



# IPO Pricing, Block Sales, and Long-Term Performance

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## Abstract

Block sales following IPOs are related to the IPOs' value relative to an estimate of intrinsic value, opening-trade return, and IPO size. Overvalued IPOs experience more block sales than undervalued IPOs. IPOs with high block sales outperform IPOs with low block sales from 20 days after IPO through lockup expiration; however, IPOs with high block sales underperform IPOs with low block sales from lockup expiration through the third year after the IPO. The results indicate that block traders are advantaged relative to other traders; whether the advantage is based on superior information or superior valuation capabilities is unknown.

*Keywords:* IPO, initial public offering, block sales, large trades, long-horizon performance

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## 1. Introduction

This paper examines the determinants of block sales just after an IPO and the relation between block sales and long-term performance following the IPO. Block sales can include the immediate sale of initial IPO allocations (“flipping”), interdealer trades and other trades by large investors. Flipping is often characterized as a proxy for institutional informed trading. The literature tends to characterize institutional investors as having unbiased estimates of long-term IPO intrinsic value, in contrast to optimistic estimates by “sentiment” investors (Ljungqvist, Nanda, and Singh, 2006). We examine whether institutions, market makers, and other block traders are advantaged relative to other investors in the IPO market.

Ritter and Welch (2002) report that the average first-day IPO return over 1980 to 2001 is 18.8%, with 70% of IPOs exhibiting positive first-day returns. This magnitude of underpricing suggests that the IPO offering price could be a biased estimate of intrinsic value. Aggarwal (2003) reports that, while trading volume (as a percentage of shares offered in the IPO) in the first two days is 74%, only 7% of shares offered in the IPO are flipped. Ellis (2006) reports that a significant proportion of seller-initiated block trades in the first two trading days occur in interdealer trading, as market makers manage their inventory positions. For cold IPOs, about one third of seller-initiated block trades are between the lead underwriter and unaffiliated market makers. These trades are due to customers selling to market makers who in turn sell excess inventory to the lead underwriter. Such trades can be informative to the extent that they reflect discrepancies between customers’ value estimates and actual offer prices. We therefore examine two questions: Can the discrepancy between observed and intrinsic IPO values predict block sales? and Are block sales predictive of long-term IPO performance?

After an IPO, investment banks allegedly implement schemes to discourage flipping in an effort to attenuate downward pressure on the share price, especially for weak offerings. If true, one might very well imagine that large block sales would also be discouraged whenever possible, even though they are not from allocations at issuance (as are flipped shares.) Underwriters and the financial press often claim that flipping and other large sales could result in poor share price performance. Carter and Dark (1993) report that flipping has a detrimental effect on the early price performance of IPOs. In contrast, Krigman, Shaw, and Womack (KSW, 1999) argue that flipping, represented by large block sell-signed trades as a percentage of trading volume, is not the cause of poor price performance, but is a rational response by institutions to differences between observed and intrinsic values. They report that cold IPOs (those with nonpositive first-day returns) exhibit more block sales than hot IPOs (those with first-day returns between 10% and 60%). KSW (1999) also find that the one-year performance of cold IPOs is worse than that of hot IPOs. They conclude that institutional investors’ superior information about expected long-term IPO performance is reflected in their selective flipping.

In contrast to KSW (1999), Aggarwal (2003) reports that hot issues are flipped more than cold issues and suggests that investment bankers prefer flipping in hot

issues because they can earn more commissions from high flipping activity. They do not want flipping to occur in cold or weak issues since flipping can cause the price to drop below the offer price. This is consistent with Ellis, Michaely, and O'Hara (2000) who report that low flipping reduces the profits of market makers. Boehmer, Boehmer, and Fishe (2006) also report that there is no relation between flips in the first two trading days and later returns, but flips by institutions from the third trading day to the end of the month following the IPO are negatively related to long-run returns up to two years after the offering. Houge, Loughran, Suchanek, and Yan (2001) find an association between high block sales (a proxy for flipping) and poor three-year aftermarket returns.

Ljungqvist, Nanda, and Singh (2006) develop a model of IPO pricing in which "regular" investors who are active participants in the IPO market form unbiased estimates of long-term intrinsic IPO value from information received in the pre-IPO phase. In the presence of short sale constraints, these investors trade in the immediate after market following IPO with sentiment investors who hold very optimistic beliefs. In their model, regular investors in cooperation with underwriters receive IPO allocations at the IPO offer price and are ready to sell (some of) their allocations in the after market to the sentiment investors with very optimistic beliefs about future prospects of the IPO firm. This initial underpricing captured by the regular investors is shown to be compensation for the likelihood that trading by the sentiment investors could unexpectedly end and consequently cause IPO firm prices to decline to levels equal to or below long-term IPO intrinsic value. Their model therefore predicts both initial underpricing and long-term underperformance for IPOs.

In this paper, we measure block selling as the ratio of the sell-signed trading volume (in the first two trading days after issue) executed in blocks of over 3,500 shares and number of shares offered in the IPO; this measure is designated as the block sales ratio.<sup>1</sup> Since flipping is reported to comprise a small percentage of trading volume during the first two days, this study examines block sales initiated not only by institutional traders but also market makers and other block traders. Consistent with Aggarwal (2003), we find that hot IPOs exhibit higher block sales than cold IPOs.

We expect block sales to reflect discrepancies between block traders' estimates of IPO intrinsic value and the observed IPO offer value. We use two valuation methods to obtain estimates of intrinsic value from pre-IPO information. The first is a comparable firm multiples method using five multiples (including two adjusted profitability multiples that allow us to also utilize IPOs with negative operating and net earnings.) The second valuation method is a regression of total offer value on firm-specific pre-IPO financial and other variables.

Our results indicate that overvalued IPOs exhibit higher block sales than undervalued IPOs after controlling for expected effects of underwriter ranking,

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<sup>1</sup> Aggarwal and Conroy (2000) find that IPOs normally do not start sales at 9:30 a.m. when the market opens on the first day of sales, but many of them start sales after 12 p.m. They also report that hot IPOs start sales later in the day. Therefore, we calculate block sales as the sell-signed sales volume during the first two sales days.

opening-trade return and IPO size. These results hold for intrinsic value estimates obtained by both methods.

We also find that IPOs with high block sales outperform IPOs with low block sales only from 20 days after IPO to the lockup expiration date. However, IPOs with high block sales underperform IPOs with low block sales from the lockup expiration until the third year after issue. Furthermore, three-year buy-and-hold returns of low block sales IPOs are higher than those of high block sales IPOs. These results are robust across parametric and nonparametric tests and bootstrap methods. The relation between block sales and post-IPO performance is also confirmed in a cross-sectional regression that controls for other factors that affect IPO performance and by a Fama-French calendar-time portfolio regression approach.

These robust results suggest that block selling is indicative not only of valuation discrepancy at the offer date but also of long-term IPO performance; high block selling is associated with relative long-term underperformance. To our knowledge, this is the first study to show how IPO valuation discrepancy can predict block sales. In contrast to Aggarwal (2003) and Boehmer, Boehmer, and Fishe (2006), who use actual flipping data, our proxy of block sales includes not only institutional trades, but also market maker, dealer, and short-seller trades. Our results indicate that institutions, market makers, dealers who block trade are advantaged relative to other traders. We cannot identify the source of this advantage as either superior information or superior valuation capabilities.

## 2. Data

The sample covers initial public offerings of common stock by U.S. firms from 1993 to 2000. We obtain the initial sample from the Thomson Financial SDC Platinum New Issues Database (SDC). We update the details reported in SDC using the corrections on Professor Jay Ritter's web site. Accounting information, such as operating cash flow, growth of profit margin, and growth of revenue, comes from Compustat when possible. We hand collect accounting data that we cannot find in Compustat from financial reports in [edgar.sec.gov](http://edgar.sec.gov). Closing prices and trading volumes come from the CRSP U.S. stock database; trade and quote and intraday price and volume data come from the NYSE Trades and Quotes Database (TAQ). Earnings forecasts come from the I/B/E/S database. Underwriter quality is based on modifications of the Carter, Dark, and Singh (1998) rankings by Loughran and Ritter (2004).

We hand-fill gaps in SDC's coverage of company founding dates and manually check all firms that, according to SDC, were zero to three years old at the IPO. Loughran and Ritter (2004) note that SDC frequently reports the most recent incorporation date rather than the founding date. As in Loughran and Ritter (2004), the founding date is defined as the date operations commenced. In IPOs of corporate divisions, we attempt to determine the date when the division commenced operations. In roll-ups and similar acquisition-based IPOs, the founding date of the IPO company is the earliest founding date of any of its constituent firms.

The sample starts in 1993 because the TAQ database begins in January of that year. We exclude IPOs of financial companies (banks, savings and loans, real estate investment trusts, closed-end funds, American Depositary Receipts (ADRs), unit offerings, rights issues, LBO firms as well as partnerships, retaining only IPOs of corporations (CRSP share code 10 or 11). We exclude IPOs with an offering price less than \$5 because firm valuations in such cases are problematic. This requirement eliminates small IPOs that are likely to underperform in the long run, thus our sampling procedure may be biased against a finding of long-run underperformance. These sample selection criteria are consistent with previous studies such as Ritter (1991) and KSW (1999).

We classify industries into the 48 industry groups defined on Kenneth French's (2005) web site, which are based on four-digit SIC codes. We obtain SIC codes from SDC. In contrast to other studies, we do not exclude IPOs that have negative earnings, book values, or EBITDA over one year before the issue; they represent a large part of the sample and tend to be high-growth, high-value and technology firms.

