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An Investigation of Market Microstructure Impacts on Event Study Returns

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ABSTRACT

We investigate the importance of bid-ask spread-induced biases on event date returns as exemplified by seasoned equity offerings by NYSE listed firms. We document significant negative return biases on the offering day which explain a large portion of the negative event date return documented in the literature. Buy-sell order flow imbalance is prominent around the offering and induces a relatively large spread bias. If order imbalances are suspected, the researcher can use returns calculated from the midpoint of the closing bid and ask quotes instead of returns calculated from closing transaction prices to avoid this return bias.

SEVERAL STUDIES DOCUMENT THE impact of bid-ask spreads on security return patterns which appear inconsistent with the informational efficiency of capital markets. Phillips and Smith (1980) find spread-induced bias to be important in explaining apparent arbitrage opportunities in the option markets. Lakonishok and Smidt (1984) uncover evidence suggesting a relation between bid-ask spreads and turn-of-the-year seasonality in stock returns.[1] Keim (1989) and Porter (1989) further document the empirical importance of systematic patterns of buy-sell order imbalances on average daily stock returns, which induce apparent year-end and day-of-the-week seasonal patterns in stock returns. This accumulated evidence has potential implications for event studies, since a common event can result in a movement of closing prices toward either the bid (a predominance of sell orders) or the ask quote

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[1] In addition, Stoll and Whaley (1983) find evidence that spreads are a partial explanation for the small firm effect, while Blume and Stambaugh (1983) show that bid-ask spreads can bias stock cumulative returns.

(a predominance of buy orders).[2] A systematic pattern of this nature can bias the researcher toward falsely rejecting or, in other cases, falsely accepting the null hypothesis of no event date abnormal return. Further, these phenomena may explain a number of apparently significant event study results that have been documented in recent years.[3]

Our primary objective is to examine the empirical importance of buy-sell order imbalance on the public offering dates of seasoned common stock issues as a potential explanation for the negative stock return observed at that time. Seasoned equity offerings are particularly interesting events because for a short period of time both a primary market and a secondary market are open concurrently. As a result, many purchase orders that normally would be routed to the secondary market are channeled to the primary market where offer price discounts and exemption from brokerage fees prevail.[4] In contrast, sell orders continue to be directed exclusively to the secondary market and are reinforced by the activities of speculators, who attempt to purchase stock at discounts in the primary market and resell immediately in the secondary market at a higher price. Thus, secondary market trading volume can rise significantly on the public offering date, even though most purchase orders are diverted to the primary market.

If order flow disruptions occur on the public offering, transactions in the secondary market would occur primarily at the specialists' bid quotes, thereby causing an artificial price drop of half the bid-ask spread. However, for daily returns (measured with closing prices) to be significantly influenced by such order flow disruptions, the imbalance must persist through the close of secondary market trading on the public offering, if the public offering begins while the NYSE is open, or through the close of trading on the following day, if the public offerings begin after the NYSE close. Order flow imbalances also result in inventory accumulation by specialists, putting downward pressure on both bid and ask quotes, thereby leading to a second order flow-related reason for negative returns occurring on the offering.[5] Following the offering date, normal secondary market buying should resume, creating an upward

[2] Dopuch, Holthausen, and Leftwich (1986) conjecture that a serious stock return bias can be induced by closing prices moving systematically toward bid quotes on a common information event.

[3] For example, see the concerns expressed about this issue in Grinblatt, Masulis, and Titman (1984) and Ohlson and Penman (1985) for stock dividends and splits. Also, see the evidence reported in Lakonishok and Vermaelen (1986) regarding upward biased stock returns just prior to cash dividend ex dates and downward biased stock returns just after these ex dates. Moreover, Holthausen, Leftwich, and Mayers (1987) report on transitory down ticks in prices at the time of block sales.

[4] Not all buy orders will shift to the primary market because of possible oversubscription of the public offering and longer delivery times; in the secondary market 5-business-day delivery is normal, but accelerated settlement is possible.

[5] This downward pressure on specialists' bid and ask quotes can be mitigated by underwriters' price stabilization actions (typically large limit orders to buy at a price just below the offering price), which are often implemented on the offer date and, occasionally, for several subsequent days.

bias in closing prices and daily returns on event day +1. However, specialists' subsequent efforts to lower their high inventory positions, as well as further reselling of the primary issue by speculators and the investment banking syndicate, may delay this price rebound for several days.

