

Trading Restrictions and Stock Prices

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I examine a series of stock splits in Japan in which firms restrict the ability of their investors to sell their shares for a period of approximately 2 months. By removing potential sellers from the market, the restrictions have the effect of increasing the impact of trading on prices. The greater the desire of investors to trade, and the greater the restrictions, the larger the impact of the restrictions. In the data, particularly severe restrictions are associated with returns of over 30% around the ex-date, most of which are reversed when investors are allowed to sell again. Firms are more likely to issue equity or redeem convertible debt during the restricted period, suggesting strong incentives for manipulation. (*JEL* G12, G14)

Can firms increase their stock price by constraining the ability of investors to sell? A growing literature in finance suggests that when there are limits to arbitrage, prices may deviate from fundamentals, often for sustained periods. These papers argue that among other things, noise trader risk (De Long et al., 1990), short-sale constraints (D'Avolio, 2002; and Jones and Lamont, 2002), investor withdrawals (Shleifer and Vishny, 1997), or systematic psychological biases (Barberis and Thaler, 2004) can make investors unwilling or unable to trade against mispricing.¹

As long as there are benefits to having a high stock price, firms have strong incentives to further constrain investors from selling shares, thus bringing prices back to fundamentals. The idea that restricting trade can affect stock prices applies in a variety of settings, but is most obvious in initial public offerings (IPOs), where differences of opinion about the prospects of the firm are high. At IPO, many firms choose to offer only a small fraction of the total shares outstanding to the public, releasing a part of the float after a lockup period during which employees and some other investors are not allowed to sell. When the restrictions are lifted, prices fall (e.g., Field and Hanka, 2001; Bradley et al., 2003; Brav and Gompers, 2003; and Ofek and Richardson, 2004). Trading restrictions also play an important role in the pricing of a private investment in

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¹ See also Chen, Hong, and Stein (2002); Duffie, Gârleanu, and Pedersen (2002); Gârleanu and Pedersen (2002); and Nagel (2005) on the effects of short-sales constraints on stock prices.

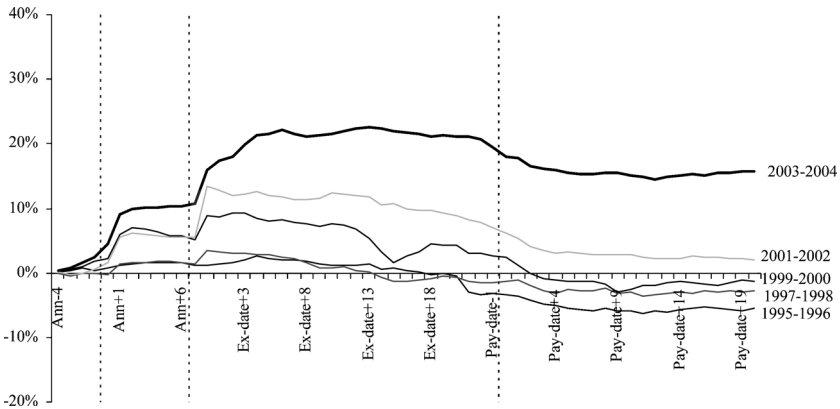


Figure 1
Buy-and-hold returns to stock splits, 1995–2004

The sample is separated into five 2-year intervals between 1995 and 2004. The figure shows the buy-and-hold abnormal return for the splits that have ex-dates in each interval. Abnormal returns are computed net of the buy-and-hold return for the TOPIX value-weighted index over the same period. Because the number of days between announcement and the ex-date vary by event, returns in the periods [Announcement date + 6:Ex-date + 2] and [Ex-date + 30:Pay-date - 3] are cumulated and assigned to one day. Dashed lines indicate the announcement date, ex-date, and pay-date.

public equity (PIPE). In a PIPE, the firm issues equity to a private party, but does not register the shares for several months. When the equity is registered, prices fall.

In this paper, I develop a few simple conjectures on the effects of trading restrictions on stock prices, which I then analyze using data from a series of corporate actions in Japan, known hereafter as the “stock split bubble.” During the stock split bubble, the average stock split ratio grew from 1.15-for-1 in the first quarter of 1995 to over 10-for-1 in the last quarter of 2004. Figure 1 shows that buy-and-hold abnormal event returns associated with the announcement and execution of a stock split grew from approximately zero to over 20% during the same interval, with some splits earning abnormal returns over 100%.

To see how the returns accruing around stock splits are related to trading restrictions, consider the unusual institutional arrangement in Japan, in which new post-split shares are not distributed to shareholders until a few months *after* the ex-date of the split. This arrangement stems from laws stipulating that stock transactions must be settled with physical shares, unlike many countries in which settlement is electronic. Thus, when a firm announces a stock split, registered shareholders on ex-date Y do not receive the new shares until the “pay-date” Z , typically 2 months later. For example, Nikkyu, a parking lot operator, announced a 21-for-1 stock split with an ex-date of July 28, 2004. Registered shareholders on July 28 were entitled to 20 additional shares, but the shares were not deposited in their accounts until September 19, the pay-date. Between these two dates, investors were free to buy and sell their old shares, but because they were unable to buy or sell the new shares, they were effectively

forced to hold a long forward position in Nikkyu equal to a fraction of their ex-date position. Thus, during this time, the effective float—the fraction of the firm available to be bought and sold—fell by 95% ($=20/21$). On September 19, the new shares were distributed and investors were free to sell. Over the course of a few days, the price of Nikkyu stock fell by over 30%.

A series of 2,094 of these stock split events serves as a form of natural experiment to understand the consequences of trading restrictions for stock prices. The restrictions resulting from a split are straightforward: investors who decide after the ex-date that the stock is overpriced can act on this view only insofar as they can sell their old holdings. Of course, positions in the new shares could be offset by taking short positions in the old shares. These short positions could then be closed by delivering the new shares on the pay-date. However, a large subset of investors, including mutual funds and insurance companies, and perhaps small retail investors, are unlikely to short at any price. More importantly, even investors who want to short must find a counterparty to borrow the shares from, which becomes exceedingly difficult once the split is announced. In addition, investors who are willing to go short are also likely to be constrained by the event. To receive the new shares, shareholders must be in physical possession of the shares on the ex-date.² Thus, many outstanding short positions at the time of the announcement are likely to be called in by lenders, possibly causing a short squeeze.

The mechanism by which trading restrictions affect stock prices is straightforward. The stock split constrains traders who would otherwise be willing to sell from accommodating demand from investors who want to buy. Thus, there must be investors *willing* to trade when the restrictions are in place; otherwise the restrictions are not binding. If this condition is satisfied, then the restrictions have the effect of removing potential liquidity suppliers from the market, increasing the price impact of trade. The greater the desire of investors to trade during the restricted period, the larger the impact of the restrictions, and the higher prices. This intuition suggests that event returns should be positively related to the degree of trading restrictions, measures of trading volume, and the interaction between the restrictions and trading volume. Returns should be positive when the constraints are imposed, and negative when the constraints are relieved.

Consistent with the conjectures above, event returns (returns between the announcement and a few days after the ex-date) are significantly positive, and strongly correlated with the split ratio, a measure of the trading restrictions placed on investors. Event returns are also positively related to pre-event-trading volume, consistent with the idea that trading restrictions are more likely to bind when investors do a lot of trading. Pay-date returns, however, are negative on average, and additionally bear an opposite relation with the inverse split ratio.

² This mechanism also appears in the United States. Lamont (2005) shows that it is one of several techniques that firms use to dissuade investors from lending out their shares.

The paper also considers several alternative interpretations. The first of these says that the announcement of the split conveys information about the future fundamentals of the firm. Fama et al. (1969) suggest that the market interprets stock split announcements as good news for future dividends. A related theory says that the information contained in stock splits relates to earnings. Lakonishok and Lev (1987); McNichols and Dravid (1987); and Asquith, Healy, and Palepu (1989) analyze evidence in favor of this theory.³ Clearly, fundamental news cannot explain the results in this paper, because market efficiency requires the stock-price reaction to occur at the time of announcement only.

A second alternative explanation is proposed by Merton (1987) and tested by Amihud, Mendelson, and Uno (1999). It says that increases in the shareholder base should have permanent positive effects on stock prices. Analyzing reductions in the trading unit of Japanese stocks, Amihud, Mendelson, and Uno (1999) find significant permanent price increases. Applied to the stock splits in my sample, the theory predicts increases in price on announcement, and no effects on the ex-date or pay-date. In contrast, I find significant positive returns on the ex-date and significant negative returns around the pay-date. Nevertheless, it is plausible that a change in the investor base is responsible for some or all of the announcement date returns.

A third alternative explanation comes from a fully rational model in which, upon announcement, investors anticipate a reduction in liquidity and desire higher expected returns to bear the risk that they may want to sell during the ex-date to pay-date period. A form of this theory, henceforth known as the illiquidity discount hypothesis, is developed in Amihud and Mendelson (1986); and described in recent surveys by Easley and O'Hara (2002) and Amihud, Mendelson, and Pedersen (2006). Applied to the events in my sample, the illiquidity discount hypothesis states that the announcement of a split sets up a segmented market: every announcement period share is equal to $1/S$ freely tradable shares and $1 - 1/S$ restricted shares, where S denotes the split ratio. During the period of segmentation, the freely traded shares are expected to be priced at a premium, and the unobserved nontraded shares have a (shadow) price at some discount. Thus, the theory predicts an initial negative announcement return, a recovery around the ex-date, and no returns around the pay-date. This theory is firmly rejected: announcement returns are positive, on average, and pay-date returns are negative. The theory has further difficulty with the finding that returns are related to the interaction of trading intensity and the inverse split ratio—under the illiquidity discount hypothesis, the illiquidity of a trader's position is solely determined by the split ratio, and should not depend on the trading of other investors.

In summary, the alternative explanations do not go far enough to explain the full pattern of returns around the ex-date and pay-date, as well as the

³ See also Grinblatt, Masulis, and Titman (1984); Lamoureux and Poon (1987); Asquith, Healy, and Palepu (1989); Desai and Jain (1997); Amihud, Mendelson, and Uno (1999); and Nayak and Nagpurnanand (2001).

cross-sectional relationships between returns, the inverse split ratio, and measures of trading intensity. However, to be clear, I cannot rule out the possibility that these other explanations (together with my mechanism, or separately) account for some of the permanent effect of stock splits experienced around announcement.