We require that IPOs be listed on CRSP at least two months or 42 trading days after the offering date. We exclude 54 issues that are first listed on Nasdaq at the market's inception on December 14, 1972. Almost 90% of the IPOs first trade on Nasdaq, with the remainder initially listed on the NYSE or AMEX. There are 3,087 IPOs in the final sample.

For each IPO, we select a matching firm from among firms in the same industry group that have Compustat data for the fiscal year before the IPO year. We delete firms that went public during the past three years, REITs, closed-end funds, ADRs, financial firms and firms with share prices less than \$5. We limit potential matching firms to those with revenue between 70% and 130% of the IPO firm's revenue. To include observations with negative EBITDA, we match based on sales divided by gross costs, defined as sales minus EBITDA. We select the final match as the one with sales divided by gross cost closest to that of the IPO firm.<sup>2</sup> Sometimes a matching firm is reused in a subsequent year. Dropping such cases does not appreciably affect our results.

Table 1 reports the screening criteria for our IPO sample and summary statistics for IPO and matching firms. IPO firms exhibit higher median market values and growth rates of revenue and net income than the matching firms.

### **3. Estimation of intrinsic IPO value**

The existing evidence on short-run underpricing and long-term underperformance suggests that the observed IPO offer value is a biased estimate of intrinsic IPO value; the offer value equals IPO offer price multiplied by the shares outstanding at the close on the offer date, as reported by CRSP. Institutional investors, market

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<sup>2</sup> Matching on sales divided by gross costs controls for differences in profitability across firms. Using gross costs yields a more stable measure of profitability than net costs, which is affected by interest expense. We do not match firms based on past sales growth as suggested by Kim and Ritter (1999) because only about 7% of our sample IPOs have sales data available for two prior fiscal years in Compustat.

Table 1

**Descriptive statistics on IPOs, 1993–2000**

Total offer value is the offer price times total shares outstanding at the close on the offer date. Total filing value is the mid-filing price multiplied by number of total shares outstanding at the close on the offer date. Market value is the first-day closing price times the number of total shares outstanding at the close on the offer date. The first day initial return is  $((\text{closing price}-\text{offer price})/\text{offer price}) \times 100$ . Revenue is measured one year before IPO. The dummy variable for venture capital is one if the offer is financed by venture capital. The market rate of return is the value-weighted NYSE-Amex-Nasdaq market rate of return over the two weeks before the offer. Float is the number of shares offered divided by the number of shares outstanding at the close on the offer date. IPO proceeds is the offer price times number of shares offered. Price adjustment =  $((\text{offer price}-\text{filing price})/\text{filing price}) \times 100$ . Filing price range =  $((\text{high filing price}-\text{low filing price})/\text{low filing price}) \times 100$ . Accounting data are for the fiscal year before the IPO. Each matching firm went public more than three years before the IPO, is in the same Fama-French industry group and has similar sales and sales divided by gross costs in the year before the IPO. Gross costs are sales minus EBITDA.

*Panel A: Sample selection criteria*

## Criteria number of IPOs remaining

All U.S. IPOs with offer price greater than \$5 from January 1, 1993 to December 31, 2000	5,692
No REITs, closed-end funds, right issues, and financial firms	4,333
No unit offerings	3,736
No LBOs	3,732
Remaining IPOs with matching firms and financial and IPO information available	3,087

*Panel B: Descriptive statistics*

Variables	All ( <i>n</i> = 3,087)		Matching firms ( <i>n</i> = 3,087)	
	Mean	Median	Mean	Median
Total offer value	668.98	118.02	576.91	103.23
Total filing value	489.14	107.14	541.64	95.80
Market value	728.40	496.87	662.22	335.71
First-day return (%)	32.19	16.68	23.30	15.83
Revenue	150.19	89.55	195.14	108.72
Net income	1.49	0.31	2.13	1.12
Operating profit (EBITDA)	6.38	0.80	7.36	1.47
Book value of equity	23.18	3.87	28.23	3.94
Profit margin (%)	2.62	1.06	3.67	1.40
Operating cash flow	7.19	0.65	11.66	2.05
Growth profit (%)	52.36	2.25	42.39	1.13
Growth of revenue (%)	45.22	26.62	36.94	19.86
Venture capital dummy	0.44	0	0.28	0
Market rate of return (%)	1.08	0.84	0.89	0.71
Float (%)	29.82	18.78	31.31	25.94
Proceeds	50.99	21.44	75.89	29.83
Price adjustment (%)	7.52	3.28	4.16	2.15
Filing price range (%)	38.42	17.64	32.93	13.66

makers, and other large traders are posited to form unbiased estimates based on superior information or superior valuation capabilities of intrinsic value. Valuation discrepancies between observed offer value and estimated intrinsic value are likely to trigger block selling.

We use two methods to estimate intrinsic IPO value. First is the comparable firm approach that is frequently used by investment bankers to price IPOs (Varaiya, Bergmark, and Taylor, 1997; Kim and Ritter, 1999) and in academic studies (Carter and Van Auken, 1990; Alford, 1992). The comparable firm method uses similar firms as benchmarks for setting IPO offering prices and values. Kim and Ritter (1999) use the comparable firm method, together with accounting information to value IPOs. They report that valuation accuracy can be improved by using forecasted data and data from comparable companies (identified in their study by a research boutique specializing in IPO pricing). In a recent paper, Purnanandam and Swaminathan (2004) use comparable firm multiples and report that from 1980 to 1997, IPOs are not undervalued, but are significantly overvalued by about 50% compared to their industry peers. The second method is a regression approach similar to Beatty, Riffe, and Thompson (2000), who report that firm-specific accounting information can explain variations in IPO offering values. Bartov, Mohanram, and Seethamraju (2002) and Johnston and Madura (2002) use a similar method.

### 3.1. Comparable-firm multiples

#### 3.1.1. Method

For each IPO, we compute:

$$\left(\frac{P}{V}\right) = \frac{\left(\frac{P}{S}\right)_{IPO}}{\left(\frac{P}{S}\right)_{match}}, \quad (1)$$

where  $S$  is sales, forecasted current earnings, or forecasted next year's earnings; and  $P$  denotes the offer value for the IPO firm and its match.  $\left(\frac{P}{V}\right)$  is the ratio of the offering value multiple for the IPO firm to the same multiple for the matching firm. The comparable firm approach assumes that  $\left(\frac{P}{S}\right)_{match}$  is an estimate of the IPO firm's (unobserved) intrinsic value multiples.

We also compute ratios of two additional multiples: (1)  $P$  divided by the ratio of sales to net costs; net costs equals (sales – earnings); and (2)  $P$  divided by the ratio of sales to gross costs. Both (1) and (2) are computed for the IPO firm and its match as in Equation (1). These two multiples allow us to include IPOs with negative earnings or negative EBITDA.

We calculate a price-to-sales ( $P/S$ ) multiple because we have the data for most IPOs. Price-to-forecasted current earnings and price-to-forecasted next year earnings

multiples can better capture expected growth (Kim and Ritter, 1999), but are available for only 1,608 and 1,510 IPOs, respectively. Also, Purnanandam and Swaminathan (2004) report that analyst earnings forecasts are available only several months after the IPO and, are therefore affected by information that is not available to investors at the IPO date.<sup>3</sup> We do not use price to book value multiples because book values tend to be low before the IPO and Liu, Nissim, and Thomas (1999) report that earnings and cash flow multiples provide better accuracy.

The offering value multiples are:

$$\left(\frac{P}{S}\right)_{IPO} = \frac{OP * NSOB}{sales_{prior}} \quad (2)$$

$$\left(\frac{P}{sales/net\ costs}\right)_{IPO} = \frac{OP * NSOB}{(sales/net\ costs)_{prior}} \quad (3)$$

$$\left(\frac{P}{sales/gross\ costs}\right)_{IPO} = \frac{OP * NSOB}{(sales/gross\ costs)_{prior}} \quad (4)$$

$$\left(\frac{P}{current\ year\ earnings_{forecasted}}\right)_{IPO} = \frac{OP * NSOB}{current\ year\ earnings_{forecasted}} \quad (5)$$

$$\left(\frac{P}{next\ year\ earnings_{forecasted}}\right)_{IPO} = \frac{OP * NSOB}{next\ year\ earnings_{forecasted}}, \quad (6)$$

where  $OP$  is the offering price and  $NSOB$  is the shares outstanding at the close on the offer date, as reported by CRSP.<sup>4</sup>  $Sales_{prior}$  is sales the year before the IPO, net costs are sales minus earnings and  $OP * NSOB$  is the IPO offering value. All prior accounting data are fiscal year data before the issue and forecasted data are obtained from the I/B/E/S database.

### 3.1.2. Results

Table 2 shows the 25th, 50th, and the 75th percentiles of the P/V ratios and the Wilcoxon rank sum test of the null hypothesis that the median P/V is equal to 1. The median P/V values based on sales, sales/net costs, sales/gross costs, current year forecasted earnings and next year forecasted earnings are significantly greater than 1.

Given the concerns with using forecast earnings data, for the remainder of the paper we focus on the version of P/V that uses the P/S definition of Equation (4). Using this definition, the median P/V value of 1.36 suggests significant overvaluation. However, there is a significant variation in the P/V ratios; for example, the first and third quartiles are 0.95 and 3.23, respectively.

<sup>3</sup> This problem is more severe due to the fact that analysts have incentives to issue excessively optimistic recommendations for IPOs (Michaely and Womack, 1999).

<sup>4</sup> We compute the post-money valuation for firms with dual-class shares using number of shares outstanding at the end of the offer date from SDC. For instance, UPS went public in November 9, 1999, and CRSP reports it as having 109 million shares outstanding, whereas SDC reports 1,210 million shares outstanding at the end of the offer date.

