FLOAT MANIPULATION AND STOCK PRICES*

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Abstract

Firms can manipulate their stock price by restricting the tradable float. When risk averse investors have differences of opinion and are short-sale constrained, reductions in the float freeze out pessimistic investors, pushing up prices. When the float is released, prices fall. To formally test this idea, I examine a series of corporate events in Japan in which firms actively reduced their float between 0.1 and 99.9 percent for periods of one to three months. Consistent with the theory, (a) prices rise when the float is contracted and fall when the float is released, and (b) returns are cross-sectionally related to the reduction in float. Firms are more likely to issue equity or redeem convertible debt during the period when float is low, suggesting strong incentives for manipulation. More generally, the results may explain why several pricing anomalies are associated with low float.

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I. Introduction

Can firms increase their stock price by constraining the ability of investors to trade? A growing literature in finance suggests that impediments to trading, or limits-to-arbitrage, can allow prices to deviate significantly from fundamentals, often for sustained periods. These papers argue that among other things, noise trader risk (De Long, Shleifer, Summers, Waldmann, 1990), short-sales constraints (e.g., D'Avolio, 2002; Lamont and Jones, 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 bringing prices back to fundamentals. In this paper, I show that firms can influence stock price by reducing the float, the number of shares available to trade. The idea that float can influence asset prices rests on a few simple assumptions. When risk averse investors have different opinions about the value of an asset and face short-sale constraints, theory suggests that prices are set by the valuations of bullish investors (e.g., Miller, 1977; Chen, Hong and Stein, 2002). Under these conditions, the most pessimistic investors do not participate in the market. If the float is then reduced, more pessimistic investors are frozen out of the market, and the price is set by only the most bullish investors. For example, in the extreme case in which the float is reduced to zero and investors are unable to go short, the price is determined by the valuation of the most optimistic investor. In general, however, the more binding are the short-sale constraints to start, or the greater are the differences of opinion about the value of the asset, the larger are the effects of changes in the float on asset prices.

[1] See also Chen, Hong, and Stein (2002), Duffie, Garleanu, and Pedersen (2002), Nagel (2005), on the effects of short-sales constraints.

This idea that float can be manipulated to affect price applies in a variety of settings, but arises most obviously in initial public offerings, 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, sometimes releasing a part of the float after a short lockup period (e.g., Hong, Scheinkman and Xiong, 2005). Are these cases of active float manipulation? The incentives to achieve a high equity price around the time of offering are obvious. Perhaps because of this, the NYSE, the NASDAQ, and the American Stock Exchange all set minimum standards for average monthly trading volume and market capitalization of publicly traded shares, thereby reducing the ability of firms to list with a limited float. Notwithstanding exchange regulations, several firms have staged offerings with only a small fraction of their shares available for trade. A float of less than ten percent of outstanding shares, for example, may explain the price commanded by Google in its recent IPO.[2]

Float manipulation arises in a different form in equity carveouts, in which a parent company states its intention to spin off the remaining shares of a subsidiary, but first allows only a small portion of these shares to be traded by the public. Lamont and Thaler (2004) identify several cases of the subsidiary, which trades with a low float, being overpriced. Consistent with the intuition that expanding the float reduces mispricing, the apparent arbitrage disappears as the distribution date approaches.

In this paper, I present a simple model of float manipulation which I then analyze using 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

[2] Standard and Poors reports that as of May 2005, the tradable float of Google was 8.9%.

10-for-1 in the last quarter of 2004.[3] Figure 1 shows that cumulative abnormal event returns associated with the announcement and execution of a stock split grew from approximately zero to over 30 percent during the same interval, with some splits earning abnormal returns of several hundred percent.

To see how the abnormal returns accruing around stock splits relate to float manipulation, consider the unusual institutional arrangement in Japan, in which new *post-split shares* are not distributed to shareholders until several weeks *after* the ex-date of the split. 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 two 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 twenty 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. This restriction would not matter if there were a well-functioning "when-issued" market that allowed investors to trade their forward claims, as in the United Kingdom.[4] Thus the effective float fell by approximately 95 (=20/21) percent. Not surprisingly, volume fell dramatically during this time. On September 19, investors received the new shares and the distinction between old and new shares disappeared. On this day, investors could, if they chose to, liquidate their forward positions. The price of Nikkyu fell by over thirty percent with respect to its peak in the ex-date-to-pay-date period.

[3] These figures correspond to splits *announced* in the first quarter of 1995 and the last quarter of 2004. Effective dates for split are typically within one or two months of the announcement.
[4] When-issued markets for rights issues are active in the United Kingdom. When-issued trading of post-stock split shares also occurs in the United States before the ex-date. See Nayar and Rozeff (2001), Vijh (1994), and Choi and Strong (1983) for descriptions of the when-issued market.

I use a series of over 2000 stock split events as a form of natural experiment to understand the consequences of float manipulation for stock prices. The float manipulation occurring in a split is straightforward: Investors who decide after the ex-date that the stock is overpriced can only act on this view insofar as they can sell their old holdings, and must wait until the pay-date to sell the new shares. Of course, positions in the new shares could be offset if investors took short positions in the old shares. These short positions could then be closed by delivering the new shares on the pay-date.[5] 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 more difficult as the float is reduced.[6] Thus, as long as most investors do not completely offset their effective long forward positions in the new shares with short positions in the old ones, the float reduction creates a temporary short-sale constraint. The higher is the split ratio, the higher is the fraction of the ex-date holdings that investors must hold through the pay-date, and the more binding is the constraint.

To understand the specific mechanism by which the stock split acts as an example of float reduction, I lay out a simple model. The model establishes the conditions under which changes in the tradable float affect asset prices. More importantly, the model acts as a vehicle for interpreting the data, developing testable predictions on the relation between returns, the split ratio, and differences of opinion. There are two main ingredients. First, there is a set of risk averse traders who differ in their assessment of the economic consequences that the split has for the fundamental value of the firm. Second, by temporarily reducing the float, the split imposes an

[5] Although theoretically possible, this trade is difficult to execute in large size, because one must find a party willing to lend a large block of shares.

[6] When the float is reduced by 90%, for example, the dollar value of the tradable holdings of large investors also falls by 90%. Thus even if an investor were to borrow from a large shareholder, it would be difficult to amass a large short position.

effective short-sale constraint on bearish investors. The higher is the split ratio, the greater is the share of each investor's holdings that cannot be sold until the pay-date, and thus the more binding is the effective short-sale constraint. The model predicts that split event returns should be positively related to the split ratio, a measure of the reduction in the float. Second, the model predicts that returns should be positively related to the amount of disagreement over the economic consequences of the split. Third, returns should be related to the interaction between differences of opinion and the split ratio. Put simply, a reduction of the float increases prices more when differences of opinion are high. Fourth, all three of the above relations hold with opposite sign when applied to the returns occurring around the pay date, the time when the new shares are released. This inverse relationship arises because the relief of the short-sale constraint allows bearish investors to sell their holdings, at which time prices fall.

Consistent with the model, event returns (returns between the announcement and a few days after the ex-date) are significantly positive, and strongly positively correlated with the split ratio, as well as being positively related to a measure of divergence of opinion. Pay-date returns, however, are negative on average, and additionally bear a strong negative correlation with the split ratio. The dual relationships between event returns and the split ratio, and pay-date returns and the split ratio, rule out explanations that are based solely on the split conveying information about fundamentals.[7] Such explanations say that the announcement of the stock split acts as a signal of future earnings or dividends, thus predicting stock returns on announcement of the split only.

