_{i,y-1} + \beta_6 NOANA_{i,y-1} + \beta_7 SSEO2_i \\
& + \beta_8 PRIM_i + \xi_{i,t},
\end{aligned} \tag{3}$$

where order imbalances (OIMB) are either NOIMB or DOIMB, and $m = 10$ for daily regressions while $m = 6$ for monthly regressions. Here, $t = -110, -109, \dots, -1, 0, 1, \dots, 119$, and 120 for daily regressions (total 231 regressions), and $t = -30, -29, \dots, -1, 0, 1, \dots, 35$, and 36 for monthly regressions (total 67 regressions).¹⁹

In the second stage, we regress the returns of stock i at day (or month) t on the predicted imbalances of the stock using the generated regressor ($\widehat{OIMB}$) from the first stage. In this step, the predicted order imbalances are used as regressors by themselves and a firm size variable, $LN(MV)$, is included as a control variable. That is, the second stage regression is run each day or month as follows:

$$RET_{i,t} = \gamma_0 + \gamma_1 \widehat{OIMB}_{i,t} + \gamma_2 LN(MV)_{i,t} + \eta_{i,t}. \tag{4}$$

Table V contains the daily horizon Fama-MacBeth statistics computed using the results from equation (4). The coefficients reported in the upper row in each interval are the time-series averages of γ_j 's from equation (4) over the interval, and the italicized statistics in the lower row are the t-ratios for the corresponding average coefficients. As can be seen in Table V, the impact of OIMBs on returns is indisputable. Both measures of OIMBs are strongly positively related to returns, with the null hypothesis of a zero coefficient being resoundingly rejected at any conventional levels of significance in any subperiod over the event window.²⁰ Given that the magnitude and statistical significance of the coefficients

¹⁹Note that the total numbers in regressions are smaller than those in the rank-order correlation analysis. This is because past values are used as regressors in the first stage, resulting in the losses of cross-sectional data for 10 days in daily regressions and for 6 months in monthly regressions within the event window. In this stage, SSEO2 and PRIM are included in the regressions only from the issue date (or month), but not before the issue date (or month). Also note that IO and NOANA are the previous year-end values.

²⁰For the 3 single-day intervals, the coefficients and t-statistics are from the individual cross-sectional regressions. So their t-statistics cannot be directly compared with those of the Fama-MacBeth t-statistics in other intervals. Nonetheless, the coefficients of NOIMB and DOIMB are statistically significant at the 10% level except for one out of the six cases in Table V.

are very stable over time, it can be concluded that the corporate event of SEOs never affects the relationship between the two variables.

At a monthly horizon [see Table AII], most of the features observed above obtain with some other noticeable features. First, the sensitivities of returns to OIMBs are now much larger at a monthly horizon. Second, the size and statistical significance of the coefficients tend to be larger for DOIMB than for NOIMB. As a result, the coefficients of DOIMB in the 3 single-month intervals are mostly significant at 1%. This suggests that in the cross section DOIMB is more tightly related to returns than NOIMB over a longer horizon.

To summarize, there is a strong positive cross-sectional relation between order imbalances and returns, with no prominent differential behavior between NOIMB and DOIMB. Higher order imbalances for a stock clearly mean larger price pressure which will induce higher returns for the stock, irrespective of the new equity offerings.

B. Time-Series Analysis

We observe a strong positive relation between OIMBs and returns in the cross-sectional analysis above. However, finding a strong cross-sectional relation between them does not imply or preclude any relation in the time series. As described in Section III, Figures 1(A), 1(B), and 5 suggest that the relation between order imbalances and returns is weakened or even turns negative immediately before the offer date. Especially at the longer horizon presented in Figure 5(B), sustained high levels of ANOIMB for more than 18 months after SEOs seem unjustifiable, considering that returns are likely to underperform relative to its control group in that time period. In this subsection, we examine how the two variables are characterized in the time-series context.

B.1 Correlation Coefficients

We first compute correlation coefficients between returns and OIMBs by (sub)period both for the SEO firms and for the size-matching firms. The results are shown in Table VI. Over the whole period at a daily horizon, Panel A shows that DOIMB for the SEO firms is positively correlated (31%), but NOIMB is negatively correlated (-9%). Over the pre-event period ($[-120, -1]$), the correlation coefficients of both NOIMB and DOIMB for the SEO firms are positive and statistically significant. In contrast, in the post-SEO period (interval $[1, 120]$), NOIMB for the SEO firms is significantly negatively correlated

(−20%) with returns, while DOIMB is positively correlated.

These features of the SEO firms are in sharp contrast with those for the control group. As shown in the right-hand part of Panel A, the correlation coefficients in the size-matching group are all positive and consistent at 20%-30% over the whole event window, without showing any dramatic fluctuation or sign reversal by subperiod for both NOIMB and DOIMB.

Given that most existing literature examines the return performance after IPOs or SEOs in the mid- to long-term, we are more interested in the OIMB-return relations at a longer horizon. At a monthly horizon in Panel B of Table VI, we observe some similar aspects, but there are distinctive features. As the panel demonstrates, for the SEO firms the correlation coefficients in the pre-event period are much larger (87% for NOIMB and 86% for DOIMB) than those in Panel A. In the post-event period, however, NOIMB is insignificantly correlated with returns, while the coefficient of DOIMB is statistically significant at 5%. Unreported results by subperiod show that the correlation coefficients of NOIMB in intervals [1, 18] and [19, 36] are −14% and −31%, respectively, while the values for DOIMB are 73% and 11%, respectively. This suggests that there is a disconnection between trade-number imbalances and returns in the post-issue period. For size-matching nonissuers in Panel B, the coefficients remain positive in both the pre- and post-event periods.

B.2 Time-series Regressions

To explore return-imbalance relations more precisely, we consider time-series regressions in the next step. We propose a candidate estimation including a scaled volume measure (turnover) as a control variable in the following equation:

$$RET_t = \varphi_0 + \varphi_1 OIMB_t + \varphi_2 TURN_t + \varepsilon_t. \quad (5)$$

The above specification may be problematic, however. Despite the argument of Evans and Lyons (2002), we do not rule out the possibility of the endogeneity bias in equation (5) for order imbalances as well as for turnover in stock markets. Thus, for both of our issuer and nonissuer samples, we perform the regression-based Hausman test for endogeneity. In most subperiods, however, the joint null hypothesis of no endogeneity could not be rejected, suggesting that OLS is a reasonable choice *vis-a-vis* two-stage least squares

(2SLS) regressions.²¹ Therefore, we just employ OLS regressions of returns on concurrent order imbalances (each of NOIMB and DOIMB) and turnover by subperiod over the event window as in equation (5).

Table VII contains the results. At a daily horizon, even after controlling for turnover, the basic relations still obtain, though the statistical significance of the loadings of returns on order imbalances is dampened. As presented in Panel A, returns in the size-matching portfolio are strongly positively related to both NOIMB and DOIMB in the pre-event period as well as in the post-event period at the 5% significance level (daily intervals $[-120, -1]$ and $[1, 120]$). However, this is not the case for the SEO portfolio in the left-hand part of Panel A. The coefficient of NOIMB is positive and significant at 1% in the pre-event period. But its sign reverses in the post-event period (interval $[1, 120]$), although the statistical significance is marginal because of the control variable. For DOIMB, the relation is rather similar to that of the nonissuer group. The coefficient of DOIMB is positive in both the pre- and post-event periods, and furthermore it is significant at the 1% level in the post-SEO period.

For the longer horizon in Panel B, the features observed in Panel A are retained. For SEO firms, the coefficient of NOIMB is positive and statistically significant at the 1% level in the pre-event period, while NOIMB is no longer related to returns after the offerings (interval $[-36, -1]$ vs. $[1, 36]$). However, the coefficients of DOIMB are consistently positive and statistically significant at 5% in both the pre- and post-event periods, without being affected by the event of equity offerings (intervals $[-36, 36]$, $[-36, -1]$, and $[1, 36]$). For the size-matching portfolio, we do not observe a sharp contrast before and after the event, although the statistical significance becomes marginal for NOIMB because of the control variable. All the coefficients of DOIMB in Panel B are statistically significant at the 10% level over the whole event window.

Based on the above analyses, our major findings can be summarized as follows. The

²¹In equation $RET_t = \varphi_0 + \varphi_1 OIMB_t + \varphi_2 TURN_t + u_t$, the endogeneity of OIMB and TURN can be tested as follows. Under an assumption that OIMB and TURN are endogenous, we fit OIMB and TURN by OLS using the instruments as in $Y_t = \delta_0 + \delta_1 RET_{t-1} + \delta_2 TURN_{t-1} + \delta_3 LN(ADJP)_{t-1} + v_t$, where Y_t is either $OIMB_t$ or $TURN_t$. Given the fitted values ($\widehat{OIMB}_t, \widehat{TURN}_t$) and the two series of estimated residuals ($\widehat{v}_{1t}, \widehat{v}_{2t}$), the regression-based Hausman test tests the joint null hypothesis $H_0 : \rho_1 = \rho_2 = 0$ where ρ_1 and ρ_2 are coefficients in the linear projection of u_t on $\widehat{v}_{1t}$ and $\widehat{v}_{2t}$, i.e., $u_t = \rho_1 \widehat{v}_{1t} + \rho_2 \widehat{v}_{2t} + e_t$. We can easily test H_0 in equation $RET_t = \varphi_0 + \varphi_1 OIMB_t + \varphi_2 TURN_t + \rho_1 \widehat{v}_{1t} + \rho_2 \widehat{v}_{2t} + e_t$ by OLS and its F-statistic computed using the sums of squared residuals from the unrestricted vs. restricted regressions. In most subperiods, we could not reject the joint null hypothesis. For details, see Wooldridge (2002).

most notable characteristic in the time series is that the relation between NOIMB and returns in the SEO portfolio is indeed “delinked” in the post-SEO period, in the sense that while that NOIMB and returns are strongly positively related in a more general setting with a broad sample, the positive relation disappears or turns negative in the post-SEO setting. However, DOIMB is consistently positively related to returns regardless of new equity offerings. In most cases for the size-matching control groups, we do not observe such a contrast between NOIMB and DOIMB. Another observation is that the explanatory power of OIMBs seems somewhat weakened as OIMBs are aggregated at longer horizons than a day. This result found in our control group at the monthly horizon compares to the daily results in a recent study. Using a large sample of NYSE stocks over the 11-year period, Chordia and Subrahmanyam (2003) show that daily returns of individual stocks are strongly positively related to current NOIMB and DOIMB in the time-series context.

V. WHO INDUCES THE DELINK?

Questions still waiting to be addressed are: Why does the delink occur only in trade-number imbalances but not in dollar-volume imbalances in the post-SEO period? Why are the reactions of small traders different from those of large traders? Who keeps trading SEO stocks aggressively in the post-issue period while those stocks perform poorly? Who causes the correction in the returns of SEO stocks in the post-issue period? Thus, are some investor groups superior to other investor groups in trading SEO stocks around the equity offerings? To answer these questions, however, we should first attempt to discern who specifically are small traders (whose reactions are picked up by NOIMB) and who are large traders (whose reactions are manifested in DOIMB). We will examine this topic in this section. Considering that we are primarily concerned with the above issues in the longer term, we limit the discussion in this section only to the monthly horizon.

We may readily assume that small traders consist of individual investors and large traders are mostly institutional investors. But this conjecture is controversial. For example, Chan and Lakonishok (1995) and Keim and Madhavan (1995) document that institutional investors often split their orders into smaller amounts across several trading days to minimize the price impact of their trades. Ex ante, we cannot discern who causes such a pattern in NOIMB or DOIMB. Given that institutional ownership data are available, however, we attempt to explore whether NOIMB captures well the trading activity

of individual investors and similarly, whether DOIMB captures that of institutional investors. In so doing, we also investigate whether institutional investors are superior to individual investors in trading SEO stocks around the seasoned equity offerings.

A. One-Way Sorting

For our purpose, we form two different SEO portfolios from the total 408 SEOs by comparing the yearly levels of IO as follows:

P1: A portfolio of SEO firms whose institutional ownership decreases after year 0. Thus, P1 is the SEO portfolio that *individual* investors buy on net after year 0.

P2: A portfolio of SEO firms whose institutional ownership increases after year 0. Thus, P2 is the SEO portfolio that *institutional* investors buy on net after year 0.²²

Two size-matching portfolios, corresponding to P1 and P2, are also constructed from the total size-matching firms for comparison purposes. We call them P1_M and P2_M, respectively. The idea is that by examining the behavior of our two OIMB measures in a situation where IO incrementally changes over time, we may be able to distinguish the differential roles of NOIMB and DOIMB. That is, if NOIMB captures well the trading activity of individual investors, the level of NOIMB in P1 following the offerings will be high, because individuals are buying on net after year 0. Similarly, if DOIMB picks up the trading activity of institutional investors, the level of DOIMB in P1 will be low or similar to that of P1_M after the offerings, because institutions are selling on net. The same logic applies to P2. If individuals are selling and institutions are buying on net in P2, the level of NOIMB in P2 will be low, while the level of DOIMB will be higher in P2 than in P1.

Let IO_t denote institutional ownership in year t since the SEO. In constructing P1 and P2, we consider 4 choices: 1) $IO_0 > IO_1$ vs. $IO_0 < IO_1$, 2) $IO_0 > IO_1 > IO_2$ vs. $IO_0 < IO_1 < IO_2$, 3) $IO_0 > IO_2$ vs. $IO_0 < IO_2$, and 4) $IO_0 > IO_3$ vs. $IO_0 < IO_3$. Among them, we adopt choice 3) for the following reason. IO_0 is the level of institutional ownership at the end of year 0, by which on average 6 months have already passed since the offerings, because SEOs can be conducted from January to December of the event

²²Our IO database which includes on average 968.6 NYSE/AMEX firms shows an almost monotonic increase in the average IO from 31.88% in 1982 to 48.96% in 1998. This indicates that IO of a stock can increase over time simply because the number of institutional investors increases as time passes, rather than because the same institutions buy the stock more and more over time.

year (year 0). So, by comparing IO_0 and IO_2 , we are actually comparing the level of IO at month 6 with the level of IO at month 30. As we see in Figures 1(B) and 5(B), NOIMB and ANOIMB continue to be high until month 28. Moreover, considering that SEO firms usually do not underperform during the first 6 months after the offerings [Loughran and Ritter (1995)], many institutional investors may buy SEO stocks upto month 6. Therefore, it is reasonable to compare IO_0 and IO_2 for our purpose.²³ By choice 3), the sample size is 128 SEOs for P1 and 203 SEOs for P2.