One alternative explanation for a negative offering date return is that the residual uncertainty regarding the potential cancellation of the offering is removed on this date. Since our sample of stock offers excludes postponed or canceled offers, which have positive returns when announced, a negative return on the offer date for the remainder of the stock offerings can be consistent with rational expectations on the part of investors. However, given that cancellations and postponements are infrequent and can occur any time up until the planned offering date, the magnitudes of the negative offer date price changes appear too large to be explained by the exclusion of these positive cancellation events. However, this is an empirical question which is put to the test in our later regression analysis.

To explore the empirical relevance of this methodological concern for event studies, we examine the extent to which bid-ask spreads bias daily stock returns around the public offering date of seasoned common stock issues. We begin by replicating earlier findings of a significant negative return on the public offering date. We go on to document a predominance of sell orders on this date which is followed by a rebound in buy orders on the following day. Using several approaches to measure the buy-sell order imbalance, we document that at least half of the negative stock return is order flow-induced.[6] Finally, we suggest a modification of event study methodology which eliminates a large portion of the bias due to order flow imbalances.

I. Methodological Approach

A 2-day event period, i.e., event days −1 and 0, is the standard period of analysis in the literature because of ambiguity about the time of day the event occurs. Using the Dow Jones News Retrieval Service, we pinpoint the exact time of the offering and find that in about 25 percent of our sample the public offerings do not commence until after the NYSE close of trading. Therefore, the price reactions associated with these delayed offerings should be observed primarily on the following trading day.[7]

We begin by presenting average common stock daily returns surrounding common stock public offering dates using conventional event study methodology. We define the public offering date of each equity offering as day 0, the preceding trading day as −1, etc. Because of our efforts to pinpoint the

[6] While significant negative returns also have been documented on the announcement date of seasoned equity offerings, we are aware of no rationale which suggests that this price reaction is induced by buy-sell order imbalances. However, returns and order flow data around the announcement date are examined as a useful matched-pair comparison with the offering date patterns. No evidence of order flow biases is uncovered.

[7] We separately analyzed this subsample to ensure the empirical validity of this operating assumption. No contrary evidence was found.

timing of the offering's commencement, we feel that we have more precise event dates than earlier studies examining offering date return effects. Accordingly, our focus is on a 1-day event window and the statistics associated with this event day.

Given the documented differences between announcement period stock price reactions of industrial and utility issuers, we dichotomize our sample by type of issuer when examining stock returns and microstructure variables around the offering dates. In addition, we partition our sample by equity offering size relative to shares outstanding to account for potential differences in economic effects across offering size quartiles. Later, we present statistics for several key microstructure variables, calculated on a daily basis and aligned in event time, which measure possible systematic buy-sell order imbalances around this date.

II. Data Description

Our final sample satisfies the following selection criteria: (i) the common stock is listed on the NYSE at the time of the seasoned public offering announcement; (ii) the announcement and public offering dates are identified unambiguously from the *Wall Street Journal*, Predicast's *F & S Index of Corporations and Industries*, Dow Jones News Retrieval Service, *Public Offerings of Corporate Securities, 1981–83*, the Registered Offering Statistics tape from the Securities and Exchange Commission or the offering prospectus; (iii) no simultaneous offerings of debt, preferred stock, or warrants occur; (iv) only firm commitment, underwritten public offerings by U.S. domiciled firms are considered; shelf registrations, private placements, rights, or standby offerings, best efforts, and secondary offerings are excluded; (v) announcements must precede public offerings by at least 2 trading days; (vi) on the public offering day, the closing transaction price must be bounded by the closing bid and ask prices; and (vii) stock splits and stock dividends cannot occur within 10 trading days of the public offering.[8]

We obtain daily NYSE common stock returns, the equally weighted index of NYSE and AMEX stock price returns, abnormal returns, and common stock outstanding prior to the offerings from data files obtained from CRSP at the University of Chicago. We collect daily NYSE closing price data from Standard & Poor's *NYSE Daily Stock Price Record*. Finally, we record closing bid and ask quotes from daily quote sheets purchased from Francis Emory Fitch. These quotes are obtained from NYSE specialists at the close of trading, although occasionally the data are based on quotes between 3:00 P.M. and the market's 4:00 P.M. close.