The main empirical tests confirm the predictions of the model concerning the relationship between returns and the split ratio, thus establishing that changes in the float have consequences

[7] See Nayak and Nagpurnanad (2001), Asquith, Healy and Palepu (1989), Amihud, Mendelson and Uno (1999), Grinblatt, Masulis, and Titman (1984), Lamoureux and Poon (1987), Desai and Jain (1997).

for asset prices. However, these 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 the (a) the number and timing of the events, and (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, and (d) press reports of abnormally high convertible bond redemptions, and (e) press 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. Interpreted in this way, the entire series of events can be viewed from the broader lens of firms balancing the costs and benefits of market manipulation. Of course, while the specific mechanism used to manipulate the float is specific to Japan (and would probably be illegal in the United States), the episode is consistent with growing empirical evidence that firms attempt to exploit market inefficiencies to reduce their cost of capital.

Consistent with my interpretation that the wave of stock splits has been a form of market manipulation, it is not surprising that regulators have taken a dim view of the entire stock split phenomenon. In a few cases, particularly high ratio splits have been forced to distribute the shares immediately.[8] 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. These high ratio splits would only be allowed with special permission from the exchange. The exchange explained that the new guidelines were meant to increase market transparency. In addition, the TSE seems to have recognized that firms have used the splits to lower the cost of issuing new securities: in its new guidelines, it discouraged stock splits within six months of convertible bond issuance.

[8] 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 effective date and distribute their new shares to these investors, in time to restart trading one week later.

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 split bubble in Japan. First, they show that firms have incentives to limit the float when differences of opinion are high. It is not surprising, therefore, that young firms may try to limit their float following IPO (Ofek and Richardson, 2004), or that the dramatic expansion of float in early 2000 has been credited for the collapse of the internet bubble (Hong, Scheinkman and Xiong, 2005). Indeed, concerns about limited float have prompted several large stock index companies to redefine their indices as “float weighted.” More generally, the results may help explain why many apparent mispricings—IPOs and carveouts, to name two-- are associated with low float. Second, and perhaps more generally, the paper shows that supply shifts in the shorting market can have significant effects on asset prices. In this respect, the results differ from Cohen, Diether, and Malloy (2005), who argue that decreases in “shorting supply” play only a minor role in determining stock prices.

The paper is organized in two parts. The first part describes the mechanism by which float manipulation affects asset prices (Section II), provides a historical overview of the split bubble (Section III), and tests the main hypotheses suggested by the theory (Section IV). The second part of the paper (Section V) shows that the changes in float resulting from stock splits are a form of market manipulation. Section VI concludes.

II. A model of float manipulation in a stock split

This section outlines the mechanism by which the distribution of new shares from stock splits in Japan cause a reduction in the float, and derives the basic relationship between float reduction and stock returns. The basic setup modifies an approach taken by Chen, Hong, and Stein (2002) to study the effects of breadth of ownership on expected stock returns. The essence of the model is quite simple: by reducing the float for a short amount of time, stock splits exacerbate short-sale constraints on bearish investors. When investors disagree about the cash flow consequences of the split, the greater is the split ratio, the higher is the post-split price. When the new shares are distributed, the short-sale constraints are partially relieved and prices fall.

A. Setup

The model has four periods, 0, 1, 2, and 3. There is a single risky asset in fixed positive supply of one share which pays a liquidating dividend of $D = F + \varepsilon$ in period 3, where F is the fundamental and ε, the noise term, is normally distributed with mean of zero and variance one.

A continuum of risk averse traders with CARA utility and risk tolerance γ operate in the capital market. They are present in total mass of one. When not subject to short-sale constraints, which I clarify below, their demand for the risky security is given by $\gamma(V_i - P)$, where V_i denotes trader i's private expectation of the fundamental F.

The chronology is as follows. At time 0, all agents correctly assess the expectation of the liquidating dividend $E(D)=F$. Equating total demand with total supply of one, the equilibrium price is given by

$$P_0 = F - 1/\gamma \tag{1}$$

Between period 0 and period 1, a split of ratio $S \geq 1$ is unexpectedly announced and becomes effective immediately (i.e., the ex-date falls between period 0 and period 1). The total number of shares rises to *S*, with each new share now representing a claim on the liquidating cash flow of $(F+\varepsilon)/S$.

Holding everything else constant, if the new shares were immediately distributed to period 0 shareholders, the equilibrium price would fall by a factor of *S* and event returns would be zero. However, the model considers the case in which the single outstanding share converts to a new share immediately, while the remaining *S-1* new shares are distributed on the pay-date, which falls between period 1 and period 2. Thus a shareholder who owns one share at the end of period 0 now has a position of 1 new share and a forward position of *S-1* new shares.

Traders disagree about the information that the split conveys about the dividend *D*. Specifically, I assume that traders receive a signal θ about a change in the expected dividend arising from information conveyed by the stock split, which is distributed uniformly on the interval [-*H, H*]. Thus on a new *per-share* basis, beliefs about the period 3 dividend are distributed uniformly on the interval $\left[\frac{F-H}{S}, \frac{F+H}{S}\right]$. Thus, on average the announcement of the split is assumed to convey no information, an assumption made for simplicity only.[9]

A short-sale constraint arises because there is no functional difference between the old shares and the new shares, except that the new shares cannot be sold until they are distributed. This constraint could be offset if traders were allowed to hold negative positions (ie, sell short) in the old shares, thereby offsetting their positive forward positions. In the model however, I make the simplifying assumption that shareholders are unable to execute this transaction.[10] The period 1 demand schedule of investor *i* is given by

[9] In the empirical part of the paper, I discuss whether one can reject this model in favor of one in which the split announcement conveys information about the quality of the firm or about future dividends.
[10] The no short-sale assumption is realistic for most retail investors and mutual funds. The results do not change if I allow for a second group of unconstrained traders; however, the algebra is complicated slightly. In practice, it was difficult to locate enough shares available to borrow to create a large short position.

$$D = Max[(S-1)Q_{i0}, S^2\gamma(V_i - P)] \tag{2}$$

where Q_{i0} denotes the period 0 holdings of trader i. Equation (2) says that even if trader i sells her current holdings of the new shares Q_{i0}, she must hold her forward position $(S\text{-}1)Q_{i0}$. Note that the multiplier on (V_i-P) has grown by a factor of S^2 because of the per-share reduction in variance of the terminal dividend.[11]

If the short-sale constraint above does not bind for a single investor, then period 1 prices are given by equation (1), times $1/S$ to adjust for the split. If the short-sale constraint binds, however, total security demand Q_1^D is the sum of demand by the constrained traders and demand by the unconstrained traders

$$Q_1^D = \frac{S}{2H}\int_{\frac{F-H}{S}}^{P+\frac{S-1}{\gamma S^2}} (S-1)dV_i + \frac{S}{2H}\int_{P+\frac{S-1}{\gamma S^2}}^{\frac{F+H}{S}} S^2\gamma(V_i - P)dV_i \tag{3}$$

Equation (3) holds only if the price exceeds the valuation of the most pessimistic trader. Integrating and setting total demand equal to total supply S yields the following expression for the constrained price P_1 at the end of period 1

$$P_1 = \frac{1}{S}\left[F + H - \frac{1-1/S}{\gamma} - 2\sqrt{\frac{H}{\gamma S}}\right] \tag{4}$$

Note that this price is expressed in post-split units. For the purposes of calculating returns, it is useful to define the adjusted price P_1^A as S times the unadjusted price in (4),

$$P_1^A = F + H - \frac{1-1/S}{\gamma} - 2\sqrt{\frac{H}{\gamma S}}\,. \tag{5}$$

The period 1 adjusted price has a number of intuitive properties. First, when the equilibrium conditions hold (see Appendix), adjusted price is increasing in S, the split ratio. Second, price is

[11] In CARA models, security demand is inversely proportional to variance.

increasing in H, the degree of disagreement over the economic significance of the stock split. This is similar to the conclusions drawn by Miller (1977) and Chen, Hong and Stein (2002).