The results are presented in Tables VIII-X and Figures 6-7. First, we look at the level changes of IO and NOANA for P1 and P2 in Figures 6(A)-6(B). (For specific values of IO and NOANA in P1, P2, P1_M, and P2_M, see Table AIII in the Appendix.) By construction, IO decreases in P1 at year 2 relative to year 0, while it increases in P2. Notice that the initial levels of IO at year -3 are similar in both portfolios at about 42%, but in P1 IO starts to rise from year -1 , showing a steeper increase at year 0. This indicates that institutional investors in P1 starts to buy SEO stocks earlier (than they do in P2) and sell after year 0. The trend of NOANA shows no large difference between P1 and P2.

Next, we examine the features of our key variables for P1 and P2 in Table VIII and Figure 7. The most noticeable characteristic after month 0 is the level of NOIMB in P1 and P2. In Panel A of Table VIII and Figure 7(A), NOIMB of P1 in interval $[1, 18]$ rises beyond 9%.²⁴ The average level of NOIMB in this interval is 6.77%-7.89%, which is obviously far above the level of its control group (P1_M) as indicated by the Wilcoxon Z-statistics in Panel A. This means that indeed NOIMB reflects well the trading activity of individual investors, because in P1 individuals buy on net in year 1 and year 2 after the offerings. Considering that institutions sell in P1, DOIMB should not be higher compared with that of the control group. As the Z-statistics show, the levels of DOIMB are not statistically different from P1_M in the post-SEO period, though relatively higher for the SEO portfolio in general.

Now we check how the two imbalance measures behave in P2. Since institutions buy while individuals sell on net in P2, we expect that NOIMB will be low but DOIMB will be relatively higher in P2 than in P1. The latter is not the case. However, Panel B of Table

²³Choice 2) would be better, but the sample size is too small. Although we adopt choice 3), the results from other choices are very similar.

²⁴Recall that in the total sample, the highest level of NOIMB after the offerings is about 6% (Figure 1(B)).

VIII and Figure 7(B) demonstrate that the levels of NOIMB in P2 are much lower than in P1 after the offerings. Specifically, NOIMB of P2 in interval $[2, 18]$ is less than half of P1. But these levels are still higher than those of the control group (P2_M) as implied by the Z-statistics. One explanation is that NOIMB of P2 also reflects partly the trading activity of *institutional* investors who split their orders to reduce the price impact. Even though SEO stocks generally underperform after the offerings, it is possible that institutions buy SEO stocks after the offerings for informational or liquidity reasons. For example, Gibson, Safieddine, and Sonti (2003) document that SEO firms experiencing the greatest increase in institutional ownership around the offer date outperform their benchmark portfolios in the year following the issue relative to those experiencing the greatest decrease. If the market depths of such stocks are small, they will split their orders, in which case their trading activity will be manifested through higher NOIMB. In general, however, this effect seems much weaker compared with the effects of individuals' buying activity.

The abnormal OIMBs for P1 and P2 are plotted in the Appendix. Figure A3 graphically contrasts the different reactions of NOIMB and DOIMB in the post-issue period. The abnormal trade-number imbalances (ANOIMB) in P1 is extremely high in interval $[1, 18]$, while ANOIMB in P2 is around 2% (except for interval $[5, 7]$). This high level of ANOIMB in P1 (aggressive buying orders for SEO stocks from individual investors) is not justified by the returns in the portfolio over the post-issue period. For instance, in Panel A of Table VIII, compare the average return of 0.34% for P1 with that of 1.43% for P1_M over the interval $[2, 18]$. The Z-statistic (-3.45) strongly suggests that P1 underperforms its benchmark portfolio, P1_M, in this period. Meanwhile, the abnormal dollar-volume imbalances (ADOIMB) in Figure A3 tend to oscillate around zero in both P1 and P2. Also note that P2 does not significantly underperform P2_M in the post-SEO period, as indicated by the Z-statistics (-0.66 and -1.58) in Panel B of Table VIII.

Another interesting feature is that DOIMB in P1 over interval $[-8, -2]$ is much higher (reaching beyond 9%) than that in P2 [see Figure 7], suggesting that some institutions buy more aggressively in this interval before they sell SEO stocks after the offerings. This is consistent with our observation above in Figure 6(A), where IO begins to rise from year -1 , eventually showing a steeper increase in year 0. Also, returns are consistently lower in P1 than in P2 over the post-issue period: for example, 0.34% in P1 vs. 1.43% in P2 over interval $[2, 18]$ in Table VIII. Given that institutions buy in P2 and individuals buy in P1 in this period, this fact suggests that institutional investors design better investment

strategies than individual investors around SEOs. This result is consistent with Gibson, Safieddine, and Sonti (2003).

In the next step, we compute correlation coefficients and regress returns on OIMBs in order to see how the delink is revealed in this situation. As can be seen in Table IX, the delink between returns and NOIMB in P1 is prominent in the post-issue period, while it does not emerge in P2. Given that for the total SEO sample, the correlation coefficient between NOIMB and returns is insignificant (6%) in interval $[1, 36]$ (see Table VI) and negative (-14% and -31%) over its subperiods, it is notable in Panel B that the correlation coefficient over the post-SEO period in P2 is now positive (42%) and significant at the 5% level. The delink does not show up in either of the two control portfolios. These features mostly obtain in the regression results, even after controlling for turnover (see Table X).

To summarize, we find that the delink between NOIMB and returns in the post-issue period is a phenomenon that is more conspicuous in the SEO portfolio which individual investors buy on net (P1). That is, the delink is more likely to be induced by the reactions of individual investors. Another notable point is that the SEO portfolio which individual investors buy aggressively (P1) underperforms its size-matching nonissuer portfolio (P1_M) as well as the SEO portfolio which institutional investors buy on net (P2) in the post-issue period, suggesting that individual investors are on average dominated by institutional investors in their investment strategies around SEOs.

B. Two-Way Sorting

One concern in the above experiment is that sorting by IO only may not capture properly the different aspects of individuals and institutions manifested in the two OIMB measures. For example, in the post-event period, DOIMB is not higher in P2 relative to P1. Therefore, we experiment again by forming two portfolios using two firm characteristics. We first sort the total SEO sample by firm size (MV) as of month 0 in ascending order, and split the SEO firms into two groups. The rationale is that because institutional investors prefer to trade large stocks while aggressive individual investors prefer small and growth-oriented stocks, sorting in this manner can potentially enable us to separate out more efficiently the effect of individual/institutional investors on our OIMB measures. Thereafter, two sub-portfolios are further constructed, one from the small-sized group

and the other from the larger-sized group, by comparing IO as follows:

P3: A portfolio of small-sized SEO firms whose institutional ownership decreases after year 0. Thus, P3 is the *smaller* SEO stocks that *individual* investors buy on net after year 0.

P4: A portfolio of large-sized SEO firms whose institutional ownership increases after year 0. That is, P4 is the *larger* SEO stocks that *institutional* investors buy on net after year 0.²⁵

For comparison, two size-matching portfolios corresponding to P3 and P4 are also constructed. Let us call them P3_M and P4_M, respectively. Again we use choice 3) as above in comparing IO. By this process, 96 SEOs are selected to form each portfolio.

As expected, there are large differences in the levels of IO and NOANA between P3 and P4 after sorting this way. Figures 6(C)-6(D) show that P3 consists of stocks with much lower IO and fewer NOANA: 32.43% vs. 50.62% in IO, and 4.15 vs. 17.21 in NOANA as of year -3 . (For specific values corresponding P3, P4, P3_M, and P4_M, see Table AIV in the Appendix.) We see in Figure 6(C) that IO does not fall very much at year 1 within P3.

As demonstrated in Table XI and Figure 8, the movements of our key variables are qualitatively very similar to those from the one-way sorted results. Therefore, we briefly discuss only some salient aspects in this subsection. One distinctive feature in the results is that now DOIMB better reflects the behavior of institutional investors. Given that institutions sell in P3 and buy in P4 after year 0, the levels of DOIMB in P3 tend to be tilted downward [see Figure 8(A)], and the levels in P4 are tilted upward [see Figure 8(B)] in the post-event period. Especially, DOIMB in P4 tends to be higher than NOIMB over interval [18, 28], reflecting buying pressure from institutional investors.

Again noticeable in Table XI is that returns in P3 in the post-SEO period are consistently lower than those in P3_M and P4. In particular, the small-sized SEO firm portfolio which individual investors buy on net (P3) strongly underperforms its benchmark portfolio (P3_M) as well as the large-sized SEO portfolio which institutions buy on net (P4) in interval [2, 18]. Notice, however, that P4 marginally underperforms its size-matching portfolio (P4_M) only in interval [2, 18] over the post-issue period. The correlation coefficients in Table XII and the regression results in Table XIII again confirm that the

²⁵Note that institutional ownership in stocks generally increases over time, however.

NOIMB-return delink in the post-issue period is a phenomenon that is more prominent in the small-sized SEO firm portfolio which individual investors buy on net (P3).

Based on the results from the two experiments, we find that the post-issue period NOIMB-return delink is a phenomenon that is conspicuous in the SEO portfolios which individual investors aggressively buy on net (P1 and P3). The NOIMB-return delink does not occur in the SEO portfolios which institutional investors buy on net (P2 and P4). We also do not observe it in most cases for the size-matching benchmark portfolios. Therefore, we conclude that the delink between NOIMB and returns is primarily induced by the reactions of small individual investors to SEOs. This in turn leads us to infer that NOIMB reasonably well picks up the trading activity of individual investors. Similarly, DOIMB captures well the reactions of institutional investors to SEOs. Of course, NOIMB also reflects the trading activity of institutions who increase the holdings of SEO stocks by splitting their buy orders as exhibited in Figures 7(B) and 8(B). In that case, however, the abnormal imbalances are not so salient [Figure A3(B)] as those of individual investors. In addition, such institutional trades do not exhibit the NOIMB-return delink [Panel B in Tables IX and XII].

Another important finding is that the SEO portfolios which individual investors aggressively buy on net strongly underperform the size-matching nonissuer portfolios as well as the SEO portfolios which institutional investors buy on net in the post-issue period. This again demonstrates that individual investors are on average dominated by institutional investors in their investment strategies in trading SEO stocks following the offerings.

VI. WHY THE DICHOTOMY?

In corporate finance, the pecking order theory [Myers (1984)] posits that firms issue equity as a last resort because of information asymmetry between insiders and investors. Managers are reluctant to issue equity when they believe their shares are undervalued, while investors often interpret an equity issue as an indication that managers believe the firm's stock is overvalued. This situation in turn leads to the negative stock market reaction when the equity offering is announced. Therefore, asymmetric information models suggest that when an equity offering is announced, the market will revalue the stock so that it is no longer overvalued or undervalued. That is, there should be no underperformance in

the post-issue period.

However, the empirical evidence is not favorable to these models, raising a question of market inefficiency. When the offering is *announced*, the market does not fully revalue the stock, and thus the stock is still substantially overvalued when the new equity is *issued*, resulting in negative abnormal returns for several years following the issuance. This has been a puzzle in the capital markets, triggering voluminous studies trying to explain the phenomenon or to ascertain the truth of underperformance.²⁶

A. Another Puzzle

Current levels of order imbalances drive returns in the cross-sectional context, and there is no significant difference in the OIMB-return relationship before and after SEOs. In the time series, however, the two order imbalance measures behave quite differently. In particular, the relation between NOIMB and returns gets delinked on the occasion of SEOs, while DOIMB does not show such a delink. In the total sample, the abnormal trade-number imbalances (ANOIMB) continue to remain high for at least 18 months, while the abnormal dollar-volume imbalances (ADOIMB) disappear soon after the offerings. This indicates that it is not the absolute size of daily or monthly NOIMB that dictates returns over the post-SEO period. Why then is buying among market orders negatively correlated with returns even in the contemporaneous context after the offerings?

In the previous section, we have explored that NOIMB and DOIMB are reliable proxies for individual and institutional trading activities. We also observe that the NOIMB-return delink and the high level of ANOIMB are conspicuous in the SEO portfolios that individual investors buy on net in the post-issue period. It follows from these facts that the two groups of investors differ in their reactions to the same corporate event. Institutional investors' abnormal trading behavior picked up by DOIMB disappears soon after the offerings [see Figure A3(B)], and the delink does not occur in DOIMB. However, individual investors' abnormal trading behavior picked up by NOIMB continues to be high throughout the post-issue period [Figure A3(A)]. All these features are predominant in our total

²⁶Daniel, Hirshleifer, and Subrahmanyam (1998) develop a model based on two psychological/behavioral biases: investor overconfidence and biased self-attribution. In this framework, if investors are overconfident, SEOs or IPOs initiated when the stock is overvalued will be associated with negative announcement abnormal returns and will also be followed by negative post-announcement abnormal returns.

SEO sample as well [Figure 5(B)]: the delink is strong in NOIMB, but is weak or non-existent in DOIMB. Obviously, there exists heterogeneous behavior between individual and institutional investors. Why do individual investors in general keep trading the SEO stocks in a manner tilted toward the buy side for more than 2 years during which the stocks tend to perform poorly? This is another puzzle that rational expectations models cannot readily explain.

B. Behavioral Biases of Individual Investors

While the empirical evidence appears strong, it is difficult to explain why the dichotomy exists. In this subsection, we discuss possible explanations about why the reactions of individual investors picked up by NOIMB are different from those of institutional investors manifested in DOIMB.