The main empirical tests treat the split as exogenous, ignoring the question of whether the splits were an attempt at active manipulation. In the final section of the paper, I argue that (a) the number and timing of the events, (b) the increase in the median split ratio over the course of the sample, (c) the increased incidence of equity issuance and managerial stock redemptions, (d) reports of abnormally high convertible bond redemptions, and (e) reports of management insiders generating profits by lending out their shares are all consistent with firms taking active measures to increase their stock price and enjoying the benefits that the high subsequent stock prices provide. While this evidence is only suggestive, it allows for an interpretation of the events from the broader lens of firms balancing the costs and benefits of market manipulation. Of course, while the institutional mechanism used to restrict trade, and thus manipulate prices, is specific to Japan, the episode is consistent with growing empirical evidence that firms attempt to exploit market inefficiencies to reduce their cost of capital.

Given the strength of the evidence that stock splits were used to manipulate prices, it is not surprising that regulators in Japan have taken a dim view of the entire stock split phenomenon. In a few cases, particularly high-ratio splits have been forced by the exchange to distribute the shares immediately.⁴ On March 5, 2005, the Tokyo Stock Exchange (TSE) announced that it would discourage stock splits in which the split ratio exceeded 5-for-1. In addition, the TSE has recognized that firms have used the splits to enrich some shareholders at the expense of others: in its new guidelines, it discouraged stock splits within 6 months of convertible bond issuance. Finally, several large brokerage houses agreed in early 2005 to take steps to make it easier for investors to trade their forward claims on the new shares.

The results in this paper have implications beyond the objective of understanding the stock split bubble in Japan. First, supply shifts in the market for shares that can be sold or sold short can have significant effects on asset prices. This differs from the results in Cohen, Diether, and Malloy (2006), who argue that decreases in the supply of lendable shares play only a minor role in determining stock prices (in contrast with changes in the *demand* to short shares). Second, and consistent with evidence in Lamont (2005), firms have incentives to limit the ability of investors to trade, particularly when potential-trading volume is high.

⁴ In a few cases, when the split ratio exceeded 100-for-1 or more, trading was halted entirely during the week after the ex-date. This allowed the splitting firm time to determine who was a shareholder on the ex-date and distribute their new shares to these investors, in time to restart trading one week later.

1. Hypothesis Development

In an S -for-1 stock split, a trader who is long Q units of the stock is constrained to be long kQ units of the stock between the ex-date and the pay-date, where $k = 1 - 1/S$. In a 2-for-1 stock split, for example, investors cannot trade half of their shares during this 2-month period. Note that the investor's holdings are expressed in units of the fraction of market capitalization outstanding, not shares outstanding (which experience a nominal change because of the stock split).⁵

Holding constant the fundamental value of the security, if there is no trading between the ex-date and the pay-date, the shadow price should remain constant.⁶ If the investors who hold long positions before the ex-date continue to hold long positions through the pay-date, and no other investors want to buy or sell, the stock split is no more than a change of units.

I consider the possibility that investors may desire to trade between the ex-date and the pay-date. In Harrison and Kreps (1978); Varian (1989); Harris and Raviv (1993); Kandel and Pearson (1995); Odean (1998); and Scheinkman and Xiong (2003), investors trade because of differences in beliefs. Ruling out short selling, investors who want to buy shares must now acquire them from other investors, who are limited in their ability to sell. Thus, buyers must purchase the stock from more bullish investors. The more constrained the investors are to sell, the higher the equilibrium price. Defining the event return as the return around the ex-date, this leads to the first hypothesis:

Hypothesis 1. The event return R is positive and increasing in trading restrictions k , where $k = 1 - 1/S$ and S denotes the split ratio:

$$\frac{\partial R}{\partial k} > 0. \quad (1)$$

Trading constraints increase prices by removing potential liquidity providers from the market, causing a higher price impact on trade. Thus, given a degree of trading constraints k , event returns will be higher if trading intensity is also high.

Hypothesis 2. The event return R is positive and increasing in trading intensity H :

$$\frac{\partial R}{\partial H} > 0. \quad (2)$$

The trading intensity of the asset is parameterized by H , which captures the counterfactual tendency of investors to trade the asset in the absence of

⁵ The nominal shares outstanding change during the stock split, so that notionally, an investor who held one share during a 2-for-1 split can sell one share. But expressed as a fraction of total shares outstanding, the investor is constrained to hold half of his/her position during the split.

⁶ I use the terminology "shadow price" here because there is no observable trade price.

constraints. Note that H measures the *willingness* of investors to trade, not the actual amount of trading that occurs between the ex-date and the pay-date, which is mechanically reduced by the presence of the constraints.

The logic developed above suggests that it is the interaction of trading constraints and trading intensity that drives event returns.

Hypothesis 3. Event returns are increasing in the interaction of trading intensity H and the degree of trading restrictions k :

$$\frac{\partial^2 R}{\partial H \partial k} > 0. \quad (3)$$

An intuitive restatement of Hypothesis 3 is that trading restrictions increase the slope of the investor demand curve. Thus, for prices to increase, we require trading volume.

The mechanism described above differs from traditional models of “price impact” such as Kyle (1985) and Easley and O’Hara (1987). In these models, the price impact of trade depends on the relative quantities of informed versus uninformed traders. In contrast, the mechanism operating in stock splits is silent on the relative shares of these different types of investors. The effect of the trading restrictions is to remove potential arbitrageurs from the market, with the consequence that even uninformed demand has a larger effect on stock prices.

On the pay-date, the restrictions are removed, and absent other considerations, prices should fall back to fundamental value. Thus, the predictions laid out in Hypotheses 1–3 should appear, albeit with opposite sign, around the pay-date.

Hypothesis 4. The pay-date return is negative and decreasing in trading restrictions k , trading intensity H , and the interaction of trading intensity with the degree of trading restrictions:

$$\frac{\partial R^{\text{Pay-date}}}{\partial k} < 0; \quad \frac{\partial R^{\text{Pay-date}}}{\partial H} < 0; \quad \frac{\partial^2 R^{\text{Pay-date}}}{\partial H \partial k} < 0. \quad (4)$$

These conjectures rely on a few important assumptions. First, I assume that investors face short-sale constraints between the ex-date and pay-date, which prevent them from taking offsetting short positions in the new shares. Thus, the short sales are essential for removing potential liquidity providers from the market.

The idea that short-sale constraints may increase stock prices was first emphasized by Miller (1977), but features prominently in a number of recent papers (e.g., Diamond and Verrecchia, 1987; D’Avolio, 2000; Chen, Hong, and Stein, 2002; and Duffie, Gârleanu, and Pederson, 2002). In all of these papers, the views of pessimistic investors, or of investors with private information that the stock is overvalued, are not immediately incorporated into current stock prices. In the specific setting studied in this paper, the assumption of limited short sales appears to be valid: it was virtually impossible to take short positions

between the ex-date and pay-date. Additionally, it appears that short-sale constraints considerably worsened during the ex-date to pay-date windows, as many short sellers were forced to cover their positions before the ex-date.

Second, I abstract away from strategic interactions between different groups of traders, as well as the behavior of prices between the announcement of the split and the ex-date. Intuition dictates that rational traders would attempt to buy in advance of the split and dump shares just prior to the pay-date, thereby dampening the effects that trading restrictions might have on prices. Consistent with that, several of the high split ratio events show declines in price after the ex-date but well before the pay-date. A similar intuition implies that some of the ex-date returns should be impounded into prices on the announcement—traders who anticipate a steeper demand curve between the ex-date and the pay-date buy prior to the ex-date. The trouble is that this is hard to differentiate from a number of other plausible explanations for the announcement effect.

2. The Split Bubble

While stock splits have long been common in Japan, before 1999, over 95% of the splits were in ratios of 1.3-for-1 or less. In the United States, low-ratio stock splits are known as stock dividends. In Japan, low-ratio stock splits were intended to keep dividend per share ratios constant following unexpected positive shocks to cash flow. Low-ratio stock splits were therefore associated with small positive event returns. For the most part, unlike in the United States (e.g., Lakonishok and Lev, 1987), low-ratio splits appear to be unrelated to price. For example, *Nagano Keiki*, an electronic instruments manufacturer, executed 1.10-for-1 splits in 1995, 1996, 1997, 2000, and 2001. During this time, its stock price rose from ¥1,100 to above ¥2,500 and then fell below ¥700 before rising again to over ¥1400 in 2003. In the specific case of *Nagano Keiki*, the average abnormal announcement return for these five splits was approximately 3%.

Figure 2 plots the distribution of stock split ratios in 2-year periods starting in 1995. The figure shows that splits with ratios exceeding 1.5-for-1 were rare prior to 1999. This was for several reasons. First, exchange rules fixed commissions on small trades, making low-priced stocks expensive to trade. Second, Japanese commercial law required net assets per share to remain above ¥50,000 for publicly traded firms, limiting the willingness of firms to increase the number of shares (Hanaeda and Serita, 2004).

Two events made it easier for Japanese firms to split. First, on October 1, 1999, the TSE changed the rules governing brokerage commissions, which had been set at fixed rates for small transactions. Following the deregulation, severe price competition among online brokers lowered trading fees by as much as 90%. Around the same time, some firms began splitting at higher ratios, with the intention of “improving liquidity” and “attracting small investors,” who had only recently become an important class of investors. Second, the law requiring

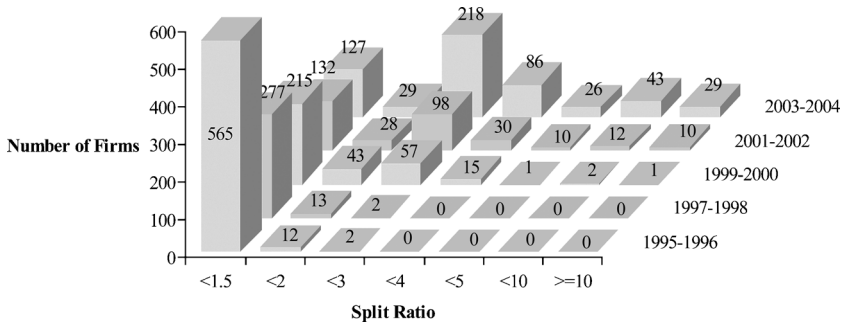


Figure 2
Split ratios, 1995–2004

The figure shows the distribution of split ratios in Japan between 1995 and 2004, in 2-year intervals. The full sample includes all firms that declared splits between January 1995 and December 2004. An S -for-1 split ratio describes a split in which $S - 1$ new shares are distributed (on the pay-date) to all holders of one share on the ex-date. Splits that are announced in early 2005 are omitted from the picture. Within each interval, split ratios are sorted into groups according to split ratio.

net assets per share to remain above ¥50,000 was repealed in 2001, allowing firms to split to lower prices.