Our final sample contains 408 offerings over the period 1981–83. Industrial issuers account for 207 offerings (185 different firms), and utility issuers account for 201 offerings (92 unique firms). By year, 109 offerings occur in 1981, 114 in 1982, and 185 in 1983. As a percentage of stock outstanding, the average seasoned issue represents a 10.9 increase in outstanding shares for

[8] Sample criteria (v), (vi), and (vii) disqualified 4, 12, and 11 events, respectively.

the overall sample.[9] Shares issued averaged 109 times the daily secondary market trading volume over the 10 days preceding the offering announcement.

III. Event Study Evidence of a Public Offer Effect

To assess whether our sample of seasoned stock issues exhibits price effects similar to those documented in prior studies, we conduct an event study using market-adjusted returns.[10] Table I contains daily average market-adjusted returns for the full sample of common stocks over the 21-day event period.[11] On the offering date, the full sample average market-adjusted percentage return is -0.15. This average return is significantly less than the post-offer comparison period ($+2$ to $+10$) based on a t-test, and a Wilcoxon signed-rank test.[12] Only 43 percent of the market-adjusted returns were positive on the offering date as compared with an average of 49 percent on the other event dates, a difference consistent with our predictions, though not statistically significant at conventional levels using a Fisher sign test. This offering day return evidence is similar to that reported by Bhagat and Hess (1986), Mikkelson and Partch (1986), and Barclay and Litzenberger (1988) on, and just prior to, the seasoned stock issue's public offering date.

For the industrial subsample, the market-adjusted offering date mean return is -0.31 percent and is statistically different from the post-offer comparison period for all these tests at a 0.01 level. For the largest size quartile of offerings, representing primarily smaller industrial firms, the offering date mean return is -0.25 percent, which is also significantly different from the post-offer comparison period based on all three tests at the 0.01 level. Somewhat at variance with these results, the market-adjusted mean return of the utility subsample is an insignificant 0.001 percent.[13]

IV. Evidence of Order Flow Imbalances

To evaluate the importance of order flow asymmetries on offering day returns, we calculate that percentage bid-ask spreads average 1.05 percent of

[9] Equity capitalization is calculated using the number of shares outstanding from the CRSP Master File times the closing price the day before the announcement.

[10] We also conducted the event study using: (i) raw returns, (ii) one-factor market model residuals, and (iii) Scholes-Williams market-adjusted residuals. Since all of the procedures yield qualitatively similar results, we present only the market-adjusted returns.

[11] Stock returns which occur on or prior to the initial *announcement* of the offering (based on a search of the Dow Jones News Retrieval Service Database) are excluded to avoid announcement effect contamination. On average, the offering follows the announcement by 14.7 days (median = 12.0 days).

[12] We observe a significant cumulative abnormal return run-down prior to the offering day. For this reason, we do not compare the day 0 offering day return to a comparison period preceding the offering date.

[13] Possible reasons for the insignificant negative returns on the offering date for utilities are discussed later.

Table I

Market-Adjusted Returns for the Period Surrounding the Offering Date of Seasoned Equity Issues

Panel A presents results for the 20 days surrounding the seasoned equity offering date (day 0), the daily sample size N, the average daily market-adjusted rate of return, and the percentage of strictly positive market-adjusted daily returns for the full sample of seasoned equity issues in 1981–1983. The market index is the CRSP equally-weighted index of NYSE and AMEX listed common stocks. The day 0 market-adjusted return is significantly less than the post-offer average daily market-adjusted return using a t-test and a Wilcoxon signed-rank test. Panel B presents the statistical tests of the offering day relative to the pre-offer (days -10 to -1) and post-offer (days $+2$ to $+10$) periods using the t-, signed-rank (W), and binomial sign test (z).

Panel A. Market-Adjusted Returns

Event day	N	Average return	Percent positive
−10	207	−0.045	48.3
−9	221	−0.100	43.0
−8	244	−0.001	47.9
−7	258	−0.029	46.1
−6	287	0.015	50.5
−5	307	−0.148	48.5
−4	322	−0.032	45.0
−3	348	0.155	43.7
−2	364	−0.025	47.8
−1	392	0.073	52.8
0	406	−0.154	43.1
1	405	−0.040	46.4
2	405	−0.113	46.7
3	405	0.041	47.9
4	406	0.006	50.5
5	406	−0.034	48.0
6	406	−0.028	46.3
7	406	0.169	51.5
8	406	0.084	53.7
9	406	−0.031	46.3
10	379	0.067	49.3

Panel B. Offer Date Statistical Tests

Offering day relative to the pre-offer period		Offering day relative to the post-offer period	
$t = -1.38$	P Value = 0.10	$t = -2.04$	P Value = 0.02
$w = -1.17$	P Value = 0.12	$w = -2.14$	P Value = 0.02
$z = -0.51$	P Value = 0.31	$z = -1.19$	P Value = 0.12

the pre-offering stock price. Therefore, the *maximum* size of the expected spread bias effect is approximately 0.5 percent for our sample if transaction prices move from the bid-ask midpoint to the bid.

