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Who trades IPOs? A close look at the first days of trading ☆

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Abstract

I examine the enormous trading volume in the first two days of trading following an initial public offering (IPO) with a sample of Nasdaq IPOs. The composition of trading varies widely with the initial return and not all trading is investor-related. Cold IPOs have a high proportion of interdealer sell trades, whereas hot IPOs have balanced investor buying and selling. Market makers hold zero inventory throughout trading, offsetting any investor inventory imbalance with a trade with the lead underwriter. The paper also helps resolve the disconnect reported in the literature between high initial trading volume and low "flipping" activity.

JEL classification: G24; G32

Keywords: Initial public offerings; Nasdaq; Trading volume

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1. Introduction

It is well documented (see Ellis et al., 2000, 2002; Aggarwal, 2000, 2003) that the trading volume on the first day or two following an initial public offering (IPO) is enormous, equivalent to over 70% of the shares sold in the offering. Academics and the financial press (for example, Siconolfi, 1998; Siconolfi and McGeehan, 1998; Tam and Ewing, 2000; Smith and Pulliam, 2000) typically believe that flippers—investors who receive allocations of shares in IPOs and sell these allocations in the first few days of trading—are responsible for this large volume. The general assumption is that flippers sell their shares to benefit from high prices in hot IPOs and stabilization in cold IPOs. However, Aggarwal (2003) shows that flipping volume accounts for only 15% of the shares sold in the offering, which is much smaller than the trading volume. This poses an intriguing question: If flipping trades are not responsible for the high trading volume, what is? Utilizing detailed transaction data in a unique proprietary database, I explain the post-IPO disconnect between the large trading volume and small amount of flipping by examining both who accounts for the remainder of the trading volume, and why they are trading.

First, not surprisingly, I find that the majority of trade (77%) is investor-motivated, which arises from a variety of sources. In IPO trading, investors are unlikely to hold their optimal allocation of shares, creating the possibility of a high-volume trading period as long-term investors adjust their portfolios to optimal positions. IPOs are typically many times over subscribed, which results in the rationing of allocations; investors may wish to accumulate more shares, as they may have received only a portion of their desired holding in the allocation process, or they may wish to liquidate (flip) their small allocations at prices higher than the offering price rather than build up their holding at higher market prices. Also, investors who did not receive an allocation in the IPO may wish to buy shares in the aftermarket as soon as possible, especially in hot IPOs. Other sources of trading are day traders, who buy and sell their positions within the day to capture price movements in these volatile stocks, and short sellers, who may appear as early as the first day of trading (Geczy et al., 2002). In this paper, I measure both how shares move from one investor to another, and the extent to which day traders and/or short sellers contribute to the enormous trading volume from a relatively small number of flipped shares.

Second, I find that the Nasdaq market's microstructure explains the rest of the post-IPO volume. The Nasdaq is a multiple-dealer market; interdealer trades and trades on Instinet that occur as dealers manage their inventory positions account for 23% of the trading volume on average. In cold IPOs, for which the inventory management problem is more severe as trading is not balanced between buys and sells, interdealer trades represent 30% of the trading volume. Although interdealer trading is lower in hot IPOs (18% of trading volume), a consistent pattern of interdealer trading emerges regardless of the success of the IPO: Market makers (dealers) who are not lead underwriters sell their long inventory positions to lead underwriters to reach close-to-zero inventory positions, and, as documented in Ellis et al. (2000), lead underwriters use the green shoe option to reach close-to-zero

inventory.[1] Examining intraday trading, I find that dealers keep minimal inventory throughout the day as inventory management via interdealer trading is performed immediately.

Based on the analysis of who trades IPOs, I am able to address some of the limitations of the flipping proxy suggested by Krigman et al. (KSW) (1999). The KSW proxy is based on the assumption that flipping trades are likely to be large (10,000 shares or more) sell-motivated trades. However, consistent with Aggarwal (2003), I find that half of the investor sell-motivated trading is achieved through medium-sized trades (1,000–9,999 shares); thus, many flipping trades may be missed with the KSW proxy. Also, for cold IPOs, one-third of large sell-motivated trades are interdealer trades; thus, the KSW flipping proxy would erroneously classify these trades as flipping trades. The combination of these two biases does not net to zero: Overall, the KSW proxy overestimates the level of flipping in cold IPOs and underestimates flipping in hot IPOs.

Although my main objective is to investigate who trades IPOs in the first few days of trading, given I find that interdealer trades account for a large portion of the trading, I explore market-maker inventory management further. In addition to trading with other dealers, market makers can encourage customer trades that assist with inventory management by offering attractive prices. I examine the quality of trading prices and find that while a substantial fraction of trades occurs within the quotes, price improvement varies depending on who is trading and the size of trades. Since market makers typically hold long positions, they reward investors who want to buy block quantities by executing the trades within the quotes. This result is unusual in that block trades usually occur at worse prices than other trades (Holthausen et al., 1987). In contrast to buy trades, large sell trades rarely receive price improvement and are almost always executed at bid prices. Lead underwriters appear to treat direct investors more favorably than investors who trade via brokers, which could be interpreted as preferential treatment for institutions that buy in the aftermarket.

The rest of the paper is organized as follows: Section 2 discusses the related literature, Section 3 describes the data and summary statistics, Sections 4 to 7 present the main results, and Section 8 concludes.

2. Related literature

The IPO aftermarket is a unique trading context because the underwriter has many mechanisms to help stabilize the market for shares. Several researchers focus on the particular role of the lead underwriter in the IPO aftermarket (Ellis et al.,

[1]The green shoe or overallotment option is an allocation of additional shares that may be sold in an equity offering and is typically 15% of the offering amount. The underwriter has 30 days to exercise the option (issue more shares); if the overallotment option is exercised, the firm receives the additional funds raised from the sale of those shares. Ellis et al. (2000) show that underwriters typically oversell offerings by the amount of the green shoe option and then either cover their short inventory position via trading or exercise the option.

2000; Aggarwal, 2000) and examine the extent of price stabilization, the use of penalty bids, and the use of overallotment options to facilitate market making. These studies show that underwriters play an important role in creating a smooth trading environment for the stock after the offering. Beyond the first month of trading, the underwriter continues to provide services to issuing firms via analyst recommendations (Michaely and Womack, 1999) and long-term market making (Ellis et al., 2002). In a theoretical model, Boehmer and Fishe (2000) show how aftermarket considerations may contribute to IPO underpricing via the incentives of the underwriter to maximize overall compensation, not just underwriting fees. My study complements this research by analyzing not only the lead underwriter's role in aftermarket trading, but also the roles of investors and market makers in early IPO trading markets.

The importance of flipping activity was first examined by Krigman et al. (1999). Using a proxy for flipping in IPOs they find flipping to be highest in IPOs with the lowest initial returns. They also find that heavily flipped IPOs perform worse in the long run. Their conclusion is that flippers are smart investors who get out of poorly performing IPOs quickly. They also conclude that given underwriters generally apply penalty bids to retail flippers, institutions, rather than retail investors, benefit from the ability to flip. Finally, KSW find that flipping accounts for almost half of the trading volume (45%) for cold IPOs, but only 14% for hot IPOs.

The ability to directly measure flipping changed dramatically in 1997 when the Depositary Trust Company (DTC) implemented its Public Offering Tracking System. With the related data, Aggarwal (2003) documents precisely occurrences of flipping, and in contrast to the KSW results, she finds that flipping is highest in hot IPOs and lowest in cold IPOs. The number of shares flipped is surprisingly low: On average 15% of shares sold in an offering are flipped and the mean trade size is below the 10,000-share trade size used in the KSW proxy. Boehmer et al. (BBF) (2003) use the DTC records to look at institutional allocations in IPOs, and in constrast to KSW, find that institutions do not flip shares of IPOs that perform worse in the future, and thus institutions do not appear to be informed. BBF suggest institutions may flip to reverse allocations in IPOs that underwriters force them to buy. In this paper I extend the observations in Aggarwal and BBF, and document the significant role of interdealer trades.