Starting in 2000 and 2001, larger stock splits (ratios greater than or equal to 2-for-1) became more prevalent. Figure 2 shows that the number of firms announcing splits with ratios between 2-for-1 and 3-for-1 increased from 3 in the 1995–1996 period to 98 in the 2001–2002 period, then again to 218 in the 2003–2004 period.

2.1 Data

I collect data on every split announced in Japan between January 5, 1995, and April 1, 2005. The bulk of the observations are from Bloomberg, which lists the split ratio, announcement date, ex-date, and pay-date. Prior to 1997, announcement dates contain some errors. I fix these by looking them up individually. The remaining observations are filled in by searching the newswires for split announcements that may have been missed by Bloomberg (small over-the-counter firms, typically), and by scanning Datastream for capital changes in Japanese listed securities. After throwing out duplicates, foreign firms, and splits that were not completed by the time of writing, the final database contains 2,094 stock splits.⁷ The median market capitalization for a splitting firm is approximately ¥24 billion (about USD 240 million), and the mean is ¥122 billion (about USD 1.2 billion), although this decreases somewhat in the later years. Thus splits were executed primarily by smaller firms, but sometimes by very large firms as well. Sony Corporation, Softbank Corporation, and Fuji Television, among other prominent large firms, announced stock splits during the sample period.

⁷ Splits announced by foreign firms are thrown out because the split decision is typically linked to the split of an underlying foreign security. Foreign splits comprise less than 10 observations in the raw data.

Table 1
Summary statistics

	Mean	Median	SD	Min	Max
Panel A: all splits ($N = 2,094$)					
Split ratio	3.53	1.20	49.23	1.001	2,000.00
Log (split ratio)	0.44	0.18	0.56	0.00	7.60
Float reduction = $1 - 1/\text{split ratio}$	0.29	0.17	0.23	0.001	0.9995
Market value presplit (¥ billion)	122.44	23.54	680.21	0.84	13,790.40
Days between announcement and ex-date	25.58	19.00	17.20	1.00	152.00
Days between ex-date and pay-date	39.21	39.00	3.52	4.00	68.00
Presplit log price	9.08	7.97	2.69	3.91	18.35
Cumulative abnormal returns (%)					
[Ann - 200, Ann - 1]	31.07	18.95	60.62	-174.86	753.07
[Ann - 1, Ann + 1]	4.40	2.11	11.69	-26.24	287.31
[Ex-date - 1, Ex-date + 1]	4.57	1.93	19.96	-87.29	403.33
[Ex-date - 1, Ex-date + 20]	8.91	4.16	32.79	-109.17	826.41
[Ann - 1, Ex-date + 5]	12.85	6.00	38.3	-171.24	801.14
[Pay-date - 10, Pay-date + 5]	-3.33	-2.06	14.79	-139.54	147.53
[Ann - 10, Pay-date + 50]	12.76	6.33	52.98	-230.01	811.95
[Ex - 1, Pay-date + 50]	4.01	0.79	40.77	-283.05	747.27
Volume (turnover, %)					
Daily avg [Ann - 50, Ann - 1]	0.61	0.17	1.44	0.00	15.50
Daily avg [Ann date, Ex-date]	0.54	0.19	1.19	0.00	19.40
Daily avg [Ex-date, Pay-date - 1]	0.36	0.15	0.79	0.00	19.40
Daily avg [Pay-date - 10, Pay-date + 5]	0.34	0.13	1.02	0.00	24.46
Panel B: split ratio = 2 ($N = 651$)					
Split ratio	8.74	2.00	88.07	2.00	2,000.00
Log (split ratio)	0.47	0.18	0.61	-2.30	7.60
Float reduction = $1 - 1/\text{split ratio}$	0.60	0.50	0.14	0.50	0.9995
Market value presplit (¥ billion)	193.08	19.80	995.40	0.84	13,548.60
Days between announcement and ex-date	28.96	25.00	17.83	7.00	111.00
Days between ex-date and pay-date	39.06	39.00	3.91	4.00	68.00
Presplit log price	12.00	13.09	2.78	3.95	18.35
Cumulative abnormal returns (%)					
[Ann - 200, Ann - 1]	61.07	51.00	75.97	-174.86	753.07
[Ann - 1, Ann + 1]	8.95	7.03	17.16	-25.82	287.31
[Ex-date - 1, Ex-date + 1]	11.21	5.49	33.35	-87.29	403.33
[Ex-date - 1, Ex-date + 20]	20.26	10.75	53.74	-109.17	826.41
[Ann - 1, Ex-date + 5]	29.53	16.87	61.27	-171.24	801.14
[Pay-date - 10, Pay-date + 5]	-8.75	-8.04	19.47	-139.54	147.53
[Ann - 10, Pay-date + 50]	26.98	15.24	81.60	-230.01	811.95
[Ex - 1, Pay-date + 50]	8.62	0.46	63.35	-283.05	747.27
Volume (turnover, %)					
Daily avg [Ann - 50, Ann - 1]	1.31	0.49	2.18	0.00	15.50
Daily avg [Ann date, Ex-date - 1]	1.25	0.63	1.90	0.00	19.40
Daily avg [Ex-date, Pay-date - 1]	0.81	0.46	1.27	0.00	19.40
Daily avg [Pay-date - 1, Pay-date + 10]	0.79	0.37	1.73	0.00	24.46

Mean, median, standard deviation, and extreme values of selected variables. The full sample contains 2,094 stock splits executed between January 1995 and April 2005, compiled from Bloomberg, newswires, and capital actions reported in Datastream. The split ratio is the ratio of new shares plus old shares to new shares. Market value is in billions of yen. The ex-date is the day on which one must be a shareholder in order to be entitled to receive the new shares. On the pay-date, additional shares created from the split are distributed to ex-date shareholders. The abnormal daily return is the difference between the return of the security and the return on the TOPIX stock index, and is presented in various cumulated intervals. Daily average turnover (volume/shares outstanding) is also shown for various intervals. Results are shown separately for the full sample and for the subsample of splits with ratios greater than or equal to 2-for-1.

Table 1 summarizes the basic data. The median split ratio for the full sample is 1.20-for-1, with a standard deviation of 49.23. The low median reflects the fact that low split ratios were common during the late 1990s. The mean split

ratio is 3.53-for-1, much higher than the median due to several large (100-for-1, 200-for-1, 1000-for-1, and 2000-for-1) outliers, all occurring after 2001.

Table 1 shows that the announcement date of a split falls 26 trading days before the ex-date, on average, and that the pay-date falls 39 trading days after the ex-date. The somewhat longer period between the pay-date and ex-date is explained by the time required to print new share certificates for ex-date holders. Until legislation was passed in June 2004, settlement of stock transactions was performed with physical stock certificates.⁸ To a first approximation, therefore, it was not possible to sell the new shares until they were distributed on the pay-date. There were some exceptions. Institutional investors could participate in a “when-issued market” for the post-split shares. Those transactions were settled with the new shares or cash following the pay-date. However, there is little trading volume in the when-issued market, with most securities not trading at all, and the remainder having most of their volume on the when-issued auction occurring on the ex-date.

Table 1 also summarizes returns and turnover during the event window. Firms exhibit positive abnormal returns before splitting, on average, of 31%. Both announcement and ex-date abnormal returns are positive, with median abnormal returns of 6% over the entire event period (the day before announcement to 5 days after the ex-date). Returns around the pay-date are negative, on average. Consistent with Amihud, Mendelson, and Uno (1999), the table reveals that the splits have a permanent effect: cumulative abnormal returns measured starting 10 days before the announcement and ending 50 days after the pay-date average 12.76%.

Panel B of Table 1 repeats the summary statistics from Panel A on the subset of firms with split ratios greater than or equal to 2. Recall from Figure 2 that these higher split ratio observations are concentrated in the period between 1999 and 2004, with well over half of the sample occurring between January 2003 and December 2004. The main point of Panel B is that the higher split ratio observations do not differ substantially from the remainder of the sample along the dimension of market capitalization. Larger-split-ratio firms do, however, tend to have higher presplit average turnover and higher presplit prices. Announcement and ex-date returns are substantially higher, while returns around the pay-date period are more negative.

2.2 Event and pay-date returns

Table 2 summarizes abnormal returns surrounding stock splits. Following standard event-study methodology, abnormal returns for security i on trading day t are calculated as the difference between the raw return R_{it} and the return on

⁸ On June 9, 2004, the Japanese government passed the Law Concerning Book-Entry Transfer of Corporate Bonds, Stocks, and Other Securities. Under the law, stock certificates of publicly listed companies will be dematerialized by 2009. The TSE has accelerated the program, allowing electronic deposit of the shares starting in January 2006.