Table 2

**Intrinsic value by the comparable firm method**

Cross-sectional distributions of IPO offer value multiples to matching firm value multiples. The sample contains 3,087 IPOs from 1993 to 2000. The IPO intrinsic value multiple, P/V is the ratio of the offer value-to-sales, offer value-to-sales divided by net costs, offer value-to-sales divided by gross costs of IPO firms divided by the corresponding market value-to-sales, market value-to-sales divided by net costs, and market value-to-sales divided by gross costs of the comparable firm. Net costs are sales minus earnings and gross costs are sales minus EBITDA. We use sales divided by costs in order to include observations with negative earnings or negative EBITDA. Each matching firm went public more than three years before the IPO, is in the same Fama-French industry group and has similar sales and sales divided by gross costs in the year before the IPO. Accounting data are for the fiscal year before the IPO. Wilcoxon *p*-value corresponds to the rank sum test for the median equal to 1.0.

Year	P/V ratio by P/sales multiple				P/V ratio by P/sales divided by net costs multiple				P/V ratio by P/Sales divided by gross costs multiple						
	Number of IPOs	Median	75%	Wilcoxon <i>p</i> -value	Number of IPOs	Median	75%	Wilcoxon <i>p</i> -value	Number of IPOs	Median	75%	Wilcoxon <i>p</i> -value			
		P/V	P/V	P/V		P/V	P/V	P/V		P/V					
1993	339	1.006	2.785	0.0001	339	1.006	2.785	0.0001	339	0.877	1.156	2.891	0.0001		
1994	271	0.949	1.429	2.686	0.0005	271	0.949	1.429	2.686	0.0005	271	1.029	1.321	2.694	0.0005
1995	277	0.785	1.647	3.077	0.0008	277	0.785	1.647	3.077	0.0008	277	0.915	1.847	3.131	0.0008
1996	553	0.861	1.178	3.008	0.0003	553	0.861	1.178	3.008	0.0003	553	0.954	1.349	3.484	0.0003
1997	461	0.975	1.241	3.599	0.0001	461	0.975	1.241	3.599	0.0001	461	0.911	1.361	3.229	0.0001
1998	332	0.879	2.123	3.845	0.0007	332	0.879	2.123	3.845	0.0007	332	0.980	1.832	4.208	0.0007
1999	456	0.862	2.035	4.131	0.0002	456	0.862	2.035	4.131	0.0002	456	1.029	1.966	3.666	0.0002
2000	398	0.867	2.121	3.015	0.0004	398	0.867	2.121	3.015	0.0004	398	0.908	2.077	2.771	0.0003
All samples	3,087	0.867	1.428	3.016	0.0002	3,087	0.867	1.428	3.016	0.0002	3,087	0.953	1.362	3.230	0.0002

  

Year	P/V ratio by P/current year earnings forecast multiple				P/E next year earnings forecast multiple					
	Number of IPOs	Median	75%	Wilcoxon <i>p</i> -value	Number of IPOs	Median	75%	Wilcoxon <i>p</i> -value		
		P/V	P/V	P/V		P/V	P/V	P/V		
1993	193	0.637	1.303	2.230	0.0001	176	0.635	1.470	2.473	0.0004
1994	150	0.812	1.624	2.093	0.0002	128	0.508	1.448	2.313	0.0004
1995	145	0.947	1.214	2.835	0.0004	123	0.685	1.565	2.811	0.0001
1996	301	0.582	1.292	3.103	0.0001	292	0.734	1.303	3.665	0.0002
1997	222	0.717	1.628	3.006	0.0001	236	1.033	1.414	4.239	0.0003
1998	154	1.060	1.966	4.833	0.0003	166	1.283	1.780	4.171	0.0001
1999	250	0.820	1.878	4.420	0.0002	214	0.864	2.013	3.848	0.0002
2000	193	0.752	1.408	3.012	0.0004	175	0.880	1.911	2.757	0.0001
All samples	1,608	0.751	1.625	3.013	0.0002	1,510	0.863	1.471	3.666	0.0003

### 3.2. Regression method to estimate intrinsic value

#### 3.2.1. Independent variables

We estimate the regression:

$$\begin{aligned}
 \text{Total Offer Value/Total Assets}_n &= a + b_1 \text{Revenue/Total Assets}_n \\
 &+ b_2 \text{Positive Earnings/Total Assets}_n + b_3 \text{Negative Earnings/Total Assets}_n \\
 &+ b_4 \text{Positive Book Value/Total Assets}_n + b_5 \text{Negative Book Value/Total Assets}_n \\
 &+ b_6 \text{Positive Operating Cash Flow/Total Assets}_n + b_7 \text{Negative Operating} \\
 &\quad \text{Cash Flow/Total Assets}_n + b_8 \text{Growth of Profit Margin}_n + b_9 \text{Growth of Sales}_n \\
 &+ b_{10} \text{Percentage of Shares Offered}_n + b_{11} \text{Market Rate of Return}_n \\
 &+ b_{12} \text{Age Less than Five}_n + b_{13} \text{Percentage of Filing Price Range}_n + \varepsilon_n,
 \end{aligned} \tag{7}$$

where  $n$  denotes the IPO firm. The percentage of shares offered is defined as number of shares offered in the IPO divided by number of shares outstanding at the close on the offer date; percentage of filing price range equals (high filing price – low filing price)/low filing price, in percent<sup>5</sup>; age less than five is a dummy variable equal to one if the issuing firm's age is less than five years; and market rate of return is the average NYSE-Amex-Nasdaq return index over the two weeks before the offer. The dependent variable and all the accounting-based independent variables are normalized by dividing by total assets. All accounting data are for the fiscal year before the IPO.

#### 3.2.2. Results

The offering price is set in light of both available financial information and what the underwriter learns about investor demand during the marketing phase (road show). The dependent variable equals total offer value/total assets.

According to the signaling literature, the percentage of outstanding shares offered in the IPO (the number of shares offered divided by total number of shares outstanding at the close on the offer date) should send a signal about company value. Leland and Pyle (1977) suggest that greater percentage ownership by insiders is a positive signal about the company, since insiders are assumed to have superior information about expected future cash flows. Hence, IPO offer value should be negatively related to percentage of shares offered to the extent that an increase in shares offered in the IPO reduces percentage ownership of insiders (while increasing percentage ownership of non-insiders). We add the cumulative market rate of return before the

<sup>5</sup> We use the original file price range rather than the final file price range. Using final price range results in an endogeneity problem in the Table 3 regression. Because almost all file price ranges are \$2 (both original and final), this variable is essentially a constant divided by the low file price range. If the price is revised upward, the denominator becomes larger and the ratio lower; at the same time, the dependent variable has a higher value. Therefore, upward revisions cause the coefficient to be biased downwards.

IPO as one of the control variables. Based on Loughran and Ritter (2004), changes in the overall market should cause revisions in the offering prices of IPOs. We calculate the market rate of return as the value-weighted NYSE-Amex-Nasdaq index rate of return for 15 days before the IPO.

Based on existing studies, we expect the Age Less than Five dummy variable to be negatively related to offering value since younger firms at time of IPO are more risky (and are more difficult to value). The filing price range is the original filing range before the IPO and reflects the valuation uncertainty for IPO shares estimated by the investment banker(s). The regression results are in Table 3 and indicate that IPOs with strong financial health, i.e., high sales, high positive earnings, high positive book value, high positive cash flow, high growth in profit margin, and high growth in sales exhibit high offer values. The other significant variables are the market rate of return and percentage filing price range whose positive coefficients indicate that overall market changes and the uncertainty of IPO price measured by filing price range are positively associated with offering values. IPOs with low percentage of shares offered have high offer values.

Using the estimated regression equation to obtain the estimate of IPO intrinsic value, ETOP, we find that the median value of TOP/ETOP where TOP is total offer value divided by total assets is 1.312, and the first and third quartile values are, respectively, 0.489 and 2.770 for the IPO sample (see Table 4); and these values are, respectively, comparable to the median, first quartile, and third quartile P/V multiples (sales to gross costs) in Table 2. Therefore, as in the comparable firm approach, we conclude that the median offer values are significantly greater than estimated intrinsic values.

## **4. Block selling**

### *4.1. Measurement of block selling*

Using the TAQ database to examine intraday trading activity, we find that most trades happen during the first hour that the market is open and then decrease very quickly. We also measure trading volume as a percentage of the number of shares offered, and find a wide range of first-day adjusted trading volume in the sample with a minimum of 3.5%, a median of 47%, and a maximum of 256% of shares offered.<sup>6</sup> Trading volume as a percentage of shares offered from the first until the fifth day after the offering is heaviest on the first day and declines rapidly from the second through the fifth day after the offering. The mean number of trades executed during the first day after the offering is 836, decreasing to 68 trades on the fifth day after the offering. The results are consistent with KSW (1999).

To measure block selling, we divide the sell-signed trading volume on the first two days of trading after the offering by the number of shares offered in the IPO where

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<sup>6</sup> Following Atkins and Dyl (1997), we divide volume on Nasdaq by two to keep NYSE/Amex and Nasdaq results comparable.

Table 3

**IPO pricing regression**

This table shows the regression equation for total offer value divided by total assets. The sample contains 3,087 IPOs from 1993 to 2000. Total offer value is offer price (OP) times the number of shares outstanding at the close on the offer date. Percentage filing price range is high filing price minus low filing price divided by filing price times 100. Accounting data are for the fiscal year before the IPO. Age less than five is a dummy variable for age and it is one if the issuing firm's age is less than five. Market rate of return is the average NYSE-Amex-Nasdaq index return over the two weeks before the offer. Percentage of shares offered is number of shares offered divided by number of total shares outstanding at the close on the offer date. Standard errors are adjusted for time clustering by assuming that observations are independent for companies at different points in time, but not necessarily for companies going public in the same month.