Another paper that uses accurate investor records to examine flipping activity is Bayley et al. (2004). They examine IPO trading in Australia using electronic share settlement records for each subscriber and aftermarket investor. Consistent with Aggarwal's U.S. results, they find that flipping only accounts for a small proportion of trading volume. They also find that day trades comprise more than 50% of post-listing trading.

In dealer markets, trading occurs not only as investors trade (via market makers), but also as market makers trade amongst themselves. By examining who is trading with whom in early IPO markets, I add to the existing literature on dealer trading behavior. In dealer markets, different dealers (also referred to as market makers) have different inventory management policies: some dealers hold large long or short inventory positions over time, while others choose to not hold inventory overnight

(Werner and Reiss, 1998). The majority of dealers aim to close trading with little or no inventory, and achieve this end by trading their inventory imbalances with other dealers. A recent paper by Griffin et al. (2003) discusses the breakdown of trading volume between institutional and individual investors on the Nasdaq-100 stocks. They document that on average interdealer trades account for 11.93% of daily trading volume. I extend these results on interdealer trading by providing a detailed picture of the daily and intraday inventory positions of market makers following IPOs, and I highlight the importance of market makers in trading situations characterized by unbalanced (i.e., mostly seller-motivated), heavy trading volume.

Other papers that are relevant to IPO trading are D'Avolio (2002) and Geczy et al. (2002). These researchers examine short selling of stocks, and discuss IPOs as a special case. D'Avolio documents that 91% of IPOs are shorted within a year post-IPO, but the cost of shorting IPO stocks is higher than shorting regular stocks. Geczy et al. (2002) discuss the feasibility of shorting IPOs during the first days of trading and they show that 75% of IPOs can be shorted "on special" on the first day of trading. This means that investors with good access to equity lenders (i.e., institutions) can short these stocks, whereas investors without such access cannot. In their sample, however, shorting on the first day is not observed frequently in small offerings (35 out of 38 offerings of less than $25 million are not shorted, and 23 out of 65 offerings in the $25 million to 50 million range are not shorted). They suggest that this could highlight the difficulty of shorting smaller IPOs or could be due to selection bias in their sample, which focuses on larger transactions. Geczy et al. (2002) examine offerings that are shorted on the first day of trading and find that both IPOs with zero (or negative) returns and IPOs with high initial returns are more costly to short. The higher cost of shorting could be due to restricted supply or high demand. Although it is not clear why supply would be more restricted in particular IPOs, demand for shorting is likely to be higher in stabilized IPOs as well as IPOs with high initial returns, as investors are more likely to believe that these prices are inflated. I use these results on IPO short selling in Section 5.1, where I examine the composition of investor trading.

3. Data description and summary statistics

I use the SDC Global Issues database to obtain a sample of 559 IPOs during October 1996 to June 1997, and verify and supplement the SDC information using the prospectuses filed via EDGAR. Also, due to errors in the dates in the SDC database (IPO dates sometimes reflect the date that the SEC received the prospectus rather than the date that it was issued), the sample includes six IPOs on the last trading day of September 1996, and 14 IPOs during the first three days of July 1996. I limit the sample to Nasdaq IPOs because I match them with detailed Nasdaq transactions data. Consistent with prior research, I exclude REITs, closed-end funds, unit offerings, and offerings below $5 million. Table 1 presents descriptive statistics for the remaining sample of 311 offerings: The average offering is for 3.16 million

Table 1
Sample statistics

The sample is 311 Nasdaq IPOs between September 28, 1996 and July 3, 1997. REITS, closed-end funds, ADRs, and unit offerings are excluded. The offer details come from SDC. The offer amount and shares offered do not include the overallotment option. The initial return is (closing price – offer price)/offer price. The trading data comes from Nasdaq. Trades that occur within normal trading hours on the IPO day and the following day are counted. Offer turnover is the shares traded divided by shares offered. In Panel B the IPOs are grouped based on their initial return

Panel A

	# Obs	Mean	Min	25%	50%	75%	Max
Offer amount ($M)	311	38.1	5.0	18.0	29.4	43.5	297.0
Shares offered (M)	311	3.16	0.7	2.0	2.57	3.5	21.75
Offer price ($)	311	11.19	5.0	8.0	10.50	14.0	25.00
Initial return (%)	311	11.29	−15.0	0.0	5.9	17.5	100.0
First two days of trading							
# Trades	311	878	10	305	590	1147	7913
Shares traded (M)	311	2.38	0.02	1.01	1.92	3.36	10.23
Dollar value ($M)	311	36.75	0.20	8.39	22.09	49.99	307.93
Offer turnover (%)	311	75.7	1.6	43.5	66.9	104.5	235.6

Panel B

	Cold ($n = 80$) Initial return $\leqslant 0\%$		Cool ($n = 76$) $0\% <$ Initial return $< 5.9\%$		Warm ($n = 75$) $5.9\% \leqslant$ Initial return $< 17.5\%$		Hot ($n = 80$) Initial return $\geqslant 17.5\%$		Kruskal Wallis Chi square
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	
Offer amount	29.30	22.40	34.30	24.80	45.50	30.00	43.50	36.00	18.5
Offer price	9.66	9.00	10.46	10.00	11.94	12.00	12.70	12.75	34.5
Shares offered	2.86	2.42	3.24	2.5	3.42	2.5	3.15	2.9	3.7
First two days of trading									
# Trades	391	308	556	454	973	721	1582	1199	108.4
Shares traded (M)	1.56	1.30	1.90	1.44	2.70	2.05	3.37	3.27	54.5
Dollar value ($M)	17.12	11.36	23.20	15.27	41.94	25.06	64.40	49.96	70.7
Offer turnover (%)	52.7	50.2	62.4	55.1	79.2	74.5	108	108	78.3

shares at $11.19/share, yielding an average offering amount of $38.1 million. The average first-day return from offer price to close price is 11.29%.

The National Association of Securities Dealers (NASD) Economic Research Department provided detailed transaction data for each IPO. The data includes the publicly available transactions and quotations (TAQ) database, and several additional fields of information for each quote and trade. For the quote data, the market maker for each quote update is identified by name, and for the trade data, both the buyer and seller are identified by name.

Consistent with Aggarwal and Conroy (2000), I measure trading volume as the cumulative amount over the first two trading days to accommodate any delay in the start of trading. Table 1 shows that over the first two days of trading, there are 878

trades on average, with 2.38 million shares worth $36.75 million changing hands. The median Figs. (590 trades, 1.92 million shares worth $22.1 million) are lower than these, indicating that the distribution of trading volume is positively skewed. Relatively speaking, these volumes are enormous; the mean (median) number of shares traded is 76% (67%) of the size of the offering.

I categorize IPOs as cold, cool, warm, and hot by splitting the sample into quartiles based on initial returns. Panel 2 of Table 1 shows that trading activity increases with initial return: The number of trades, number of shares traded, dollar value, and offer turnover are all higher for hot IPOs. Using both F- and Kruskal-Wallis tests, I find these differences are significant at the 1% level.