One approach to inferring whether a transaction is initiated by a buy or sell order is to measure the proximity of the closing transaction price to the closing bid and ask quotes. The left-most seven columns of Table II presents

the percentages of closing prices occurring at the ask, at the bid, at the midpoint, and over the two intermediate intervals for the 21-day event window. A systematic shift toward the closing bid price on event day 0 is predicted by our order flow imbalance hypothesis and is indicative of an excess of sell orders.

Scrutinizing Table II, several interesting order flow patterns emerge near the offering date. The percentage of closing transaction prices occurring at the bid quote increases dramatically from 30.4 percent on day −1 to 50.5 percent on day 0; a level significantly larger than the average proportion observed in the post-offer comparison period based on a chi-square test. On day +1, the percentage of closing prices at the bid quote drops to 37.5, but the percentage at the ask quote increases from 34.8 on day 0 to 42.1, significantly higher than the average proportion observed in the post-offer comparison period. This pattern suggests an increase in buy orders and a decrease in sell orders on the day after the offering. This evidence of a short-term buy-sell order imbalance on the public offering is consistent with the negative average stock return observed on this date.[14] The patterns for the three subsamples of stock offerings are qualitatively similar.

The last two columns of Table II present a measure of order flow imbalance which is (i) less sensitive to stale closing quotes and (ii) has the advantage of aggregating the closing price distribution within the bid and ask quotes for a given event date. We calculate the average ratio of (ask − close)/(ask − bid) for the individual stocks on each event day surrounding the offering, where bid and ask quotes again are measured at the close. The nearer this ratio is to 1.0, the more likely the closing transaction price is at the bid quote—an indication of selling pressure. The closer the ratio is to 0.0, the more likely the closing transaction price is at the ask quote—reflecting buying pressure.[15]

On the offering date, the only event day with a ratio different from 50 percent, the median order flow ratio is 100 percent. The mean ratio increases from 48.4 percent on day −1 to 58.1 percent on day 0. Comparing the order flow ratio on day 0 with the ratios in the post-offer period yields a statistically significant difference using a *t*-test, a Wilcoxon signed-rank test, and a sign test. On day +1, the median order flow ratio drops back to 50 percent, while the mean ratio drops to 47.9 percent. This day +1 shift represents a significant decrease in the ratio using the same tests and significance levels and reflects a movement of transaction prices back toward an equal balance of buy and sell orders. We also find evidence of buy-sell order flow imbalances

[14] Since our sample consists of comparatively large NYSE firms with relatively low percentage spreads, detection of a buy-sell order imbalance bias is more difficult. This order flow imbalance should be smaller for our sample than for a sample which includes AMEX or OTC firms that typically have smaller equity capitalization and higher stock price volatility. The observation that our smallest quartile of NYSE stocks have statistically larger negative returns on the offering day than the full sample (−0.25 versus −0.15) supports this observation. Also, see the discussion by Dopuch, Holthausen, and Leftwich (1986).

[15] This procedure has been used previously by Vijh (1987), Harris (1989), and Keim (1989).

Table II

Closing Prices Relative to Bid and Ask Quotes Surrounding the Offering Date of Seasoned Equity Offerings

Panel A presents the event day relative to the offering day (day 0), daily sample size N, the percentage distribution of closing prices in relation to the bid and ask quotes, and order flow ratios for the full sample of seasoned common stock issues in 1981–1983. The order flow ratio is calculated as (Closing Ask − Closing Transaction Price)/(Closing Ask − Closing Bid). On day 0, the percentage of prices at the bid quote is significantly larger than the proportion of prices at the bid quote during the pre-offer comparison period (days −10 to −1) and the post-offer comparison period (days +2 to +10) using a chi-square test. On day +1, the percentage of prices at the ask quote is significantly larger than the proportion of prices at the ask quote during the pre-offer and the post-offer comparison periods using a chi-square test. Statistics are shown in Panel B. Panel C presents statistical tests of the offering date order flow ratio relative to the pre- and post-offer periods using the t-, signed-rank (W), and binomial sign test (z).