Dependent variable: Total offer value divided by total assets		
Variables	Coefficient	<i>t</i> -statistics
Constant	0.96	0.05
Revenue/total assets	1.11	31.88***
Positive earnings/total assets	1.86	2.13**
Negative earnings/total assets	-1.50	-1.27
Positive book value/total assets	0.79	1.86*
Negative book value/total assets	-1.71	-1.10
Positive operating cash flows/total assets	1.77	2.38**
Negative operating cash flows/total assets	0.89	0.02
Growth of profit margin	1.76	2.74**
Growth of sales	1.65	2.01**
Percentage of shares offered	-0.90	-1.72
Market rate of return	0.14	1.28
Age less than five	2.35	0.05
Percentage of filing price range	1.22	2.67**
Adjusted $R^2$	36.79%	
Number of observations	3,087	

\*\*\*, \*\*, \* indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

the sell volume is executed in blocks of 3,500 shares or more. To determine if a trade has a sell sign, we use the Lee and Ready (1991) rule. If trades have execution prices greater than the midpoint of the prevailing bid-ask quote at least five seconds before the trade, they are classified as buyer initiated. If trades occur below the midpoint, they are classified as seller initiated. For trades that occur at the midpoint, they are classified based on the prior trade.<sup>7</sup>

KSW (1999) and Houge, Loughran, Suchanek, and Yan (2001) measure block sales using 10,000 shares as the cutoff size and assume that most of these sellers are institutions. Aggarwal (2003) reports a median flipping size for institutions of

<sup>7</sup> As suggested by Lee and Ready (1991), the prevailing quote for each trade is the most recent bid and ask that is at least five seconds old. Ellis, Michaely, and O'Hara (2000) and Odders-White (2000) test the accuracy of various trade classification rules, and conclude that the quote rule correctly classifies 76.4% and 75.0% of Nasdaq and NYSE transactions, respectively.

Table 4

**Trading activity and ex ante IPO valuation from January 1993 to December 2000**

The sample contains 3,087 IPOs from 1993 to 2000. P/V is the ratio of the offer value-to-sales divided by gross costs of IPO firms divided by the corresponding market value-to-sales divided by gross costs of the comparable firm. Gross costs are sales minus EBITDA. We use sales divided by costs in order to include observations with negative earnings or negative EBITDA. Each matching firm went public more than three years before the IPO, is in the same Fama-French industry group and has similar sales and sales divided by gross costs in the year before the IPO. Accounting data are for the fiscal year before the IPO. TOP is total offer value divided by total assets and ETOP is the estimated offer value divided by total assets that is computed from the coefficients of the regression equation in Table 3. First-day return is the percentage change of closing price from the offer price. Adjusted numbers of shares transacted in day 1 is Nasdaq trading volume divided by two to take interdealer transactions into account. Market capitalization is first-day closing price multiplied by number of total shares outstanding at the close on the offer date. Proceeds are offer price multiplied by number of shares offered. Block selling is sell-signed trading volume executed in blocks of over 3,500 shares during the first two days of trading. Block selling/trading volume is based on the first two trading days.

	High P/V		Medium P/V		Low P/V	
	Mean	Median	Mean	Median	Mean	Median
P/V	2.726	2.816	1.462	1.369	0.648	0.337
TOP/ETOP	2.621	2.770	1.554	1.312	0.546	0.489
First day return (%)	50.180	30.190	28.670	16.680	17.310	6.120
Number of shares transacted in day 1	4,600,835	3,839,221	3,082,708	2,289,459	2,432,694	1,932,088
Adjusted number of shares transacted in day 1	2,691,489	2,245,944	1,849,625	1,373,676	1,520,434	1,207,555
Number of trades in day 1	1,801	1,314	499	596	432	439
Number of shares per trade	2,836	2,373	3,399	2,724	4,006	3,406
Market capitalization (millions) \$	871.33	651.23	789.62	496.87	525.16	357.82
Proceeds (millions) \$	93.69	39.12	37.08	21.44	22.32	8.41
Block selling/trading volume (%)	17.47	13.16	25.45	18.10	28.81	20.55
Block selling/total shares offered (%)	25.20	19.27	22.20	17.73	18.86	15.58

3,809 shares. She suggests that block sales of institutions may be small due to small allocations by underwriters, especially in hot IPOs. Institutions could also be splitting larger orders to reduce price impact (Boehmer and Fische, 2004). To ensure that we capture most block sales, we use 3,500 shares as a cutoff point.

Aggarwal (2003) reports that a large proportion of the trading volume in IPOs during the first few days is due to trading by retail investors. Ellis (2006) reports that, for cold IPOs, one third of block sell-motivated trades are interdealer trades. In contrast to Aggarwal (2003) and Boehmer, Boehmer, and Fische (2006), our block-sales figures include interdealer trades.

#### 4.2. *Block selling, first day return, and valuation*

Table 4 reports trading activity on the first day following the IPO for three portfolios by P/V ratio. The portfolios are formed monthly based on the terciles of P/V ratios of IPOs from the previous 12 months. We cannot assign 1993 IPOs to such portfolios because we lack 1992 data.<sup>8</sup> Table 4 shows that the number of shares transacted on the first day and the number of trades are highest for high P/V IPOs (4.6 million shares and 1,801 trades) and lowest for low P/V IPOs (2.4 million shares and 432 trades).<sup>9</sup>

When we measure block sales as a percentage of trading volume (as in KSW, 1999), we obtain results similar to KSW (1999). We also find that block sales account for a larger proportion of trading volume in cold IPOs than in hot IPOs (based on the KSW (1999) definition of cold and hot IPOs).<sup>10</sup> Table 4 indicates that this is because low P/V, low TOP/ETOP IPOs exhibit the lowest first day returns, and the lowest trading volume compared to high P/V, high TOP/ETOP IPOs. When shares are sold in blocks, they may go through several trades. The resulting high volume is a consequence of repeated sales. The high trading volume could also be the result of short selling, which is observed to be very active in the first few days of post-IPO trading (Geczy, Musto, and Reed, 2002). Therefore, “true” block sales can be measured only by relating block sales to initial allocations; this, however, requires access to detailed information (not generally available) about institutional allocations and block selling. Appendix A shows that dividing block sales by shares offered in the IPO (also denoted as block sales ratio) is more appropriate than dividing it by total trading volume, which is the definition of block sales that will be used in this study.

Table 4 also shows that high P/V IPOs exhibit higher mean and median values for TOP/ETOP, higher mean and median first day returns, and higher mean and median block sales compared to total shares offered than those for low P/V IPOs. Thus, IPOs that are overvalued (high P/V IPOs) at the offer date increase in price even more (exhibit higher first day returns) than IPOs that are undervalued (low P/V IPOs) at the offer date.

#### 4.3. *IPO pricing and block selling*

In Table 5, we separate all IPOs by their issue years. IPOs issued in the same year are sorted into three TOP/ETOP (Panel A) and P/V (Panel B) portfolio groups; low,

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<sup>8</sup> Purnanandam and Swaminathan (2004) also use this method to ensure that there is no peek-ahead bias and calendar time clustering across the three portfolios.

<sup>9</sup> The mean two-day sales volume is 144% of shares offered for high P/V IPOs and 65.5% for the low P/V IPOs. The large sales volume during the first day does not include insider selling due to lockup provisions (Field and Hanka, 2001; Brav and Gompers, 2003).

<sup>10</sup> The mean block sales (based on sales volume) for cold IPOs is 25.56% versus 19.61% (for hot IPOs), for low TOP/ETOP IPOs it is 24.47% versus 15.33% (for high TOP/ETOP IPOs), and it is 28.81% for low P/V IPOs versus 17.47% (for high P/V IPOs).

Table 5

**Block selling by degree of valuation discrepancy**

The sample contains 3,087 IPOs from 1993 to 2000. A block sale is defined as the sell-signed trading volume of over 3,500 shares during the first two trading days divided by total shares offered. P/V is the ratio of the offer value-to-sales divided by gross costs divided by the corresponding market value-to-sales divided by gross costs of the matching firm, where gross costs are sales minus EBITDA. Each matching firm went public more than three years before the IPO, is in the same Fama-French industry group and has similar sales and sales divided by gross costs in the year before the IPO. EBITDA is the sum of earnings before interest and taxes (EBIT) and depreciation and amortization (DA) and represents operating cash flows. TOP is total offer value divided by total assets and ETOP is the estimated offer value divided by total assets that is computed from the coefficients of the estimate regression equation in Table 3. Standard errors are adjusted for time clustering by assuming that observations are independent for companies at different points in time, but not necessarily for companies go public in the same month.