In the analysis of who is trading with whom, I identify four distinct types of traders per stock, namely, lead underwriters, other market makers, brokers, and customers. I do not consider co-managers separately as Ellis et al. (2002) show co-managers play a minimal role in aftermarket trading. One limitation of the data is that it does not have complete information about whether a trade occurred via an electronic communications network (ECN) or not. ECNs are alternative trading venues that allow traders to execute trades without the assistance of a market maker. At the time of this sample, the only ECN in operation was Instinet, which is a trading venue for institutions (customers) and NASD members. For the small number of trades that are ECN-identified, I know a customer is trading and thus I categorize these trades as direct customer trades. The market makers, including the lead underwriter, are NASD members who can enter quotes and trades for a particular stock. Brokers are NASD members who can see all of the market makers quotes and can direct trades to market makers, but cannot enter quotes themselves. Finally, customers are traders who are not NASD members. A particular NASD member firm (e.g., Goldman Sachs) may be a registered market maker for one stock, ABCD, but not in another stock, XXYZ. In this case, the Goldman Sachs trades in ABCD would be termed market-maker trades and their trades in XXYZ would be broker trades.

I assume that when market makers trade, they act as principals and any shares purchased or sold affect their inventory position, and when brokers trade, they always act as agents, executing trades initiated by customers. Although I do not know to what extent these assumptions are precisely valid, unlike market makers, brokers pay and do not make the spread. Brokers also do not have any advantage over other investors in accumulating inventory. Market makers can indicate whether or not they are trading as a principal or agent, but for my time period, such reporting was voluntary and hence rare. NASD estimates that 95% of market maker trades for this time period are as a principal. With these assumptions, trades are either market maker-initiated (lead underwriter or other market maker) or investor-initiated (via a broker, via Instinet, or direct). Although market makers and brokers are identified by a four-letter name in my data, customers are not uniquely identified, thus I cannot determine the positions of individual customers, nor whether customers are of the retail or institutional type.

I classify trades as either buy- or sell-motivated based on who facilitates the trade. For all market maker-customer trades I assume that customers motivate the trade,

and thus assign buys and sells accordingly. For the rest of the trades (market maker-market maker, market maker–broker, broker–broker), ECN trading complicates direct inference of trade direction. In non-ECN trading, market makers provide liquidity to customers or brokers. In ECN trading, however, market makers, brokers, and institutions can all be liquidity providers. For these trades, because I have no ECN indicator, I rely on the Lee and Ready (1991) algorithm to infer who initiates the trade.

4. Volume analysis: Who is trading with whom and why?

4.1. The composition of total volume

In this section I investigate who trades immediately after IPOs commence trading. Table 2 summarizes who is trading with whom, firstly in all trades (Panel A) and then in buy (Panel B) and sell trades (Panel C). The tables are divided into quadrants that depict the general description of the trader (investor or dealer), and entries within each quadrant break down the trading volume into particular pairs of participants. In the top-left quadrant of Panel A are the investor–investor trades. These trades occur on Instinet and are a small percentage of the overall volume (4.22% of trading volume). Other Instinet trades (shown in the bottom-left quadrant) are dealer-investor trades that are initiated by dealers (5.23% of trading volume). Because these are a relatively small fraction of trading volume, they are not the main focus of this paper.

In the top-right quadrant are investor–dealer trades, trades initiated by investors and that account for 72.82% of total trading volume. Looking closer at the trading pairs, it is not surprising that investor-dealer trades are dominated by customers that trade with lead underwriters (34.68%) as lead underwriters allocate the majority of shares in offerings. Customer trades via unaffiliated market makers (18.73%) are the second-most frequent type of trade. Broker trades are more evenly split between lead underwriters (7.82%) and unaffiliated market makers (11.59%). Griffin et al. (2003) classify all NASD participants into those representing institutional investors and those representing individual investors. Using their classification to further break-down the "broker" and "other market maker" categories in Table 2 Panel A, I find that 61% of the customer/other market maker trades are customers trading with wholesalers (i.e., individual traders), 30% are with the co-managers of the offering (individuals or institutions), 5% are institutional trades (with wirehouses or institutional brokers), and 4% are individual traders with regional or small brokers. For the broker/other market maker trades, 50% of the brokers are individual-based, and 50% are institutional-based; the main "other market maker" counterparty is a wholesaler in 75% of the trades.

In the bottom-right quadrant are the interdealer trades which account for 17.74% of trading volume. It is interesting that interdealer trading among unaffiliated market makers and lead underwriters is 13.36% of trading volume, and is exceeded only by customer-initiated trading. In comparison, Griffin et al. (2003)

Table 2
Who is trading with whom: the composition of buyer- and seller-initiated volume

The tables present the fraction of trading volume over the first two days of trading accounted for by each trading pair, with totals in the last column and row. In Panels B and C, trades are signed as buy or sell either directly (for the customer–market maker trades) or using the Lee–Ready (1991) algorithm. Customers are investors who are not NASD members, brokers are NASD members who facilitate trades for investors, and the lead underwriter and other market makers set quotes as well as trade

Panel A: all trades

		Liquidity provider			Total (per initiator)
		Investor	Dealer		
		Customer	Lead	Other mmkr	
Initiator	Customer	1.93%	34.68	18.73	55.34
	Broker	2.29	7.82	11.59	21.69
	Investor	4.22		72.82	77.03
	Lead	2.10	0.71	1.60	4.40
	Other market maker	3.13	13.36	2.07	18.56
	Dealer	5.23		17.74	22.96
Total (per liquidity provider)		9.45		90.56	100.00

Panel B: buyer-initiated trades

		Seller			Total (per buyer)
		Investor	Dealer		
		Customer	Lead	Other mmkr	
Buyer	Customer	0.76%	22.22	4.41	27.39
	Broker	1.02	1.25	3.96	6.22
	Investor	1.78		31.84	33.61
	Lead	1.39	0.35	0.99	2.73
	Other market maker	1.56	0.52	0.86	2.95
	Dealer	2.95		2.72	5.68
Total (per seller)		4.73		34.56	39.29%

Panel C: seller-initiated trades

		Buyer			Total (per seller)
		Investor	Dealer		
		Customer	Lead	Other mmkr	
Seller	Customer	1.17%	12.46	14.32	27.95
	Broker	1.27	6.57	7.63	15.47

Table 2 (*continued*)

Panel C: seller-initiated trades

		Buyer			Total (per seller)
		Investor	Dealer		
		Customer	Lead	Other mmkr	
	Investor	2.44		40.98	43.42
	Lead	0.71	0.36	0.61	1.67
	Other market maker	1.56	12.84	1.21	15.61
	Dealer	2.27		15.02	17.28
Total (per buyer)		4.71		55.99	60.71%

document that interdealer trading accounts for 11.93% of trading volume on an average day for the Nasdaq-100 stocks. Although I do not have distributional statistics for the Griffin et al. (2003) sample, I use their mean estimate as a pinpoint value and conduct a t-test to compare their result to mine: I find that interdealer trading volume is statistically significantly higher in my sample.

4.2. The composition of buyer- and seller-initiated volume

Splitting trades into buyer-motivated and seller-motivated types in Table 2 Panels B and C, the composition of trading becomes more apparent. Overall, sells account for 60.71% of the volume. This finding is consistent with KSW who find a positive order imbalance, indicating that there are more sells than buys on the first day of trading.

Turning first to buy trades, I find investor-initiated trades comprise most of the volume (33.61%). Further, investors generally buy directly from lead underwriters (22.22% of volume) rather than from other market makers (4.41%) or through brokers (6.22% of volume). As the lead underwriter allocates initial share positions in IPOs, they are the natural counterparty for investors that receive initial allocations who want to build larger positions once trading starts. An additional reason for the lead underwriter acting as the main counterparty for buy trades is tie-in agreements with lead underwriters, wherein investors that receive initial allocations in offerings commit to purchasing additional shares in the aftermarket (Pulliam and Smith, 2000); one interpretation of these results is that investors buy through lead underwriters to show that they have met their commitment.