B.1 DOIMB and Institutional Investors

First, we consider why institutional investors' trading behavior represented by DOIMB does not show abnormal buying after the equity offerings. A possible explanation is their superior information stemming from competition, cost efficiency, and better access to information sources. There is evidence that some institutional investors trade based on superior information about forthcoming earnings, although such trading may not be widespread. Ali et al. (2002) document that the change in institutional ownership of a firm during a calendar quarter is positively associated with the three-day abnormal returns at the time of the subsequent announcement of the company's quarterly earnings. They report that changes in ownership by independent investment advisors, investment companies, and insurance companies are positively associated with subsequent earnings announcement returns, while those by internally managed pension funds, educational funds, and private foundations are not. This is because the former institutions face greater competition for clients, which creates pressure to improve returns by actively seeking information in the short run.

As argued in Hand (1990), institutional investors are "sophisticated" traders who can correctly interpret available information. They have incentives to engage in information search activities because of increasing returns to scale in information production. That is, data search and information production is more cost-efficient for institutions than for

individual investors. Furthermore, institutional investors have enjoyed superior access to information from companies until the adoption of SEC Regulation FD in August 2000.²⁷ Evidence shows that at least before the enactment of this regulation, institutional investors and analysts had opportunities to obtain private information regarding future earnings through a selective disclosure process such as conference calls or meetings open only to analysts/institutional investors, and private communications/interviews with company executive officials [see Hutchins (1994), and Berenbeim (1994)].

Overall, it is reasonable to propose that large sophisticated institutional investors indeed trade on superior information, discount adequately the stock price for possible earnings management as well as analysts' overoptimism, and sell short overvalued SEO stocks with lower costs. This, together with the price-setting activities of the market-making sector, drives the market prices of issuers to appropriate levels after SEOs. In that case, it is likely that the trading activity of large institutional investors will be manifested in DOIMB. Therefore, DOIMB reflecting the trading activity of larger institutional investors will not show a delink with returns in the post-SEO period.

B.2 NOIMB and Individual Investors

Why is the NOIMB-return delink more prominent in the portfolios that individual investors buy on net after SEOs? More specifically, we discuss why small individual investors keep trading the SEO stocks in a manner tilted toward the buy side in the post-issue period while such stocks tend to underperform.

The most probable explanation would be the behavioral biases of small individual investors. Given that rational expectation models cannot explain the observed anomalous reactions of individual investors manifested in NOIMB, an alternative explanation based on imperfect investor rationality seems justifiable. In the framework of Daniel, Hirshleifer, and Subrahmanyam (1998), investors are susceptible to psychological/behavioral biases: overconfidence and biased self-attribution. The model implies that investors overreact to private information signals and underreact to public information. Possibly, overconfident individual investors invest in SEO stocks with some private signals, experiencing good performance in the pre-issue period. If they receive confirming public information, their

²⁷Regulation FD requires that when a firm intentionally discloses material information, it should do so publicly, but not selectively. The disclosure may be in the form of an 8-K filing with the SEC, a press release, or a public statement.

overconfidence grows, which leads them to buy more aggressively. However, when they receive disconfirming public information (in this case, the announcements of SEOs), their confidence falls only modestly. Thus, they are sluggish in adjusting to the market response, continuing to buy SEO stocks for a considerable period after the offerings.

Lakonishok, Shleifer, and Vishny (1994) show that “value” stocks exhibit abnormally higher returns than “glamour” stocks. This implies that investors are too optimistic about stocks that have performed better in the recent past and are too pessimistic about the stocks that have performed poorly. As shown in the behavioral literature, naive and unsophisticated investors are subject to extrapolation bias. That is, small investors tend to extrapolate the past trend too far into the future after observing the price run-ups before SEOs. Therefore, small individual investors continue to aggressively purchase stocks which have already appreciated, while larger, institutional investors whose trades are picked up by DOIMB cause stock prices to correct after SEOs. It is likely that large sophisticated institutions are contrarians to the naïve strategies of small investors, effectively exploiting their expectational errors.

We find in Figures 1(B) and 2(B) that the price run-up and return outperformance of SEO firms in the pre-issue period begins from month -16 . This price run-up can occur for several reasons. One candidate is the bull market. Managers are more likely to issue new stock when the price level is high enough. The second reason is that managers may manage earnings before offering new issues to boost up the stock price. Another possibility is underwriters’ efforts to maintain the price at high levels before and after the offerings. Consequently, stock prices of the firms considering issuing new shares are likely to rise for a certain period of time before the event. The prices of our SEO firms continue to increase for 16 months on average before the issuances. Presumably, small, and possibly naïve, investors observe this outperformance in the pre-event period and tend to extrapolate this trend, trading aggressively more than what is justified by subsequent return performance of such stocks.

Now we discuss in more detail the elements that could affect the behavioral biases of small individual investors. First, buying and selling of small individual investors may be decided by different processes. For example, some researchers believe that buying decisions of small investors are affected by news events which bring the stock to small investors’ attention, but their selling decisions are likely to be driven by consumption or liquidity needs [see Lee (1992)]. According to this view, news about a corporate event that

simply receives media coverage can induce buying activities of small traders regardless of the nature of the news. In that case, it is not whether the news is good or bad, but the attention itself that triggers their buying behavior. Based on this view, the propensity toward buys will occur in small trades for any corporate events that receives sufficient media coverage.

Next, small investors spend far less time on investment analysis and rely more heavily on advisors in their investment decisions. Several studies document that there is a general tendency to be optimistically biased in analysts' earnings forecasts. Moreover, Ali (1997) and others find that analysts' earnings forecast have greater optimistic bias for equity issuers than for nonissuers [see also Dechow, Hutton, and Sloan (1997), Lin and McNichols (1997), Michaely and Womack (1996), and Rajan and Servaes (1997)]. If post-issue earnings forecasts of analysts are systematically too optimistic and small investors do not discount appropriately for such views about the issuing firms, they are likely to keep buying the SEO stocks in the post-event period.

Another possible source for this overoptimism is the earnings management of some issuers coupled with investor credulity. Some issuers attempt to manage earnings consciously, boosting the stock price prior to issuing, and the inflated earnings systematically fool small investors. For example, Teoh, Welch, and Wong (1997), and Rangan (1997) report that firms making more aggressive use of discretionary accruals to inflate earnings have the worst subsequent return underperformance after equity offerings.²⁸

Moreover, to keep the market price from dropping below the offer price, analysts affiliated with underwriting banks try to make earnings projections look favorable. If the IPO and SEO markets are fully efficient, investors will adequately discount the stock price to reflect earnings management and analysts' overoptimism. However, small investors may not rationally discount for the earnings management or overoptimism about the future performance of issuing firms.

One more explanation along the lines of Miller (1977) is that less sanguine investors may want to sell short SEO stocks, but they face short sale constraints. The constraints may contribute to abnormal buying, because individual investors face much higher costs of short selling than large institutional investors, leading them to buy rather than sell short the SEO stocks. As mentioned above, some institutional investors do purchase SEO

²⁸Of course, other issuers simply issue equity after observing a stock price run-up without intentionally attempting to manipulate. See Lee (1997).

stocks by splitting their buy orders for informational or liquidity reasons in the post-issue period. This trading activity will also be manifested in NOIMB. In this case, however, the abnormal imbalances are not prominent and the NOIMB-return delink does not arise as we see above.

To sum up, there exists an individual/institutional dichotomy in reactions to the same signal. Market participants are not homogeneous in their reactions to seasoned equity offerings. Given that NOIMB effectively captures the trading activity of small individual investors and DOIMB captures that of large institutional investors, it is the large, presumably more sophisticated institutional investors (together with the market-making sector) that cause the correction in returns after SEOs. It appears that individual investors overweight pre-issue period outperformance and do not modify their confidence accordingly when they receive disconfirming public signals. As a result, they are tardy in adjusting their overoptimism about future earnings potential of the issuers, systematically lagging behind the market response. It takes more than two years before small investors adequately revise their overoptimistic views. They may not even recognize the fact that SEO stocks perform poorly after the offerings on average. Consequently, the SEO stock portfolios they buy significantly underperform the nonissuer benchmark portfolios and the SEO portfolios that institutional investors buy on net.

VII. CONCLUSION

The literature on financial markets has traditionally centered on explaining asset prices, while trading activity has not attracted its due attention. In conformance with this observation, the literature on securities offerings (IPOs or SEOs) has also focused on return performance after issuance, ignoring the trading activity around those corporate events. Trading activity, however, can potentially shed useful additional light on the cause of the predictable return patterns following equity issues.

Many researchers have recently explored the association between stock returns and trading activity. However, trading activity has been mostly proxied by an unsigned activity measure, or volume. Signed order flows, however, may be a stronger driver of (signed returns). Thus, this study investigates patterns of two signed trading activity measures (order imbalance in transactions, NOIMB and dollars, DOIMB) and their implications for price movements surrounding the SEOs for NYSE-listed firms over the 10-year period

(July 1988-June 1998). We observe many interesting features in key variables of the SEO portfolio compared to the size-matching benchmark portfolio. Current levels of order imbalances (both NOIMB and DOIMB) drive returns in the cross-sectional context, and there is no significant difference in the relationship before and after SEOs. In the time series, however, the two order imbalance measures behave quite differently. The abnormal trade-number imbalances (ANOIMB) continue to remain high for at least 18 months, while the abnormal dollar-volume imbalances (ADOIMB) disappear soon after the offerings. Most importantly, we uncover that the relation between NOIMB and returns is delinked in the post-SEO period. This NOIMB-return delink in the post-issue period is a phenomenon that is conspicuous in the SEO portfolios which individual investors aggressively buy on net. The delink does not occur in the SEO portfolios which institutional investors buy on net. We also do not observe it in most cases for the size-matching benchmark portfolios.

This suggests that there is heterogeneity across individual and institutional investors in their reactions to the equity offerings. By our two sets of empirical tests, we infer that small traders are well represented by individual investors and large traders by institutional investors. Thus, the evidence supports the notion that small, possibly naïve, individuals keep buying SEO stocks aggressively while their returns reverse in the post-issue period. This is a puzzle that rational expectations models cannot explain.²⁹ We also draw the conclusion that it is the large, more sophisticated institutional investors that cause the general return reversal after SEOs. Small individual investors appear to be sluggish in adjusting their overoptimism about earnings potential of the SEO firms, thereby lagging behind the market response. It takes more than two years before small investors adequately revise their overoptimistic views. Consequently, the SEO portfolios which individual investors aggressively buy on net strongly underperform the size-matching nonissuer portfolios as well as the SEO portfolios which institutional investors buy on net in the post-issue period. This demonstrates that individual investors are on average dominated by institutional investors in their investment strategies in trading SEO stocks following the offerings.

The key contribution of this study is to show that the behavioral biases of small

²⁹While the insightful papers of Brav and Heaton (2002) and Lewellen and Shanken (2003) rationalize pricing anomalies in a setting with learning and structural uncertainty, they do not explore the trading activity-return relation.

individual investors induce anomalous order flow patterns (the NOIMB-return delink) in SEO stocks. However, the sample of this study is constrained by the availability of OIMB data. Thus, the analysis is based on a relatively small sample compared with the studies on the post-issue underperformance of IPOs or SEOs. The difficulties of obtaining broader and longer OIMB data preclude us from doing a larger sample study. In this sense, some caution is warranted in drawing a general conclusion from our results. Our hope is that this work can act as a catalyst, leading to more fruitful research in this area. In particular, an order flow analysis with a broader sample of SEOs conducted by AMEX- and NASDAQ-listed firms will shed further light on this debate.

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Table I
Sample of SEOs

Panel A shows the sample of SEOs by year. The sample period is from July 1988 to June 1998 at a daily horizon, and January 1989 to December 1997 at a monthly horizon. The definitions in Panel A are: *PRIM*: pure primary offerings; *SECON*: both primary and secondary offerings together, or pure secondary offerings; *#SEOs*: the number of SEOs (*PRIM* + *SECON*). Panel B contains summary statistics for the SEO sample (521 SEOs). The definitions of items in Panel B are: *Proceeds*: the amount of proceeds from SEOs in million US dollars; *#Issues*: the number of issues from SEOs in million shares; *SSEO1*: size of SEO defined as {Proceeds/market value at day(-1)}*100; *SSEO2*: size of SEO defined as {#Issues/shares outstanding at day(-1)}*100; *MV(t-1)*: price*shares outstanding as of the end of the previous year in billion US dollars; *BTM(t-1)*: book-to-market ratio as of the end of the previous year. Panel C breaks down the sample (daily) by industry.

Panel A: SEO Sample by Year						
Year	Daily Horizon			Monthly Horizon		
	PRIM	SECON	#SEOs	PRIM	SECON	#SEOs
Jul-Dec 1988	5	2	7	-	-	-
1989	16	2	18	8	2	10
1990	20	2	22	18	2	20
1991	58	7	65	48	4	52
1992	54	13	67	50	12	62
1993	62	19	81	49	12	61
1994	46	11	57	37	10	47
1995	29	17	46	27	11	38
1996	51	19	70	47	18	65
1997	31	23	54	31	22	53
Jan-Jun 1998	26	8	34	-	-	-
Total	398	123	521	315	93	408

Panel B: Summary Statistics for SEOs				
Variable	MEAN	STD	MIN	MAX
Proceeds (\$mill)	139.27	203.10	2.70	2459.20
#Issues (mill shares)	4.71	5.02	0.18	40.00
SSEO1 (%)	15.69	13.17	0.35	120.78
SSEO2 (%)	16.05	13.78	0.37	124.17
MV(t-1) (\$bill)	2.15	4.53	0.01	53.04
BTM(t-1)	0.59	0.43	-2.31	3.73

Panel C: Industry Breakdown for SEO Sample		
Industry	#SEOs	%
Mining, Oil, Gas, and Refining	42	8.06
Construction	11	2.11
Food and Tobacco	9	1.73
Textile and Apparel	15	2.88
Wood, Paper, Printing, and Publishing	22	4.22
Chemical, Drug, and Cosmetics	25	4.80
Rubber, Leather, Stone, and Glass	16	3.07
Metal	25	4.80
Machinery, Computer, and Office Equipment	34	6.53
Electronic and Communication Equipment	19	3.65
Transportation Equipment, and Aircraft	16	3.07
Measuring, Medical Equipment, and Misc. Manufacturing	15	2.88
Transportation, Air Transportation, and Shipping	13	2.50
Telecomm. and Broadcasting	3	0.58
Electric, Gas, Water Distribution, and Sanitary Services	73	14.01
Wholesale	17	3.26
Retail	46	8.83
Financial and Holding Companies	60	11.52
Hotel and Personal Services	9	1.73
Advertising, Business Services, and Other Services	49	9.40
Other	2	0.38
Total	521	100.00

Table II
Descriptive Statistics of Key Variables for the SEO firms

This table exhibits the descriptive statistics of key variables for the SEO sample at a daily horizon (Panel A) and a monthly horizon (Panel B) over the event windows. The values of each statistic are first calculated cross-sectionally each day or month and then the time-series averages of those values over each interval are reported here. The definitions of variables are: trade-number order imbalances (*NOIMB*), dollar-volume imbalances (*DOIMB*), returns (*RET*), turnover (*TURN*), split- and stock dividend-adjusted prices (*ADJP*), and market values (*MV*). *Period* [*a*, *b*] means an interval from day (month) *a* to day (month) *b* relative to the event day (month). The numbers of samples at daily and monthly horizons are 521 SEOs and 408 SEOs, respectively, over the sample period (from July 1988 to June 1998 at a daily horizon, and January 1989 to December 1997 at a monthly horizon).