*Panel A: Mean block selling by TOP/ETOP quartile and calendar year*

	1993	1994	1995	1996	1997	1998	1999	2000	Full sample (1993–2000)
TOP/ETOP Portfolio	16.20%	23.02%	32.87%	26.29%	31.54%	28.12%	22.72%	27.47%	26.09%
High TOP/ETOP	16.69%	25.95%	17.41%	14.25%	22.53%	21.96%	26.07%	35.90%	22.43%
Medium TOP/ETOP	8.78%	16.68%	19.71%	14.77%	11.55%	24.62%	20.84%	26.71%	17.74%
Low TOP/ETOP	7.42%	6.34%	13.16%	11.52%	19.99%	3.50%	1.88%	0.76%	8.35%
t-statistics	2.75***	3.62**	4.36***	3.91***	4.58***	2.64**	2.25**	2.53**	3.33***

*Panel B: Mean block selling by P/V quartile and calendar year*

	1993	1994	1995	1996	1997	1998	1999	2000	Full sample (1993–2000)
P/V Portfolio	32.55%	26.31%	28.17%	22.86%	30.97%	30.78%	32.10%	21.36%	26.60%
High P/V	27.98%	22.74%	23.48%	15.63%	15.92%	30.53%	25.92%	21.02%	23.51%
Medium P/V	24.44%	15.57%	19.86%	12.21%	15.32%	15.46%	22.87%	14.09%	17.17%
Low P/V	8.11%	10.74%	9.62%	10.66%	15.65%	5.32%	3.05%	7.27%	8.90%
t-statistics	2.42**	2.27**	2.76***	3.31***	3.6***	2.04**	1.85*	2.16**	2.35**

\*\*\*, \*\*, \* indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

medium, and high valuation discrepancy groups, and block selling for each group is reported for each issue year. The results indicate that block sales increase with an increase in the offering value relative to estimated intrinsic value (using either the regression or comparable firm method; i.e., TOP/ETOP or P/V, respectively). To test the robustness of this finding, we compute *t*-statistics for the difference of mean block sales between the high and low groups. The computed *t*-statistics are significant at the 1% level for almost every year and across the full sample for both TOP/ETOP and P/V multiples.

This finding suggests that overvalued IPOs experience more block selling than undervalued IPOs. However, the difference declines from 1993–1997 to 1998–2000. In Table 2, median P/V ratios for the full sample show a rising trend from 1993 to 2000. The time series of P/V ratios suggests a tendency toward higher overvaluation, with median values much greater than one toward the end of the period. Thus block sales are increasing for both high and low P/V portfolios from 1993 through 2000 and the difference between block trading activities for the two portfolios is declining.

To see if the relation between block trading and valuation discrepancy is robust, we examine the effect of valuation discrepancy after controlling for other determinants of block trading. We therefore estimate the regression:

$$\begin{aligned} \text{Block Sales Ratio}_n + a + b_1 D_{1n} + b_2 D_{2n} + b_3 \text{Misvaluation}_n \\ + b_4 D_{1n}^* \text{Misvaluation}_n + b_5 D_{2n}^* \text{Misvaluation}_n + b_6 \text{Ln(Proceeds)}_n \\ + b_7 \text{Underwriter Rank}_n + b_8 (\text{Opening} - \text{Trade Return})_n + \varepsilon_n, \end{aligned} \quad (8)$$

where *n* denotes the IPO firm and valuation discrepancy is measured by either P/V or TOP/ETOP. We include two dummy variables to capture all three levels of valuation discrepancy (high, medium, and low). *D*<sub>2</sub> is a dummy variable equal to one if an IPO is in the high TOP/ETOP (high P/V) portfolio group. *D*<sub>1</sub> is a dummy variable equal to one if an IPO is in the medium TOP/ETOP (medium P/V) portfolio group.

KSW (1999) report that the opening trade return can affect block selling. In our sample, the opening trade return ranges from –6.1% to 136.8% with an average of 18.3%. We also include the log of total IPO proceeds and underwriter ranking as explanatory variables. Both explanatory variables are presumed to reflect IPO quality so that IPO quality and block sales are inversely related. IPO proceeds equal IPO offer price multiplied by number of shares offered. If larger IPOs are more easily valued than smaller IPOs, thereby having less valuation discrepancy than smaller IPOs, they are likely to exhibit lower block sales than smaller IPOs. We use Loughran and Ritter's (2004) version of the Carter, Dark, and Singh (1998) ranks. IPOs with higher underwriter ranks could be more likely to exhibit IPO offer values that are close to their intrinsic values and therefore should exhibit less block selling.

The results in Table 6 indicate that block selling is related to valuation discrepancy measured by both P/V and TOP/ETOP. Overvalued IPOs exhibit higher block sales than undervalued IPOs as predicted (positive and significant coefficients for *D*<sub>1</sub> and *D*<sub>2</sub>); and block trading is positively related to the magnitude of overvaluation

Table 6

**Predicting block selling in IPOs**

The sample contains 3,087 IPOs from 1993 to 2000. A block sale is defined as the sell-signed trading volume of over 3,500 shares during the first two trading days divided by total shares offered. P/V is the ratio of the offer value-to-sales divided by gross costs divided by the corresponding market value-to-sales divided by gross costs of the matching firm, where gross costs are sales minus EBITDA. Each matching firm went public more than three years before the IPO, is in the same Fama-French industry group and has similar sales and sales divided by gross costs in the year before the IPO. Accounting data are for the fiscal year before the IPO. TOP is total offer value divided by total assets and ETOP is the estimated offer value divided by total assets that is computed from the coefficients of the regression in Table 3.  $D_2$  is a dummy variable and equal to one if the IPO is in the group of the highest TOP/ETOP (P/V).  $D_1$  is a dummy variable and equal to one if the IPO is in the group of medium level TOP/ETOP or P/V. Opening trade return is the percentage of change from offer price to opening trade price. Ln(proceeds) is natural log of offer price multiplied by the number of shares offered. Underwriter ranking is based on the rankings assigned to the underwriters by Carter, Dark, and Singh (1998) as modified by Loughran and Ritter (2004). Standard errors are adjusted for time clustering by assuming that observations are independent for companies at different points in time, but not necessarily for companies going public in the same month.

Variable	Coefficient	<i>t</i> -statistics	Variable	Coefficient	<i>t</i> -statistics
Constant	0.139	0.61	Constant	0.086	1.28
$D_1$	0.157	2.46**	$D_1$	0.178	2.35**
$D_2$	0.193	2.74**	$D_2$	0.206	2.58**
TOP/ETOP	0.471	3.52***	P/V	0.537	3.65***
$D_1*(TOP/ETOP)$	0.154	2.55**	$D_1*(P/V)$	0.184	2.50**
$D_2*(TOP/ETOP)$	0.220	2.59**	$D_2*(P/V)$	0.279	3.49***
Opening trade return	0.123	2.64**	Opening trade return	0.154	2.54**
Ln(proceeds)	-0.178	-2.12**	Ln(proceeds)	-0.149	-1.85*
Underwriter ranking	-0.123	-1.02	Underwriter ranking	-0.193	-1.16
Adjusted $R^2$	48.17%		Adjusted $R^2$	44.32%	

\*\*\*, \*\*, \* indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

(positive and significant coefficients for interaction terms). The results hold after controlling for the effects of IPO quality and opening trade return. Time clustering adjusted *t*-statistics for valuation discrepancy, size, and opening trade return are all highly significant, but those of underwriter rank are insignificant. While we do not know how block traders utilize pre-IPO information to form their estimates of IPO intrinsic values, our valuation discrepancy proxies P/V and TOP/ETOP are reasonable proxies to capture block traders’ estimates of IPO misvaluation.

**5. Block sales and long-term IPO performance**

Table 4 shows that overvalued IPOs at the offer date (high P/V group) exhibit more block selling than undervalued IPOs (low P/V group). The former group also exhibits a much greater first-day return suggesting that overvalued IPOs become more overvalued. How then does the long-term performance of IPOs with high block sales

compare with that of IPOs with low block sales? We therefore examine the returns from IPOs with high and low block sales following the offer date. We estimate long-term returns using a buy-and-hold abnormal returns (BHARs) method, the cross-sectional regression method, and a Fama-French three-factor regression.

### 5.1. BHAR

Long-run BHARs are calculated as in Purnanandam and Swaminathan (2004), Ritter (1991), and Loughran and Ritter (1995) without rebalancing using daily returns from the beginning of the holding period until the end of the holding period or the delisting date, whichever is earlier.<sup>11</sup> Purnanandam and Swaminathan (2004) caution that there is high misspecification in small samples of an event study (especially BHAR over three to five years). To address this concern, we follow their approach by undertaking *t*-tests of differences in means and medians based on a randomization procedure or sampling without replacement in Table 7. We take the IPOs in each year and shuffle their block sales ratios. The block sales ratios are then assigned to each IPO randomly and, for each year, we use this pseudo sample to form three IPO portfolios based on block sales ratios. For each yearly portfolio, we calculate abnormal returns and parametric and nonparametric *t*-statistics for differences in means and medians between portfolios of IPOs with low and high block sales. We perform this procedure for 4,000 iterations to create a small-sample distribution for the *t*-statistic with the null hypothesis of equality for both means and medians between portfolios of IPOs with low and high block sales at the 90th, 95th, and 99th percentiles for upper tail tests using bootstrap Monte Carlo simulations from sampling without replacement. The advantage of this procedure is that it limits times-series autocorrelation, cross-correlation or clustering, and skewness of the original sample. These pseudo empirical distributions are used in our statistical inferences that involve the use of BHAR.

### 5.2. Returns of IPOs with low, medium, and high block sales

KSW (1999) report that IPOs with high block sales outperform IPOs with low block sales where the performance is measured only up to one year after the offering. Hogue, Loughran, Suchanek, and Yan (2001) measure performance up to three years after the IPO, but do not distinguish between different event windows within the

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<sup>11</sup> If a firm is delisted during the period, the mean return reflects fewer observations in subsequent periods. Nevertheless, the returns at the time of delisting are not significant outliers and do not bias our results. We also adjust for survivorship bias as follows. Assume that we want to calculate two-year buy-and-hold returns and  $r_{11}$  is the return of IPO firm one for the first year. Also, assume that IPO firm one is delisted one year after the offering. We invest its first-year return into a treasury bill. Hence, the two-year return of IPO firm one is  $(1 + r_{11})(1 + r_f)$  where  $r_f$  is the return on treasury bills and our results are unchanged. KSW (1999) and Purnanandam and Swaminathan (2004) also use the delisting date as the cutoff when they compute BHAR.