For seller-initiated trades, investors comprise most of the volume (43.42%), which is much higher than previous measures of flipping (15% in Aggarwal, 2003; BBF, 2003). This suggests that many investors initiate sell trades that do not involve shares

coming from initial allocations, which is consistent with day trading and/or short selling. Most of the investor-initiated sell trading is by customers directly (27.95%) as opposed to through brokers (15.47%). Interestingly, although customers predominantly buy shares from lead underwriters, they are more likely to sell shares via other market makers rather than lead underwriters (14.32% versus 12.46%). An explanation for this is that lead underwriters discourage flipping trades, so investors who want to sell avoid lead underwriters in order to avoid penalty bids. Also in contrast to buys, for which there is little interdealer trading (2.72%), sells represent a total of 15.02% of the volume in interdealer trades, thus interdealer trades are one-sided, mostly coming from unaffiliated market makers selling to lead underwriters.

4.3. The composition of buyer- and seller-initiated volume by initial returns

To analyze how trading volume varies across IPOs, in this section I split the sample into initial return quartiles. Table 3 shows the fraction of trading volume for each category of buyer- and seller-initiated trades.

Table 3 indicates that the dominance of sell-motivated trades that is apparent in Table 2 is only apparent in cold IPOs. For the coldest IPOs, seller-initiated trading accounts for 76.11% of trading volume, whereas in warm and hot IPOs, seller-initiated trading accounts for 52.35% and 52.20% of trading volume, respectively. Overall, buying and selling activity is balanced in hot IPOs, suggesting a vibrant aftermarket characterized by many investors wanting to trade. For cold IPOs it is clear that selling pressure outweighs buying interest.

Looking closer at cold IPOs, one observes the same pattern observed earlier: Investors buy shares almost exclusively from lead underwriters (14.65% of 20.89% investor buying), however, investors sell more frequently to other market makers (17.32%) than lead underwriters (7.24%). Brokers trade evenly with both counterparties (sell 11.53% with other market makers versus 11.46% with lead underwriters, and buy 2.62% from other market makers versus 0.8% from lead underwriters). As already discussed, this pattern is consistent with customers fulfilling aftermarket buying agreements with lead underwriters, but avoiding selling penalties from lead underwriters.

Investor buy trades account for more trading volume in hot IPOs (40.79%) than in cold IPOs (20.89%). In hot IPOs, lead underwriters remain the main counterparty to investor buy trades, but other market makers play a relatively greater role than in the cold IPOs (6.81% versus 1.82%, respectively), perhaps reflecting buying activity that is not due to commitments to lead underwriters. On the sell side, lead underwriters are a more active counterparty (18.66%), overtaking the volume of other market makers (11.98%). This suggests that investors are less concerned with selling to lead underwriters in hot IPOs and therefore are more willing to trade with them.

Trading volume composition varies widely across initial return quartiles, suggesting diverse investor behavior depending on the performance of the IPO. Also, this is mirrored by a diminishing level of interdealer trading for hotter IPOs. For cold IPOs, unaffiliated market makers selling to lead underwriters accounts for

Table 3
Composition of buyer- and seller-initiated volume by initial return

The eight panels present buyer- and seller-motivated trades for the four subgroups of IPOs based on initial returns. Each panel calculates the percentage of trading volume traded by each pair over the first two days

	Seller			Total per buyer		Buyer			Total per seller
Buyer	Cust	Lead	Mmkr		Seller	Cust	Lead	Mmkr	
Cool IPOs (n = 80) buyer-initiated trades					*Cool IPOs (n = 80) seller-initiated trades*				
Cust	0.36	14.65	1.82	16.82	Cust	0.71	7.24	17.32	25.28
Broker	0.64	0.80	2.62	4.07	Broker	1.08	11.46	11.53	24.07
Lead	0.89	0.22	0.65	1.75	Lead	0.74	0.22	0.37	1.33
Mmkr	0.74	0.19	0.31	1.24	Mmkr	1.13	23.35	0.95	25.43
Total per seller	2.62	15.86	5.40	23.89%	Total per buyer	3.66	42.28	30.18	76.11%
Cool IPOs (n = 76) buyer-initiated trades					*Cool IPOs (n = 76) seller-initiated trades*				
Cust	0.65	22.78	3.81	27.25	Cust	1.01	9.68	14.92	25.62
Broker	1.18	1.22	3.62	6.03	Broker	1.50	7.86	7.98	17.34
Lead	1.28	0.52	0.91	2.72	Lead	0.73	0.52	0.54	1.80
Mmkr	1.29	0.47	0.54	2.30	Mmkr	1.34	14.61	1.00	16.95
Total per seller	4.41	25.00	8.89	38.30%	Total per buyer	4.58	32.67	24.45	61.70%
Warm IPOs (n = 75) buyer-initiated trades					*Warm IPOs (n = 75) seller-initiated trades*				
Cust	0.91	26.27	5.22	32.40	Cust	1.43	14.22	13.01	28.66
Broker	1.14	1.74	4.58	7.46	Broker	1.30	3.92	5.71	10.92
Lead	1.97	0.52	1.26	3.75	Lead	0.82	0.53	0.66	2.01
Mmkr	2.02	0.92	1.11	4.05	Mmkr	1.54	8.03	1.20	10.76
Total per seller	6.04	29.44	12.17	47.65%	Total per buyer	5.09	26.69	20.58	52.35%
Hot IPOs (n = 80) buyer-initiated trades					*Hot IPOs (n = 80) seller-initiated trades*				
Cust	1.12	25.45	6.1	33.38	Cust	1.55	18.66	11.98	32.19
Broker	1.13	1.27	5.02	7.41	Broker	1.25	2.93	5.18	9.36
Lead	1.46	0.17	1.14	2.76	Lead	0.56	0.17	0.85	1.59
Mmkr	2.24	0.53	1.48	4.25	Mmkr	2.22	5.16	1.69	9.07
Total per seller	5.95	27.41	14.44	47.80%	Total per buyer	5.58	26.92	19.71	52.20%

23.35% of total volume, but in hot IPOs these interdealer trades only represent 5.16% of total volume. In Section 6, I discuss interdealer trades in detail.

4.4. The turnover of buyer- and seller-initiated shares by initial return

Aggarwal (2003) points out that comparing buys and sells as a fraction of trading volume ignores the difference in the size of trading volume. For cold IPOs, trading volume averages 1.6 million shares or 52.7% of the offering, whereas it averages 3.4 million shares or 107.8% of the offering in hot IPOs. Therefore, the results on the composition of total volume in Table 3 do not address turnover of issued shares.

Table 4 recalculates Table 3 and scales the numbers by shares offered in IPOs rather than shares traded on the first two days. Although the inference that selling dominates the first day of trading for cold IPOs remains, the magnitude becomes more clear: investors sell only 25.5% of issued shares in cold IPOs compared to 31.9% and 45.0% of issued shares in warm and hot IPOs, respectively. For buyer-initiated trades in cold IPOs, only 11.7% of issued shares are purchased by investors in the first two days of trading, compared to 31.5% and 44.0% in warm and hot IPOs, respectively. Thus, the hottest IPOs have active secondary markets on the first two days with investors both buying and selling. In cold IPOs, intermediaries (particularly lead underwriters) are the main purchasers of shares via interdealer

Table 4
Turnover of buyer- and seller-initiated shares by initial return

The eight panels present buyer- and seller-initiated trades for each of the four subgroups of IPOs based on initial return. In contrast to Table 3, this table calculates the percentage of the offering amount traded by each pair over the first two days of trading