Table 2
Announcement and ex-date abnormal returns

	Full sample			1995–1999			2000–2005			Split ratio < 2			Split ratio ≥ 2		
	AR%	CAR%	[t]	AR%	CAR%	[t]	AR%	CAR%	[t]	AR%	CAR%	[t]	AR%	CAR%	[t]
Ann - 1	0.18	0.18	[1.90]	-0.59	-0.59	[-5.39]	0.87	0.87	[5.96]	-0.26	-0.26	[-2.59]	1.64	1.64	[4.85]
Announcement	1.11	1.29	[9.04]	0.66	0.06	[0.41]	1.52	2.39	[10.50]	0.62	0.37	[2.60]	2.63	4.26	[7.78]
Ann + 1	2.96	4.26	[15.99]	1.23	1.29	[6.08]	4.51	6.90	[15.27]	1.74	2.11	[10.19]	6.27	10.54	[7.80]
Ann + 2	0.73	4.98	[16.14]	0.40	1.69	[6.83]	1.02	7.92	[15.08]	0.46	2.57	[10.01]	1.23	11.77	[8.04]
Ann + 3	0.11	5.09	[15.76]	0.06	1.75	[6.68]	0.15	8.07	[14.69]	0.03	2.60	[9.82]	0.85	12.61	[8.16]
Ann + 4	0.15	5.24	[15.60]	0.40	2.15	[7.79]	-0.07	8.00	[13.95]	0.17	2.77	[10.39]	0.33	12.94	[7.96]
Ann + 5	0.02	5.26	[14.74]	0.08	2.23	[7.65]	-0.04	7.96	[13.02]	-0.06	2.71	[9.91]	0.60	13.54	[7.65]
Ann + 6	0.01	5.27	[14.33]	0.06	2.29	[7.52]	-0.04	7.92	[12.58]	0.03	2.74	[9.79]	0.02	13.57	[7.29]
Ann + 7	0.07	5.33	[14.37]	0.17	2.46	[7.92]	-0.02	7.89	[12.43]	0.07	2.81	[9.85]	-0.05	13.51	[7.29]
Ann + 8	0.22	5.55	[14.28]	0.10	2.56	[8.13]	0.32	8.21	[12.28]	0.18	2.98	[10.40]	1.03	14.54	[7.15]
Ann + 9	0.44	5.99	[14.56]	0.38	2.94	[9.03]	0.49	8.70	[12.23]	0.32	3.30	[11.02]	1.28	15.82	[7.22]
Ann + 10	0.06	6.04	[13.71]	-0.56	2.38	[7.01]	0.61	9.31	[12.19]	-0.25	3.05	[9.58]	1.62	17.44	[7.32]
Ex-date - 1	-0.64	-0.64	[-6.86]	-0.89	-0.89	[-8.10]	-0.41	-0.41	[-2.81]	-0.82	-0.82	[-8.62]	0.07	0.07	[0.21]
Ex-date	3.66	3.02	[6.58]	0.19	-0.71	[-2.73]	6.76	6.35	[7.70]	0.98	0.16	[0.74]	17.33	17.40	[5.70]
Ex-date + 1	0.36	3.37	[7.53]	0.32	-0.38	[-1.56]	0.39	6.74	[8.35]	-0.21	-0.05	[-0.23]	3.71	21.12	[7.33]
Ex-date + 2	0.57	3.95	[9.09]	0.28	-0.10	[-0.36]	0.83	7.57	[9.85]	0.61	0.56	[2.64]	0.94	22.06	[8.13]
Ex-date + 3	0.56	4.51	[10.07]	0.14	0.04	[0.14]	0.94	8.51	[10.75]	0.14	0.70	[3.28]	2.66	24.72	[9.01]
Ex-date + 4	0.70	5.21	[11.03]	1.18	1.22	[4.41]	0.28	8.79	[10.38]	0.45	1.15	[5.13]	2.40	27.11	[9.40]
Ex-date + 5	-0.44	4.78	[9.59]	-0.20	1.02	[3.15]	-0.64	8.14	[9.18]	-0.71	0.44	[1.82]	1.60	28.71	[9.51]
Ex-date + 6	0.13	4.91	[9.65]	-0.09	0.93	[2.73]	0.33	8.47	[9.40]	-0.06	0.38	[1.52]	1.08	29.79	[9.74]
Ex-date + 7	-0.26	4.64	[9.03]	0.01	0.93	[2.60]	-0.50	7.97	[8.77]	-0.05	0.33	[1.30]	-0.86	28.93	[9.24]
Ex-date + 8	-0.22	4.42	[8.31]	-0.24	0.69	[1.87]	-0.20	7.76	[8.24]	-0.33	0.00	[-0.00]	0.08	29.01	[8.92]
Ex-date + 9	-0.25	4.17	[7.63]	-0.87	-0.18	[-0.46]	0.30	8.06	[8.38]	-0.60	-0.60	[-2.22]	1.01	30.02	[9.09]
Ex-date + 10	0.61	4.78	[8.40]	-0.05	-0.23	[-0.55]	1.19	9.26	[9.35]	0.41	-0.19	[-0.67]	1.33	31.35	[9.18]

Cumulative abnormal returns around the announcement date and ex-date for stock splits occurring in Japan between 1995 and March 2005, expressed in percentage terms. An S -for-1 split ratio is one in which $S - 1$ new shares are distributed, on the pay-date, to all holders of one share on the ex-date. The abnormal daily return is the difference between the return of the security and the return on the TOPIX stock index. In Panel A, returns are accumulated beginning 1 day before the announcement date and ending 10 days after. In Panel B, accumulation of returns begins 1 day before the ex-date and ends 10 days after. Results are shown separately for the full sample, the subperiod 1995 through 1999, the subperiod 2000 through March 2005, the sample of splits with ratios less than 2, and the sample of splits with ratios greater than or equal to 2. t -statistics are in brackets.

the value-weighted Tokyo Stock Exchange Section 1 index (TOPIX), R_{mt} .⁹

$$AR_{it} = R_{it} - R_{mt}. \quad (5)$$

In the top panel, returns start 1 day before the announcement of the split and end 10 days after. In the bottom panel, returns start 1 day before the ex-date and end 10 days after.

The table shows significantly positive cumulative abnormal returns surrounding both the announcement and effective day of stock splits. For the full sample, average abnormal returns in the 10-day window around the announcement are approximately 6%, and average abnormal returns in the 10-day window around the ex-date average approximately 5%. The remainder of Table 2 summarizes abnormal returns for various subsets of the data. I first break the data into the 1995–1999 and 2000–2005 subperiods. In the early period, abnormal announcement returns are low (about 2.4%) but significantly positive. This is consistent with the idea that the announcement of a split conveys some news about fundamentals. In the later years, however, announcement returns are over 9.3%. This pattern is repeated for the ex-date returns. Between 1995 and 1999, abnormal returns around the ex-date are insignificantly different from zero. Between 2000 and 2005, they are approximately 9.3%.

The remaining panels of Table 2 show that the distinction between the early and late samples is not as meaningful as the distinction between the low and high split ratios. Low-ratio splits earn announcement returns of 3.1%, compared with over 17.4% for high-ratio splits. More strikingly, low-ratio splits earn ex-date returns insignificantly different from zero, while high-ratio splits earn over 31.4%.

Table 3 summarizes abnormal returns around the pay-date, calculated in the same way as above. On the pay-date, the float is released as shareholders who were registered on the ex-date receive $S - 1$ new shares, where S denotes the split ratio. For the full sample, cumulative abnormal returns for the 21-day window starting 10 days before the pay-date and ending 10 days after the pay-date are -3% . In the early sample from 1995 to 1999, pay-date returns are slightly lower in magnitude than in later years. As in Table 2, the important distinction turns out to be between low- and high-ratio splits. Low-ratio splits have no returns around the pay-date, while high-ratio splits have pay-date returns of -16% (in the extended 21-day window around the pay-date). Thus, over half of the returns accruing to shareholders immediately after the ex-date are given back when trading restrictions are removed.¹⁰

⁹ The magnitude of the findings in Tables 2 and 3 ensures that the results are unchanged if I alternately use (a) raw returns, (b) security specific risk-adjusted returns, or (c) market-adjusted returns. The results are stronger for buy-and-hold abnormal returns (buy-and-hold returns of the security minus the buy-and-hold return of the benchmark), but I do not report these here because of some debate as to their statistical properties (see Mitchell and Stafford, 2000; and Brav, Geczy and Gompers, 2000).

¹⁰ When measured on a buy-and-hold basis, about three quarters of the ex-date period returns are given back in the period surrounding the pay-date. The difference between the buy-and-hold returns and the cumulative abnormal returns is mechanically driven by the high announcement and ex-date returns.

Table 3
Pay-date abnormal returns

	Full sample			1995–1999			2000–2005			Split ratio <2			Split ratio ≥2		
	AR%	CAR%	[t]	AR%	CAR%	[t]	AR%	CAR%	[t]	AR%	CAR%	[t]	AR%	CAR%	[t]
Pay-date – 10	–0.21	–0.21	[–2.66]	–0.62	–0.62	[–5.94]	0.16	0.16	[1.39]	–0.31	–0.31	[–3.68]	–0.35	–0.35	[–1.30]
Pay-date – 9	0.57	0.36	[3.05]	0.57	–0.05	[–0.34]	0.57	0.73	[4.12]	0.69	0.37	[3.05]	0.50	0.15	[0.33]
Pay-date – 8	0.46	0.82	[5.50]	–0.14	–0.20	[–1.10]	1.00	1.73	[7.51]	0.39	0.76	[4.87]	0.19	0.35	[0.61]
Pay-date – 7	0.50	1.32	[8.09]	0.92	0.72	[3.69]	0.14	1.86	[7.30]	0.73	1.49	[8.89]	0.11	0.45	[0.71]
Pay-date – 6	0.31	1.63	[8.72]	0.40	1.12	[4.89]	0.23	2.09	[7.24]	0.46	1.95	[10.08]	–0.34	0.11	[0.15]
Pay-date – 5	0.14	1.77	[8.82]	0.00	1.11	[4.67]	0.26	2.35	[7.51]	0.10	2.05	[10.26]	–0.18	–0.08	[–0.09]
Pay-date – 4	–0.23	1.53	[7.19]	–0.16	0.96	[3.89]	–0.30	2.05	[6.05]	–0.08	1.97	[9.37]	–0.90	–0.98	[–1.10]
Pay-date – 3	–0.65	0.88	[3.84]	–0.48	0.47	[1.77]	–0.80	1.25	[3.44]	–0.36	1.61	[7.16]	–2.21	–3.19	[–3.31]
Pay-date – 2	–0.43	0.45	[1.91]	–0.60	–0.12	[–0.46]	–0.28	0.97	[2.55]	–0.25	1.36	[5.69]	–1.21	–4.40	[–4.72]
Pay-date – 1	–0.35	0.10	[0.40]	0.21	0.09	[0.33]	–0.86	0.11	[0.26]	0.18	1.54	[6.07]	–2.73	–7.13	[–7.59]
Pay-date	–0.33	–0.23	[–0.86]	0.04	0.14	[0.42]	–0.67	–0.56	[–1.33]	–0.01	1.53	[5.55]	–0.86	–7.99	[–7.30]
Pay-date + 1	–0.07	–0.30	[–1.03]	0.22	0.35	[1.02]	–0.32	–0.88	[–1.96]	0.20	1.73	[5.85]	–0.83	–8.82	[–7.63]
Pay-date + 2	–0.92	–1.21	[–3.96]	–0.58	–0.22	[–0.61]	–1.22	–2.10	[–4.37]	–0.56	1.16	[3.84]	–2.01	–10.83	[–8.52]
Pay-date + 3	–0.43	–1.65	[–5.10]	–0.53	–0.75	[–2.00]	–0.35	–2.45	[–4.80]	–0.34	0.83	[2.58]	–1.16	–11.99	[–9.09]
Pay-date + 4	–0.41	–2.06	[–6.19]	–0.23	–0.98	[–2.54]	–0.57	–3.02	[–5.76]	–0.31	0.51	[1.57]	–0.84	–12.83	[–9.39]
Pay-date + 5	–0.02	–2.08	[–6.08]	–0.03	–1.02	[–2.60]	–0.02	–3.04	[–5.58]	0.12	0.64	[1.93]	–0.69	–13.52	[–9.33]
Pay-date + 6	–0.38	–2.47	[–6.96]	–0.28	–1.29	[–3.21]	–0.48	–3.51	[–6.22]	–0.19	0.45	[1.32]	–1.26	–14.79	[–9.86]
Pay-date + 7	–0.06	–2.52	[–6.97]	–0.04	–1.33	[–3.30]	–0.07	–3.59	[–6.17]	–0.10	0.35	[1.03]	–0.09	–14.88	[–9.63]
Pay-date + 8	0.22	–2.30	[–6.09]	0.60	–0.73	[–1.75]	–0.11	–3.70	[–6.10]	0.48	0.83	[2.36]	–0.31	–15.19	[–9.34]
Pay-date + 9	–0.60	–2.90	[–7.58]	–0.89	–1.62	[–3.79]	–0.34	–4.04	[–6.59]	–0.74	0.10	[0.27]	–0.36	–15.55	[–9.34]
Pay-date + 10	0.00	–2.89	[–7.46]	0.14	–1.48	[–3.45]	–0.12	–4.16	[–6.66]	–0.01	0.09	[0.26]	–0.41	–15.96	[–9.36]