Table 7

**Buy-and-hold returns of low, medium, and high block sales portfolios of IPOs**

The sample contains 3,087 IPOs from 1993 to 2000. Block selling is defined as the sell-signed trading volume of over 3,500 shares during the first two trading days divided by shares offered. We compute buy-and-hold abnormal returns (BHARs) for the first 20 trading days in Panel A, those from 20 trading days after the offering to the lockup expiration date in Panel B and those from the day after the lockup expiration date to three years after the offering in Panel C for low, medium, and high block selling portfolios of IPOs. The BHAR is computed according to (I) the value-weighted NYSE, Amex, and Nasdaq index, (II) matching firms based on sales and sales divided by gross costs where gross cost is sales minus EBITDA. Each matching firm went public more than three years before the IPO, is in the same Fama-French industry group and has similar sales and sales divided by gross costs in the year before the IPO. Accounting data are for the fiscal year before the IPO. *t*-statistics are computed for differences of means under the assumption of independence of observations. Standard errors are adjusted for time clustering by assuming that observations are independent for companies at different points in time, but not necessarily for companies going public in the same month. Wilcoxon-Mann-Whitney *t*-statistics are computed for testing difference in medians under the assumption of independence of observations. *p*-value from simulation is the percentile for an upper tail test computed from a Monte Carlo simulation.

Block selling portfolio	Median						Mean					
	NYSE/Amex/Nasdaq VW index			Sales and sales divided by gross costs matched			NYSE/Amex/Nasdaq VW index			Sales and sales divided by gross costs matched		
	Issuers	Index	BHAR	Issuers	Matches	BHAR	Issuers	Index	BHAR	Issuers	Matches	BHAR
Low block selling	-0.26%	0.49%	-0.75%	-0.26%	0.09%	-0.35%	0.83%	0.86%	-0.03%	0.83%	1.10%	-0.27%
Medium block selling	-0.06%	0.94%	-1.00%	-0.06%	0.11%	-0.17%	1.09%	1.36%	-0.27%	1.09%	1.38%	-0.29%
High block selling	0.37%	1.11%	-0.74%	0.37%	0.24%	0.13%	1.40%	1.50%	-0.10%	1.40%	1.47%	-0.07%
Low-high block selling	-0.63%	-0.62%	-0.01%	-0.63%	-0.15%	-0.48%	-0.57%	-0.64%	0.07%	-0.57%	-0.37%	-0.20%
<i>t</i> -statistic			-0.12			-1.54			-0.26			-1.43
<i>p</i> -value from simulation	90%	95%	99%	90%	95%	99%	90%	95%	99%	90%	95%	99%
All IPOs	1.15	2.14	2.52	1.34	2.14	2.19	1.15	1.72	1.87	1.24	1.73	2.61
	0.02%	0.85%	-0.83%	0.02%	0.15%	-0.13%	1.11%	1.24%	-0.13%	1.11%	1.32%	-0.21%
<i>Panel B: Return and BHAR from 20 trading days after the offering to the lockup expiration</i>												
Low block selling	-1.29%	2.77%	-4.06%	-1.29%	0.43%	-1.72%	3.96%	3.08%	0.88%	3.96%	4.86%	-0.90%
Medium block selling	-0.34%	5.00%	-5.34%	-0.34%	1.15%	-1.49%	5.44%	4.93%	0.51%	5.44%	5.11%	0.33%
High block selling	1.75%	5.23%	-3.48%	1.75%	0.68%	1.07%	6.07%	4.59%	1.48%	6.07%	6.41%	-0.34%
Low-high block selling	-3.04%	-2.46%	-0.58%	-3.04%	-0.25%	-2.79%	-2.11%	-1.51%	-0.60%	-2.11%	-1.55%	-0.56%
<i>t</i> -statistic			-0.51			-2.57**			-1.77*			-2.17**
<i>p</i> -value from simulation	90%	95%	99%	90%	95%	99%	90%	95%	99%	90%	95%	99%
All IPOs	1.34	1.91	2.42	0.92	1.62	3.08	1.00	1.80	2.29	1.18	2.21	2.00
	0.04%	4.33%	-4.29%	0.04%	0.75%	-0.71%	5.16%	4.20%	0.96%	5.16%	5.46%	-0.30%

(continued)

Table 7 (continued)  
**Buy-and-hold returns of low, medium, and high block sales portfolios of IPOs**  
*Panel C: Return and BHAR from lockup expiration to three years after the offering*

Block selling portfolio	Median						Mean					
	NYSE/Amex/Nasdaq			Sales and sales divided by gross costs matched			NYSE/Amex/Nasdaq			Sales and sales divided by gross costs matched		
	Issuers	Index	BHAR	Issuers	Matches	BHAR	Issuers	Index	BHAR	Issuers	Matches	BHAR
Low block selling	9.63%	35.72%	-26.09%	9.63%	2.70%	6.93%	33.94%	38.45%	-4.51%	33.94%	28.66%	5.28%
Medium block selling	-1.56%	45.56%	-47.12%	-1.56%	10.23%	-11.79%	30.07%	54.37%	-24.30%	30.07%	28.57%	1.50%
High block selling	-6.94%	47.13%	-54.07%	-6.94%	9.25%	-16.19%	18.76%	37.63%	-18.87%	18.76%	33.35%	-14.59%
Low-high block selling	16.57%	-11.41%	27.98%	16.57%	-6.55%	23.12%	15.18%	0.82%	14.36%	15.18%	-4.69%	19.87%
<i>t</i> -statistic	90%	95%	99%	90%	95%	99%	90%	95%	99%	90%	95%	99%
<i>p</i> -value from simulation	1.14	1.78	2.24	1.02	1.42	2.26	1.06	1.65	2.54	1.07	1.54	2.68
All IPOs	0.38%	42.80%	-42.43%	0.38%	7.39%	-7.02%	27.59%	43.48%	-15.89%	27.59%	30.19%	-2.60%

\*\*\*, \*\* indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

three-year period. In Table 7, we compute medians and means of long-run BHARs based on two benchmarks for each block sales level. These returns are computed for three windows: the first 20 trading days after the offering or stabilization period expiration, the day after expiration of stabilization period until the lockup expiration date, and the day after the lockup expiration date until three years after the offering.

Most IPOs have a 180-day lockup period; however, there are some IPOs with 90-, 270-, and 360-day lockups.<sup>12</sup> Assuming that all IPOs use 180 days may add noise to the results. Hence, a stronger relation with block sales can be found by using the actual lockup date of each firm as well as the stabilization window in our return estimation. The justification for computing the buy-and-hold returns for the first 20 trading days and the period after the first 20 trading days until lockup expiration relies on the evidence provided by the IPO stabilization literature. Keasler (2001) finds that negative abnormal returns prior to the lockup release are caused by unrestricted investors' liquidation prior to the scheduled lockup release. Hanley, Kumar, and Seguin (1993), Schultz and Zaman (1994), Asquith, Jones, and Kieschnick (1998), and Aggarwal (2000) report underwriter price stabilization within the first 20 trading days after the offering. We calculate BHARs for both before and after 20 trading days to avoid any bias in returns caused by stabilization.

The first benchmark is the value-weighted NYSE-Amex-Nasdaq index; the second benchmark is based on matching firms by industry, sales, and sales divided by gross costs; these are the same matching firms used to obtain IPO intrinsic value estimates using the comparable firms method. We test the null hypothesis that the difference in BHAR between IPOs with low and high block sales is zero. To implement the test, we assume that the observations are independent and compute *t*-statistics for both the mean and the median BHAR. If a control firm is delisted before the IPO delisting date or the end date, we replace it with another control firm with similar characteristics. If this firm is also delisted, we substitute with another firm and so on.

The results show that portfolios of IPOs with high block sales underperform portfolios of IPOs with low block sales after the lockup expiration until three years after the offering and for the two benchmarks used (see Panel C, Table 7).<sup>13</sup> By contrast, portfolios of IPOs with low block sales underperform those of IPOs with high block sales from the expiration of stabilization period through lockup expiration (Panel B).

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<sup>12</sup> Pre-issue shareholders can agree to waive their rights to sell shares during a lockup period. The shareholders that are subject to lockup usually include managers and directors, strategic partners and large investors. Underwriters generally require lockups of at least 180 days from owners of 1% or more of the shares. Stock price performance and insider selling around lockup expiration are reported by Aggarwal, Krigman, and Womack (2002) and Brav and Gompers (2003).

<sup>13</sup> We also compute BHARs using three alternative benchmarks: the S&P 500 index excluding dividends, size-matched control firms, and size- and B/M ratio-matched control firms. The results are not sensitive to the choice of benchmarks.

During the first 20 trading days, although low block sales IPOs underperform those high block sold IPOs; the difference is insignificant (Panel A).<sup>14</sup>

These results confirm that high block sales IPOs outperform low block sales IPOs after the first 20 trading days until lockup expiration. From that period until three years after the offering, this performance differential is reversed in that low block sales IPOs outperform high block sales IPOs. The estimated overvaluation at the offer date for high block sales IPOs continues through lockup expiration (Panel B) but it is reversed after lockup expiration until three years after the offering (Panel C). This reversal pattern of long-term performance relating to block sales remains a puzzle. Low block sales firms might be those that experience undue selling pressure in the immediate after market, thus driving down the price too low (and explaining the subsequent recovery and strong performance) but this is mere speculation.