	Seller			Total per buyer		Buyer			Total per seller
Buyer	Cust	Lead	Mmkr		Seller	Cust	Lead	Mmkr	
Cold IPOs (n = 80) buyer-initiated trades					*Cold IPOs (n = 80) seller-initiated trades*				
Cust	0.24	8.58	0.94	9.76	Cust	0.40	4.27	9.32	13.98
Broker	0.28	0.35	1.33	1.97	Broker	0.47	5.46	5.55	11.47
Lead	0.48	0.08	0.34	0.89	Lead	0.41	0.08	0.17	0.66
Mmkr	0.41	0.15	0.16	0.72	Mmkr	0.56	12.21	0.47	13.24
Total per seller	1.41	9.15	2.77	13.34%	Total per buyer	1.84	22.02	15.50	39.35%
Cool IPOs (n = 76) buyer-initiated trades					*Cool IPOs (n = 76) seller-initiated trades*				
Cust	0.36	15.04	2.08	17.47	Cust	0.66	6.52	9.74	16.92
Broker	0.53	0.64	1.97	3.14	Broker	0.74	4.65	4.58	9.97
Lead	0.66	0.23	0.68	1.57	Lead	0.63	0.23	0.32	1.18
Mmkr	0.75	0.25	0.30	1.31	Mmkr	0.80	9.46	0.60	10.86
Total per seller	2.30	16.16	5.03	23.50%	Total per buyer	2.83	20.86	15.24	38.93%
Warm IPOs (n = 75) buyer-initiated trades					*Warm IPOs (n = 75) seller-initiated trades*				
Cust	0.88	21.60	4.07	26.55	Cust	1.22	11.72	10.55	23.49
Broker	0.87	0.98	3.09	4.94	Broker	0.93	3.10	4.38	8.41
Lead	1.39	0.26	0.87	2.52	Lead	0.57	0.27	0.49	1.33
Mmkr	1.54	0.56	0.84	2.93	Mmkr	1.21	6.84	1.02	9.07
Total per seller	4.67	23.40	8.87	36.94%	Total per buyer	3.93	21.93	16.44	42.30%
Hot IPOs (n = 80) buyer-initiated trades					*Hot IPOs (n = 80) seller-initiated trades*				
Cust	1.19	27.36	6.95	35.50	Cust	1.60	20.58	12.90	35.08
Broker	1.18	1.31	6.03	8.51	Broker	1.17	2.90	5.81	9.88
Lead	1.39	0.15	1.13	2.67	Lead	0.57	0.15	0.77	1.49
Mmkr	2.60	0.63	1.69	4.92	Mmkr	2.54	5.44	1.81	9.79
Total per seller	6.36	29.45	15.79	51.60%	Total per buyer	5.88	29.07	21.29	56.24%

trading and investor selling. As lead underwriters have short positions to fill, they are well positioned to purchase large volumes of shares.

5. Initial trading and flipping activity

5.1. How flipped shares are traded during the day

Comparing investor selling of 25% to 45% of issued shares (Table 4) to the flipping numbers of Aggarwal (2003) and BBF (2003) suggests there are other sources for customer sell trades besides flipping. These sources are greatest in hot IPOs and most likely constitute short sellers or day traders. Geczy et al. (2002) suggest that 75% of IPOs may be shorted on the first day of trading by institutional investors. They find, however, that short selling is concentrated in larger IPOs, with only around 40% of offerings of less than $50 million being shorted in their sample.

To measure the extent of day trading or short selling, I calculate the ratio of customer buying and selling to flipped shares.[2] I estimate the level of flipping using the mean flipping numbers for quartiles based on initial returns in BBF (2003). I thank Ekkehart Boehmer for providing this data. To the extent that their sample is from a different time period than mine, and given there is some variation in flipping within each quartile, using their mean level of flipping for each IPO is a noisy estimate of the actual level of flipping in each offering. Following BBF, I assume that the number of shares sold is the number of shares in the offering plus the overallotment option. Their estimates are the percent of the shares sold that are flipped by institutions and retail investors over the first two trading days. To measure the level of day trading, I calculate the number of times flipped shares are bought (BUY/FLIP) and then the number of times flipped shares are sold (SELL/FLIP), where BUY (SELL) is the cumulative share volume purchased (sold) by customers. Table 5 shows the estimated number of times each flipped share is bought and sold.

For cold IPOs, only 97% of flipped shares are purchased in the first two days of trading whereas the number of shares sold by customers is 1.91 times the number of shares flipped. This represents 100% of the flipping trading volume plus an additional 91% of these shares being sold. Overall only six out of every 100 flipped shares (97–91%) are transferred from investors who received IPO allocations to investors who bought shares in the aftermarket. The remaining 94 shares accumulate

[2]Initial shareholders who own stock in companies before IPOs are typically unable to sell their shares due to lock-up agreements or due to their shares being restricted under Rule 144. Restricted shares are those owned by insiders or buyers in private placements where shares are not sold under the SEC registration requirements. Insiders shares are restricted as long as the party remains affiliated with the firm, whereas buyers' shares are not restricted if the shares have been owned longer than one year (before February 1997, it was two years) and the party has not been affiliated with the firm for 90 days (Rule 144(k)). Restricted shares can only be sold in small amounts: In each three-month period, only up to the greater of 1% of the shares outstanding per month or the average weekly trading volume for the last four weeks. For our sample, 1% of shares outstanding would result in 111,000 shares available for trade on the first day.

Table 5
How flipped shares are traded during the day

For each offering, the number of flipped shares (FLIP) is calculated by multiplying the number of shares in the offering (including the overallotment option) by the mean flipping ratios. The mean percent of offering flipped for each quartile is provided by Ekkehart Boehmer. Using this number of shares as a denominator, the number of times that the flipped shares are bought is calculated by dividing the shares bought by customers by FLIP, and the number of times that the flipped shares are sold, including the flipping trades, is calculated by dividing the shares sold by customers by FLIP

	Cold ($n = 80$)		Cool ($n = 76$)		Warm ($n = 75$)		Hot ($n = 80$)	
	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev
% of offering flipped	14.1%		19.7%		22.7%		26.5%	
Times bought	0.97	0.72	1.22	0.82	1.59	0.81	1.90	0.77
Times sold	1.91	1.02	1.51	0.87	1.64	0.86	1.95	0.78

in dealers' inventory positions. This finding can be interpreted in two ways. One interpretation is that the majority of buyers are day traders who re-sell within the first two days. This implies that for every 100 shares flipped, 97 are purchased by investors, and 91 of these 97 shares are re-sold by investors back to dealers. An alternative interpretation is that the majority of buyers are long-term investors who hold the shares, and the additional selling volume is due to short sellers. In this case, for every 100 shares flipped, 97 shares are purchased and held by one group of investors and 91 shares are short sold by other investors, resulting in a net aggregate investor position of six shares.

The first of these interpretations relies on day traders being active in cold IPOs. As day traders are typically associated with highly volatile stocks, it is curious to suggest they participate in IPOs that do not change price. Perhaps these day traders are investors who purchase shares in the first minutes of trading but quickly realize their mistake and reverse their decision when prices fail to climb. Another possibility is there exist institutions that commit to purchasing shares from the lead underwriter in the aftermarket but then re-sell them (to another market maker) at no profit. These short-term trades are facilitated by price support as positions can be reversed without making a loss.

The second of the above interpretations, that traders in cold IPOs are long-term buyers and short sellers, is supported by Geczy et al. (2002) results. They provide evidence that there is more demand for short selling in cold IPOs, and thus the excess selling volume most likely comes from short sellers who anticipate the stock price falling.