Between period 1 and period 2, the new shares are distributed, and the short-sales constraints of the bearish investors are relieved, as they are now able to liquidate what was a forward position in the new shares. However, I assume that they are still subject to a general short-sale constraint.[12] Their Period 2 security demand is given by Max[0, $\gamma S^2(V_i-P_2)$]. Summing the demands of the constrained and unconstrained investors yields period 2 security demand

$$Q_2^D = \frac{S}{2H}\int_P^{\frac{F+H}{S}} \gamma S^2 (V_i - P_2) dV_i \tag{6}$$

Imposing market clearing and solving yields the unadjusted period 2 price

$$P_2 = \frac{1}{S}\left[F + H - 2\sqrt{\frac{H}{\gamma}} \right] \tag{7}$$

Which gives the period 2 split adjusted price P_2^A

$$P_2^A = F + H - 2\sqrt{\frac{H}{\gamma}}\ . \tag{8}$$

I define the *event return* as the change in split adjusted price between period 0 and period 1, and the *pay-date return* as the change in split adjusted price between period 1 and period 2. Under general conditions, it is straightforward to prove the following propositions

Proposition 1. The event return $(P_1^A - P_0)$ is increasing in both the split ratio *S,* disagreement *H*, and their interaction.

$$\frac{d(P_1^C - P_0)}{dS} > 0\,;\ \frac{d(P_1^C - P_0)}{dH} > 0; \frac{d^2(P_1^C - P_0)}{dHdS} > 0. \tag{9}$$

[12] A simpler assumption would be to assume that they are now unconstrained, as in the initial period. In this case, pay-date returns are simply the negative ex-date returns, and all of the comparative statics go through. The only benefit of having the constraint in period 2 is that it allows prices to remain higher after the split.

Proposition 2. The pay-date return ($P_2^A - P_1^A$) is decreasing in both the split ratio *S*, disagreement *H*, and their interaction.

$$\frac{d(P_2^A - P_1^A)}{dS} < 0\,;\ \frac{d(P_2^A - P_1^A)}{dH} < 0\,;\frac{d^2(P_2^A - P_1^A)}{dHdS} < 0. \tag{10}$$

For the empirical work, I find it convenient to define the increasing concave transformation of the split ratio *K=1-1/S*, where *K* denotes the percentage reduction in the float. It is straightforward to show that Proposition 1 and Proposition 2 also hold substituting *K* for *S*. This transformation solves the problem that as *S* gets large, that changes in *S* have less effect on the float (ie, a 5-for-1 split reduces the float by 80 percent, while a 10-for-1 split reduces the float by 90 percent, only 10 percent more). A similar transformation with intuitive appeal is the log of the split ratio.

B. Discussion

The purpose of the model is to relate returns between the ex-date and the pay-date, and after the pay-date, to the split ratio *S* and a measure of differences of opinion about the economic consequences of the split. In doing so, it has abstracted away from strategic interactions between different groups of traders, as well as the behavior of prices between the *announcement* of the split and the effective date. Indeed, intuition dictates that rational traders who anticipate the interactions given in the model would attempt to buy in advance of the split and dump shares just prior to the pay-date. Consistent with that, in the data several of the high split ratio events show declines in price after the effective date but well before the pay-date.

Several features of the model deserve comment. First, it is important not to mistake changes in float for changes in the supply or demand for shares. Because of risk aversion, shocks to supply or demand for shares affect prices in the model even if there is no disagreement over fundamentals. However, in the case in which there is no disagreement (or other reason for investors to trade), shocks to the float do not affect prices. Float only affects prices if parties who wanted to hold the stock before the reduction in float, but now want to sell, cannot sell. In this way, reductions in float amplify the effect of trading activity in the stock.

Second, by specifying no disagreement in the initial period, the model ensures that the price at the end of period 2 (after split shares are distributed) is higher than the price before the split is announced in period 0. This is consistent with the intuition that any event, split or otherwise, that increases disagreement about the prospects of the firm, is likely to increase prices when there are short-sales constraints. However, sacrificing simplicity, one could alter this assumption to say that disagreement does exist prior to the split, but that it is enhanced (H increases) when the split is announced.

Third, the model suggests that both disagreement H and the split factor S should be positively related to ex-date returns, and negatively related to pay-date returns. However, it will be difficult empirically to isolate the effects of each variable if unobserved H and observed S are positively correlated in the data. Put differently, disagreement over the economic implications of a split may be higher when the split ratio is high, as some agents may view the high split ratio as a strong signal of economic prospects. This concern is alleviated somewhat if one chooses ex-ante measures of disagreement (measured before the split), such as trading volume before announcement, but in practice these are unlikely to be good instruments. More importantly, other papers have focused on understanding the link between disagreement and stock returns (e.g., Chen, Hong and Stein (2002)). Although I experiment with various proxies for disagreement, the innovation in the current paper is that I have a particularly clean measure of float reduction.

Fourth, when taking the model to the data, it should be noted that due to significant cross-holdings and bank ownership of firms, many firms executing stock splits have low tradable float to start with. Unfortunately, I am not able to obtain measures of the pre-event float. However, it is easy to see that the basic mechanism outlined by the model should work in the same way for these firms. Put simply, the percentage change in float depends only on the split factor.

III. The Split Bubble

While stock splits have long been common in Japan, they historically bore little resemblance to the higher ratio (3-for-2, 2-for-1, and 3-for-1) stock splits occurring on a regular basis in the United States. Specifically, before 1999, over 95 percent of splits executed in Japan were in ratios of 1.3-for-1 or less. In the United States, these low ratio stock splits might have been called stock dividends; in Japan they are known as *Musho-koufu* and were intended to keep dividend per share ratios constant following unexpected positive shocks to cash flow. For the most part, 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 ¥1100 to above ¥2500, then fell to below ¥700 before rising again to over ¥1400 in 2003. Thus, at least for *Nagano Keiki*, the split decision appears unrelated to current stock price. This can be contrasted with splits in the United States, where price is an important determinant of the split decision (Lakonishok and Lev, 1987).

Press accounts of stock splits in Japan during the mid to late 1990s state that stock splits are perceived as an attempt to maintain a constant dividend-per-share or earnings-per-share ratio.

Thus, unexpected announcements of stock splits were perceived as positive signals for firms' stock price. In the specific case of *Nagano Keiki*, the average abnormal announcement return for these five splits was approximately 3 percent. In general, these small stock splits resulted in small positive abnormal announcement returns.

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 extremely rare prior to 1999. This was for several reasons. First, exchange rules fixed commissions on small trades. This meant that low priced stocks were proportionately more expensive to trade, thus firms lacked incentives to reduce prices via split. Second, Japanese Commercial Law required net assets per share to remain above 50,000 yen 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 Tokyo Stock Exchange 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 percent. Around the same time, some firms began to split at higher ratios, with the stated intention to "improve liquidity" and "attract small investors", who had only recently become an important class of investors. Second, the law requiring net assets per share to remain above 50,000 yen was repealed in 2001, allowing firms to split to much lower prices.