### 5.3. Cross-sectional regressions

To validate the effect of block trading on long-run post-IPO performance documented in Table 7, we control for factors that could affect risk-adjusted long-run performance. We estimate the following regression:

$$\begin{aligned} \text{Long-Run Risk-Adjusted Returns}_n = & a + \beta_1 \text{Block Trading}_n + \beta_2 \text{Initial Returns}_n \\ & + \beta_3 \text{Ln(Book-to-Market Ratio)}_n + \beta_4 \text{Ln}(1 + \text{Analyst Consensus Growth})_n \\ & + \beta_5 (\text{Accruals/Total Assets})_n + \beta_6 \text{Ln(Proceeds)}_n + \beta_7 \text{Venture Capital Backing}_n \\ & + \beta_8 \text{Ln}(1 + \text{Analyst Consensus Growth})_n + \beta_9 (\text{Sales/Gross Costs})_n + \mu_n, \quad (9) \end{aligned}$$

where  $n$  denotes the IPO firm. Long-run risk-adjusted returns are estimated as the intercept from a Fama and French (1993) three-factor regression involving individual IPO monthly excess returns starting from the IPO month until the lockup expiration, and starting from the lockup expiration and ending three years after the offering. We use this measure instead of the BHAR because it is the monthly average abnormal return that tends to have better statistical and distributional properties.

We estimate the regression using a pooled time-series cross-sectional approach and a Fama-MacBeth approach. In the pooled approach, standard errors are adjusted for time clustering by assuming that observations are independent for companies at

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<sup>14</sup> To check the robustness of the results, we also calculate the means and medians of BHARs differences (for the same three windows as in Table 7) between low- and high-block-traded IPOs for each year from 1993 to 2000. We use Hansen-Hodrick-Newey-West corrected  $t$ -statistics for time-series means with autocorrelation adjustment for two lags to correct for the cross-correlation among returns of IPOs in the same year and to correct for autocorrelation in long-run buy-and-hold returns. The results are significant for both mean and median BHARs from lockup expiration out to three years, across all benchmarks. The number of positive differences between low- and high-block-traded IPOs from lockup expiration to three years is over 50% across all benchmarks. The results confirm that high-block-traded IPOs perform worse than low-block-traded IPOs after lockup until the three-year period following the IPO.

different points in time, but not necessarily for companies going public in the same month. They are more conservative than White (1980) standard errors. In the Fama-MacBeth approach, we use Newey-West lags to correct for any autocorrelation in annual coefficients. In the Fama-MacBeth approach, we estimate a cross-sectional regression using each annual cohort of IPOs from 1994 to 2000 and report the time-series average of slope coefficients.

In Equation (9), we control for initial return and venture capital backing (see Brav and Gompers, 1997; Bhabra and Pettway, 2003). B/M ratios are related to the cross-section of stock returns even though there is no evidence that they are related to the cross-section of IPO returns. However, it is important to control for B/M effects on long-run returns. We include analyst growth forecasts because Rajan and Servaes (1997) find IPOs with high analyst growth expectations subsequently underperform IPOs with low growth expectations. We also include the accruals variable from the first annual statement after the IPO date as a control since Teoh, Welch, and Wong (1998) find underperformance in IPOs with high accruals.<sup>15</sup> We include IPO proceeds as a proxy for size and prior fiscal year sales divided by gross costs as a control for profitability. Although Carter, Dark, and Singh (1998) find that long-term IPO performance is affected by underwriter reputation, we do not control for it. Logue, Rogalski, Seward, and Foster-Johnson (2002) find no evidence of the relation between underwriter reputation and investor returns over different holding periods. Doukas and Gonenc (2005) show that underwriter reputation is not linked to post-issue IPO performance when they control for venture capital backing.

The results in Table 8 show that block sales is significantly positively related to risk-adjusted returns for the period from expiration of stabilization period until lockup expiration, but significantly negatively related for the period after lockup expiration until three years after the offering. The relation is robust in both the pooled regressions and in the Fama-MacBeth regressions. The slope coefficient is 1.35% (1.31%) before the lockup expiration and  $-2.11\%$  ( $-2.41\%$ ) from the lockup expiration until three years after the offering in the pooled (Fama-MacBeth) regression, which can be interpreted as the return premium corresponding to block sales. A return premium of this magnitude is economically significant. The cross-sectional relation between block sales and long-run returns is also quite robust over time. Six out of seven Fama-MacBeth annual regression coefficients corresponding to block sales are positive before the lockup expiration and negative from the lockup expiration to

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<sup>15</sup> The accrual variable is the ratio of accruals to total assets based on the first annual statement after the firm goes public and is considered a measure of earnings quality. This variable is constructed from the statement of cash flows for fiscal years after 1987 (from Compustat) and from the balance sheet data for the earlier period. Using the cash flow statement, we construct the accrual variable as income before extraordinary items (item 123) minus cash flow from operations (item 308 minus item 124). For the earlier period, we construct the accrual variable as change in current assets ( $\Delta 4$ ) minus change in cash ( $\Delta 1$ ) minus change in current liabilities ( $\Delta 5$ ) plus change in debt included in current liabilities ( $\Delta 34$ ) plus change in income tax payable ( $\Delta 71$ ) minus depreciation and amortization (14). The accrual variable is scaled by the average of the beginning and year-end total assets (item 6).

Table 8

**Cross-sectional long-run risk-adjusted returns regressions**

The aggregate sample for regressions is 2,316 IPOs from 1993 to 2000 having a growth forecast within one year after going public. The dependent variables are risk-adjusted returns from the first 20 trading days to lockup expiration and from the day after lockup expiration to three years after the offering. We regress each IPO's monthly excess returns (in excess of one-month T-bill rate) starting from the first 20 trading days until lockup expiration and from the day after the lockup expiration till three years after they go public on Fama-French factors (market, SMB, and HML) for the same period. The risk-adjusted return is the intercept from these regressions. Block selling is defined as the sell-signed trading volume of over 3,500 shares during the first two trading days divided by total shares offered. Book value of equity is for the fiscal year after the IPO date. Venture capital is a dummy variable equal to one if IPO is venture backed. Analyst consensus growth is measured over the next five years or one year whichever is available. Accruals is the ratio of accruals to total assets based on the first annual statement after the IPO goes public and sales divided by gross costs is for the fiscal year ending at least three months before the IPO goes public. Gross costs are sales minus EBITDA. Ln(proceeds) is the natural log of proceeds calculated by offer price times number of shares offered. Accounting variables are fiscal year data prior to the IPO from Compustat and analysts' growth forecasts are from I/B/E/S. The regression is estimated using pooled time series and Fama-MacBeth approach based on each annual cohort of IPOs from 1994 to 2000. For the pooled regressions, standard errors are adjusted for time clustering by assuming that observations are independent for companies at different points in time, but not necessarily for companies going public in the same month. For the Fama-MacBeth approach, the *t*-statistic computed with Newey-West autocorrelation correction with four lags is shown under each coefficient.

Independent variable	Pooled		Fama-MacBeth	
	Returns after the first 20 trading days until lockup expiration	Returns after lockup expiration until three years	Returns after the first 20 trading days until lockup expiration	Returns after lockup expiration until three years
Block selling	1.35 2.56**	-2.11 -3.83***	1.31 3.14***	-2.41 -6.17***
Initial return	0.17 1.44	-0.16 -1.16	0.04 0.10	-0.08 -0.26
Venture capital	0.38 2.59**	0.38 1.66	0.45 3.41***	0.23 1.51
Ln(book-to-market ratio)	0.27 1.28	0.73 1.66	0.07 0.34	0.45 1.73
Ln(1 + analyst consensus growth)	1.77 1.39	-0.85 -1.96*	1.57 1.65	-1.04 -1.87*
Accruals/total assets	-0.20 -0.38	-0.36 -0.52	-0.10 -0.15	-0.34 -0.73
Ln(proceeds)	-0.23 -2.32**	0.14 1.72	-0.58 -1.47	0.24 1.05
Sales divided by gross costs	-0.05 -1.06	-0.02 -0.89	-0.22 -1.71	-0.26 -0.79
Adjusted $R^2$	38.14%	43.76%	46.55%	38.09%
<i>N</i>	2,316	2,316	2,316	2,316

\*\*\*, \*\*, \* indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

three years after the offering indicating the stability of the relation between block sales and long-run risk-adjusted returns over time reported in Table 7.

In contrast to the negative relation between long-run risk-adjusted returns and first-day returns as reported by KSW (1999), we find no evidence of such a relation either for the period before lockup expiration or the period from lockup expiration to three years after the offering. Venture capital backing is significantly positively related to returns. There is no B/M and size effect in our sample. Analyst growth forecasts and accruals both are negatively related to long-run returns but only analyst growth forecasts are statistically significant. These results clearly show that the relation between block sales and long-run abnormal returns persists after controlling for the effects of initial returns, venture capital backing, B/M ratios, analyst growth forecasts, accruals, offering size, and profitability. As a final robustness check, we examine the relation between block sales and long-run returns using a portfolio test.

#### *5.4. Long-term performance based on the Fama-French three-factor model*

The BHAR in Section 5.1 is based on market-adjusted abnormal returns but does not fully control for systematic risks other than the market index. To address this issue, we estimate Fama-French three-factor regressions using monthly returns; the estimated intercept represents the mean monthly risk-adjusted abnormal return.<sup>16</sup> We estimate both value-weighted and equal-weighted abnormal returns. Fama (1998) demonstrates that much of the apparent overreaction and underreaction to information disappears when portfolios are value-weighted. On the other hand, Loughran and Ritter (2000) point out that value-weighted portfolios are likely to be dominated by a few large firms. An equally weighted portfolio is also likely to be more consistent with the way an investor would implement a trading strategy based on the results of this study.