For hot IPOs, the mean number of times each flipped share is bought is 1.9 and the mean number of times it is sold is 1.95. Again, these numbers can have two interpretations. First, if there is no short selling, for every 100 shares flipped, 100 are purchased, 95 of these are re-sold, and 90 are purchased again. Thus, 95 out of every 100 shares that are flipped are transferred to new owners, and only five out of every 100 flipped shares accumulate in dealers' inventory positions. Alternatively, if short

selling is possible and there are no day traders, the interpretation is as follows: For every 100 flipped shares, there are an additional 95 short sold and a total of 190 purchased. The net imbalance is five shares that accumulate in market maker inventory.

As Geczy et al. (2002) show, demand for short selling increases with initial returns, so it is likely that a portion of the selling volume is due to short sellers. However, unlike cold IPOs, for which it is difficult to provide reasons for day traders to be present, hot IPOs are likely to attract day traders. Thus, for hot IPOs both interpretations of trading activity are plausible, with the buying activity, most likely representing a combination of day traders and long-term investors, being balanced by selling from a combination of flippers, day traders, and short sellers. As I do not know the true level of flipping in each IPO, the standard deviations around these estimates are large (particularly for the cold IPOs). However these findings highlight that there is very little investor buying demand in the aftermarket for cold IPOs, compared to the active, liquid market that exists for hot IPOs.

5.2. *Limitations of flipping proxy*

Measuring flipping activity is challenging. Ideally one would utilize true flipping records or detailed trading identities, both of which are not available in standard data sources. As a first attempt, KSW utilize readily available data and a well-reasoned method to develop a proxy measure for flipping (i.e., they characterize flipped trades as block sales of 10,000 shares or more). Using a proprietary data set, I develop a screen for possible flipping trades by separating investor and dealer trades and can therefore calibrate the KSW proxy for flipping.

In Table 6, I split sell trades into three trade sizes, small (1–999 shares), medium (1,000 to 9,999 shares), and large (10,000 or more shares). In the first panel I calculate the fraction of trading volume accounted for by each trade size, and in the second panel I calculate the offering turnover in each trade size.

In Panel A I observe the KSW result: Large sell trades account for 41.7% of the trading volume in cold IPOs, but only 23% of the trading volume in hot IPOs. However, it is also clear that not all large sell trades are customer motivated. For the cold IPOs, interdealer trades account for 17.98% of the volume and customer trades account for 23.75% of the volume. Thus, too many trades are erroneously categorized as coming from flippers. For the IPOs with positive initial returns, this is less of a problem as there are fewer interdealer trades overall.

In Panel B, if I compare the percent of the offering that is sold in large customer trades (13.28% for cold IPOs to 20.21% for hot IPOs) and compare these to the flipping numbers in Table 5, I see that not enough of the offering is traded via large trades to account for all of the flipped shares. Also, the BBF flipping numbers in Table 5 are based on a percentage of shares offered including the overallotment option. Rewriting these as a percentage of shares offered excluding the overallotment option yields flipping levels of 16.2%, 22.7%, 26.1%, and 30.5% for cold, cool, warm, and hot IPOs, respectively. Aggarwal (2003) and BBF (2003) both show that the average size of a flipping trade is smaller than that suggested by KSW, and in

Table 6
Size of sell-motivated trades

This table shows the percent of two-day trading volume accounted for by three sizes of sell-motivated trades. The motivator of the trade (i.e., the seller) is identified as either a customer (direct or indirect via a broker) or a dealer (underwriter or unaffiliated market maker). The trade sizes are small (1–999 shares), medium (1,000–9,999 shares), and large (10,000 + shares). The IPOs are separated into four groups based on their initial return: Cold, cool, warm, and hot. The total numbers are consistent with the totals for sell trades in Tables 3 and 4. *F*-statistics test for equality of means across the four types of IPOs

	Small			Medium			Large		
	Investor	Dealer	Total	Investor	Dealer	Total	Investor	Dealer	Total
Panel A: Percent of trading volume									
Cold	2.10%	0.30	2.40	23.50	8.48	31.99	23.75	17.98	41.73
Cool	2.17%	0.37	2.54	22.24	7.08	29.31	18.55	11.30	29.85
Warm	3.34%	0.42	3.77	19.38	5.77	25.15	16.85	6.57	23.43
Hot	3.79%	0.50	4.29	19.24	5.66	24.90	18.51	4.49	23.01
F	9.6	3.5	10.1	7.8	8.8	11.5	10.7	72.2	42.4
Panel B: Percent of shares offered									
Cold	1.03%	0.14	1.17	11.14	3.79	14.93	13.28	9.97	23.25
Cool	1.23%	0.20	1.44	12.56	4.08	16.64	13.09	7.76	20.86
Warm	2.59%	0.30	2.89	15.11	4.49	19.60	14.20	5.62	19.82
Hot	4.20%	0.60	4.80	20.55	5.94	26.49	20.21	4.75	24.96
F	33.4	9.8	31.7	22.8	9.2	21.6	8.8	11.4	1.9

fact, many medium and small trades may be flipping trades. However, the two errors do not cancel each other out; the overestimation error is still much larger than the underestimation error. These results suggest that there are limitations to the usefulness of using large sell trades as a flipping proxy.

6. Inventory management of dealers

6.1. Interdealer trade

Although customer trades comprise the majority of trading volume on the first two days following IPOs, they are not always balanced between buyers and sellers. Dealer trades (interdealer and via Instinet) are important, especially in the coldest IPOs where they account for 30% of trading volume (see Table 3). Dealers provide liquidity for customers, particularly in unbalanced trading, and this often results in large inventory positions that need to be managed. To show how interdealer trades are important for market maker inventory management, I calculate the aggregate market-maker inventory positions in Table 7. Panel A shows the aggregate inventory position of "other" market makers, and Panel B shows the inventory position of lead underwriters.

Table 7
Market maker inventory management

The aggregate inventory position (as a percentage of the shares offered) of "other market makers" (unaffiliated market makers and co-managers) (Panel A) and the lead underwriter (Panel B) is calculated by tallying the inventory position accumulated via trade with investors, and the inventory position accumulated via trade with other market makers. For the lead underwriters, the initial short position generated by overselling the offering by the amount of the overallotment option (see Ellis et al., 2000) is included

	Cold (%)	Cool	Warm	Hot
Panel A: other market makers				
Initiate (trade = buy)	0.41	0.75	1.54	2.60
Counter (trade = sell)	14.86	14.31	14.93	18.71
Total bought	15.27	15.07	16.47	21.31
Initiate (trade = sell)	0.56	0.80	1.21	2.54
Counter (trade = buy)	2.27	4.05	7.16	12.98
Total sold	2.83	4.85	8.37	15.52
Net customer imbalance	12.45	10.21	8.10	5.79
Interdealer (trade = buy)	0.78	1.24	2.45	3.92
Interdealer (trade = sell)	13.01	10.80	9.12	9.08
Net interdealer imbalance	−12.23	−9.56	−6.66	−5.16
Overall	0.21	0.65	1.44	0.63
Panel B: lead underwriters				
Initiate (trade = buy)	0.48	0.66	1.39	1.39
Counter (trade = sell)	9.73	11.17	14.82	23.48
Total bought	10.20	11.83	16.21	24.87
Initiate (trade = sell)	0.41	0.63	0.57	0.57
Counter (trade = buy)	8.93	15.68	22.58	28.67
Total sold	9.34	16.30	23.16	29.23
Net customer imbalance	0.86	−4.47	−6.95	−4.36
Interdealer (trade = buy)	12.70	10.60	8.24	6.86
Interdealer (trade = sell)	0.47	1.04	1.57	1.70
Net interdealer imbalance	12.23	9.56	6.66	5.16
Overall	13.09	5.08	−0.28	0.80
Short position	10.29	7.70	2.58	1.28
After including short	2.81	−2.61	−2.87	−0.48

6.1.1. Other market makers

The first rows in Table 7 show the aggregate inventory position that market makers accumulate from buying investor shares. Market makers buy between 15% and 21% of issued shares from investors, mostly by being counterparty to investor sell trades

(14.9% to 18.7%). On the sell side, market makers in cold IPOs sell only 2.8% of issued shares to customers, whereas they sell 15.5% in the hottest IPOs. Overall, the per-stock aggregate inventory position accumulated from trades of all "other" market makers with customers is 12.45% (5.79%) of issued shares for cold (hot) IPOs.