Cumulative abnormal returns around the pay-date for stock splits in Japan occurring between 1995 and March 2005, expressed in percentage terms. An S -for-1 split ratio is one in which $S - 1$ new shares are distributed, on the pay-date, to all holders of one share on the ex-date. On the pay-date, additional shares created from the split are distributed to ex-date shareholders. The abnormal daily return is the difference between the return of the security and the return on the TOPIX stock index. Returns are accumulated beginning 10 days before the pay-date and ending 10 days after. t -statistics are in brackets. Results are shown separately for the full sample, the subperiod 1995 through 1999, the subperiod 2000 through March 2005, the sample of splits with ratios less than 2, and the sample of splits with ratios greater than or equal to 2.

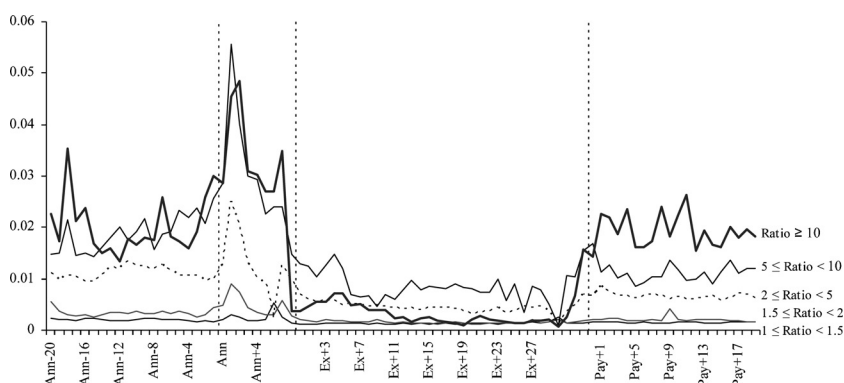


Figure 3
Turnover during a stock split

The figure shows average turnover around the announcement, ex-date, and pay-date for stock splits occurring in Japan between 1995 and March 2005, sorted by split ratio. An S -for-1 split ratio is one in which $S - 1$ new shares are distributed (on the pay-date) to all holders of one share on the ex-date. Turnover is yen denominated volume divided by total market capitalization. The average distance between the announcement date and the ex-date is 26 trading days; the average distance between the ex-date and the pay-date is 39 days. Because the distances between the announcement date, the ex-date, and the pay-date are specific to each event, volumes of the periods [Announcement date + 6:Ex-date + 2] and [Ex-date + 30:Pay-date - 3] are averaged and assigned to 1 day. Announcement dates, pay-dates, and ex-dates are shown with dashed lines.

3. Results

3.1 Trading volume

As the split ratio becomes very large, it becomes virtually impossible for a shareholder to sell all but a small fraction of shares. It seems reasonable that for extremely high-ratio splits (say 100-for-1 or more), small shareholders would not sell *any* shares, even at high overvaluations, because the benefits of selling at a high price would be offset by transaction costs. Therefore, trading volume should decline in the period between the ex-date and the pay-date, potentially increasing to normal levels after that.

Figure 3 plots average turnover around the announcement, ex-date, and pay-date, sorted by split ratio. Turnover is defined as trading volume, denominated in yen, divided by market capitalization. For each firm, I winsorize the turnover series at the 1% level to remove extreme outliers.

Figure 3 shows that trading volume declines between the ex-date and the pay-date, climbing again to announcement-period levels as the pay-date approaches. More importantly, turnover between the ex-date and pay-date drops the most for high-ratio stock splits.

Figure 3 warrants some additional observations. First, turnover increases just prior to the pay-date. This increase is probably due to smart-money arbitrageurs trying to close long positions in advance of the exodus by individual traders after the pay-date. This is consistent with models in which arbitrageurs sell in advance of liquidations by other traders (Brunnermeier and Pedersen, 2005).

Table 4
Determinants of turnover changes

	Announcement period turnover		[Ex-date, Pay-date - 1] period turnover	
	Full sample	Split ratio ≥ 2	Full sample	Split ratio ≥ 2
Constant	-0.03 [-0.65]	-0.65 [-1.77]	0.17 [2.94]	1.54 [3.40]
$k = 1 - 1/\text{split ratio}$	-0.06 [-0.51]	0.89 [1.51]	-1.69 [-11.55]	-3.87 [-5.28]
R^2	0.000	0.004	0.068	0.043

OLS regressions of announcement and ex-date to pay-date period abnormal turnover on the split ratio: $V_i - \bar{V}_i = a + bk_i + u_{it}$. Turnover is the yen value of shares traded divided by total market capitalization. Abnormal turnover is the difference between the average daily turnover in a particular period and the average daily turnover during the 50 trading days preceding the announcement. k is one minus the reciprocal of the split ratio and is a measure of the restrictions placed on trading between the ex-date and pay-date. t -statistics are in brackets and are based on an assumption of independence across observations.

Second, Figure 3 shows that higher ratio stock splits tend to be higher turnover stocks to start with. This could be for several reasons. First, these could be stocks that have high levels of disagreement over fundamentals. Second, these stocks may have high turnover because of heavy trading by individuals prior to the split announcement. Both interpretations are consistent with the view that the firms with the most to gain from stock splits choose higher split ratios.

Third, Figure 3 shows an increase in turnover between the announcement date and the ex-date, with larger increases for larger split ratios. Returns during this period are not described in the main hypotheses, but it seems reasonable that some of the disagreement about the implications of the split is resolved during that time. Alternatively, this turnover may partly reflect smart money arbitrageurs trading in advance of the constraints that they know will affect other investors.

Table 4 analyzes the relationship between changes in turnover induced by the stock split, and the split ratio. I first calculate average daily turnover for each stock in the 50-trading-day period before the split is announced, denoted $\bar{V}_i$. I then run univariate regressions of abnormal turnover during the announcement, and ex-date to pay-date periods, $V_i - \bar{V}_i$ on k , the transformed split ratio ($k = 1 - 1/S$):

$$V_i - \bar{V}_i = a + bk_i + u_i. \tag{6}$$

Results are shown separately for announcement period turnover and turnover between the ex-date and the pay-date. Announcement period volume is unrelated to the split ratio, except for the subsample of 2-for-1 or greater splits, for which announcement period turnover is positively correlated with the split ratio. Abnormal volume between the ex-date and the pay-date has a strong negative correlation with the split ratio. Thus, high-ratio stock splits reduce

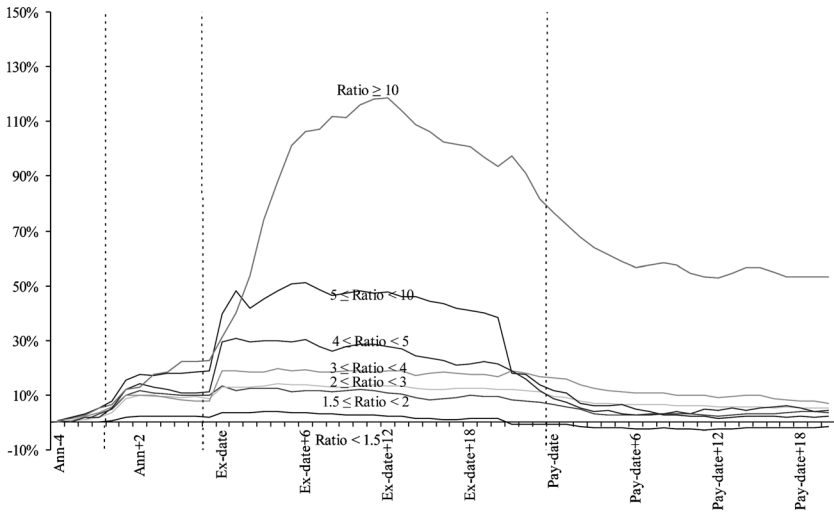


Figure 4

Buy-and-hold returns by split ratio

The sample of stock splits between 1995 and 2005 is sorted into seven groups according to the split ratio. An S -for-1 split ratio is one in which $S - 1$ new shares are distributed on the pay-date to all holders of one share on the ex-date. The figure shows the average buy-and-hold average abnormal return for the stocks in each group, shown in event time. Abnormal returns are computed net of the buy-and-hold return for the TOPIX value-weighted index over the same period. Because the number of days between announcement and the ex-date vary by event, abnormal returns in the periods [Announcement date + 6; Ex-date + 2] and [Ex-date + 30; Pay-date - 3] are cumulated and assigned to 1 day. Dashed lines indicate the announcement date, ex-date, and pay-date.

volume below their usual levels, presumably the direct result of the trading constraints.