Starting in 2000 and 2001, the rate of announcement of small stock splits (ratios less than 2) declined, while the rate of execution of larger stock splits (ratios greater than or equal to 2) increased rapidly. Figure 2 shows that the number of firms announcing splits with ratios between

2 and 3 increased from 3 in the period 1995-1996 to 98 in the period 2001-2002, then again to 219 in the period 2003-2004.

Data

To start my analysis, I collect data on every split announced in Japan between January 1995 and April 1, 2005, merging information from three sources. The bulk of the observations are from Bloomberg, which lists the split ratio, announcement date, the ex-date, and the pay-date. Prior to 1997, announcement dates contain some errors, and I fix these by looking them up manually. 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 complete by the time of writing, the final database contains 2,122 stock splits, announced between January 5, 1995, and April 1, 2005.[13] The median market capitalization for a splitting firm is approximately ¥ 24 billion (about US$ 240 million), and the mean is ¥ 122 billion (about US$ 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. Each split was matched with unadjusted prices, returns, dividends, and volume data for the entire period.

Table 1 summarizes the basic data. The median split ratio for the full sample is 1.20, with a standard deviation of 49.23. The low median is already evident from Figure 2 – recall that low split ratios were common during the late 1990s. The mean split ratio is 3.53, much higher

[13] 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.

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.

The table 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 likely explained by the time required to print new share certificates for ex-date holders. The table also shows that the average pre-split log price is about 9. I report the log instead of the level because of the significant variation in unadjusted prices in Japan. For example, on April 1, 2005, approximately the same number of firms on the Tokyo Stock Exchange had prices below 200 yen (~ US$ 2) as the number that had prices above 100,000 yen (~ US$ 1000).

The table also summarizes returns and turnover during the event window. Firms exhibit positive abnormal returns before splitting, on average, of 31 percent. Both announcement and ex-date abnormal returns are positive, with median abnormal returns over the entire event period (the day before announcement to five days after the ex-date) of 6 percent. Returns around the pay-date are negative, on average.

Panel B of the table 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 takeaway from Panel B is that the higher split ratio observations do not differ substantially the remainder of the sample along the dimension of market capitalization. Larger split ratio firms do, however, tend to have higher pre-split average turnover and higher pre-split prices. Announcement and ex-date returns are substantially higher, while returns around the pay-date period are more negative.

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 the value-weighted TOPIX index R_{mt}[14]

$$AR_{it} = R_{it} - R_{mt} \tag{11}$$

In the top panel, returns start one day before the announcement of the splits and end ten days after. In the bottom panel, returns start one day before the ex-date and end ten 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 announcement period abnormal returns are approximately 6 percent, and effective date abnormal returns average approximately 5 percent.

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, announcement abnormal returns are low (about 2.5 percent) 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 percent. This pattern is repeated for the effective date returns. Between 1995 and 1999, abnormal returns around the effective date are insignificantly different from zero. Between 2000 and 2005, they are approximately 9 percent.

[14] The magnitude of the findings in Table 2 and Table 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 and Gompers (2000)

The remaining panels show that the distinction between the early and late samples is not as meaningful as the distinction between low and high split ratios. Low ratio splits earn announcement returns of 3 percent, compared with over 17 percent for high ratio splits. More strikingly, low ratio splits earn effective day returns insignificantly different from zero, while high ratio firms earn over 31 percent.

Table 3 summarizes abnormal returns around the pay-date, calculated the same way as above. Recall that on the pay-date, the float is released as shareholders 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 ten days before the pay-date and ending ten days after the pay-date are negative three percent. In the early sample from 1995 to 1999, pay-date returns are slightly lower in magnitude, while in the late sample, they are slightly higher. As in the previous table, the important distinction turns out to be between low- and high-ratio splits. Low ratio splits have no returns associated with the pay-date, while high ratio splits have pay-date returns of a stunning negative 16 percent.

IV. Empirical Results

This section performs the basic tests of the model. I begin with an analysis of trading volume during the event period. I then verify the model's predictions on the relation between ex-date returns and the split ratio and disagreement. Next, I verify the predictions on the relation between pay-date returns, the split ratio, and disagreement. Finally, I ask whether the results might be better explained by alternative theories.

Trading volume

The primary assumption of the model is that by reducing the tradeable float of shares, stock splits restrict the ability of bearish investors to sell. In theory, as the split ratio becomes very large, it becomes virtually impossible for a shareholder to sell all but a small fraction of her claim on the firm. It seems reasonable that for extremely high ratio splits (say 100-for-1 or more), that small shareholders would not sell *any* shares, even at overvaluation of several hundred percent, because the benefits of selling at a high price would be offset by transactions costs. Therefore, the prediction for trading volume is that it declines in the period between the ex-date and the pay-date, increasing after that.

To look at this prediction, 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 percent level to remove extreme outliers.

Consistent with the assumptions of the model, the figure 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.

It is worth commenting on three additional feature of Figure 3. 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. Although this behavior is not present in the model, it is consistent with models in which arbitrageurs sell in advance of liquidations by other traders (eg, Brunnermeier and Pedersen, 2005).[15]

[15] Unlike the Brunnermeier and Petersen (2005) model, however, it seems unlikely that the smart-money has any role in accelerating liquidations by other traders.

Second, the figure shows that higher ratio stock splits tend to be higher turnover stocks to start with. The high turnover may arise because these stocks have high levels of disagreement over fundamentals. Alternatively, the turnover may arise because these stocks were already heavily traded 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, the figure shows an increase in turnover between the announcement and the ex-date, with larger increases for larger split ratios. Again, the model leaves out this period, but it is clear 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 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. I then run univariate regressions of abnormal turnover during the announcement, ex-date, and pay-date periods $V_i - \overline{V}_i$ on the log of the split ratio S

$$V_{it} - \overline{V}_i = a + bS + u_{it} \tag{12}$$

Panel A shows results for abnormal announcement period turnover, while Panel B shows results for turnover between the ex-date and pay-date. Announcement period volume is positively related to the split ratio. This holds both for the full sample and for the subsample that includes only observations for which the split ratio was greater than or equal to 2. Consistent with the assumptions of the model, abnormal volume between the ex-date and pay-date is negatively related to the split ratio.

Announcement and Ex-date returns

The model predicts that returns around the split should be related to the split ratio and the disagreement over the news that the split imparts for the firm's fundamentals. Figure 4 takes a first look at this prediction. I sort the full sample of stock splits into eight groups according the split ratio. The figure plots the cumulative average abnormal return for the stocks in each group, shown in event time, in the interval starting four days before the announcement and ending 35 days after the ex-date. 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 100 and above, the figure shows average abnormal event returns close to 200 percent. Buy-and-hold abnormal returns for these high ratio stock splits are even higher (not shown).

Table 5 provides the formal test corresponding to the results in Figure 4. Recall that Proposition 1 says that event returns are increasing in the split ratio, disagreement *H,* and the interaction. I estimate

$$R_{it} = a + bS_i + cH_i + dS_iH_i + u_{it} \tag{13}$$

S denotes the percentage float reduction (one minus the reciprocal of the split ratio), as described in Section II. I measure disagreement *H* using either ex-ante or ex-post turnover. 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. Therefore, the first measure of disagreement, H_1, is the average turnover during the 50 days before the announcement of a split. It proxies for the extent to which investors disagreed about the cash flows of the firm in the past. H_1 is an imperfect proxy for disagreement because while it is meant to measure the degree to which the split *creates* disagreement about the fundamentals of the firm, it actually only measures how much investors *already* disagree about the value of the firm. Thus I also calculate an ex-post measure of disagreement H_2, where H_2 is the difference between average daily turnover between the announcement date and ex-date and the average daily turnover during the 50 trading days before the ex-date.