Panel A: Sample at a Daily Horizon																
	Whole Period [-120, 120]				Pre-event Period [-120, -1]				Event Day [day 0]				Post-event Period [1, 120]			
Variable	MEAN	STD	MIN	MAX	MEAN	STD	MIN	MAX	MEAN	STD	MIN	MAX	MEAN	STD	MIN	MAX
NOIMB (%)	2.69	34.24	-99.95	99.72	2.21	36.14	-100.00	100.00	-4.81	34.39	-100.00	100.00	3.22	32.32	-99.90	99.43
DOIMB (%)	2.76	46.06	-100.00	99.94	3.72	47.78	-100.00	100.00	-2.36	40.40	-100.00	100.00	1.84	44.39	-99.99	99.87
RET (%)	0.13	2.29	-11.30	12.82	0.20	2.28	-9.90	13.85	-0.12	2.79	-15.79	11.95	0.05	2.29	-12.65	11.81
TURN (%)	0.39	0.55	0.00	6.62	0.33	0.49	0.00	6.06	2.20	3.79	0.00	43.41	0.44	0.60	0.00	6.88
ADJP (\$)	19.92	11.19	0.89	68.60	18.97	10.65	0.65	63.47	20.45	11.46	0.74	63.25	20.87	11.72	1.15	73.76
MV (\$bill)	1.90	4.35	0.01	57.99	1.73	4.02	0.01	51.47	1.87	4.27	0.01	56.36	2.06	4.67	0.01	64.53

Panel B: Sample at a Monthly Horizon																
	Whole Period [-36, 36]				Pre-event Period [-36, -1]				Event Month [month 0]				Post-event Period [1, 36]			
Variable	MEAN	STD	MIN	MAX	MEAN	STD	MIN	MAX	MEAN	STD	MIN	MAX	MEAN	STD	MIN	MAX
NOIMB (%)	1.96	15.77	-54.66	48.46	0.66	16.84	-60.52	50.76	-4.54	16.76	-58.67	54.67	3.44	14.67	-48.70	45.99
DOIMB (%)	1.16	20.19	-79.66	74.05	0.66	22.81	-88.05	82.71	-3.30	19.84	-71.59	61.74	1.78	17.57	-71.50	65.73
RET (%)	1.63	10.86	-39.39	52.15	2.32	11.13	-35.25	58.88	2.00	10.38	-53.33	38.89	0.93	10.60	-43.13	45.80
TURN (%)	7.50	7.71	0.43	76.51	6.51	6.61	0.19	58.68	14.51	10.35	0.28	96.99	8.29	8.74	0.67	93.78
ADJP (\$)	17.53	10.68	0.61	71.57	14.28	9.13	0.27	53.89	20.07	11.23	0.76	68.13	20.70	12.23	0.94	89.34
MV (\$bill)	1.87	4.20	0.01	45.36	1.35	3.21	0.01	35.40	1.87	3.90	0.00	37.51	2.39	5.19	0.01	55.54

Table IIIa

The Wilcoxon Test: Comparison of the SEO-Firm Portfolio with the Size-Matching Benchmark Portfolio around SEOs (Daily)

This table shows how the characteristics of the issuers (SEO firms) at daily horizons are different from those of the non-issuers (size-matching firms) in trade-number order imbalances (*NOIMB*), dollar-volume imbalances (*DOIMB*), turnover (*TURN*), and returns (*RET*) around SEOs. Panel A contains the cross-sectional means in each period for the SEO firm portfolio, while Panel B does the same for the size-matching portfolio. For the values in an interval, the cross-sectional means are computed after the time series of the variables are first averaged over the interval for each firm. Panel C presents Z-statistics for the Wilcoxon test. Interval $[a, b]$ means a period from day a to day b relative to the event date. The number of SEO firms is 521. N is the number of observations used to calculate the mean values. N^* is the number of non-zero differences used in the Wilcoxon test. Let the Wilcoxon statistic be W and the significance level be α . Then, for large N^* in a two-tailed test, we can reject the null hypothesis that the distribution of issuer and non-issuer values is identical if

$$Z = \frac{W - E(W)}{\sqrt{Var(W)}} < -z_{\alpha/2}, \text{ where } E(W) = \frac{N^*(N^* + 1)}{4}, Var(W) = \frac{N^*(N^* + 1)(2N^* + 1)}{24}.$$

Panel A: Means for SEO Firms															
Item	[-120, -81]	[-80, -61]	[-60, -41]	[-40, -11]	[-10, -1]	-2	-1	0	1	2	[0, 10]	[11, 40]	[41, 60]	[61, 80]	[81, 120]
NOIMB (%)	2.312	2.461	2.361	1.812	2.338	5.200	2.057	-4.806	-19.015	-8.035	-4.438	2.857	4.181	4.391	4.315
DOIMB (%)	3.086	4.409	4.033	3.328	4.574	6.677	4.776	-2.365	-11.724	-3.909	-1.122	2.931	2.186	1.940	1.612
TURN (%)	0.317	0.353	0.343	0.331	0.319	0.340	0.394	2.202	3.778	1.069	1.067	0.419	0.389	0.385	0.377
RET (%)	0.240	0.280	0.259	0.149	-0.008	-0.157	-0.510	-0.123	0.491	0.360	0.179	0.051	0.037	0.024	0.035
N	477	484	495	509	508	439	438	506	507	507	507	511	510	509	505
Panel B: Means for Non-issuer Size-matching Firms															
Item	[-120, -81]	[-80, -61]	[-60, -41]	[-40, -11]	[-10, -1]	-2	-1	0	1	2	[0, 10]	[11, 40]	[41, 60]	[61, 80]	[81, 120]
NOIMB (%)	1.059	0.754	1.103	0.037	0.397	-1.031	0.954	0.944	0.236	-1.689	0.452	0.839	0.606	-0.185	-0.001
DOIMB (%)	0.944	1.365	2.183	0.102	0.809	1.243	2.161	-0.641	0.579	-1.245	0.874	1.623	0.808	1.627	1.270
TURN (%)	0.326	0.343	0.326	0.320	0.322	0.284	0.315	0.351	0.344	0.299	0.326	0.323	0.311	0.321	0.317
RET (%)	0.085	0.121	0.099	0.060	0.052	0.133	0.246	0.090	0.101	-0.021	0.077	0.047	0.038	0.087	0.040
N	477	484	495	509	508	439	438	506	507	507	507	511	510	509	505
Panel C: Z-statistics for the Wilcoxon Test															
Item	[-120, -81]	[-80, -61]	[-60, -41]	[-40, -11]	[-10, -1]	-2	-1	0	1	2	[0, 10]	[11, 40]	[41, 60]	[61, 80]	[81, 120]
NOIMB	-1.56	-1.76	-1.26	-1.62	-1.41	-2.65	-0.34	-2.44	-9.18	-2.83	-4.71	-2.28	-4.36	-5.00	-5.37
DOIMB	-3.03	-3.59	-2.19	-4.31	-3.24	-1.84	-1.01	-0.36	-4.96	-1.08	-1.97	-2.00	-1.62	-0.37	-0.54
TURN	-1.26	-1.27	-1.83	-1.60	-1.27	-2.88	-4.15	-13.90	-19.12	-16.70	-17.54	-6.47	-5.40	-4.64	-4.97
RET	-7.01	-5.01	-6.08	-3.85	-1.55	-2.42	-5.47	-1.66	-2.10	-3.48	-2.39	-0.15	-0.00	-1.77	-0.49
N*	463	476	489	508	507	435	432	496	502	505	506	509	500	495	497

Table IIIb

The Wilcoxon Test: Comparison of the SEO-Firm Portfolio with the Size-Matching Benchmark Portfolio around SEOs (Monthly)

This table shows how the characteristics of the issuers (SEO firms) at monthly horizons are different from those of the non-issuers (size-matching firms) in trade-number order imbalances (*NOIMB*), dollar-volume imbalances (*DOIMB*), turnover (*TURN*), and returns (*RET*) around SEOs. Panel A contains the cross-sectional means in each period for the SEO firm portfolio, while Panel B does the same for the size-matching portfolio. For the values in an interval, the cross-sectional means are computed after the time series of the variables are first averaged over the interval for each firm. Panel C presents Z-statistics for the Wilcoxon test. Interval $[a, b]$ means a period from month a to month b relative to the event month. The number of SEO firms is 408. N is the number of observations used to calculate the mean values. N^* is the number of non-zero differences used in the Wilcoxon test. Let the Wilcoxon statistic be W and the significance level be α . Then, for large N^* in a two-tailed test, we can reject the null hypothesis that the distribution of issuer and non-issuer values is identical if

$$Z = \frac{W - E(W)}{\sqrt{Var(W)}} < -z_{\alpha/2}, \text{ where } E(W) = \frac{N^*(N^* + 1)}{4}, Var(W) = \frac{N^*(N^* + 1)(2N^* + 1)}{24}.$$

Panel A: Means for SEO Firms															
Item	[-36, -25]	[-24, -17]	[-16, -9]	[-8, -5]	[-4, -1]	-2	-1	0	1	2	[1, 4]	[5, 8]	[9, 16]	[17, 24]	[25, 36]
NOIMB (%)	-0.440	0.938	1.017	1.563	3.888	4.102	1.898	-4.538	2.270	4.511	4.320	5.673	5.163	2.631	1.611
DOIMB (%)	-1.389	-0.627	1.895	2.835	5.250	6.107	4.121	-3.303	2.569	1.925	1.706	2.120	1.254	1.755	1.872
TURN (%)	6.488	6.453	7.050	6.537	7.345	7.462	7.250	14.512	10.070	10.240	9.379	8.210	8.277	8.063	8.257
RET (%)	1.287	1.332	3.079	3.827	5.031	5.266	2.526	1.999	1.517	0.612	1.032	1.272	0.798	0.908	0.805
N	283	309	331	342	346	343	345	346	346	350	358	373	381	350	308
Panel B: Means for Non-issuer Size-matching Firms															
Item	[-36, -25]	[-24, -17]	[-16, -9]	[-8, -5]	[-4, -1]	-2	-1	0	1	2	[1, 4]	[5, 8]	[9, 16]	[17, 24]	[25, 36]
NOIMB (%)	0.308	0.650	0.605	-0.228	0.866	0.943	0.854	0.406	0.128	1.335	0.869	0.130	1.553	0.630	-1.296
DOIMB (%)	0.102	0.028	0.417	0.512	1.069	0.944	2.542	1.091	0.050	1.507	1.322	1.421	1.489	1.703	0.784
TURN (%)	6.056	6.551	6.429	5.995	6.456	6.260	6.579	6.234	6.381	6.173	6.323	6.548	6.414	6.708	7.102
RET (%)	1.202	1.191	1.696	1.393	2.292	1.872	1.496	1.034	0.813	1.431	1.340	1.633	1.116	1.252	1.087
N	283	309	331	342	346	343	345	346	346	350	358	373	381	350	308
Panel C: Z-statistics for the Wilcoxon Test															
Item	[-36, -25]	[-24, -17]	[-16, -9]	[-8, -5]	[-4, -1]	-2	-1	0	1	2	[1, 4]	[5, 8]	[9, 16]	[17, 24]	[25, 36]
NOIMB	-0.96	-0.69	-0.56	-1.42	-2.94	-2.28	-0.57	-4.48	-2.25	-3.38	-4.24	-6.54	-4.90	-2.74	-3.94
DOIMB	-1.12	-0.79	-2.56	-2.26	-4.54	-4.06	-0.12	-2.03	-2.32	-0.53	-1.11	-1.53	-0.65	-0.16	-0.84
TURN	-1.90	-0.47	-1.81	-2.17	-2.62	-2.96	-2.43	-13.16	-7.72	-6.52	-6.55	-4.67	-5.30	-4.24	-3.90
RET	-1.07	-0.58	-5.10	-6.39	-7.23	-4.28	-0.65	-1.69	-1.07	-1.87	-1.20	-0.30	-0.92	-0.30	-0.74
N*	211	242	280	308	336	326	332	333	335	338	352	367	373	327	279

Table IV

Rank-Order Correlation Coefficients between Returns and Order Imbalances around SEOs (Daily)

This table shows Spearman's rank-order correlation coefficients between returns and order imbalances for daily data. For each pair (total 241 pairs) of cross-sectional sample $(RET_{i,t}, OIMB_{i,t})$, where $t = -120, -119, \dots, -1, 0, 1, \dots, 119$, and 120 , RET_i and $OIMB_i$ are first ranked separately in ascending order to assign ranks for each variable. Then the sample correlation of these ranks is computed for each day (total 241 trading days) in the event window. Panel A shows the results for the rank-order correlation coefficients between returns (RET) and trade-number imbalances (NOIMB), while Panel B does for the rank-order correlation coefficients between returns (RET) and dollar-volume imbalances (DOIMB). *Interval* $[a, b]$ means a period from day a to day b relative to the event date. *Rank-order Correlation* is the average of rank-order correlation coefficients in the corresponding interval when the interval has more than one trading day (i.e., if #days > 1). The number of SEO firms is 521. *Obs* is the average number of observations (firms) used in the interval. *#days* is the number of trading days corresponding to the interval. *Max* is the day with maximum correlation within the event window. *Min* is the day with minimum correlation within the event window. Under the null hypothesis of zero correlation, the asymptotic standard error of the rank-order correlation coefficient is $1/\sqrt{Obs}$.