The t -statistics reported in Table 4 assume independence across observations. As there is some temporal overlap in the samples (approximately 50 days per firm in the ex-date to pay-date period, distributed over 10 years) and trading volumes often have strong common factors (Lo and Wang, 2000), this may understate the standard errors somewhat. This is less of a concern in the stock return tests because the market factor is removed from the left-hand-side variable. To deal with the overlap in the volume regressions, I estimate Equation (6) including equal-weighted market turnover as an additional control in the regression (not tabulated). This adjustment has an insignificant effect on the standard errors and point estimates.¹¹

3.2 Announcement and ex-date returns

Hypothesis 1 states that returns around the stock split should be related to the degree of trading restrictions. Figure 4 takes a first look at this prediction. I sort the full sample of stock splits into groups according to the split ratio. The

¹¹ Specifically, the coefficients on k in the last two columns change from -1.69 [$t = -11.56$] to 1.61 [$t = -9.64$] and from -3.87 [$t = -5.28$] to -3.77 [$t = -5.15$], respectively.

figure plots the buy-and-hold abnormal returns for the stocks in each group, shown in event time, in the interval starting 4 days before the announcement and ending after the pay-date.¹² For low-ratio splits (ratio < 1.5), typical in the early years of the sample, event returns are slightly positive but small. As the split ratio increases, abnormal event returns increase quickly. For splits with ratios of 10 and above, the figure shows average abnormal event returns over 100%. An interesting feature of the figure is that both announcement date and ex-date returns appear to be positive for most stock splits.

Table 5 provides the formal test corresponding to the results in Figure 4. Recall that the main conjectures state that event returns are increasing in the transformed split ratio, trading intensity H , and the interaction. I estimate the regression

$$R_i = a + bk_i + cH_i + dk_iH_i + u_i, \quad (7)$$

where k denotes the percentage float reduction (one minus the reciprocal of the split ratio), as described in Section 1. I measure H using average daily turnover during the 50 days before the announcement of a split. This is a proxy for how much investors *would have traded* in the absence of the restrictions imposed by the split. Clearly, H is an imperfect proxy, because it captures how much investors were likely to trade before the split, rather than how much investors want to trade after the split is announced (equivalently, how much they disagree about the value of a firm following a split). To the extent that the split *induces* trading activity (e.g., by creating traders who think the split indicates good news about the firm), measurement error in H may be correlated with the split ratio.

To start, abnormal returns are measured starting 1 day before the announcement and ending 10 days after the ex-date. Estimates from Equation (7) are shown for both the full sample of splits and the subsample of splits with ratios greater than or equal to 2. Event returns have a strong positive relation with the transformed split ratio in both samples. This confirms Hypothesis 1 that trading restrictions increase asset prices. The stronger the restriction, the more prices increase.

Column 2 of Table 5 shows that event returns are positively related to measures of past-trading volume, consistent with Hypothesis 2 that constraints imposed by the split matter the most when they are likely to bind.

Column 3 of Table 5 shows that event returns are strongly positively correlated with the interaction of past-trading volume and the split ratio, confirming Hypothesis 3. Thus, a higher split ratio binds more strongly when trading volume is high. Columns 4–6 show that these results hold on the subset of events with split ratios of two or more.

¹² Because the number of days between the announcement date and the ex-date, and between the ex-date and pay-date, vary by event, for purposes of the figure, periods [Announcement-date + 6:Ex-date + 2] and [Ex-date + 30:Pay-date - 3] are cumulated and assigned to 1 day.

Table 5
Determinants of event abnormal returns

	$R = \text{Event return} [\text{Announcement day} - 1, \text{Ex-date} + 10]$					$R = \text{Ex-date return} [\text{Ex-date} - 1, \text{Ex-date} + 20]$				
	Full sample					Full sample				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	Split ratio ≥ 2 ($k = 0.5$)
Constant	-0.05 [-4.44]	0.10 [11.10]	-0.03 [-2.24]	-0.73 [-7.18]	0.26 [9.41]	-0.57 [-5.34]	-0.03 [-2.79]	0.06 [7.86]	-0.01 [-1.04]	-0.39 [-4.20]
$k = 1 - 1/\text{split ratio}$	0.64 [19.53]		0.45 [11.75]	1.69 [10.35]		1.35 [7.29]	0.42 [14.37]		0.28 [8.04]	0.98 [6.55]
$H = \text{pre-event turnover}$		4.58 [7.52]	9.51 [11.37]		2.50 [2.25]	7.67 [5.02]		4.67 [9.01]	3.95 [5.22]	3.65 [3.78]
$k \times H$			10.28 [8.68]			6.89 [3.26]			7.45 [6.94]	5.41 [2.75]
R^2	0.15	0.03	0.20	0.14	0.01	0.17	0.09	0.04	0.11	0.06

OLS regressions of announcement and ex-date abnormal returns on the split ratio, trading intensity H , and the interaction of H and the split ratio: $R_i = a + bk_i + cH_i + dk_iH_i + u_i$, where k is one minus the reciprocal of the split ratio and is a measure of the restrictions placed on trading between the ex-date and pay-date. H is measured as the average turnover during the 50 trading days preceding announcement of the split. The dependent variable is alternately the cumulative abnormal return between 1 day before the announcement and the ex-date, or the cumulative abnormal return between 1 day before the ex-date and 20 days after. The table presents results for both the full sample and the subsample of splits for which the split ratio was 2-for-1 or greater. t -statistics are in brackets and are based on an assumption of independence across observations.

Columns 7–12 of Table 5 repeat the basic tests on abnormal returns measured during a 22-day period surrounding the ex-date. These returns characterize changes in prices occurring for investors who bought just prior to the imposition of the trading constraints, and sold some period before the trading constraints were relieved. Because the ex-date typically occurs a few weeks after the announcement, focusing on the ex-date period reduces concerns about the split announcement conveying improved fundamentals about the firm. The table shows that returns during the ex-date window show strong positive correlations with the transformed split ratio, the trading volume, and the interaction of the transformed split ratio and trading volume. In both the univariate and multivariate specifications, the results appear stable across low and high split ratios.

3.3 Pay-date returns

On the pay-date, the new shares created because of the split are distributed to all investors who held shares on the ex-date. Hypothesis 4 states that the returns around the pay-date should be negatively related to the degree of trading restrictions and past measures of trading volume. Figure 4 provides strong support for these predictions. For low-ratio splits (ratio < 1.5), pay-date returns are not distinguishable from zero. As the split ratio increases, abnormal event returns quickly become more negative. For splits with ratios of 5-for-1 or more, the figure shows that most of the increases in prices earned after the ex-date are reversed. Nevertheless, a permanent effect is still apparent.

The dotted line on the right-hand side of Figure 4 indicates the placement of the pay-date. Particularly for the high-ratio splits, a portion of the negative pay-date return occurs before the pay-date. It is plausible that this comes from front-running arbitrageurs who understand that individual investors will sell on the ex-date, lowering the price. These traders may try to profit by selling their shares and/or selling short in advance of the exodus.

Table 6 shows the tests that correspond to the pay-date period shown in Figure 4. I estimate

$$R_i = a + bk_i + cH_i + dk_iH_i + u_i, \quad (8)$$

where R_i now denotes the cumulative abnormal return in the 21-day window around the pay-date. Results are shown separately for the full sample and for splits of ratios of 2-for-1 or more.

Consistent with the predictions, pay-date returns are strongly negatively related to the split ratio. Furthermore, using the same measure of trading intensity as before, there is some evidence that pay-date returns are negatively related to measures of trading intensity before the split. Also consistent with my predictions, the table shows that pay-date returns are negatively related to the interaction between the float reduction and trading intensity.

Table 6
Determinants of pay-date abnormal returns

	Full sample			Split ratio ≥ 2 ($k = 0.5$)		
Constant	0.02 [4.56]	-0.02 [-6.18]	0.01 [2.99]	0.16 [4.78]	-0.07 [-8.38]	0.11 [3.09]
$k = 1 - 1/\text{split ratio}$	-0.19 [-14.84]		-0.14 [-8.99]	-0.41 [-7.60]		-0.29 [-4.79]
$H = \text{pre-event turnover}$		-1.92 [-8.17]	-1.85 [-5.41]		-1.03 [-2.92]	-1.86 [-3.67]
$k \times H$			-2.86 [-5.93]			-2.47 [-3.52]
R^2	0.10	0.03	0.20	0.08	0.01	0.10

OLS regressions of pay-date abnormal returns on the split ratio, trading intensity H , and the interaction of H and the split ratio: $R_i = a + bk_i + cH_i + dk_i H_i + u_i$, where k is one minus the reciprocal of the split ratio and is a measure of the restrictions placed on trading between the ex-date and pay-date. H is measured as the average turnover during the 50 trading days preceding the announcement of the split. The dependent variable is cumulative abnormal returns starting 10 days before the pay-date and ending 10 days after. Results are shown separately for the full sample and for those splits with split ratios of 2-for-1 or greater. t -statistics are in brackets and are based on an assumption of independence across observations.

To summarize, the data confirm all of the predictions laid out in Section 1. Temporary-trading constraints increase prices, with the amount of increase positively related to the degree to which the constraints are likely to bind. The symmetry of the ex-date and pay-date effects reduces concerns that the independent variables proxy for changes in perceived fundamentals occurring during the split.

3.4 Economic consequences of trading under constraints

An important question is whether the effects measured thus far are of economic significance. To the extent that stock splits inhibit trading, it is possible that prices shoot up after the ex-date, but with little trading, the wealth transfer between constrained and unconstrained traders could be minimal.