The activity in interdealer trades reflects this inventory position: in cold IPOs, these market makers sell net 12.23% of issued shares to lead underwriters, compared to 5.16% of issued shares in hot IPOs. Regardless of offering type, the resulting inventory position of other market makers is small. In cold IPOs, the aggregate inventory position per IPO is 0.21% of issued shares ($p = 0.14$) compared to small but significant aggregate inventories for warm and hot IPOs (1.44% with $p = 0.0001$ and 0.63% with $p = 0.047$, respectively). Despite severe trading imbalances in cold IPOs, market makers finish trading with very little inventory, and hence limited financial exposure. I also use the data to examine each individual market maker's inventory position after two days of trading, though these results are not reported in a table. Overall, the mean inventory position for other market makers is 0.08% ($p = 0.001$), a small but significantly positive inventory position. The 5% and 95% cutoffs for the distribution of inventory holdings are −0.5% and 1.0% of offerings, respectively, thus most market makers hold very little stock (−17,000 to 30,000 shares).

The results thus far suggest a natural timing of trades: Customers trade with unaffiliated market makers who build up unwanted inventory positions. These customers then offload their inventory to lead underwriters. By looking at the intraday inventory positions of market makers, I examine whether this is indeed the case. Fig. 1 shows the cumulative inventory of the average market maker in cold, cool, warm, and hot IPOs. I find that the net inventory position of market makers throughout the day is extremely close to zero, thus customer trade imbalances are quickly offset by trades with lead underwriters. Throughout the first trading day, the tightness of the 95% confidence interval around the mean inventory position suggests that the mean is indeed representative of each market maker's behavior.

6.1.2. Lead underwriters

If market makers sell unwanted inventory to lead underwriters, I must examine the impact of these trades on lead underwriters' inventory positions. Panel B of Table 6 shows that for all but the coldest IPOs, lead underwriters are net sellers of shares to investors (0.86%, −4.47%, −6.95%, and −4.36% for cold, cool, warm, and hot IPOs, respectively). For warm and hot IPOs, interdealer trades (6.66% and 5.16%) balance the customer trade imbalances and result in negligible inventory for lead underwriters (−0.28% and 0.8%). For cool IPOs, however, lead underwriters are net buyers of shares from other market makers (9.56%), and these buys outweigh short positions from customers. Underwriters thus face substantial long inventory positions (5.08%). For cold IPOs, the situation is even more interesting, as lead underwriters have little inventory imbalance from customer trades but generate inventory from interdealer trades (12.23%); this results in an overall inventory of 13.09% of shares issued.

In all markets, however, after factoring in the overallotment option, lead underwriters hold very little inventory. This is consistent with Ellis et al. (2000), who

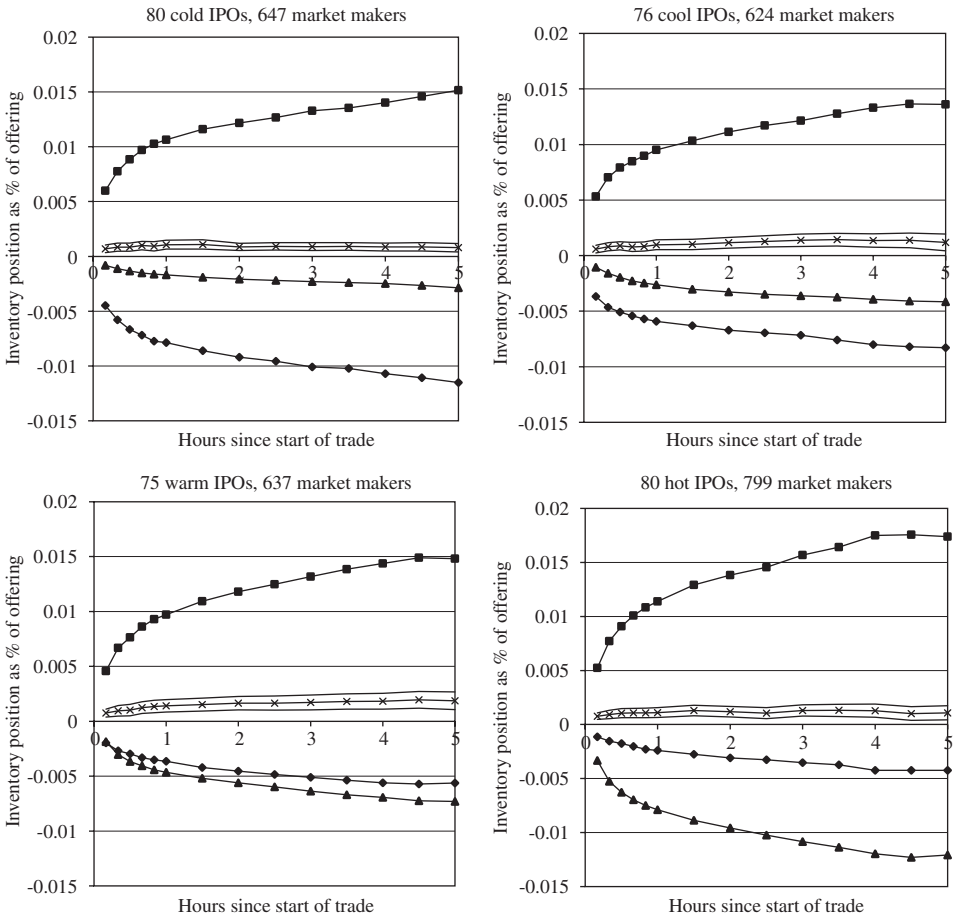

Fig. 1. Graphs of average inventory of "other" market makers throughout the first day. The squares indicate the average long inventory position that a market maker accumulates from shares bought from customers. The triangles indicate the short position that a market maker accumulates from shares sold to customers. The diamonds indicate the cumulative shares sold to the lead underwriter. The 'x' line indicates the mean inventory position per market maker (buys from customer—sells to customer—sells to lead). The mean inventory position is bounded by 95% confidence intervals.

discuss the role of underwriters in the aftermarket: Lead underwriters manage their inventory positions by overselling offerings and buying back shares in the aftermarket to cover their short positions, or by exercising the green shoe if selling volume is balanced by buying volume. For cold IPOs, for which price stabilization is important, green shoes are not exercised. Large inventory positions created through price-stabilizing trades are offset by large initial short positions. In hot IPOs, for which no trading inventory position is created, overallotment options are exercised, thereby leaving lead underwriters with no short position.

With the enormous trading volume following an IPO, dealers face inventory imbalances from customer trading. These inventory imbalances are quickly dissipated via interdealer trading with the lead underwriter, and the majority of dealers hold inventory very close to zero. The lead underwriter's green shoe option facilitates inventory management for all dealers, which in turn facilitates liquidity in the IPO for all customers.

6.2. Trading prices relative to quotes

Another way dealers can manage their inventory is via quotes. However, quotes in IPO trading are dominated by lead underwriters at the bid (Schultz and Zaman, 1994), especially in stabilized IPOs, and these quotes do not adjust to trading. Thus, instead of focusing on quoting behavior, I examine the trading prices relative to the posted quotes to determine which trades receive superior execution—dealers can provide superior prices to internal customer order flow, whereas trades from brokers are directed to the best available quote.