Interval	Panel A: With NOIMB		Panel B: With DOIMB		#days
	Rank-order Correlation	Obs	Rank-order Correlation	Obs	
[-120, 120]	0.36	494.5	0.35	494.5	241
[-120, -1]	0.35	481.2	0.35	481.2	120
[1, 120]	0.36	507.8	0.36	507.8	120
[-120, -61]	0.33	466.6	0.33	466.6	60
[-60, -1]	0.38	495.8	0.37	495.8	60
[-10, -1]	0.39	492.0	0.37	492.0	10
-1 ^a	0.41	438.0	0.34	438.0	1
0 ^a	0.21	506.0	0.33	506.0	1
1 ^a	0.26	507.0	0.42	507.0	1
[1, 10]	0.37	506.7	0.42	506.7	10
[1, 60]	0.39	507.7	0.39	507.7	60
[61, 120]	0.33	507.9	0.34	507.9	60
Max ^a	0.47	505.0	0.48	506.0	1
Min ^a	0.19	450.0	0.21	450.0	1

^a single-day intervals.

Table V

Fama-MacBeth Statistics from 2SLS Cross-Sectional Regressions around SEOs (Daily)

This table presents the Fama-MacBeth statistics from the second stage of 2SLS regressions (total 231 regressions for each of NOIMB and DOIMB). In the first stage, order imbalances (OIMB) are estimated by:

$$OIMB_{i,t} = \beta_0 + \sum_{k=1}^m \beta_{1k} RET_{i,t-k} + \sum_{k=1}^m \beta_{2k} TURN_{i,t-k} + \sum_{k=1}^m \beta_{3k} LN(P)_{i,t-k} + \beta_4 LN(MV)_{i,t} + \beta_5 IO_{i,y-1} \\ + \beta_6 NOANA_{i,y-1} + \beta_7 SSEO2_i + \beta_8 PRIM_i + u_{i,t},$$

where OIMB is either trade number imbalances (NOIMB) or dollar volume imbalances (DOIMB), $m=10$, and $t = -110, -109, \dots, -1, 0, 1, 2, \dots, 119$, and 120 . Other definitions: RET is a return; $TURN$ is turnover; $LN(P)$ is logarithm of a split-adjusted price; IO is institutional ownership; $NOANA$ is the number of analysts; $SSEO2$ is the size of an SEO; and $PRIM$ is a dummy for a primary offering. The second-stage regressions are performed by an equation,

$$RET_{i,t} = \gamma_0 + \gamma_1 \hat{OIMB}_{i,t} + \gamma_2 LN(MV)_{i,t} + v_{i,t}.$$

Panel A shows the results for the relationship between returns (RET) and estimated trade number imbalances ($\hat{NOIMB}$), while Panel B does for the relationship between returns and estimated dollar volume imbalances ($\hat{DOIMB}$). The dependent variable is returns, RET , in both panels. *Interval* $[a, b]$ means a period from day a to day b relative to the event date. *Const* is an intercept. *Predicted NOIMB (DOIMB)* is the estimated trade number (dollar volume) imbalances from the first-stage regressions. $LN(MV)$ is natural logarithm of a market value. *#days* is the number of trading days (= the number of coefficients used in computing the average coefficient) corresponding to the interval. The number of SEO firms is 521. *Obs* is the average number of observations (firms) used in the cross-sectional regressions. The values in the upper row for each interval are the time-series averages of coefficients obtained from the second-stage cross-sectional regressions run each day in the interval. The values italicized in the lower row of each interval are Fama-MacBeth t-statistics for the corresponding average coefficients. Coefficients significantly different from zero at the significance levels of 1%, 5%, and 10% are indicated by ***, **, and *, respectively.

Interval	Panel A: For NOIMB			Panel B: For DOIMB			# days
	Constant	Predicted NOIMB	LN(MV)	Constant	Predicted DOIMB	LN(MV)	
[-110, 120]	0.2278 ***	0.0244 ***	-0.0269 ***	0.2928 ***	0.0190 ***	-0.0343 ***	231
	4.84	24.36	-4.23	6.31	29.39	-5.39	
[-110, -1]	0.4410 ***	0.0243 ***	-0.0451 ***	0.4441 ***	0.0186 ***	-0.0488 ***	110
	6.14	17.54	-4.56	6.50	17.75	-5.23	
[1, 120]	0.0361	0.0245 ***	-0.0109	0.1585 ***	0.0193 ***	-0.0216 **	120
	0.63	16.84	-1.36	2.59	24.45	-2.51	
[-110, -56]	0.7715 ***	0.0206 ***	-0.0869 ***	0.7218 ***	0.0151 ***	-0.0814 ***	55
	8.71	10.56	-6.68	8.09	10.48	-6.21	
[-55, -1]	0.1106	0.0279 ***	-0.0032	0.1664 *	0.0222 ***	-0.0162	55
	1.17	15.09	-0.26	1.86	16.03	-1.37	
[-10, -1]	-0.5132 **	0.0308 ***	0.0622 **	-0.4615 **	0.0271 ***	0.0481 *	10
	-2.16	8.80	2.25	-1.97	6.36	1.74	
-1 ^a	-1.5874 ***	0.0319 ***	0.1510 *	-1.2312 **	0.0419 ***	0.0761	1
	-2.80	3.16	1.77	-2.17	4.57	0.88	
0 ^a	-0.2071	0.0205 *	0.0431	-0.2492	0.0177 *	0.0392	1
	-0.27	1.77	0.39	-0.34	1.89	0.36	
1 ^a	1.3144 *	0.0161	-0.0813	1.2506 *	0.0237 **	-0.0725	1
	1.75	1.51	-0.81	1.84	2.21	-0.75	
[1, 10]	0.3242 *	0.0217 ***	-0.0081	0.4139 ***	0.0191 ***	-0.0278	10
	1.93	7.20	-0.39	2.76	11.16	-1.45	
[1, 60]	-0.0230	0.0260 ***	0.0022	0.0981	0.0183 ***	-0.0106	60
	-0.33	15.79	0.24	1.32	20.64	-1.04	
[61, 120]	0.0951	0.0230 ***	-0.0240 *	0.2190 **	0.0203 ***	-0.0325 **	60
	1.05	9.59	-1.87	2.25	15.62	-2.36	
Obs		477.2			477.2		

^a Coefficients and t-values are directly from the individual cross-sectional regressions.

Table VI**Time-Series Correlation Coefficients between Returns and Order Imbalances around SEOs**

This table shows correlation coefficients between the two time series of returns and order imbalances at both daily and monthly horizons. The time series are obtained by cross-sectionally averaging (equal-weighted) the returns and order imbalances of the component stocks for each portfolio over the event window. Panel A contains the results of the SEO-firm portfolio and the size-matching portfolio at a daily horizon, while Panel B does the same at a monthly horizon. *Interval* $[a, b]$ means a period from day (month) a to day (month) b relative to the event date (month). *NOIMB* stands for trade number order imbalances and *DOIMB* for dollar volume imbalances. The numbers of SEO firms are 521 for Panel A and 408 for Panel B. Under the null hypothesis of zero correlation, asymptotic standard error of the correlation coefficient is $1 / \sqrt{N}$, where N is the number of observations (trading days or months) used in computing the correlation coefficients.

Panel A: Daily Horizon				
Interval	SEO Firms		Size-Matching Firms	
	Correlation with NOIMB	Correlation with DOIMB	Correlation with NOIMB	Correlation with DOIMB
[-120, 120]	-0.09	0.31	0.31	0.24
[-120, -1]	0.29	0.16	0.30	0.30
[1, 120]	-0.20	0.16	0.30	0.21
Panel B: Monthly Horizon				
Interval	SEO Firms		Size-Matching Firms	
	Correlation with NOIMB	Correlation with DOIMB	Correlation with NOIMB	Correlation with DOIMB
[-36, 36]	0.04	0.51	0.19	0.14
[-36, -1]	0.87	0.86	0.24	0.30
[1, 36]	0.06	0.36	0.17	0.32

Table VII
Time-Series Regressions of Returns on Order Imbalances around SEOs

This table shows the results of time-series regressions of returns on order imbalances and turnover for daily and monthly data as in $RET_t = \varphi_0 + \varphi_1 OIMB_t + \varphi_2 TURN_t + \varepsilon_t$. The time series are obtained by cross-sectionally averaging (equal-weighted) the returns (RET), order imbalances (OIMB), and turnover (TURN) of the component stocks for each portfolio over the event window. Panel A contains the results for the SEO-firm portfolio and the size-matching portfolio for the daily horizon. Panel B does the same for the monthly horizon. *Interval* $[a, b]$ means a period from day (month) a to day (month) b relative to the event date (month). *Const* is an intercept. *NOIMB* stands for trade number order imbalances and *DOIMB* for dollar volume imbalances. The values in the upper row for each interval are coefficients estimated from the regressions over the interval. The values italicized in the lower row of each interval are t-statistics. Coefficients significantly different from zero at the significance levels of 1%, 5%, and 10% are indicated by ***, **, and *, respectively. The numbers of SEO firms are 521 for Panel A and 408 for Panel B.

Panel A: Daily Horizon Regressions												
Interval	SEO Firms						Size-Matching Firms					
	On NOIMB			On DOIMB			On NOIMB			On DOIMB		
	Const	NOIMB	TURN	Const	DOIMB	TURN	Const	NOIMB	TURN	Const	DOIMB	TURN
[-120, 120]	0.1598 ***	-0.0063	-0.0167	0.0111	0.0259 ***	0.1378 ***	-0.1517 *	0.0203 ***	0.6539 **	-0.1631 *	0.0098 ***	0.6860 **
	5.13	-1.27	-0.34	0.44	6.13	3.40	-1.68	4.94	2.33	-1.77	3.64	2.39
[-120, -1]	0.2922	0.0263 ***	-0.4402	0.3039 *	0.0119 *	-0.4330	-0.0310	0.0202 ***	0.3156	-0.0481	0.0127 ***	0.3711
	1.62	3.28	-0.80	1.64	1.87	-0.76	-0.23	3.40	0.76	-0.36	3.41	0.90
[1, 120]	-0.0520	-0.0086	0.2121 ***	-0.0902 ***	0.0257 ***	0.2543 ***	-0.2314 *	0.0185 ***	0.8704 **	-0.2220 *	0.0080 **	0.8266 **
	-1.20	-1.47	3.67	-3.57	5.25	6.61	-1.87	3.25	2.24	-1.74	2.06	2.06
Panel B: Monthly Horizon Regressions												
Interval	SEO Firms						Size-Matching Firms					
	On NOIMB			On DOIMB			On NOIMB			On DOIMB		
	Const	NOIMB	TURN	Const	DOIMB	TURN	Const	NOIMB	TURN	Const	DOIMB	TURN
[-36, 36]	3.1559 ***	0.0601	-0.2177 *	3.3399 ***	0.3578 ***	-0.2812 ***	2.6884 **	0.1225	-0.2208	3.6375 ***	0.1289 *	-0.3811 **
	3.38	0.83	-1.71	4.33	5.61	-2.74	2.17	1.61	-1.15	3.03	1.76	-2.00
[-36, -1]	-0.8621	0.7889 ***	0.4136	-1.7023	0.4546 ***	0.5738	-4.0614 **	0.1425	0.9052 ***	-4.5366 **	0.1756 **	0.9809 ***
	-0.34	7.21	1.05	-0.67	6.86	1.45	-2.00	1.42	2.71	-2.38	2.16	3.14
[1, 36]	-0.6289	0.0080	0.1871	-0.7267	0.2024 **	0.1589	5.4784 *	0.1268	-0.6459	4.5862 **	0.2326 *	-0.5654 *
	-0.49	0.16	1.20	-0.61	2.15	1.09	1.87	1.01	-1.49	2.13	1.89	-1.77

Table VIII

One-Way Sorting: Comparison of the SEO Portfolio that Individual Investors Buy on Net with the SEO Portfolio that Institutional Investors Buy on Net in Period Year 1-Year 2 (Monthly)

This table presents how the SEO portfolio that individual investors buy on net (Panel A) compares to the portfolio that institutional investors buy on net (Panel B) from year 1 to year 2 after the offerings in trade number order imbalances (*NOIMB*), dollar volume imbalances (*DOIMB*), turnover (*TURN*), and returns (*RET*). It also shows how the characteristics of the issuers (SEO firms) are different from those of the non-issuers (size-matching firms). To form an SEO portfolio (P1) for Panel A, the SEO firms whose institutional ownership at year 2 is less than that at year 0 are selected from the total 408 SEO firms. For portfolio P2 in Panel B, the SEO firms whose institutional ownership at year 2 is greater than that at year 0 are selected from the total sample. The numbers of SEO firms are 128 in Panel A and 203 in Panel B. The upper part contains the cross-sectional means in each interval for the SEO firm portfolios (P1 and P2), while the central part does the same for the size-matching portfolios (P1_M and P2_M). For the values in an interval, the cross-sectional means are computed after the time series of the variables are first averaged over the interval for each firm. The lower part exhibits Z-statistics for the Wilcoxon test so that portfolios P1 and P2 can be compared with their size-matching portfolios P1_M and P2_M, respectively. Interval $[a, b]$ means a period from month a to month b relative to the event month. N is the number of observations used to calculate the mean values. N^* is the number of non-zero differences used in the Wilcoxon test.