Panel A. Distribution of Closing Prices

Day	N	At ask	Between ask and midpoint	At midpoint	Between bid and midpoint	At bid	Order flow ratio	
							Median	Mean
−10	200	32.5	6.5	25.0	7.0	29.0	50	48.3
−9	220	26.8	7.3	27.3	6.4	32.3	50	52.6
−8	237	27.8	5.9	29.1	5.1	32.1	50	51.9
−7	256	29.3	5.1	27.7	5.5	32.4	50	51.6
−6	281	27.4	6.4	24.9	6.4	34.9	50	53.8
−5	301	26.6	6.6	25.3	7.0	34.6	50	54.0
−4	315	27.9	7.3	25.7	6.0	33.0	50	52.3
−3	341	29.0	7.0	22.6	7.3	34.0	50	52.5
−2	359	24.5	6.4	24.2	8.6	36.2	50	56.1
−1	391	34.0	4.3	25.8	5.4	30.4	50	48.4
0	408	34.8	0.2	12.7	1.7	50.5	100	58.1
1	397	42.1	2.3	14.6	3.5	37.5	50	47.9
2	402	34.3	3.7	21.4	2.7	37.8	50	51.6
3	402	38.3	4.0	19.7	6.0	32.1	50	47.2
4	395	36.2	4.6	27.1	5.1	27.1	50	45.5
5	395	37.0	5.3	23.3	6.1	28.4	50	45.8
6	398	32.2	6.0	24.4	6.5	30.9	50	49.4
7	403	35.7	6.9	21.6	7.7	28.0	50	46.2
8	401	34.4	5.7	22.2	7.2	30.4	50	48.2
9	396	33.3	6.8	24.5	5.8	29.5	50	47.9
10	369	31.7	5.7	24.9	8.9	28.7	50	49.0

Panel B. Tests of Percentages of Closing Prices by Bid-Ask Position

Percent of quotes at the bid quote on the offer (day 0) relative to pre- and post-offer periods		Percent of quotes at the ask quote on the first post offer day (day +1) relative to pre- and post-offer periods	
Pre-offer $X_0^2 = 47.65$,	p value = 0.00	Pre-offer $X_1^2 = 29.97$,	p value = 0.00
Post-offer $X_0^2 = 67.72$,	p value = 0.00	Post-offer $X_1^2 = 8.18$,	p value = 0.00

Panel C. Test of Mean Order Flow Ratio on Day 0 Relative to the Comparison Periods

Pre-offer period		Post-offer period	
$t = 2.68$	P Value = 0.00	$t = 4.39$	P Value = 0.00
$w = 2.48$	P Value = 0.01	$w = 4.51$	P Value = 0.00
$z = 3.44$	P Value = 0.00	$z = 3.44$	P Value = 0.00

for the industrial, utility, and top quartile subsamples consistent with those reported for the full sample.[16]

One approach for mitigating the influence of these observed shifts in the frequencies of transactions occurring at the bid or the ask is to measure stock returns using the midpoints of the closing bid and ask quotes rather than the closing transaction prices. This alternative approach eliminates one of the two forms of return biases induced by order flow imbalances, since the effect of closing price movements toward the bid or the ask is eliminated. To explore the empirical importance of this bias, Table III reproduces the event study reported in Table I using daily returns calculated from closing bid and ask midpoints. On the public offering day, we observe a market-adjusted average return of -0.076 percent, insignificantly different from the daily average in the post-offer comparison period using any of our three testing procedures. The significant reduction in average offer day returns also is consistent across our various subsamples of stocks and provides further support for the conclusion that the negative average offer date return is a statistical artifact of buy-sell order flow imbalances.

To estimate the importance of a stock return bias caused by a shift in closing transaction prices away from the bid-ask average, we examine the difference in average offer day returns derived from closing transaction prices (reported in Table I) and closing bid and ask midpoints (reported in Table III). The average return bias obtained from this procedure is -0.078 percent, an approximately 50 percent reduction in the conventionally measured offer date return. The remaining negative offer date return effect can be caused by (i) new information released by the offering discount announcement or (ii) a further order flow bias caused by transitory downward shifts in both specialist's bid and ask quotes which reflect the market maker's aversion to further inventory accumulation.

Interestingly, using midpoint returns, we observe relatively large negative returns on days $+1$ and $+2$ which were obscured in Table I by a *positive* spread bias induced by a resurgence of buy orders in the secondary market over the first few days following the public offering. These two negative returns are consistent with the specialists and underwriters efforts to lower their inventory positions in the stock over this period.