Table 8 presents the percentage of trades that occur at the quote, inside the quote or outside the quote. I do not adjust the time of the quotes; however, if I require that the quote prevailed five seconds or ten seconds prior to the trade, the results do not change substantially. Overall, 33.2% of trades occur inside the quote, 62% occur at the quote, and 4.8% occur outside the quote. However, for buy trades, the majority, 55.3%, is executed within the quotes and only 39.1% of buy trades are executed at the posted ask quote. This suggests significant internalization of order flow, and market makers providing price improvement to most buys. In contrast, for sell trades, only 21.9% receive a better price than the posted quote, and 73.5% are executed at the bid quote. Given sellers worsen the inventory management problem of dealers, they enjoy less price improvement than buyers.

To look further into the characteristics of trades that receive price improvement, I split buy and sell trades into trade-size groups. Large buy trades (greater than 10,000 shares) execute within the quotes 60.9% of the time, compared to 29.6% of the time for small buy trades ($F = 267$). This is a surprising result: In standard market microstructure models, large trades move market makers away from their desired inventory levels, and hence are executed at worse prices (Holthausen et al., 1987). For sell trades, the situation is reversed and large trades receive less price improvement than small trades (18.4% versus 27.3%, $F = 33$). Thus, dealers appear to encourage large buy trades that assist with inventory management problems, and discourage large sell trades that exacerbate them.

For the large buy trades, the identity of the trader also contributes to the likelihood of trading within the quotes. Customers who trade directly with a dealer, either lead underwriters or other dealers, receive significantly more price improvement than customers who trade with a dealer via a broker. For example, customers that buy blocks from lead underwriters directly trade within the quote 62.1% of the time, but brokers who buy large amounts from lead underwriters only trade within the quote 32.1% of the time. Direct customer trades are likely to be internal order flow, thus dealers know the customer identity and provide superior trade execution

Table 8
Trade price relative to quotes

The trade price of each trade is compared to the prevailing inside quote at the time of the trade. For buy (sell) trades, the trading price is either at the ask (bid) quote, outside the quote (above the ask for buys and below the bid for sells), or inside the quote (below the ask for buys and above the bid for sells). For each trade type, the distribution of trades inside, at, and outside the prevailing quote is given. *F*-statistics test for equality in the fraction of trades executed within the quotes

	% trading volume	*N*	% outside quote	% at quote	% inside quote	*F*-statistic (% inside quote)
All trades	100.0	311	4.8	62.0	33.2	
All buys	39.3	311	5.7	39.1	55.3	
All sells	60.7	311	4.6	73.5	21.9	
Small buys (<100 shares)	2.4	311	3.6	66.8	29.6	267
Large buys (>10000 shares)	20.7	303	6.6	32.6	60.9	
Small sells (<100 shares)	3.2	310	2.0	70.6	27.3	33
Large sells (>10000 shares)	29.6	308	6.9	74.7	18.4	
Large buy trades						
Customer with lead	15.8	298	5.8	32.1	62.1	44
Broker with lead	0.6	67	11.2	56.7	32.1	
Customer with other dealer	2.2	198	5.1	40.8	54.1	64
Broker with other dealer	0.6	86	10.1	71.1	18.7	
Dealer with dealer	0.9	138	9.4	35.9	54.7	
Large buy trades: customer with lead underwriter						
Cold	12.0	73	3.5	26.0	70.5	4
Cool	16.8	73	2.7	34.1	63.2	
Warm	16.8	73	5.0	34.1	60.9	
Hot	17.7	79	11.7	34.0	54.3	

to these clients. Also, as the trades are block buys of more than 10,000 shares, it is likely that institutions are buyers who benefit from such superior trade execution. The preferential treatment of large buy trades of customers trading directly with lead underwriters occurs across all IPOs, with 54.3% (70.5%) executing within the quotes for the hottest (coldest) IPOs. The prevalence of price improvement for these trades is consistent with institutions receiving favorable prices when purchasing shares from lead underwriters as fulfillment of aftermarket trading agreements.

Overall, market makers (including lead underwriters) strongly enforce bid prices for large sell trades, which suggests that these trades adversely impact the inventory positions of counterparties. The unusual pattern observed for large buy trades, although at odds with typical market microstructure results, makes sense given the inventory management problems faced by market makers: market makers encourage parties that want to buy in large quantities by offering better-than-advertised prices.

7. Multivariate analysis of the composition of trading volume

The results in the earlier sections show a strong relation between initial returns and the composition of trading volume; however, there may be other factors that influence the composition of trading. In a multivariate regression (Table 9) I model trading activity as a function of initial return, underwriter quality, aftermarket

Table 9
Regression of customer and interdealer trading

The dependent variables for the three regressions are shares purchased in the first two trading days by customers (direct and indirectly via a broker) as a fraction of the shares offered in the IPO, shares sold by customers (direct and indirect) as a fraction of the shares offered in the IPO, and shares sold by an unaffiliated market maker to the lead underwriter as a fraction of the shares offered in the IPO. The independent variables are initial return (offer price to close on first trading day), log of the amount offered in the IPO (millions), underwriter rank (a higher rank signifies a larger amount of underwriting), above and below filing range (dummy variables equal to one if the offer price is above (below) the initial filing range). *T*-statistics are in parentheses

	Customer buying	Customer selling	Interdealer selling
Intercept	0.3069	0.3377	0.1108
	[5.47]*	[5.52]*	[4.13]*
Initial return	0.5404	0.3073	−0.1751
	[10.34]*	[5.39]*	[−7.01]*
Log (offer amount)	−0.0074	0.0021	−0.0014
	[−0.54]	[0.14]	[−0.21]
Underwriter quality	0.0023	0.0021	0.0004
	[4.82]*	[3.92]*	[1.61]
Above filing range	0.0870	0.1260	0.0197
	[3.90]*	[5.18]*	[1.85]***
Below filing range	−0.1082	−0.0918	−0.0189
	[−6.32]*	[−4.92]*	[−2.31]**
R-square	56.8%	43.2%	13.2%

*, **, *** indicate significance at the 1%, 5%, 10% levels, respectively.

demand, and offering size. I measure the quality of underwriters by ranking them based on the size of deals underwritten during this time period, and capture aftermarket demand via the price revision from the initial filing range to the offer price.

I find the univariate results are supported: customer buying and selling demand is higher with higher initial returns, and interdealer trading is inversely related to initial returns. In addition, customer buying and selling are both greater for higher quality underwriters, suggesting that these underwriters have a greater ability to generate interest in IPOs through their distribution network, institutional contacts, or reputation. Customer trading activity is also strongly related to the price adjustment during the filing period: More (less) customer buying and selling occurs when stocks are offered above (below) the initial filing range. The size of offerings does not matter: Investors trade proportionally the same amount regardless of the offering size. As interdealer trading is a by-product of customer demand, I find that it is related to offering price adjustments in accordance with the customer trading results.

The multivariate results suggest that in addition to the initial returns, IPO trading activity is related to underwriter reputation and pricing revisions from the filing price to the offer price.

8. Conclusion

In this paper I document that although IPO trading volume is large, the composition of volume can vary widely. In hot IPOs, large volume represents large investor interest. Customers are buying and selling shares equally and shares are owned by investors at the end of two days of trading. Market makers do not build large inventory positions, but rather act as intermediaries for customer trades.

In cold IPOs, trading volume mostly comprises flipping trades and interdealer trades. Flipped shares are bought and sold again in the first two days, with the majority accumulating in market-maker inventory and then being sold to lead underwriters. They are then used to cover the lead's short position. Very little new investor demand exists in the aftermarket, and market makers provide liquidity to investors who wish to sell in the absence of other buyers.

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