Panel A: For SEO Portfolio Individuals Buy on Net in Year 1-Year 2									Panel B: For SEO Portfolio Institutions Buy on Net in Year 1-Year 2								
Item	Means for SEO Firms (P1)								Item	Means for SEO Firms (P2)							
	[-36, -19]	[-18, -9]	[-8, -2]	-1	0	1	[2, 18]	[19, 36]		[-36, -19]	[-18, -9]	[-8, -2]	-1	0	1	[2, 18]	[19, 36]
NOIMB (%)	2.036	2.062	3.336	3.072	-1.223	6.766	7.886	2.349	NOIMB (%)	-0.556	0.429	3.207	0.311	-5.011	1.186	3.408	1.861
DOIMB (%)	1.069	2.615	5.505	4.609	0.051	3.675	2.948	2.426	DOIMB (%)	-2.075	1.402	3.134	3.145	-3.969	2.837	0.843	1.676
TURN (%)	7.234	7.567	7.581	8.050	15.053	9.996	9.371	8.981	TURN (%)	6.359	6.659	6.462	6.836	13.947	8.637	7.385	7.570
RET (%)	1.869	2.644	4.698	3.068	2.930	1.464	0.344	0.481	RET (%)	1.006	2.838	4.406	2.337	1.408	2.158	1.428	0.695
N	95	108	115	115	115	115	127	115	N	153	161	171	169	170	171	198	188
Item	Means for Non-issuer Size-matching Firms (P1_M)								Item	Means for Non-issuer Size-matching Firms (P2_M)							
	[-36, -19]	[-18, -9]	[-8, -2]	-1	0	1	[2, 18]	[19, 36]		[-36, -19]	[-18, -9]	[-8, -2]	-1	0	1	[2, 18]	[19, 36]
NOIMB (%)	0.481	-0.003	1.221	1.113	0.819	-0.656	0.392	-0.325	NOIMB (%)	0.729	1.309	-0.068	0.450	0.514	0.871	1.263	-1.124
DOIMB (%)	2.103	-0.709	1.720	4.614	2.311	-0.322	1.623	1.737	DOIMB (%)	0.150	1.478	0.248	1.136	1.362	0.343	1.358	0.946
TURN (%)	6.085	5.953	6.033	6.639	6.160	5.588	6.290	6.846	TURN (%)	6.174	6.787	6.454	6.576	6.455	6.850	6.519	6.827
RET (%)	1.267	1.475	2.070	1.948	0.744	0.044	1.432	0.913	RET (%)	1.263	1.772	1.719	1.075	1.350	0.994	1.558	1.164
N	95	108	115	115	115	115	127	115	N	153	161	171	169	170	171	198	188
Item	Z-statistics for the Wilcoxon Test								Item	Z-statistics for the Wilcoxon Test							
	[-36, -19]	[-18, -9]	[-8, -2]	-1	0	1	[2, 18]	[19, 36]		[-36, -19]	[-18, -9]	[-8, -2]	-1	0	1	[2, 18]	[19, 36]
NOIMB	-0.31	-1.27	-1.49	-0.25	-1.30	-3.68	-5.63	-2.39	NOIMB	-0.33	-0.40	-2.36	-0.10	-3.50	-0.51	-2.69	-3.28
DOIMB	-0.51	-2.52	-2.53	-0.99	-0.06	-1.62	-1.69	-0.37	DOIMB	-1.56	-1.01	-3.08	-0.24	-2.05	-1.53	-0.75	-0.25
TURN	-2.01	-2.59	-2.24	-2.09	-7.45	-5.38	-3.98	-2.81	TURN	-0.88	-0.11	-0.78	-1.16	-8.66	-4.40	-2.34	-2.15
RET	-1.62	-3.00	-5.14	-0.41	-2.36	-1.09	-3.45	-0.77	RET	-0.17	-2.78	-6.62	-0.38	-0.10	-1.35	-0.66	-1.58
N*	75	93	115	111	111	112	127	114	N*	119	137	166	165	166	168	198	183

Table IX

One-Way Sorting: Time-Series Correlation Coefficients between Returns and Order Imbalances for the SEO Portfolio that Individual Investors Buy on Net and for the SEO Portfolio that Institutional Investors Buy on Net in Period Year 1-Year 2 (Monthly)

This table shows correlation coefficients between the two time series of returns and order imbalances for monthly data. The time series are obtained by cross-sectionally averaging (equal-weighted) the returns and order imbalances of the component stocks for each portfolio over the event window. Panel A contains the results for the SEO-firm portfolio that individual investors buy on net in period year 1-year 2 (P1), while Panel B does the same for the SEO portfolio that institutional investors buy on net (P2). The numbers of SEO firms are 128 in Panel A and 203 in Panel B. *Interval* $[a, b]$ means a period from month a to month b relative to the event month. *NOIMB* stands for trade number order imbalances and *DOIMB* for dollar volume imbalances. Under the null hypothesis of zero correlation, asymptotic standard error of the correlation coefficient is $1 / \sqrt{N}$, where N is the number of observations (months).

Interval	Panel A: SEO Portfolio Individuals Buy		Panel B: SEO Portfolio Institutions Buy	
	Correlation with NOIMB	Correlation with DOIMB	Correlation with NOIMB	Correlation with DOIMB
	P1: SEO Firms		P2: SEO Firms	
[-36, 36]	-0.18	0.45	0.30	0.53
[-36, -1]	0.75	0.73	0.72	0.75
[1, 36]	-0.19	0.31	0.42	0.26
	P1_M: Size-matching Firms		P2_M: Size-matching Firms	
[-36, 36]	0.23	0.28	0.21	0.21
[-36, -1]	0.18	0.28	0.17	0.28
[1, 36]	0.27	0.44	0.22	0.24

Table X

One-Way Sorting: Time-Series Regressions of Returns on Order Imbalances for the SEO Portfolio that Individual Investors Buy on Net and for the SEO Portfolio that Institutional Investors Buy on Net in Period Year 1-Year 2 (Monthly)

This table shows the results of time-series regressions of returns on order imbalances and turnover for monthly data as in $RET_t = \varphi_0 + \varphi_1 OIMB_t + \varphi_2 TURN_t + \varepsilon_t$. The time series are obtained by cross-sectionally averaging (equal-weighted) the returns (RET), order imbalances (OIMB), and turnover (TURN) of the component stocks for each portfolio over the event window. Panel A contains the results for the SEO-firm portfolio that individual investors buy on net in period year 1-year 2 (P1), while Panel B does the same for the SEO portfolio that institutional investors buy on net (P2). For comparison purposes, the results from the corresponding size-matching portfolios (P1_M and P2_M) are also reported. The numbers of SEO firms are 128 in Panel A and 203 in Panel B. *Interval* $[a, b]$ means a period from month a to month b relative to the event month. *Const* is an intercept. *NOIMB* stands for trade number order imbalances and *DOIMB* for dollar volume imbalances. The values in the upper row for each interval are coefficients estimated from the regressions over the interval. The values italicized in the lower row of each interval are t-statistics. Coefficients significantly different from zero at the significance levels of 1%, 5%, and 10% are indicated by ***, **, and *, respectively.

Panel A: Small SEO Portfolio Individuals Buy							Panel B: Large SEO Portfolio Institutions Buy					
Interval	P1: SEO Firms						P2: SEO Firms					
	On NOIMB			On DOIMB			On NOIMB			On DOIMB		
	Const	NOIMB	TURN	Const	DOIMB	TURN	Const	NOIMB	TURN	Const	DOIMB	TURN
[-36, 36]	3.1057 **	-0.0711	-0.1583	3.5188 ***	0.4109 ***	-0.3548 **	2.1750 **	0.2100 ***	-0.1162	2.3805 ***	0.3184 ***	-0.1355
	2.53	-0.91	-1.00	3.42	4.92	-2.80	2.13	2.68	-0.80	2.63	5.33	-1.05
[-36, -1]	-2.7069	0.7227 ***	0.5773 *	-3.0436	0.3657 ***	0.6915 **	-7.7258 **	0.6537 ***	1.5437 ***	-3.3259	0.4237 ***	0.8553
	-1.21	4.45	1.71	-1.38	4.37	2.12	-2.53	6.31	3.16	-0.98	5.78	1.58
[1, 36]	-1.4055	-0.0781	0.2550	-1.0213	0.2913 *	0.0849	-1.6076	0.3261 ***	0.2701	0.6121	0.1450	0.0592
	-0.54	-1.38	0.87	-0.41	1.84	0.32	-0.63	2.80	0.82	0.23	1.51	0.17
P1_M: Size-matching Firms							P2_M: Size-matching Firms					
Interval	On NOIMB			On DOIMB			On NOIMB			On DOIMB		
	Const	NOIMB	TURN	Const	DOIMB	TURN	Const	NOIMB	TURN	Const	DOIMB	TURN
[-36, 36]	0.1871	0.2195 **	0.1708	0.9989	0.1736 **	0.0200	0.1248	0.1332 *	0.1858	1.3149	0.1052 *	-0.0042
	0.14	2.02	0.78	0.73	2.32	0.09	0.09	1.90	0.86	0.89	1.72	-0.02
[-36, -1]	-6.1415 ***	0.0891	1.3248 ***	-4.9934 **	0.0997	1.1088 **	-3.9543 **	0.0476	0.8621 ***	-3.6376 **	0.0491	0.8121 ***
	-2.57	0.57	3.19	-2.32	1.00	3.00	-2.29	0.43	3.10	-2.00	0.69	2.78
[1, 36]	-0.0907	0.2923 *	0.1757	1.1059	0.2927 ***	-0.0749	3.2018	0.1042 *	-0.2896	4.4624	0.1487 *	-0.5025
	-0.04	1.66	0.47	0.53	2.83	-0.24	1.02	1.68	-0.62	1.51	1.65	-1.13

Table XI

Two-Way Sorting: Comparison of the Small-sized SEO Portfolio that Individual Investors Buy on Net with the Large-sized SEO Portfolio that Institutional Investors Buy on Net in Period Year 1-Year 2 (Monthly)

This table presents how the small-sized SEO portfolio that individual investors buy on net (Panel A) compares to the large-sized SEO portfolio that institutional investors buy on net (Panel B) from year 1 to year 2 after the offerings in trade number order imbalances (*NOIMB*), dollar volume imbalances (*DOIMB*), turnover (*TURN*), and returns (*RET*). It also shows how the characteristics of the issuers (SEO firms) are different from those of the non-issuers (size-matching firms). The 408 SEO firms are first sorted by the market value of month 0 in ascending order and split into the two groups. Then the SEO firms whose institutional ownership at year 2 is less than that at year 0 are selected from the smaller-sized group to form a portfolio (P3) for Panel A. For portfolio P4 in Panel B, the SEO firms whose institutional ownership at year 2 is greater than that at year 0 are selected from the larger-sized group. The number of SEO firms is 96 in each panel. The upper part contains the cross-sectional means in each interval for the SEO firm portfolios (P3 and P4), while the central part does the same for the size-matching portfolios (P3_M and P4_M). For the values in an interval, the cross-sectional means are computed after the time series of the variables are first averaged over the interval for each firm. The lower part exhibits Z-statistics for the Wilcoxon test so that P3 and P4 can be compared with P3_M and P4_M, respectively. Interval $[a, b]$ means a period from month a to month b relative to the event month. N is the number of observations used to calculate the mean values. N^* is the number of non-zero differences used in the Wilcoxon test.

Panel A: For Small-sized SEO Portfolio Individuals Buy in Year 1-Year 2									Panel B: For Large-sized SEO Portfolio Institutions Buy in Year 1-Year 2								
Item	Means for SEO Firms (P3)								Item	Means for SEO Firms (P4)							
	[-36, -19]	[-18, -9]	[-8, -2]	-1	0	1	[2, 18]	[19, 36]		[-36, -19]	[-18, -9]	[-8, -2]	-1	0	1	[2, 18]	[19, 36]
NOIMB (%)	0.672	-0.457	2.039	2.634	-5.663	2.915	5.890	1.088	NOIMB (%)	0.110	1.921	4.334	0.774	-3.312	1.952	3.763	2.379
DOIMB (%)	-2.539	-1.486	1.509	3.223	-8.520	-2.376	-0.462	-1.010	DOIMB (%)	2.254	4.334	3.729	4.686	-2.128	5.711	2.878	3.402
TURN (%)	7.566	6.549	7.013	7.184	16.750	13.289	9.250	8.558	TURN (%)	6.887	6.643	6.373	6.199	11.232	7.725	7.292	7.793
RET (%)	1.309	2.458	5.445	1.242	0.773	0.176	-0.005	0.728	RET (%)	1.043	3.350	3.747	2.190	2.775	1.492	1.411	0.916
N	59	70	78	78	78	78	93	66	N	74	81	89	89	89	90	96	90
Item	Means for Non-issuer Size-matching Firms (P3_M)								Item	Means for Non-issuer Size-matching Firms (P4_M)							
	[-36, -19]	[-18, -9]	[-8, -2]	-1	0	1	[2, 18]	[19, 36]		[-36, -19]	[-18, -9]	[-8, -2]	-1	0	1	[2, 18]	[19, 36]
NOIMB (%)	-3.480	-1.984	-1.599	-1.128	-1.926	-4.624	-0.739	-0.460	NOIMB (%)	2.657	2.114	0.450	0.652	1.218	1.627	0.954	-0.671
DOIMB (%)	-1.206	-4.352	-1.564	1.799	-0.029	-3.836	-0.671	-0.761	DOIMB (%)	3.423	3.922	2.330	1.566	3.538	2.147	3.542	3.379
TURN (%)	6.429	6.781	6.376	7.185	6.082	5.722	6.268	7.054	TURN (%)	6.422	6.543	5.975	5.839	6.306	6.275	6.644	7.184
RET (%)	1.333	1.018	2.305	1.233	1.144	0.255	1.351	0.968	RET (%)	1.531	1.577	1.460	0.791	0.221	1.611	1.915	0.936
N	59	70	78	78	78	78	93	66	N	74	81	89	89	89	90	96	90
Item	Z-statistics for the Wilcoxon Test								Item	Z-statistics for the Wilcoxon Test							
	[-36, -19]	[-18, -9]	[-8, -2]	-1	0	1	[2, 18]	[19, 36]		[-36, -19]	[-18, -9]	[-8, -2]	-1	0	1	[2, 18]	[19, 36]
NOIMB	-0.47	-0.53	-1.83	-0.68	-1.60	-3.07	-4.30	-1.66	NOIMB	-0.74	-0.26	-1.98	-0.40	-2.66	-0.07	-2.25	-2.44
DOIMB	-0.37	-0.99	-1.07	-0.79	-1.76	-0.81	-0.19	-0.69	DOIMB	-1.15	0.00	-1.29	-0.79	-1.46	-1.14	-0.45	-0.31
TURN	-0.41	-0.44	-0.59	-0.02	-6.97	-3.87	-3.20	-1.91	TURN	-1.30	-0.72	-0.98	-0.98	-5.42	-2.73	-1.87	-2.21
RET	-0.46	-2.58	-4.88	-0.02	-0.19	-0.18	-3.48	-0.22	RET	-0.68	-2.56	-4.17	-0.67	-1.97	-0.24	-1.99	-0.12
N*	41	61	77	76	76	76	93	56	N*	66	74	88	87	87	88	96	89

Table XII

Two-Way Sorting: Time-Series Correlation Coefficients between Returns and Order Imbalances for the Small-sized SEO Portfolio that Individual Investors Buy on Net and for the Large-sized SEO Portfolio that Institutional Investors Buy on Net in Period Year 1-Year 2 (Monthly)

This table shows correlation coefficients between the two time series of returns and order imbalances for monthly data. The time series are obtained by cross-sectionally averaging (equal-weighted) the returns and order imbalances of the component stocks for each portfolio over the event window. Panel A contains the results for the small-sized SEO-firm portfolio that individual investors buy on net in period year 1-year 2 (P3), while Panel B does the same for the large-sized SEO portfolio that institutional investors buy on net (P4). The number of SEO firms is 96 in each panel. *Interval* $[a, b]$ means a period from month a to month b relative to the event month. *NOIMB* stands for trade number order imbalances and *DOIMB* for dollar volume imbalances. Under the null hypothesis of zero correlation, asymptotic standard error of the correlation coefficient is $1 / \sqrt{N}$, where N is the number of observations (months).