In Panel A, abnormal returns are measured starting one day before the announcement and ending ten days after the ex-date. Estimates from (11) are shown for both the full sample of splits, as well as the subsample of splits with ratios greater than or equal to 2. Split returns have a strong positive relation with the split ratio in both samples.

The table shows that when H is measured as past turnover (ie, $H=H_1$), event returns are positively related to H. Event returns are also positively related to H_2. In both the univariate and multivariate specifications, the results appear stable across low and high split ratios. The last two columns of Panel A show that event returns are related to the interaction of S and H when $H=H_1$ (ex-ante turnover), but not when $H=H_2$ (ex-post turnover).

Panel B repeats the analysis from Panel A on the smaller sample of splits with split ratios greater than or equal to 2. The results appear stronger within this subsample. Panel C and Panel D repeat the analysis from Panel A and Panel B, replacing the return in equation (11) with the 22-day ex-date return. The differences between these panels can help distinguish between a fundamentals-based explanation of the results and the explanation proposed by the model. A fundamentals-based explanation might say that the positive relation between the split ratio and event returns arises because high split ratios are a signal of high future dividends or earnings. To the extent that this is true, however, market efficiency requires that this information should be captured in the announcement return. But the table shows that the relationship between returns and the split ratio exists around the ex-date. Thus, the results hold even if I ignore the announcement period altogether.

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. The model predicts that the returns around the pay-date should be negatively related to the split ratio, and negatively related to the disagreement over the news that the split implies for the firm's fundamentals. Figure 5 looks at this prediction. As before, I sort the full sample of stock splits into eight groups according the split ratio. The figure plots the cumulative average abnormal return for the stocks in each group, shown in event time, in the interval starting twenty days before the pay-date and ending 20 days after the pay-date. For low ratio splits (ratio<1.5), pay-date returns are not distinguishable from zero. As the split ratio increases, abnormal event returns increase quickly. For splits with ratios between 10 and 100, the figure shows average abnormal pay-date period returns of approximately minus forty percent.

In the figure, the dotted line indicates the timing 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 Figure 5. I estimate

$$R_{it} = a + bS_i + cH_i + dS_iH_i + u_{it} \qquad (14)$$

Where R_{it} now denotes the cumulative abnormal return around the pay-date. Results are shown separately for the full-sample and for the subsample of splits for which the ratio was greater than or equal to 2.

Consistent with the model's predictions, pay-date returns are strongly negatively related to the split ratio. Furthermore, using the same measures of investor disagreement as before, there is some evidence that pay-date returns are negatively related to pay-date returns. Also consistent with my predictions, the table shows that pay-date returns are negatively related to the interaction between the float reduction and my proxy for disagreement.

Fundamentals-based explanations of the results

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.[16] Because the splits do not themselves affect a company's cash flows, two broad classes of explanations have been suggested to account for these returns.

The first explanation, proposed by Fama, Fischer, Jensen and Roll (1969), says that the market interprets stock split announcements as good news for future dividends. Consistent with this, they find that firms that split are more likely to experience an increase in dividend in the year after the split. A slightly different explanation, along the same lines, says that the information contained in stock splits relates to earnings rather than dividends. Lakonishok and Lev (1987), McNichols and Dravid (1987), and Asquithy, 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

[16] See Fama (1969), Bar-Yosef and Brown (1977), Charest (1978), Foster and Vickrey (1978), Woolridge (1983), Grinblatt, Masulis, and Titman (1984), and Asquith, Healey and Palepu (1989).

17.44 percent return around announcement to news about fundamentals, but it would be unreasonable to argue the same for the 31.35 percent 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).

The second class of theories says that the value of the underlying security goes up because of an increase in liquidity associated with the split. The liquidity arises because the lower stock price allows liquidity constrained traders to buy the stock. Although this theory is popular in market folklore, evidence in support of it is mixed. Copeland (1979) shows that while the number of shareholders following a split tends to go up, liquidity declines.

Similar to the evidence in the United States, post-split turnover in Japan is significantly lower than before the announcement. However, even if liquidity measured in a different way yielded different results, the predictions with regard to stock returns are similar to the earnings/dividend news theory. That is, if investors expect post-split shares to be more liquid, in an efficient market, the returns should accrue around the announcement only. Thus the results appear inconsistent with both sets of fundamentals-based explanations.

V. Evidence for manipulation

Thus far, the data support the broad conclusions of the model. I have not, however, shown any motivation for these actions. This section uses a variety of measures to show that the reduction in float arising from stock splits was a form of manipulation. To do this, I first ask whether firms or their managers were more likely to sell equity after announcement of a split than before. I then describe two highly publicized ways that managers were able to exploit the reduction in float: First, by lending out large blocks of shares in exchange for fees, and second, by redeeming convertible debt into old shares and selling them to the public. Next, I show that in the aggregate, firms respond to the growing "split premium" by splitting more and at higher ratios. Finally, I describe regulator's responses to the growing incidence of stock splits, showing that their reaction is consistent with efforts to curb market manipulation.

Although I am able to obtain some quantitative measures of market manipulation, in large part the evidence cited in this section is based on press accounts of firm activity before and after splits, and can thus be considered suggestive.

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.

Table 8 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 one percent 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 (say, greater than 5 percent, say) are more likely to be seasoned equity offerings.

The table shows that firms are more likely to issue equity after a 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 pre-announcment stock returns and firm size.[17] 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.

The above data on equity issuance do not provide any insight into insider purchases and sales. Although there are no publicly available data on insider transactions in Japan, I am able to infer some of these transactions using data from the "investable weight factor" (IWF) database from Standard and Poors. These data, available annually, report the fraction of shares outstanding that are not held by insiders or publicly traded corporations.[18] Therefore, I can infer on an annual basis the fraction of shares outstanding that were bought or sold by large blockholders. Unfortunately, the data do not allow me to discern the timing of these purchases and sales through the year. Thus I cannot determine whether insiders reduce their holdings in the period between the ex-date and pay-date. Nor do the data allow me to distinguish between various blockholders.

I match changes in net percentage insider sales, to 531 of the stock splits in my sample. The average split ratio in the matched sample is 3.2-for-1, the median is 1.2-for-1, and the maximum is 500-for-1. Panel B of Table 7 shows that the insider sales are positively related to 1-1/S, the reduction in the float. Thus insiders are more likely to sell when the ability of other investors to sell has been constrained. On average, insiders sell 2.3 percent of the shares outstanding when the split ratios is less than 2-for-1, but 5.2 percent of their holdings when the split ratio is greater than or equal to 2-for-1.

[17] I sort possible matches first by pre-announcement stock return. Among the ten firms with the closest 50-day pre-announcement return, I select the one with the closest market capitalization.

[18] Specifically, Standard and Poors distinguishes three classes of strategic shareholders, including "1. Holdings by other publicly traded corporations, venture capital firms, private equity firms, strategic partners or leveraged buyout groups. 2. Holdings by government entitites, including all levels of government in the United States or foreign countries. 3. Holdings by current or former officers and directors of the company, founds or the company, or family trusts of officers, directors, or founders. In addition, holdings of trusts, foundations, pension funds, employee stock ownership plans or other investment vehicles associated with and controlled by the company."

Convertible bonds and lending out shares

Although some managers may have benefited from the stock splits by selling equity, other managers took more direct approaches to profiting from the reduction in effective supply. This section describes anecdotal evidence, taken from press reports (Nikkei Report 2005a, 2005b, 2005c, 2005d, 2005e) about two techniques used to execute these transactions.