A simple calculation runs to the contrary. Figure 3 reveals that while volume is certainly reduced during the ex-date to pay-date period, it is still significant. Summing over the events in my sample, there is approximately USD 150 billion of trading volume between the ex-date and pay-date. With average ex-date event returns of approximately 31% for high-ratio stock splits, this yields a total wealth transfer of USD 23 billion ($=150 \times 31 \times 1/2$, where $1/2 \times 31$ is the average percentage overpricing at the time of any particular trade).

A more formal calculation of the wealth transfer can be done as follows. I calculate the yen amount by which investors overpaid for a given stock during the ex-date to pay-date period:

$$WealthTransfer_i = \sum_{t=\text{Ex-date}}^{\text{Pay-date}} BHR_{it} \cdot P_{i,\text{Ex-date}} \cdot Turnshares_{it}. \quad (9)$$

BHR denotes the buy-and-hold return, starting the day before the ex-date, *P* is the split-adjusted price just prior to the ex-date, and *Turnshares* is the number of shares traded on that day. For the sample of splits with ratios of 2-for-1 or greater, I calculate an aggregate wealth transfer of USD 22 billion.¹³

3.5 Alternative explanations

This subsection considers alternative explanations for the empirical results. I consider three possibilities. These include (a) fundamentals-based theories that have been used to explain abnormal returns around stock splits in the United States, (b) the hypothesis that a wider shareholder base should be associated with a higher stock price, and (c) the hypothesis that investors will require compensation for illiquidity of their positions between the ex-date and the pay-date.

A large empirical literature documents that stock splits in the United States usually occur after increases in stock prices and are associated with small positive abnormal returns upon announcement.¹⁴ Fama et al. (1969) suggest that the market interprets stock split announcements as good news for future dividends. They find that firms that split their shares are more likely to increase dividends in the year after the split. A slightly different explanation says that the information contained in stock splits relates to earnings rather than dividends. Lakonishok and Lev (1987); McNichols and Dravid (1987); and Asquith, Healy, and Palepu (1989) analyze evidence in favor of this theory.

The dividend/earnings news theory cannot fully explain the results in this paper, because market efficiency requires the stock-price reaction to occur at the time of announcement only. The theory could, however, explain some of the returns that accrue on the announcement date. Returning to the last set of results for high-ratio stock splits in Table 2, one could attribute the positive average returns around announcement to news about fundamentals, but it would be unreasonable to argue the same for the 31.35% return around the ex-date. More importantly, there is no reason why positive news about future earnings or dividends would be associated with significantly negative returns around the pay-date (Table 3).

A second theory says that a stock split may increase firm value by increasing the investor base. Merton (1987) proposes such a model in which he shows that firms have incentives to increase the number of shareholders. Amihud, Mendelson, and Uno (1999) test his theory using data in Japan by analyzing reductions in stocks' minimum trading unit. These reductions make stock more accessible to individual investors who are potentially liquidity constrained before the reduction in trading unit. Amihud, Mendelson, and Uno find that increases in the investor base are associated with permanent increases in the price.

¹³ To put this number in perspective, the total market value of stocks listed on the first section of the TSE was approximately \$3.5 trillion at the end of December 2004.

¹⁴ See Fama et al. (1969); Bar-Yosef and Brown (1977); Charest (1978); Foster and Vickrey (1978); Woolridge (1983); Grinblatt, Masulis, and Titman (1984); and Asquith, Healy, and Palepu (1989).

Under market efficiency, the enhanced investor base theory predicts returns around the announcement of the split, but not thereafter. I find that there is a permanent effect of the stock splits, largely due to the announcement return. Table 1 shows that cumulative abnormal returns starting 10 days before the split announcement and ending 50 days after the pay-date average 12.76%. Thus, the announcement effects I find are largely consistent with the results in Amihud, Mendelson, and Uno (1999).

A third hypothesis comes from a fully rational model in which, upon announcement of a stock split, investors anticipate a reduction in liquidity between the ex-date and pay-date and desire higher expected returns to bear the risk that they may want to sell during this time. This theory, the illiquidity discount hypothesis, is developed in Amihud and Mendelson (1986). The authors argue that illiquidity may be one explanation for the higher average returns of small stocks. Silber (1991) finds discount as high as 30% on restricted stock in the United States.

Applying the illiquidity discount theory to my sample of stock splits is straightforward. The announcement of a split sets up a segmented market; after announcement, each share is a claim on two different types of assets: $1/S$ shares that will be freely traded throughout, and $1 - 1/S$ shares that cannot be traded between the ex-date and pay-date in share. Because investors apply a discount to the restricted shares, prices between the announcement date and ex-date should be depressed, recovering for the freely traded shares on the ex-date (after the ex-date, the freely traded shares are no longer coupled with the restricted shares). On the pay-date, there should be no returns, because the freely traded shares are priced correctly, at least in expectation. In summary, the theory predicts negative announcement returns proportional to $1 - 1/S$, positive ex-date returns proportional to $1 - 1/S$, and no returns on the pay-date.

This theory is rejected as an explanation for my results. Announcement returns are positive, on average, and pay-date returns are negative. Consistent with my results, the theory predicts positive ex-date returns, but the magnitude is inconsistent: the theory predicts that prices should recover to the preannouncement level. In contrast, post-ex-date prices are well above announcement levels. The magnitude of returns also seems inconsistent with the prices of restricted stock in the United States, documented by Silber (1991).¹⁵ Finally, the theory has trouble with the finding that returns are related to the interaction of trading intensity and the inverse split ratio: under the illiquidity discount hypothesis, the illiquidity of a trader's position is solely determined by the split ratio, and should not depend on the trading intensity of other investors.

To summarize, there are several reasonable explanations of announcement returns that do not rely on the mechanism that I develop in this paper. And the true explanation for returns around the announcement most likely involves some

¹⁵ While Silber (1991) documents prices depressed by as much as 30%, it is important to point out that the shares in his sample are locked up for substantially longer periods (a year or two, compared with 4 to 6 weeks for the stock splits in Japan).

Table 7
Equity issuance around stock splits

	<i>N</i>	Before event	After event	After – before	<i>t</i>
Panel A: full sample					
All splits	2,092	0.07	0.12	0.05	[5.14]
Matched sample	2,092	0.04	0.06	0.02	[3.07]
Difference	2,092	0.02	0.07	0.04	[3.79]
Panel B: split ratio =2 (<i>k</i> = 0.5)					
Splits (ratio =2)	650	0.10	0.19	0.09	[4.31]
Matched sample	650	0.04	0.09	0.04	[3.59]
Difference	650	0.06	0.13	0.07	[2.91]

This table describes equity issuance activity around stock splits. In Panel A, the measure of equity issuance is binary, taking a value of 1 if the firm issued equity during the period in question, and zero otherwise. Equity issuance is inferred from changes in split-adjusted shares outstanding. The table shows the percentage of firms that issued equity 100 days before a split announcement, as a fraction of all firms announcing splits. The second column shows the fraction of firms that issued equity within 100 days after the split announcement, as a fraction of all firms announcing splits. The matched sample describes equity issuance over the same intervals for a group of firms matched by size and past stock return, but that did not split. The panel also shows these same results, together with the corresponding matched sample, for the firms executing splits with a split ratio of 2-for-1 or greater. *t*-statistics are in brackets and are based on an assumption of independence across observations.

combination of these theories. However, all of the alternative explanations have trouble with the high returns around the ex-date followed by the low returns around the pay-date. And none of the alternative theories have predictions related to the cross-sectional results in Table 5 and 6. While it may be interesting to further decompose announcement returns during this unusual period of Japan’s financial history, it takes me away from my current objectives.

4. Evidence for Manipulation

Thus far, the data broadly support my initial conjectures regarding the effects of trading constraints on stock prices. However, the initial hypotheses do not say anything about firms’ motivations to impose the trading restrictions in the first place. This section suggests that trading restrictions imposed by stock splits were a form of market manipulation.

4.1 Issuing equity after split announcement

Other than the increased recognition that might accompany a temporarily higher stock price, the shareholders of a firm (in contrast to its managers) do not benefit unless the firm issues equity. Equity issuance may occur in a seasoned offering, in options grants to employees, or via a stock-financed merger.

Table 7 summarizes equity issuance before and after the announcement of a split. Although I do not have specific data on equity issuance, I can infer it by calculating the change in the split-adjusted number of shares outstanding. When the total shares outstanding increases by 1% or more, I classify it as an issuance of equity. It is reasonable to think of small equity issues (say changes in shares outstanding of 1–5%) as option exercises, and possibly equity conversions of

convertible bonds. Larger equity issues (e.g., greater than 5%) are more likely to be seasoned equity offerings.

Table 7 shows that firms are more likely to issue equity after a stock split announcement than before. Of course, both the split announcement and the sale of equity to the public could be driven by past returns. Thus, for each firm announcing a split, I select a matching firm based on preannouncement stock returns and firm size. For the matched firm, I then ask whether it issued equity in the corresponding periods. The table shows that controlling for these determinants, firms are still more likely to issue equity after announcement of a split than before.

4.2 Convertible bonds and lending out shares

In several of the high-ratio stock splits (100-for-1 and higher), firms issued convertible debt prior to announcing the stock split. The convertible debt, issued in “private” transactions either to the management itself or to friends of the managers, could be converted into old shares during the period between the ex-date and the pay-date at a ratio that was adjusted for the split factor. Thus shares created from the conversion were not subject to the same constraints facing ordinary shareholders, and could be sold immediately. For example, Cima Co. conducted a 101-for-1 stock split with an ex-date of January 26, 2005. On the ex-date, turnover was over 100%, a fact observers credited to bonds that the firm had issued overseas in November 2004 being converted into the old shares. After reaching a peak of ¥116 during the ex-date to pay-date period, the price eventually fell to ¥14 in intraday trading on February 8, 2005. Press reports cite market participants who “believe that the increase in supply was partly behind the sharp drop in share price.”