Interval	Panel A: Small SEO Portfolio		Panel B: Large SEO Portfolio	
	Individuals Buy		Institutions Buy	
	Correlation with NOIMB	Correlation with DOIMB	Correlation with NOIMB	Correlation with DOIMB
	P3: SEO Firms		P4: SEO Firms	
[-36, 36]	-0.03	0.33	0.26	0.33
[-36, -1]	0.67	0.58	0.59	0.49
[1, 36]	-0.11	0.28	0.34	0.21
Interval	P3_M: Size-matching Firms		P4_M: Size-matching Firms	
	Correlation with NOIMB	Correlation with DOIMB	Correlation with NOIMB	Correlation with DOIMB
	P3_M: Size-matching Firms		P4_M: Size-matching Firms	
	Correlation with NOIMB	Correlation with DOIMB	Correlation with NOIMB	Correlation with DOIMB
[-36, 36]	0.19	0.20	0.18	0.34
[-36, -1]	0.29	0.21	0.17	0.47
[1, 36]	0.26	0.33	0.22	0.26

Table XIII

Two-Way Sorting: Time-Series Regressions of Returns on Order Imbalances for the Small-sized SEO Portfolio that Individual Investors Buy on Net and for the Large-sized SEO Portfolio that Institutional Investors Buy on Net in Period Year 1-Year 2 (Monthly)

This table shows the results of time-series regressions of returns on order imbalances and turnover for monthly data as in $RET_t = \varphi_0 + \varphi_1 OIMB_t + \varphi_2 TURN_t + \varepsilon_t$. The time series are obtained by cross-sectionally averaging (equal-weighted) the returns (RET), order imbalances (OIMB), and turnover (TURN) of the component stocks for each portfolio over the event window. Panel A contains the results for the small-sized SEO-firm portfolio that individual investors buy on net in period year 1-year 2 (P3), while Panel B does the same for the large-sized SEO portfolio that institutional investors buy on net (P4). For comparison purposes, the results from the corresponding size-matching portfolios (P3_M and P4_M) are also reported. The number of SEO firms is 96 in each panel. *Interval [a, b]* means a period from month *a* to month *b* relative to the event month. *Const* is an intercept. *NOIMB* stands for trade number order imbalances and *DOIMB* for dollar volume imbalances. The values in the upper row for each interval are coefficients estimated from the regressions over the interval. The values italicized in the lower row of each interval are t-statistics. Coefficients significantly different from zero at the significance levels of 1%, 5%, and 10% are indicated by ***, **, and *, respectively.

Panel A: Small SEO Portfolio Individuals Buy							Panel B: Large SEO Portfolio Institutions Buy					
Interval	P3: SEO Firms						P4: SEO Firms					
	On NOIMB			On DOIMB			On NOIMB			On DOIMB		
	Const	NOIMB	TURN	Const	DOIMB	TURN	Const	NOIMB	TURN	Const	DOIMB	TURN
	3.1135 ***	0.0271	-0.2383 *	3.4670 ***	0.2429 ***	-0.2374 **	3.3892 **	0.1819 **	-0.2945	2.3738	0.2089 ***	-0.1920
[-36, 36]	3.36	0.33	-1.99	4.01	3.15	-2.22	2.22	2.21	-1.39	1.51	2.74	-0.90
	-2.9256	0.4738 ***	0.8538 **	-3.1541	0.2473 ***	0.9618 **	1.0180	0.5159 ***	0.0720	3.3230	0.3753 ***	-0.3693
[-36, -1]	-1.19	3.96	2.19	-1.10	2.67	2.17	0.28	4.16	0.13	0.87	3.21	-0.65
	-0.1304	-0.0630	0.0576	-0.0299	0.2027 *	0.0415	3.6138	0.2630 **	-0.4249	4.4346	0.0909	-0.4682
[1, 36]	-0.11	-0.73	0.41	-0.03	1.71	0.32	1.35	2.03	-1.21	1.62	1.22	-1.28
Interval	P3_M: Size-matching Firms						P4_M: Size-matching Firms					
	On NOIMB			On DOIMB			On NOIMB			On DOIMB		
	Const	NOIMB	TURN	Const	DOIMB	TURN	Const	NOIMB	TURN	Const	DOIMB	TURN
	0.8064	0.1193	0.0892	0.5037	0.1091 *	0.1316	1.8996	0.0881	-0.0875	2.4782 **	0.2124 ***	-0.2698
[-36, 36]	0.51	1.51	0.37	0.33	1.68	0.55	1.61	1.46	-0.50	2.28	3.37	-1.60
	-4.2215 *	0.1710 *	0.9753 ***	-5.6850 **	0.2090 **	1.2258 ***	-3.2779	0.0518	0.7592 **	-1.2308	0.1580 **	0.3402
[-36, -1]	-1.76	1.65	2.59	-2.50	2.10	3.28	-1.56	0.47	2.18	-0.68	2.20	1.14
	2.6675	0.1980 *	-0.2304	2.9053	0.1871 **	-0.2709	5.0575 ***	0.1103	-0.5346 **	4.7932 ***	0.1932 *	-0.5904 *
[1, 36]	1.27	1.64	-0.73	1.42	2.09	-0.88	2.73	1.11	-2.00	2.65	1.78	-2.29

Figure 1
Order Imbalances vs. Returns around SEOs

The following graphs plot the values of our key variables around the event date or month for the SEO firm portfolios at a daily horizon in Figure 1(A) and at a monthly horizon in Figure 1(B) over the event windows. The definitions of variables are: trade number order imbalances (*NOIMB*), dollar volume imbalances (*DOIMB*), and returns (*RET*). The numbers of sample firms are 521 at a daily horizon and 408 at a monthly horizon. The sample periods are from July 1988 to June 1998 at a daily horizon, and January 1989 to December 1997 at a monthly horizon.

(A) Daily

(B) Monthly

Figure 2
Order Imbalances vs. Prices around SEOs

The following graphs plot the values of our key variables around the event date or month for the SEO firm portfolios at a daily horizon in Figure 2(A) and at a monthly horizon in Figure 2(B) over the event windows. The definitions of variables are: trade number order imbalances (*NOIMB*), dollar volume imbalances (*DOIMB*), and split- and stock dividend-adjusted prices (*ADJP*). The numbers of sample firms are 521 at a daily horizon and 408 at a monthly horizon. The sample periods are from July 1988 to June 1998 at a daily horizon, and January 1989 to December 1997 at a monthly horizon.

(A) Daily

(B) Monthly

Figure 3

Order Imbalances vs. Returns of the Size-Matching Benchmark Portfolio

The following graphs plot the values of our key variables around the event date or month for the size-matching portfolios at a daily horizon in Figure 4(A) and at a monthly horizon in Figure 4(B) over the event windows. The definitions of variables are: trade number order imbalances (*NOIMB*), dollar volume imbalances (*DOIMB*), and returns (*RET*). The numbers of sample firms are 521 at a daily horizon and 408 at a monthly horizon. The sample periods are from July 1988 to June 1998 at a daily horizon, and January 1989 to December 1997 at a monthly horizon.

(A) Daily

(B) Monthly

Figure 4

Order Imbalances vs. Prices of the Size-Matching Benchmark Portfolio

The following graphs plot the values of our key variables around the event date or month for the size-matching portfolios at a daily horizon in Figure 5(A) and at a monthly horizon in Figure 5(B) over the event windows. The definitions of variables are: trade number order imbalances (*NOIMB*), dollar volume imbalances (*DOIMB*), and split- and stock dividend-adjusted prices (*ADJP*). The numbers of sample firms are 521 at a daily horizon and 408 at a monthly horizon. The sample periods are from July 1988 to June 1998 at a daily horizon, and January 1989 to December 1997 at a monthly horizon.

(A) Daily

(B) Monthly

Figure 5

Abnormal Order Imbalances Relative to the Size-Matching Benchmark Portfolios

The following graphs plot the values of abnormal trade-number order imbalances (ANOIMB) and abnormal dollar-value imbalances (ADOIMB) around the event date or month for the SEO firm portfolios at a daily horizon in Figure 7(A) and at a monthly horizon in Figure 7(B) over the event windows. ANOIMB are computed by subtracting the trade-number order imbalances (NOIMB) of the size-matching benchmark portfolio from those of the SEO portfolio for each horizon. Similarly, DNOIMB are computed by subtracting the dollar-value order imbalances (DOIMB) of the size-matching benchmark portfolio from those of the SEO portfolio for each horizon. The numbers of sample firms are 521 at a daily horizon and 408 at a monthly horizon. The sample periods are from July 1988 to June 1998 at a daily horizon, and January 1989 to December 1997 at a monthly horizon.

(A) Daily Abnormal Order Imbalances

(B) Monthly Abnormal Order Imbalances

Figure 6

Institutional Ownership and the Number of Analysts for Portfolios P1-P4 (Yearly)

Figure (A) plots the values of institutional ownership (IO) and the number of analysts (NOANA) for the SEO portfolio that individual investors buy on net in Year 1-Year 2 (P1), and Figure (B) does the same for the SEO portfolio that institutional investors buy on net in Year 1-Year 2 (P2). Figure (C) plots IO and NOANA for the small-sized SEO portfolio that individual investors buy on net in Year 1-Year 2 (P3), and Figure (D) does the same for the large-sized SEO portfolio that institutional investors buy on net in Year 1-Year 2 (P4). IO (a solid, diamond-noded line) is measured on the left-hand scale (in %), while NOANA (a dotted, square-noded line) is measured on the right-hand scale. The numbers of observations are 128 for P1, 203 for P2, 96 for P3 and P4.

1) One-Way Sorted Portfolios

(A) **P1**: SEO Portfolio that Individuals Buy in Year 1-Year 2

(B) **P2**: SEO Portfolio that Institutions Buy in Year 1-Year 2

2) Two-Way Sorted Portfolios

(C) **P3**: Small-Sized SEO Portfolio that Individuals Buy in Year 1-Year 2

(D) **P4**: Large-Sized SEO Portfolio that Institutions Buy in Year 1-Year 2

Figure 7

One-Way Sorting: Comparison of the SEO Portfolio Individual Investors Buy on Net with the SEO Portfolio Institutional Investors Buy on Net in Period Year 1–Year 2

The following graphs plot the values of our key variables around the event month for the two SEO portfolios sorted by institutional ownership. The definitions of variables are: trade number order imbalances (*NOIMB*), dollar volume imbalances (*DOIMB*), and returns (*RET*). To form portfolio P1 for Figure 9(A), the SEO firms whose institutional ownership at year 2 is less than that at year 0 are selected from the total 408 SEO firms. To form portfolio P2 for Figure 9(B), the SEO firms whose institutional ownership at year 2 is greater than that at year 0 are selected from the total sample. The numbers of SEO firms are 128 in Panel A and 203 in Panel B.

(A) P1: SEO Portfolio that Individual Investors Buy on Net in Year 1-Year2

(B) P2: SEO Portfolio that Institutional Investors Buy on Net in Year 1-Year2

Figure 8

Two-Way Sorting: Comparison of the Small-sized SEO Portfolio Individual Investors Buy on Net with the Large-sized SEO Portfolio Institutional Investors Buy on Net in Period Year 1–Year 2

The following graphs plot the values of our key variables around the event month for the two SEO portfolios sorted by firm size and institutional ownership. The definitions of variables are: trade number order imbalances (*NOIMB*), dollar volume imbalances (*DOIMB*), and returns (*RET*). The 408 SEO firms are first sorted by the market value of month 0 in ascending order and split into the two groups. Then the SEO firms whose institutional ownership at year 2 is less than that at year 0 are selected from the smaller-sized group to form portfolio P3 for Figure 10(A). To form portfolio P4 for Figure 10(B), the SEO firms whose institutional ownership at year 2 is greater than that at year 0 are selected from the larger-sized group. The number of SEO firms is 96 in each portfolio.