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.[19] 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 yen during the ex-date to pay-date period, the price eventually fell to 14 yen in intraday trading on February 8. 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

[19] Typically, the terms of the convertible bond specify that the conversion factor is to be multiplied by *S*, where *S* is the split ratio.

executed similar transactions in which they were paid high fees for lending out their own shares to speculators, at borrowing costs of several hundred percent (annualized). For example, the *Nikkei Report* writes about Moss Institute Co., an internet company executing a 100-for-1 stock split in early 2005

> Meanwhile, an individual residing in Tokyo owned 7,975 shares, or 20.17% of the outstanding [tradable] shares […], according to a large-shareholding report. Moss' investor relations department said a large shareholder and company President Ichiro Hayashi lent their shares to this individual. The company's stock fluctuated wildly after going ex-rights.
>
> (Nikkei Report, 2005a)

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

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. The evidence is consistent with manipulation because it shows that the split decision is driven by the potential returns accruing to splitters, rather than more fundamental considerations.

Panel A of Figure 6 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 lagged return on splits. This can be interpreted quite simply: when the returns on splits are observed to be high, more firms split in an effort to increase stock price. In the context of the model, one can read the figure to say that when differences of opinion are high, firms have more to gain from splitting, and hence split more and at higher ratios.

Panel B of Figure 6 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

$$N_{Ratio\geq 2,t} = a + b\overline{R}_{Event,t-1} + u_t$$

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

The next regressions looks at the determinants of *changes* in the number of firms announcing stock splits, $\Delta N_{Ratio\geq 2,t}$. Again, the table 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.

The last regression in Table 7 shows 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.

Regulatory responses to the manipulation

By early 2005, several large stock splits had generated a series of complaints from smaller investors. One press account 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, 2005). Following an investigation by regulators, 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, additionally asking firms to refrain from carrying out stocks splits soon after issuing convertible bonds. Splits with ratios of 5-for-1 or more would only be allowed with special permission from the exchange. If a firm nevertheless decided to perform a high ratio split, it would be required to disclose (a) the purpose of the split, (b) the way the firm determined the split ratio, and (c) the post-split dividend policy. According to the TSE, the purpose of the new guidelines was to "increase the transparency of stock trading" and to discourage "money games" by firms and speculative traders (Nikkei English News, 2005a; Nikkei English News, 2005c). As of May 2005, the Osaka Securities Exchange, and the small cap Jasdaq Securities Exchange were expected to join 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 (Nikkei English News, 2005b). 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. Another possibility is that regulators support a retail "when-issued" market for post-split shares, similar to the spontaneous markets that arise for post-split shares in the United States, or for rights issues in the United Kingdom. Choi and Strong (1983) and Nayar and Rozeff (2001) discuss the when-issued market in the U.S. These markets allow participants to trade their forward claims, and hence alleviate the short-sales constraint.

VI. Conclusion

Float manipulation occurs when a firm limits the number of shares available to trade. When there are significant differences of opinion about the value of the shares, and investors are short-sale constrained, reductions in float push up prices. Firms may use the period of float reduction as an opportunity to raise equity, or managers may exploit it as an opportunity to sell overpriced shares.

This paper exploits an unusual institutional mechanism for executing stock splits in Japan to understand the effects of float manipulation for stock prices. Because new post-split shares are not distributed until several weeks after the effective date of the split, bearish investors can sell only a fraction of their holdings after the effective date. The higher the split ratio, the larger the forward position that investors must hold, and the higher are prices. When the shares are distributed, the short-sale constraint on bearish investors is relieved, and prices fall.

Consistent with a simple model, I show that following the announcement of a split, event returns are positively correlated with the log of the split ratio, a measure of the degree to which the float is reduced. When the shares are distributed, that pay-date returns are negatively related to the split ratio, consistent with the investors' short-sale constraints being relieved. I also find that returns (pay-date returns) are positively (negatively) related to measures of investors' differences of opinion.

At a minimum, the results in this paper make sense of an unusual period in Japanese financial market history. Although the float manipulation described here is extreme and would probably be illegal in the United States, a more benign variety occurs regularly when firms list only a small fraction of their shares at IPO. More generally, however, the results show that when institutional constraints restrict the ability of investors to bring prices back to fundamentals, firms may take actions to make these constraints more severe.

Appendix: Model Proofs

A1. Solving for P_1:

Evaluating (3), aggregate demand is given by a quadratic in P

$$\frac{\gamma S^3}{4H}P^2+\left(\frac{(S-1)S-\gamma S^2(F+H)}{2H}\right)P+\frac{\gamma S(F+H)^2}{4H}+\frac{(S-1)^2}{4\gamma HS}+\frac{(S-1)}{2}-\frac{F(S-1)}{2H} \quad (15)$$

Setting demand equal to total supply S and solving for P yields, after some algebra, two solutions

$$P=\frac{F+H}{S}+\frac{1-S}{\gamma S^2}\pm\frac{2}{S}\sqrt{\frac{H}{\gamma S}} \quad (16)$$

For the higher of these two solutions, the lower bound of the integral in equation (3) exceeds (F+H)/S. Therefore, the period 1 constrained price must equal

$$P_1=\frac{1}{S}\left[F+H-\frac{1-S}{\gamma S}-\frac{2}{S}\sqrt{\frac{H}{\gamma S}}\right] \quad (17)$$

To get the period 1 adjusted price, we multiply by S

$$P_1^A=SP_1=F+H-\frac{1-S}{\gamma S}-2\sqrt{\frac{H}{\gamma S}}\,. \quad (18)$$

We can establish some additional properties of the equilibrium, however. Equation (2) requires that the short-sale constraint binds as long as

$$\gamma S^2(V_i-P)<S-1 \quad (19)$$

The unconstrained price must be high enough to cause the short sale constraint to bind for the most bearish investor. Post-split, the unconstrained price is given by *1/S* times the result in equation (1). That is, the unconstrained post-split price would be

$$P_1^{Unconstrained}=\frac{F-1/\gamma}{S} \quad (20)$$

Therefore, substituting *(F-H)/S* for V_i and the unconstrained price above into equation (17) yields

$$\gamma S^2(\frac{F-H}{S}-\frac{F}{S}-\frac{1}{S\gamma})<S-1 \Rightarrow \gamma SH>1 \tag{21}$$

Condition (19) implies that only the smaller of the two solutions to (16) is valid, as the larger of the two solutions exceeds (*F+H)/S*, the per share valuation of the most bullish investor.

A2. Solving for P_2:

Evaluating equation (6) and setting equal to total supply *S* yields a quadratic equation in *P*. The solution of that quadratic is

$$P_2 = \frac{F+H \pm 2\sqrt{\frac{H}{\gamma}}}{S} \tag{22}$$

P_2 must be given by the smaller root of equation (21), as the larger root exceeds *(F+H)/S*, the valuation of the most bullish investor. Following the same reasoning as above, this is an equilibrium price if the short-sale constraint binds for the most pessimistic investor. Thus,

$$\frac{F-H}{S}-\frac{F}{S}+\frac{1}{\gamma S}<0 \Rightarrow \gamma H<1 \tag{22}$$

Finally, the period 2 adjusted price is simply *S* times the period 2 unadjusted price. Thus,

$$P_2^A = F+H \pm 2\sqrt{\frac{H}{\gamma}} \tag{23}$$

A3. Proving that the ex-date returns are increasing in *S* and *H* and interaction:

Returns around the ex-date (between period 0 and period 1) are given by the difference between the adjusted period 1 price and the period 0 price:

$$P_1^A - P_0 = H + \frac{1}{S\gamma} - 2\sqrt{\frac{H}{S\gamma}} \tag{24}$$

Take the derivative with respect to S

$$\frac{d(P_1^A - P_0)}{dS} = -\frac{1}{S}\left(\frac{1}{\gamma S} + \sqrt{\frac{H}{S\gamma}}\right) \qquad (25)$$

Since 1<γSH, this is positive.