An analysis of the cross-sectional variability in offer date returns is undertaken to further substantiate the importance of order flow imbalances on

[16] While utilities exhibit similar order flow imbalances to the other subsamples, their offering date residual returns are not significantly negative. This evidence seems at odds with the buy-sell order flow explanation for the negative offering day returns. However, utilities price their offerings at a statistically significant average *premium* of 0.46 percent above the day -1 close in contrast to industrial issues which are priced at a significant *discount* of -0.38 percent. This observation implies price stabilizing limit orders to buy (bids) at or very close to the day -1 closing price for the typical utility issuer (see the evidence documented in Bhagat and Frost (1986)) minimizing the negative impacts of a preponderance of sell orders on these stocks' offer date closing transaction prices. This effect is further mitigated by the smaller average bid-ask spreads exhibited by utilities relative to other subsamples of offers. Consequently, the closing price movement toward the bid price will create less, if any, downward bias in the offering day return for utilities.

Table III

Returns Calculated from Midpoints of Closing Bid and Ask Quotes around the Offering Date of Seasoned Equity Offerings

Panel A presents the event day relative to the offering day (day 0), daily sample size N, the average midpoint return, and the percentage of individual midpoint returns which are strictly positive for the full sample of seasoned common stock issues in 1981–1983. The daily midpoint return is calculated using the average of the daily bid and ask quotes. The average offering day midpoint return is not significantly different from the pre-offer period (days -1 to -10) or the post-offer period (days $+2$ to $+10$) using a t-test or a Wilcoxon signed-rank test (W). The percentage of positive returns on the offering day is not significantly different from the pre- or post-offer comparison period using a binomial sign test (z). Panel B presents the statistical tests of the offering day (day 0) midpoint return relative to the pre- and post-offer day midpoint returns.

Panel A. Midpoint Returns

Event day	N	Average midpoint return	Percent positive
−10	168	−0.074	46.4
−9	199	−0.087	48.7
−8	212	0.060	47.2
−7	233	−0.052	46.8
−6	249	0.100	48.6
−5	275	−0.175	49.8
−4	294	−0.092	44.6
−3	308	−0.161	43.8
−2	333	−0.061	44.7
−1	356	−0.002	50.8
0	391	−0.076	48.1
1	397	−0.131	43.6
2	392	−0.125	47.7
3	398	−0.033	48.7
4	389	−0.085	49.1
5	383	−0.066	46.7
6	386	−0.045	45.6
7	395	0.063	47.9
8	397	0.081	51.1
9	390	−0.081	43.6
10	361	0.076	47.6

Panel B. Statistical Tests of Midpoint Offering Day Returns Versus Pre- and Post-Offer Periods

Mean midpoint return on offering (day 0) relative to pre-offer period		Mean midpoint return on offering day (day 0) relative to post-offer period	
$t = -0.56$	p value = 0.29	$t = -0.56$	p value = 0.29
$w = 0.29$	p value = 0.39	$w = -0.13$	p value = 0.45
$z = 0.47$	p value = 0.32	$z = -0.15$	p value = 0.44

stock returns after the potential influence of other important variables is taken into account. To document the extent to which order flow bias contributes to the observed negative offer date returns, we regress the individual stock offer date raw returns against the order flow bias measured by the

order flow ratio on the offer day minus this ratio on the prior trading day, all multiplied by the percentage spread on the offer day (dollar spread divided by the prior day's closing transaction price).[17]

In these regressions, we also control for other potentially important information and market effects that also could have an impact on the offering date return. These explanatory variables are: (i) the offering price discount or premium (measured as a percentage change from the prior day's closing transaction price), (ii) the contemporaneous return on the CRSP equally-weighted market index, and (iii) the common stock's *announcement day* abnormal return. We hypothesize that the sign of parameter estimates for these three variables will be positive as explained below.

The offer price discount should itself be affected by any new information about the firm which reaches the market between the close on day -1 and the open on the offer date. As a result, when major information events occur in this interval, the offer discount will act as a proxy for their expected impact on the stock's secondary market price. In addition, the offering price discount also can directly influence the offering date return if the market interprets the discount as a credible signal of the management's or the investment banker's level of confidence in the issue's market value. The contemporaneous market return captures the influence of aggregate economic conditions on the stock's price.