(A) P3: Small-sized SEO Portfolio that Individual Investors Buy on Net in Year 1-Year2

(B) P4: Large-sized SEO Portfolio that Institutional Investors Buy on Net in Year 1-Year2

APPENDIX

Table AI
Rank-Order Correlation Coefficients between Returns and Order Imbalances around SEOs
(Monthly)

This table shows Spearman's rank-order correlation coefficients between returns and order imbalances for monthly data. For each pair (total 73 pairs) of cross-sectional sample $(RET_{i,t}, OIMB_{i,t})$, where $t = -36, -35, \dots, -1, 0, 1, \dots, 35, 36$, RET_i and $OIMB_i$ are first ranked separately in ascending order to assign ranks for each variable. Then the sample correlation of these ranks is computed for each month (total 73 months) in the event window. Panel A shows the results for the rank-order correlation coefficients between returns (RET) and trade number imbalances (NOIMB), while Panel B does for the rank-order correlation coefficients between returns (RET) and dollar volume imbalances (DOIMB). *Interval* $[a, b]$ means a period from month a to month b relative to the event month. *Rank-order Correlation* is the average of rank-order correlation coefficients in the corresponding interval when the interval has more than one month (i.e., if #months > 1). The number of SEO firms is 408. *Obs* is the average number of observations (firms) used in the interval. *#months* is the number of months corresponding to the interval. *Max* is the month with maximum correlation within the event window. *Min* is the month with minimum correlation within the event window. Under the null hypothesis of zero correlation, the asymptotic standard error of the rank-order correlation coefficient is $1/\sqrt{Obs}$.

Interval	Panel A: With NOIMB		Panel B: With DOIMB		#months
	Rank-order Correlation	Obs	Rank-order Correlation	Obs	
[-36, 36]	0.20	323.9	0.37	323.9	73
[-36, -1]	0.24	303.6	0.36	303.6	36
[1, 36]	0.16	342.2	0.38	342.2	36
[-36, -19]	0.24	269.0	0.36	269.0	18
[-18, -1]	0.23	338.3	0.36	338.3	18
[-8, -1]	0.23	363.4	0.33	363.4	8
-1 ^a	0.19	391.0	0.32	391.0	1
0 ^a	0.18	391.0	0.37	391.0	1
1 ^a	0.21	394.0	0.34	394.0	1
[1, 8]	0.16	395.4	0.36	395.4	8
[1, 18]	0.18	384.9	0.36	384.9	18
[19, 36]	0.15	299.5	0.39	299.5	18
Max ^a	0.33	255.0	0.48	280.0	1
Min ^a	0.04	263.0	0.27	289.0	1

^a single-month intervals.

Table AII

Fama-MacBeth Statistics from 2SLS Cross-Sectional Regressions around SEOs (Monthly)

This table presents the Fama-MacBeth statistics from the second stage of 2SLS regressions (total 67 regressions for each of NOIMB and DOIMB). In the first stage, order imbalances (OIMB) are estimated by:

$$OIMB_{i,t} = \beta_0 + \sum_{k=1}^m \beta_{1k} RET_{i,t-k} + \sum_{k=1}^m \beta_{2k} TURN_{i,t-k} + \sum_{k=1}^m \beta_{3k} LN(P)_{i,t-k} + \beta_4 LN(MV)_{i,t} + \beta_5 IO_{i,y-1} \\ + \beta_6 NOANA_{i,y-1} + \beta_7 SSEO2_i + \beta_8 PRIM_i + u_{i,t},$$

where OIMB is either trade number imbalances (NOIMB) or dollar volume imbalances (DOIMB), $m=6$, and $t = -30, -29, \dots, -1, 0, 1, 2, \dots, 35, 36$. Other definitions: *RET* is a return; *TURN* is turnover; *LN(P)* is logarithm of a split-adjusted price; *IO* is institutional ownership; *NOANA* is the number of analysts; *SSEO2* is the size of an SEO; and *PRIM* is a dummy for a primary offering. The second-stage regressions are performed by an equation,

$$RET_{i,t} = \gamma_0 + \gamma_1 \hat{OIMB}_{i,t} + \gamma_2 LN(MV)_{i,t} + v_{i,t}.$$

Panel A shows the results for the relationship between returns (RET) and estimated trade number imbalances ($\hat{NOIMB}$), while Panel B does for the relationship between returns and estimated dollar volume imbalances ($\hat{DOIMB}$). The dependent variable is returns, *RET*, in both panels. *Interval* [*a*, *b*] means a period from month *a* to month *b* relative to the event month. *Const* is an intercept. *Predicted NOIMB (DOIMB)* is the estimated trade number (dollar volume) imbalances from the first-stage regressions. *LN(MV)* is natural logarithm of a market value. *#months* is the number of months (= the number of coefficients used in computing the average coefficient) corresponding to the interval. The number of SEO firms is 408. *Obs* is the average number of observations (firms) used in the cross-sectional regressions. The values in the upper row for each interval are the time-series averages of coefficients obtained from the second-stage cross-sectional regressions run each month in the interval. The values italicized in the lower row of each interval are Fama-MacBeth t-statistics for the corresponding average coefficients. Coefficients significantly different from zero at the significance levels of 1%, 5%, and 10% are indicated by ***, **, and *, respectively.

Interval	Panel A: For NOIMB			Panel B: For DOIMB			# months
	Constant	Predicted NOIMB	LN(MV)	Constant	Predicted DOIMB	LN(MV)	
[-30, 36]	0.1051	0.1549 ***	0.1663 **	1.8784 ***	0.2062 ***	-0.1089	67
	0.16	9.10	2.08	3.06	11.19	-1.30	
[-30, -1]	4.0009 ***	0.1804 ***	-0.2740 ***	5.2383 ***	0.2314 ***	-0.5199 ***	30
	4.73	8.63	-2.68	6.32	9.35	-4.63	
[1, 36]	-3.0961 ***	0.1289 ***	0.5165 ***	-0.8330	0.1838 ***	0.2127 **	36
	-5.66	5.02	6.24	-1.38	6.77	2.31	
[-30, -16]	1.2912 *	0.1623 ***	-0.0091	3.1645 ***	0.1655 ***	-0.2972 **	15
	1.84	4.42	-0.09	3.75	7.62	-2.35	
[-15, -1]	6.7106 ***	0.1984 ***	-0.5389 ***	7.3122 ***	0.2973 ***	-0.7426 ***	15
	5.62	9.75	-3.63	5.94	7.81	-4.36	
[-8, -1]	8.2631	0.1835 ***	-0.6857 ***	9.0322 ***	0.3390 ***	-0.9611 ***	8
	4.20 ***	6.01	-2.80	4.91	10.24	-4.07	
-1 ^a	-0.7050	0.1518	0.4724	0.9697	0.4202 ***	-0.0034	1
	-0.23	1.42	1.01	0.31	2.72	-0.01	
0 ^a	-1.5265	0.3220 ***	0.7669 *	-1.3129	0.2578 ***	0.6468	1
	-0.50	3.60	1.79	-0.42	3.56	1.45	
1 ^a	-3.0485	0.0262	0.6726 *	1.9096	0.3110 **	-0.1868	1
	-1.18	0.23	1.73	0.59	2.54	-0.37	
[1, 8]	-2.5911 ***	0.1175 *	0.4686 ***	-0.0211	0.2013 ***	0.1108	8
	-5.06	1.70	3.71	-0.03	4.33	1.00	
[1, 18]	-3.9092 ***	0.1637 ***	0.6063 ***	-1.2655	0.1875 ***	0.2897 **	18
	-6.61	4.36	6.53	-1.63	5.45	2.41	
[19, 36]	-2.2830 **	0.0941 ***	0.4267 ***	-0.4004	0.1801 ***	0.1356	18
	-2.54	2.76	3.12	-0.43	4.18	0.96	
Obs		345.6			345.6		

^a Coefficients and t-values are directly from the individual cross-sectional regressions.

Table AIII
One-Way Sorting: Institutional Ownership and Number of Analysts for the SEO Portfolio Individual Investors Buy on Net and for the SEO Portfolio Institutional Investors Buy on Net in Period Year 1-Year 2 (Yearly)

This table presents the trends of institutional ownership (IO: in %) and the number of analysts following the firms (NOANA) for the SEO Portfolio that individual investors buy on net (portfolio P1 in Panel A) and for those that institutional investors buy on net (portfolio P2 in Panel B) in period year 1-year 2 after the offerings. To form an SEO portfolio for Panel A, the SEO firms whose institutional ownership at year 2 is less than that at year 0 are selected from the total 408 SEO firms. For Panel B, the SEO firms whose institutional ownership at year 2 is greater than that at year 0 are selected from the total sample. The numbers of SEO firms are 128 in Panel A and 203 in Panel B. For comparison, the values for the corresponding size-matching portfolios (P1_M and P2_M) are also provided.

Panel A: SEO Portfolio Individuals Buy in Year 1-Year 2							Panel B: SEO Portfolio Institutions Buy in Year 1-Year 2					
P1: SEO Firms							P2: SEO Firms					
Item	-3	-2	-1	0	1	2	-3	-2	-1	0	1	2
IO (%)	42.19	42.96	47.34	58.74	55.06	49.59	42.35	42.67	42.53	49.28	56.80	61.14
NOANA	11.5	11.6	12.5	13.8	14.8	15.2	11.4	11.4	11.5	12.9	13.9	14.4
P1_M: Non-issuer Size-matching Firms							P2_M: Non-issuer Size-matching Firms					
Item	-3	-2	-1	0	1	2	-3	-2	-1	0	1	2
IO (%)	47.24	48.59	48.85	48.74	50.68	50.58	46.71	46.64	47.88	49.72	53.01	52.94
NOANA	13.2	13.5	13.7	13.8	13.8	12.5	13.5	13.1	13.0	12.9	13.0	12.4

Table AIV
Two-Way Sorting: Institutional Ownership and Number of Analysts for the Small-sized SEO Portfolio Individual Investors Buy on Net and for the Large-sized SEO Portfolio Institutional Investors Buy on Net in Period Year 1-Year 2 (Yearly)

This table presents the trends of institutional ownership (IO: in %) and the number of analysts following the firms (NOANA) for the small-sized SEO Portfolio that individual investors buy on net (portfolio P1 in Panel A) and for the large-sized SEO portfolio that institutional investors buy on net (portfolio P2 in Panel B) in period year 1-year 2 after the offerings. The 408 SEO firms are first sorted by the market value of month 0 in ascending order and split into the two groups. Then the SEO firms whose institutional ownership at year 2 is less than that at year 0 are selected from the smaller-sized group to form a portfolio for Panel A. For Panel B, the SEO firms whose institutional ownership at year 2 is greater than that at year 0 are selected from the larger-sized group. The number of SEO firms is 96 in each panel. For comparison, the values for the corresponding size-matching portfolios (P3_M and P4_M) are also provided.

Item	Panel A: Small-sized SEO Portfolio Individuals Buy						Panel B: Large-sized SEO Portfolio Institutions Buy					
	P3: SEO Firms						P4: SEO Firms					
	-3	-2	-1	0	1	2	-3	-2	-1	0	1	2
IO (%)	32.43	32.79	35.89	50.80	50.69	41.98	50.62	50.91	48.15	54.74	62.07	65.59
NOANA	4.15	4.96	5.27	7.36	7.80	7.11	17.21	17.00	16.97	18.43	19.39	19.64
Item	P3_M: Non-issuer Size-matching Firms						P4_M: Non-issuer Size-matching Firms					
	-3	-2	-1	0	1	2	-3	-2	-1	0	1	2
	-3	-2	-1	0	1	2	-3	-2	-1	0	1	2
IO (%)	39.20	40.31	39.92	41.74	43.72	43.36	54.28	53.83	55.14	56.25	59.77	58.42
NOANA	5.72	6.10	6.70	7.09	7.35	6.99	19.50	19.09	18.85	18.30	18.52	17.83

Figure A1

Order Imbalances vs. Turnover around SEOs

The following graphs plot the values of our key variables around the event date or month for the SEO firm portfolios at a daily horizon in Figure 3(A) and at a monthly horizon in Figure 3(B) over the event windows. The definitions of variables are: trade number order imbalances (*NOIMB*), dollar volume imbalances (*DOIMB*), and turnover (*TURN*). The numbers of sample firms are 521 at a daily horizon and 408 at a monthly horizon. The sample periods are from July 1988 to June 1998 at a daily horizon, and January 1989 to December 1997 at a monthly horizon.

(A) Daily

(B) Monthly

Figure A2

Order Imbalances vs. Turnover of the Size-Matching Benchmark Portfolio

The following graphs plot the values of our key variables around the event date or month for the size-matching portfolios at a daily horizon in Figure 1(A) and at a monthly horizon in Figure 1(B) over the event windows. The definitions of variables are: trade number order imbalances (*NOIMB*), dollar volume imbalances (*DOIMB*), returns (*RET*), turnover (*TURN*), split- and stock dividend-adjusted prices (*ADJP*), and market values (*MV*). The numbers of sample firms are 521 at a daily horizon and 408 at a monthly horizon. The sample periods are from July 1988 to June 1998 at a daily horizon, and January 1989 to December 1997 at a monthly horizon.

(A) Daily

(B) Monthly

Figure A3

One-Way Sorting: Abnormal Order Imbalances for the SEO Portfolio Individual Investors Buy on Net and for That Institutional Investors Buy on Net in Period Year 1–Year 2

The following graphs plot the values of abnormal trade-number order imbalances (ANOIMB) and abnormal dollar-value imbalances (ADOIMB) around the event month for the two SEO firm portfolios sorted by institutional ownership. To form portfolio P1 for Figure A1(A), the SEO firms whose institutional ownership at year 2 is less than that at year 0 are selected from the total 408 SEO firms. To form portfolio P2 for Figure A1(B), the SEO firms whose institutional ownership at year 2 is greater than that at year 0 are selected from the total sample. Also the two corresponding size-matching portfolios (P1_M and P2_M) are constructed using the total size-matching sample firms. ANOIMB are then computed by subtracting the trade-number order imbalances (NOIMB) of the size-matching benchmark portfolio from those of the SEO portfolio. Similarly, DNOIMB are computed by subtracting the dollar-value order imbalances (DOIMB) of the size-matching benchmark portfolio from those of the SEO portfolio. The numbers of SEO firms are 128 in P1 and 203 in P2.

(A) Abnormal OIMBs for the SEO Portfolio that Individual Investors Buy on Net in Year 1–Year2 (P1)

(B) Abnormal OIMBs for the SEO Portfolio that Institutional Investors Buy on Net in Year 1–Year2 (P2)