Now taking the derivative with respect to *H*

$$\frac{d(P_1^A - P_0)}{dH} = 1 - \frac{1}{\sqrt{\gamma HS}} \qquad (26)$$

Again, this is positive as long as 1<γSH.

Finally, event returns are increasing in the interaction between *S* and *H*:

$$\frac{d^2(P_1^A - P_0)}{dSdH} = \frac{1}{2S\sqrt{\gamma HS}} > 0\,. \qquad (27)$$

<u>A3. Proving that pay-date returns are decreasing in *S* and *H*:</u>

Applying equation (20) and (23), returns between period 1 and period 2 are given by

$$P_2^A - P_1^A = -2\sqrt{\frac{H}{\gamma}}\left(1 - 1/\sqrt{S}\right) + \frac{1 - 1/S}{\gamma} \qquad (28)$$

Taking the derivative with respect to *S*

$$\frac{d(P_2^A - P_1^A)}{dS} = \frac{1 - \sqrt{\gamma SH}}{\gamma S^2} \qquad (29)$$

If $\gamma SH<1$ then (29) must be negative. Now, taking the derivative with respect to *H*,

$$\frac{d(P_2^A - P_1^A)}{dH} = \frac{1 - \sqrt{S}}{\sqrt{\gamma SH}} \qquad (30)$$

This is negative for $S>1$.

Finally, $\frac{d^2(P_2^A - P_1^A)}{dHdS} = \frac{-1}{2S\sqrt{\gamma SH}} < 0.$ (31)

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Figure 1. Returns to Splits, 1995-2004.

The sample is separated into five two-year intervals between 1995 and 2004. The figure shows the mean cumulative abnormal return for the splits that have ex-dates in each interval. The abnormal daily return is the difference between the return of the security and the return on the TOPIX market index. Abnormal returns are calculated for each day in the interval starting four days before the announcement of the event, and ending 35 days after the split becomes effective. Because the number of days between announcement and the ex-date vary by event, abnormal returns between six days after the announcement and two days before the ex-date are cumulated into one day. Split announcement days are collected from Bloomberg and various other sources. Returns are from Datastream.

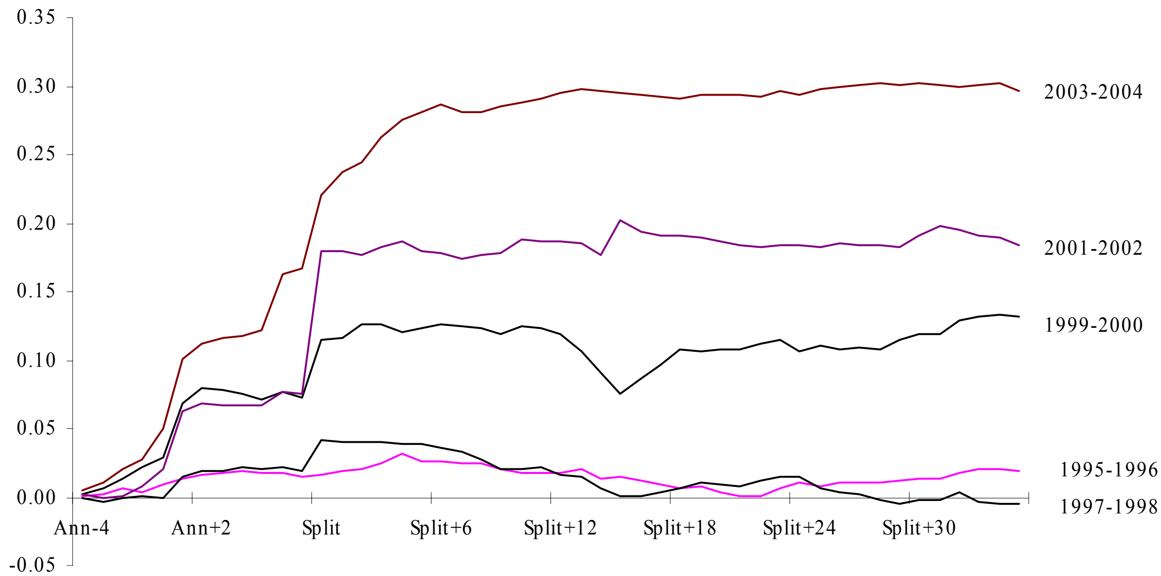


Figure 2. Split ratios, 1995-2004.

The figure shows the distribution of split ratios in Japan between 1995 and 2004, in two year intervals. The full sample includes all firms that declared splits between January 1995 and December 2004. A *S*-for-1 split ratio describes a split in which *S*-1 new shares are distributed (on the pay-date) to all holders of 1 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 the buckets [1,1.5), [1.5,2), [2,3), [3,4), [4,5), [5,10), [10,100), [100, 2000), [2000,∞), according to the ex-date of the split.

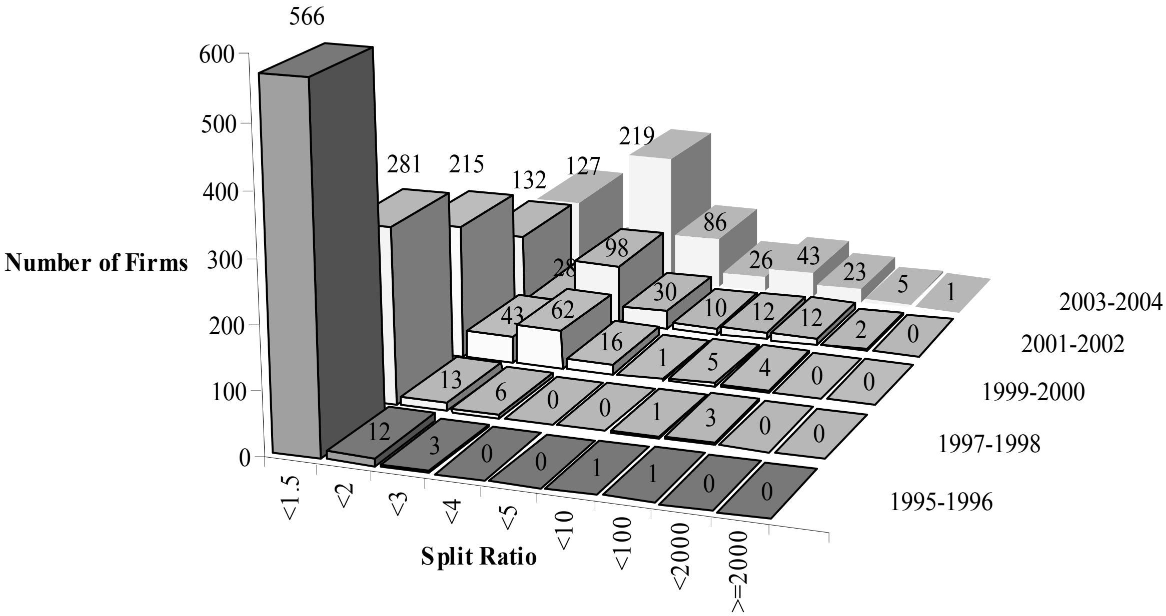


Figure 3. Turnover during a stock split

The figure shows average turnover around the announcement, ex-date, and pay-date for stock splits occurring in Japan between 1995 and March 2005, separated 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 1 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, volume the periods [Announcement-date+6:Ex-date+2] and [Ex-date+30:Pay-date-3] are averaged and assigned to one day. Announcement dates, pay-dates, and ex-dates are are collected from Bloomberg. Volume is from Datastream.