Lastly, the stock's *announcement* return captures the market's valuation assessment of the planned offering for the existing stock.[18] To the extent that a negative offer date return reflects the market's disappointment over the completion of the planned stock offering with its negative valuation implications, the magnitude of the offering date abnormal return should be positively correlated with the prior announcement date abnormal return. However, if cancellations are too rare to explain a substantial portion of the observed negative price reactions on the offering date, which is likely, then we should fail to observe a significant effect from inclusion of this variable.

We estimate four related regression equations using ordinary least squares, successively adding explanatory variables. The results are presented in Table IV for the full sample. All four regression estimates are significant at the

[17] Mathematically, this relationship is written as:

$$\text{Bias} = -\left[\left(\frac{A_0 - C_0}{A_0 - B_0}\right) - \left(\frac{A_{-1} - C_{-1}}{A_{-1} - B_{-1}}\right)\right]\left(\frac{A_0 - B_0}{C_{-1}}\right),$$

where

A_t = closing ask quote on event day t,
B_t = closing bid quote on event day t, and
C_t = closing transaction price on event day t.

[18] Unfortunately this announcement day valuation impact can be distorted by varying prior market expectations of an offering. However, stock offers tend to be very rare events, especially for industrial issues, which implies that prior anticipation of these offer announcements generally will be quite small.

Table IV

Ordinary Least Squares Estimates with the Offer Date Returns as the Dependent Variable for Seasoned Equity Offerings

Regressions are based upon the full sample of seasoned equity issues in 1981–1983. Offer date return = $b_0 + b_1 *$ order flow bias + $b_2 *$ offer market return + $b_3 *$ offer price discount + $b_4 *$ announcement stock return + error, where 1) offer date return is the daily stock return on the public offering date based on closing transactions prices, 2) order flow bias is (order flow ratio on day 0 − order flow ratio on day −1) * (percent spread on day 0), 3) offer market return = the CRSP equally-weighted portfolio of NYSE and AMEX listed stocks on the offering date, 4) offer price discount is the public offering price minus the closing price on the prior trading day divided by this same closing price, and 5) announcement stock return is the daily stock return on the initial offer announcement (t values are in parentheses).

Regression	Intercept	Order flow bias	Offer market return	Offer price discount	Ann. stock return	Adjusted R^2	F-Value
(1)	0.0390	0.6469	–	–	–	0.0325	14.015
	(0.481)	(3.744)					
(2)	−0.0219	0.6394	0.4312	–	–	0.0647	14.415
	(−0.269)	(3.763)	(3.786)				
(3)	−0.0443	0.5717	0.4456	0.6823	–	0.2762	50.344
	(−0.618)	(3.821)	(4.446)	(10.667)			
(4)	−0.0124	0.5749	0.4456	0.6836	2.3233	0.2756	37.911
	(−0.154)	(3.840)	(4.445)	(10.680)	(0.848)		

0.001 level. The coefficient of determination for the final cross-sectional model is approximately 28 percent. Notice that the parameter estimates and t values are relatively invariant to the addition of other explanatory variables, indicating that the explanatory variables are not strongly correlated with each other. Overall, we find that order flow bias, offer price discount, and market return have statistically significant positive parameter estimates.[19] However, the announcement data abnormal return does not contribute significantly to the explanatory power of the statistical model. This result is consistent with our earlier argument that the probability of cancellation is too low to have much of an impact on offering date returns.[20]

V. Conclusions

At a seasoned public offering of common stock, purchase orders are diverted from the secondary market to the temporary primary market. This order flow disruption causes a preponderance of sell orders to be observed in

[19] This specification of the market model implicitly assumes that all stocks in our sample have the same beta. We reestimated the regression substituting the offering date market return times the stock's estimated beta in lieu of using only the market return. Beta is derived from OLS estimation of a one factor market model, using the equally-weighted CRSP Index as the market proxy, and is calculated over the period −170 to −20 days relative to the announcement date. The regression results are nearly identical with those shown in Table IV.

[20] Similar results are found using weighted least squares and several different weighting factors. See White (1980).

the secondary market on this date. We evaluate the impact of this imbalance on the average daily returns of a sample of NYSE firms undertaking public offerings of common stock. We predict that this order imbalance will cause transaction prices to occur more frequently at the specialist's lower bid quotes, inducing an artificial negative impact on the offering date return.