Table 9 presents the results.<sup>17</sup> The key insight is the difference in risk-adjusted abnormal returns between high and low block sales portfolios. Before the lockup expiration, high block sales IPOs earn a positive 20.82% (1.73% times 12 months) for the value-weighted portfolio and 15.48% (1.29% times 12 months) for the equal-weighted portfolio on an annualized basis, whereas low block sales IPOs earn an insignificant negative 1.41% per annum (−0.12% times 12) for the value-weighted portfolio and negative 0.96% (−0.08% times 12) for the equal-weighted portfolio on an annualized basis. Thus high block sales IPOs outperform low block sales IPOs by

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<sup>16</sup> See Lyon, Barber, and Tsai (1997) for reasons why this method could be preferable to using BHARs. However, Loughran and Ritter (2000, 2004) argue that this approach has a lower power to reject the null of no abnormal returns when they are in fact present, especially when the samples consist of small stocks, as is typical for IPOs.

<sup>17</sup> There are 101 observations from February 1993 to June 2001 and 126 observations from July 1993 to December 2003.

Table 9

**Fama-French calendar-time portfolio regressions**

The sample contains 3,087 IPOs from 1993 to 2000. Block selling is defined as the sell-signed trading volume of over 3,500 shares during the first two trading days divided by total shares offered. Three portfolios are shown: the high block selling portfolio, the low block selling portfolio and the difference between low and high block selling portfolios. According to Fama and French (1993) the three-factor regression model is:

$$R_{pt} - R_{ft} = C_p + B_p(R_{mt} - R_{ft}) + S_p(SMB_t) + H_p(HML_t) + \varepsilon_t,$$

where  $p$  is an index of a portfolio;  $t$  is month  $t$ ;  $R_{pt}$  is the monthly returns on the portfolio of IPOs.  $R_{ft}$  is the monthly return on the one-month T bill.  $R_{mt} - R_{ft}$  is the excess returns on the NYSE-Amex-Nasdaq value (equal)-weighted index presented in Panel A (B).  $SMB$  is the difference in the returns of a value (equal)-weighted portfolio of small stocks and big stocks.  $HML$  is the difference in the returns of a value (equal)-weighted portfolio of high book-to-market stocks and low book-to-market stocks.  $C_p$  is the monthly risk-adjusted abnormal returns in percent. The estimate of  $C_p$  provides a test of the null hypothesis that the mean monthly abnormal return on the calendar portfolio is zero.  $B_p$ ,  $S_p$ , and  $H_p$  are factor loadings. The regression uses value (equal)-weighted monthly calendar time returns for low, high, and low minus high block selling portfolios in Panel A (B). To construct the portfolios in Panel A (B), we allocate IPOs to low, medium, and high block selling portfolios and hold them either until lockup expiration computed from the 20 trading days after the IPO or until three years after the IPO computed from the day after lockup expiration. When all IPOs are allocated in this manner, we compute value (equal)-weighted average returns across all stocks for each calendar month and the results of IPOs during the first 20 trading days after the offering until the lockup expiration and those after the lockup expiration until three years after the offering for both value (equal)-weighted portfolios as shown in Panel A (B).

*Panel A: Value-weighted index*

Independent variable	From the first 20 trading days after the offering until the lockup expiration			From the day after the lockup expiration to three years after the offering		
	Low block selling	High block selling	Low-high block selling	Low block selling	High block selling	Low-high block selling
Intercept	-0.12	1.73	-1.85	-0.25	-0.64	0.39
$t$ -statistic	-0.60	4.47***	-2.67**	-0.51	-2.46**	1.86*
$R_m - R_f$	1.14	1.28	-0.14	1.08	1.13	-0.05
$t$ -statistic	12.82***	11.91***	-0.33	11.33***	11.74***	-1.30
$SMB$	1.25	1.13	0.12	0.87	0.95	-0.08
$t$ -statistic	13.35***	10.45***	0.89	6.63***	8.47***	-0.72
$HML$	0.40	-0.84	1.25	0.15	-0.37	0.52
$t$ -statistic	1.05	-1.73	4.48***	1.11	-2.31**	3.60***
$R^2$	66.81%	66.07%	5.62%	75.68%	77.98%	15.81%

*Panel B: Equal-weighted index*

Intercept	-0.08	1.29	-1.37	-0.72	-1.17	0.44
$t$ -statistic	-0.82	5.49***	-3.34***	-0.60	-2.54**	2.64**
$R_m - R_f$	1.25	1.63	-0.38	1.35	1.63	-0.28
$t$ -statistic	10.66***	13.69***	-0.43	11.38***	13.19***	-2.18**
$SMB$	1.10	1.17	-0.07	0.59	0.70	-0.11
$t$ -statistic	12.32***	8.34***	-0.61	11.06***	16.17***	-0.86
$HML$	0.37	-0.96	1.33	0.60	-0.23	0.83
$t$ -statistic	1.04	-2.02**	2.08**	1.14	-4.54***	5.38***
$R^2$	65.13%	61.74%	5.87%	72.43%	68.75%	11.34%

\*\*\*, \*\*, \* indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

about 22.2% (1.85% times 12) for the value-weighted portfolio and 16.40% (1.37% times 12) for the equal-weighted portfolio on an annualized basis.

From lockup expiration until three years after the offering, the risk-adjusted average abnormal returns for high block sales IPOs is  $-7.68\%$  per year ( $-0.64\%$  times 12) for the value-weighted portfolio and  $-14.01\%$  for equal-weighted portfolio and are all statistically significant. Low block sales IPOs also earn negative abnormal returns, but they are not significant. High block sales IPOs underperform low block sales IPOs over this period by  $4.68\%$  and  $5.34\%$  for the value-weighted and equal-weighted portfolios, respectively.

These results indicate that there is significant positive momentum in the short-run followed by reversals in the long run, which is consistent with the results in Tables 7 and 8; high block sales IPOs outperform low block sales IPOs from 20 trading days after the offering to lockup expiration. However, this performance differential is reversed from the day after lockup expiration to three years after the offering. Both the low and high block sale IPOs load positively on the SMB factor. This might be explained by the fact that most IPOs tend to be smaller and younger firms. In contrast, there is a difference in the coefficients on HML between high and low block sales IPOs. The high block sales portfolios load negatively on HML while the low block sales portfolios load positively. Therefore, high block sales IPOs behave more like growth stocks while low block sales IPOs are more like value stocks. The HML loadings are consistent for both periods from 20 trading days after the offering to lockup expiration and from the day after lockup expiration to three years after the offering.

In summary, over the long term, high block sales IPOs underperform low block sales IPOs after controlling for any systematic effects of size and book to market effects. These results suggest that high block sales IPOs are more likely to be overvalued at the offer and become even more overvalued from the end of the stabilization period through lockup expiration. However, the high block sales IPOs' superior performance is reversed after the lockup expiration through three years after the offering.

## **6. Conclusions**

We investigate IPO valuation, block selling, and long-term performance for 3,087 IPOs from 1993 to 2000. We find that a proxy for block selling is related to valuation discrepancy—the ratio of the offering value to estimated intrinsic value—controlling for the opening-trade return and IPO size. IPOs that are overvalued exhibit significantly more block selling than less overvalued IPOs.

We also find that block selling can predict long-term IPO performance. High block selling IPOs outperform low block selling IPOs from 20 trading days after the offering to lockup expiration; but underperform from lockup expiration until three years after the offering. After lockup expiration until three years after the offering, BHARs of IPOs with low block selling are higher than IPOs with high block selling. The results are robust to the choice of benchmark return.

Cross-sectional regressions that control for initial returns, venture capital backing, B/M ratio, analyst earnings forecasts, accruals, size and profitability, and Fama-French (1993) factors produce similar results. High block selling IPOs outperform low block selling IPOs from 20 trading days after the offering to lockup expiration; but the risk-adjusted performance is reversed from lockup expiration until three years after the offering.

Our results indicate that high block sales IPOs are overvalued and low block sales IPOs are less overvalued (and likely to be undervalued) at the offer date, and the overvaluation of high block sales IPOs persists beyond day one. While high block sales IPOs outperform low block sales IPOs from 20 trading days after the offering to lockup expiration, the difference is reversed following lockup expiration until three years after the offering.

## Appendix A: Calculation of block selling

Let:

$S$  = number of shares offered in IPO,

$V$  = number of shares traded,

$F$  = number of block sales shares, and

$N$  = volume of trading which is not due to block selling;  $V = F + N$ .

Then Aggarwal's (2003) and our block selling measure is

$$RA = \frac{F}{S}. \quad (\text{A.1})$$

The KSW (1999) flipping measure is

$$RT = \frac{F}{V} = \frac{F}{F + N}. \quad (\text{A.2})$$

Aggarwal reports higher block sales for hot issues, whereas, KSW (1999) report lower block sales for hot issues

$$RA > RT, \text{ then } \frac{1}{S} > \frac{1}{F + N}, \text{ or } \frac{F + N}{S} > 1. \quad (\text{A.3})$$

This implies that the trading volume on the first day is larger than the number of shares offered. This is true for "hot" issues. In Table 4,  $P/V$  is positively related to the first day return. The high  $P/V$  portfolio of IPOs has high first day return and trading volume divided by shares offered exceeds 100%. In addition, the rate of change of  $RT$  depends on  $F$ . Taking the first derivative of  $RT$  and  $RA$  with respect to  $F$ , we get

$$\frac{d(RT)}{dF} = \frac{N}{(F + N)^2}; \quad \frac{d(RA)}{dF} = \frac{1}{S}. \quad (\text{A.4})$$

The smaller (larger) is  $F$ , the more (less) sensitive is  $RT$  to changes in  $F$ ; however,  $RA$  does not suffer from this problem.

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