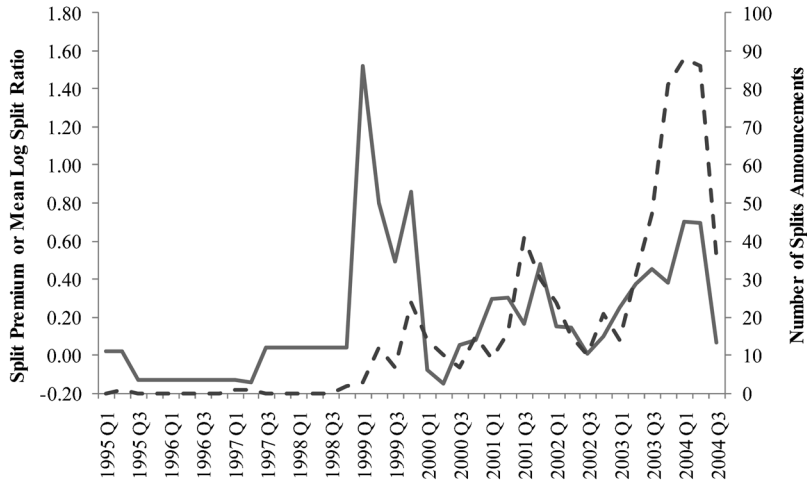
A second and perhaps more obvious way that managers profited from the high split-induced prices was to locate a large block of shares to borrow (which was difficult due to the reduced float), sell them, and return the shares to the owner after the pay-date. Although managers appeared unwilling to go short themselves, perhaps because of fear of exposure, they executed similar transactions in which they were paid high fees for lending out their own shares to speculators, at annualized borrowing costs of several hundred percent. For example, the *Nikkei Report* writes that the president of Moss Institute, an Internet company executing a 100-for-1 stock split, lent out all of his shares (20% of the float) to a trader who sold them short after the ex-date.

By early 2005, some of these transactions started receiving unfavorable media coverage, possibly leading to the later change in exchange rules.

4.3 More splitting at higher ratios

In the aggregate time series, the number of splitters and the average split ratio respond to the past returns earned by firms that have split. Thus, the split decision appears to be driven by the potential returns accruing to splitters, rather than more fundamental considerations.

Panel A. Lagged ex-date returns and number of new split announcements



Panel B. Lagged ex-date returns and mean split ratio

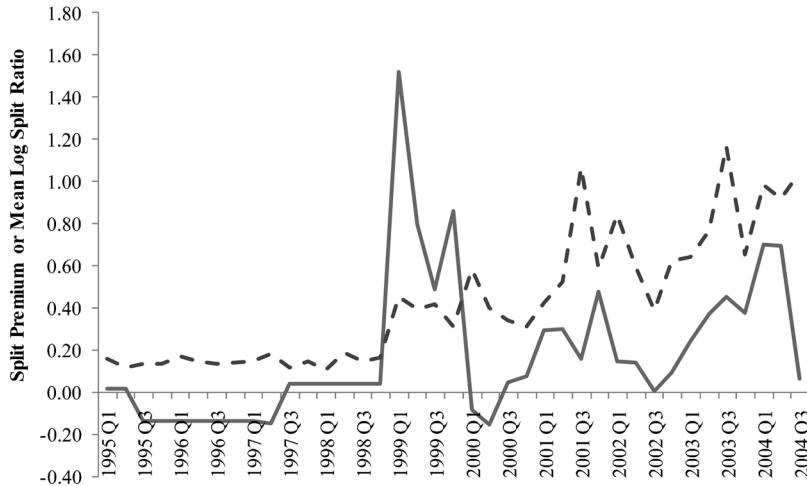


Figure 5
Split premium, the split ratio, and new stock split announcements

Time-series plots of the average split premium, the number of firms announcing splits, and the average log split ratio. In both panels, the solid line shows the average split premium, defined as the mean event return to all stock splits occurring in a quarter, lagged one period. The event return is defined as the cumulative abnormal return between 1 day before the announcement date and ending 5 days after the ex-date. In Panel A, the dotted line shows the number of firms that announce splits during the quarter (although the ex-date may be in the following quarter). In Panel B, the dotted line shows the average log split ratio of firms announcing splits in that quarter.

Panel A of Figure 5 plots (lagged) equal-weighted average event returns and the number of new split announcements, in calendar time. Both series are aggregated at the quarterly level, with event returns calculated as before. The number of split announcements shows a loose positive correlation with the

Table 8
Corporate responses to the split premium

	$Y = N_{\text{Ratio} \geq 2}$	$Y = \Delta N_{\text{Ratio} \geq 2}$	$Y = N_{\text{Ratio} \geq 2} / N_{\text{All}}$	$Y = \log(\text{Ratio})$
<i>a</i>	10.97 [2.81]	-0.63 [-0.29]	0.25 [4.73]	0.36 [6.87]
<i>b</i>	29.29 [3.05]	8.22 [1.46]	0.36 [2.75]	0.37 [2.81]
<i>N</i>	40	40	40	40
<i>R</i> ²	0.20	0.05	0.17	0.18

Time-series regressions of the number of firms announcing stock splits with ratios greater than or equal to 2-for-1 in a particular quarter on the average event return accruing to firms that split in the previous quarter: $Y = a + b\bar{R}_{\text{Event},t-1} + u_t$. A firm is defined to have split in quarter t if its ex-date falls before the end of the quarter. The dependent variable is alternately the number of firms announcing splits greater than 2-for-1, the change in this number from the previous quarter, the share of firms announcing splits greater than 2-for-1 as a fraction of all stock splits in that quarter, or the average of the log split ratio in that quarter. The event return is the cumulative abnormal return between 1 day before the announcement date and ending 5 days after the ex-date. t -statistics are in brackets and are based on an assumption of independence across observations.

lagged return on splits. This can be interpreted quite simply: when the returns on stock splits are observed to be high, more firms split in an effort to increase stock price.

Panel B of Figure 5 plots the time series of (lagged) average event returns together with the average log split ratio in that quarter. The average log split ratio shows a strong positive correlation with lagged event returns, consistent with the intuition that firms observing high returns to splits decide to split in higher ratios themselves.

To examine these claims more carefully, Table 8 shows the results of time-series regressions of the number of firms announcing stock splits with ratios greater than or equal to 2-for-1 in a particular quarter, on the average abnormal return accruing to firms that split in the previous quarter:

$$N_{\text{Ratio} \geq 2,t} = a + b\bar{R}_{\text{Event},t-1} + u_t. \quad (10)$$

The first column shows these results. The data show a significant positive relationship between the number of split announcements and lagged returns accruing to stock splits.

The next regression looks at the determinants of *changes* in the number of firms announcing stock splits, $\Delta N_{\text{Ratio} \geq 2,t}$. Again, Table 8 shows a positive correlation between this variable and average event returns in the previous quarter. Finally, the third specification scales the number of splits with ratios greater than or equal to 2 by the total number of splits (including splits with ratios of 1.1-for-1, for example) in that quarter. In the last specification, I show the relationship between the average log split ratio and the returns to splits in the previous quarter. Consistent with the idea that firms begin to associate higher

split ratios with high event returns, the table documents a positive relationship between these two variables.

4.4 Regulatory responses to the manipulation

By early 2005, several large stock splits had generated complaints from smaller investors. Traders blamed a system in which “a handful of investors are able to reap big profits by selling borrowed shares at a high level and buying them back at a lower level, and in which some large shareholders are able to make money by lending shares. This all comes at the expense of average investors, who as usual are kept in the dark” (Nikkei Report, 2005a). Following an investigation by regulators, on March 5, 2005, the TSE announced that it would discourage stock splits in which the split ratio exceeded 5-for-1, additionally asking firms to refrain from carrying out stock splits soon after issuing convertible bonds. According to the TSE, the purpose of the new guidelines was to “increase the transparency of stock trading” (Nikkei Report, 2005b). The Osaka Securities Exchange and the small cap JASDAQ Securities Exchange eventually joined the TSE in issuing similar guidelines.

In addition to the actions undertaken by the exchanges, in early March 2005, Japanese securities companies announced that they would make it possible for investors to immediately trade the new shares created through stock splits. Under this proposal, securities firms and banks that use the Japan Securities Depository Center would electronically add the number of shares issued because of a split to investor accounts, enabling investors to trade shares the following business day. As a result, the TSE announced that “issues arising from imbalances between demand and supply during the period up to the issuance of new share certificates are expected to be almost completely addressed and resolved” (Tokyo Stock Exchange, 2006).

5. Conclusion

This paper exploits an unusual institutional mechanism for executing stock splits in Japan to understand the effects of trading restrictions on stock prices. Because new postsplit shares are not distributed until several weeks after the ex-date of the split, investors can sell only a fraction of their holdings after the ex-date. The higher the split ratio, the larger the forward position that investors must hold. The constraint is relieved on the pay-date, when shareholders can once again trade both old and new shares.

I develop the hypothesis that trading restrictions steepen the investor demand curve. The restrictions have the effect of removing potential liquidity suppliers from the market. The greater the desire of investors to trade during the restricted period, the larger the impact of the restrictions, and the higher the prices. This intuition suggests that event returns should be positively related to the degree of trading restrictions, the measures of trading volume, and the interaction

between the restrictions and trading volume. Returns should be positive when the constraints are imposed, and negative when the constraints are relieved.

In the data, prices rise significantly around both the announcement date and the ex-date, and fall on the pay-date. Ex-date returns are positively related to the split ratio, to measures of past trading volume, and their interaction. Pay-date returns, which are significantly negative, are proportional to the split ratio, to measures of past trading volume, and to the interaction of these terms. Thus, the data broadly confirm that the mechanism by which prices increase operates through the slope of the investor demand curve. Several alternative explanations have some success in accounting for announcement-period returns, but are unable to account for the complete pattern of prices observed on the pay-date and ex-date.

The results are broadly consistent with the view that firms may try to constrain their investors from trading in an effort to manipulate the stock price. When restrictions are successful at raising prices, firms may use the restricted period to raise equity, or managers may exploit the opportunity to sell overpriced shares. In Japan, there is considerable evidence that the unusual stock split mechanism was exploited by firms to raise capital cheaply and to enrich managers.

Although the trading restrictions described in this paper are extreme—and probably would be illegal in the United States—more benign versions occur regularly in day-to-day capital markets. Many firms list only a small fraction of their shares outstanding at IPO, constraining the remainder of their investors from trading. Other firms may offer equity at a discount to private parties, under the condition that they not be allowed to sell until the shares are registered. During these times, prices should be more sensitive to trading.

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