We document a significant downward shift in the average location of the closing transaction price relative to the closing bid and ask quotes on the public offering date of seasoned common stock offers, indicating an excess of sell orders in the secondary market. This order imbalance induces a significant downward bias in the average offering date return which explains about one-half of the observed negative stock return effect. If this buy-sell order imbalance shift is eliminated, the offering day return is insignificantly different from zero. The offering price discounts and premiums also appear to be positively related to offering day returns, which is consistent with these discounts and premiums signaling new information about the stock's intrinsic value.

Our analysis indicates that when systematic order flow imbalances are anticipated, due to institutional or regulatory influences, or due to shifts in aggregate demand or supply, average event day stock returns can be significantly biased. Also, when information releases trigger a preponderance of buy or sell orders, average stock price reactions can be exaggerated by the effects of bid-ask spreads. For samples of securities where percentage bid-ask spreads are relatively large, i.e., stocks of smaller firms or firms with low equity capitalization and stocks with high price variability, this order flow bias is of greater concern since the magnitude of the bias is larger. In samples dominated by such stocks, as well as in instances where measured average returns appear to be inconsistent with investor rationality or where evidence of order flow imbalances exists, researchers should evaluate carefully whether their event study results are robust to the elimination of bid-ask spread biases. One effective approach for mitigating one form of spread bias induced by asymmetric order flow is to calculate returns based on the midpoint of the closing bid and ask quotes. An approach for eliminating the other form of order flow imbalance bias manifested by transitory parallel shifts in bid and ask quotes is to expand the event window to include the subsequent trading day so as to capture the rebound effect from the transitory shifts in bid-ask quotes.

REFERENCES

Barclay, Michael and Robert Litzenberger, 1988, Announcement effects of new equity issues and the use of intraday price data, *Journal of Financial Economics* 21, 71-99.

Bhagat, Sanjai and Peter Frost, 1986, Issuing costs to existing shareholders in competitive and underwritten public offers, *Journal of Financial Economics*, 15, 213-232.

——— and Alan C. Hess, 1986, Size effects of seasoned stock issues: Empirical evidence, *Journal of Business* 59, 567-584.

Blume, Marshall E. and Robert F. Stambaugh, 1983, Biases in computed returns: An application to the size effect, *Journal of Financial Economics* 12, 387-404.

Dopuch, Nicholas, Robert W. Holthausen, and Richard W. Leftwich, 1986, Abnormal stock

returns associated with media disclosures of 'subject to' qualified audit opinions, *Journal of Accounting and Economics* 8, 93-117.

Grinblatt, Mark, Ronald Masulis, and Sheridan Titman, 1984, The valuation effects of stock splits and stock dividends, *Journal of Financial Economics* 13, 461-490.

Harris, Lawrence, 1989, A day-end transaction price anomaly, *Journal of Financial and Quantitative Analysis* 24, 29-45.

Holthausen, Robert, Richard Leftwich, and David Mayers, 1987, The effects of large block transactions on security prices: A cross-sectional analysis, *Journal of Financial Economics* 19, 237-267.

Keim, Donald, 1989, Trading patterns, bid-ask spreads and estimated security returns: The case of common stocks at the turn of the year, *Journal of Financial Economics* 25, 75-97.

Lakonishok, Josef and Seymour Smidt, 1984, Volume, price and rate of return for active and inactive stocks with applications to turn-of-the-year behavior, *Journal of Financial Economics* 13, 435-456.

——— and Theo Vermaelen, 1986, Tax induced trading around ex-dividend days, *Journal of Financial Economics* 16, 287-320.

Mikkelson, Wayne H. and M. Megan Partch, 1986, Valuation effects of security offerings and the issuance process, *Journal of Financial Economics* 15, 31-60.

Ohlson, James and Stephen Penman, 1985, Volatility increases subsequent to stock splits: An empirical aberration, *Journal of Financial Economics* 14, 251-266.

Phillips, Susan and Clifford Smith, 1980, Trading costs for listed options: The implications for market efficiency, *Journal of Financial Economics* 8, 179-201.

Porter, David, 1989, The probability of a trade at the ask: An examination of intraday and interday behavior, Working paper, Marquette University.

Stoll, Hans R. and Robert Whaley, 1983, Transaction costs and the small firm effect, *Journal of Financial Economics* 12, 57-79.

Vijh, Anan, 1987, Liquidity of equity options traded on the CBOE, analysis of the bid-ask spread and the price and information effects of trading volume, Unpublished Ph.D. dissertation, University of California at Berkeley.

White, Halbert, 1980, A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity, *Econometrica* 48, 817-838.