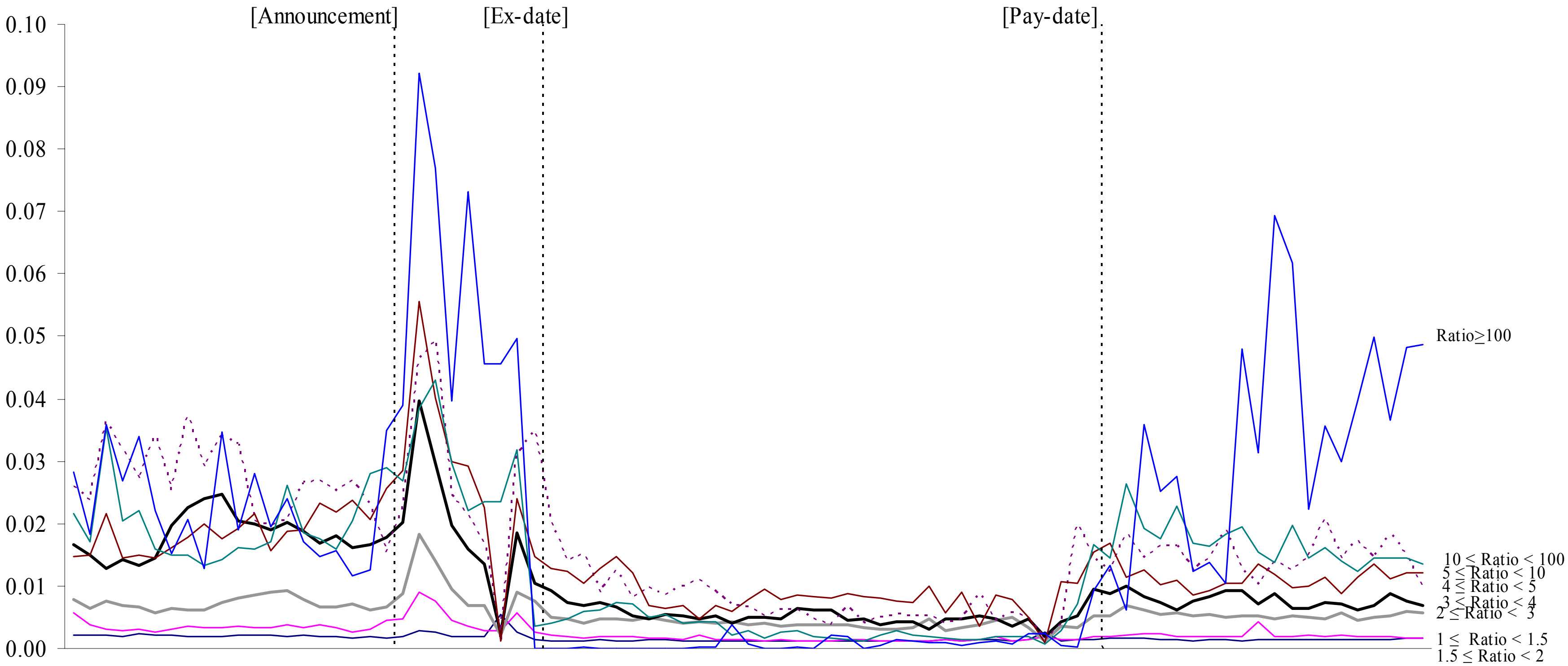


Figure 4. Event returns by split ratio

The sample of stock splits between 1995 and 2005 is sorted into eight 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 1 share on the ex-date. The figure shows the cumulative average abnormal return for the stocks in each group, shown in event time. The abnormal daily return is the difference between the return of the security and the return on the TOPIX stock index. Abnormal returns are calculated for each day in the interval starting four days before the announcement of the event, and ending 35 days after the split becomes effective. Because the number of days between announcement and the ex-date vary by event, abnormal returns between six days after the announcement and two days before the ex-date are cumulated into one day. Returns are from Datastream. Dashed lines indicate the announcement date and ex-date.

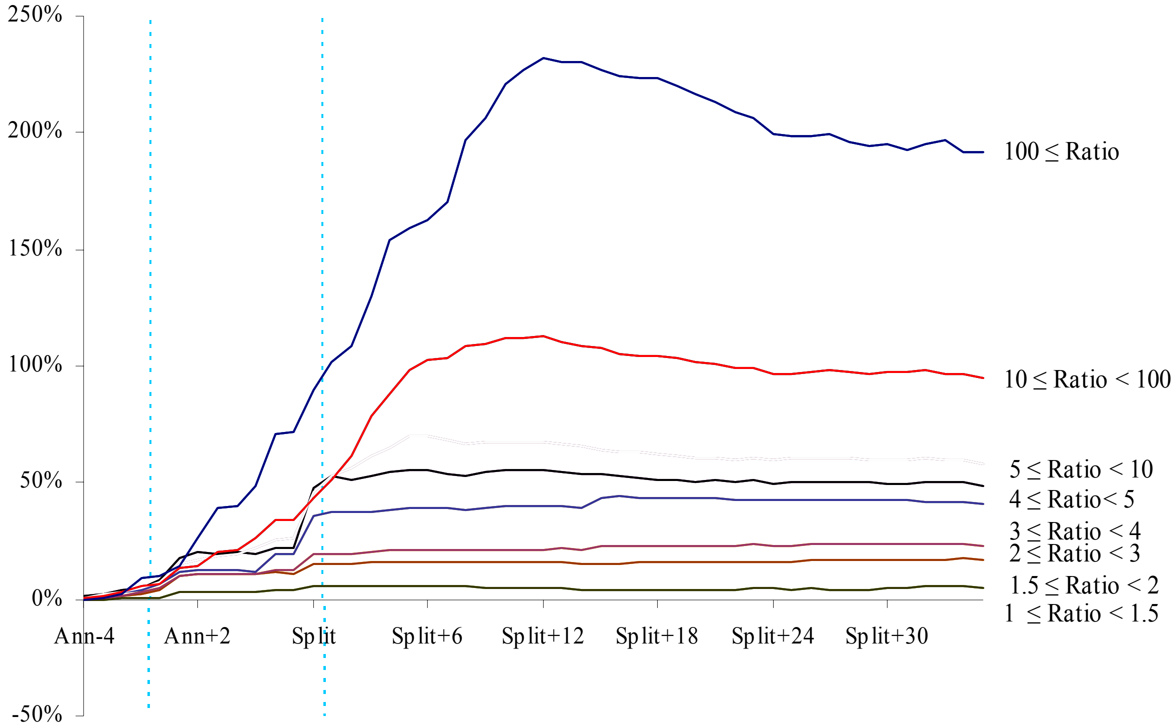


Figure 5. Pay-date returns by split ratio

The figure shows cumulative abnormal returns surrounding the split payment date, by split ratio. The sample of stock splits between 1995 and 2005 is sorted into eight 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 1 share on the ex-date. The figure shows the cumulative average abnormal return for the splits in each interval. The abnormal daily return is the difference between the return of the security and the return on the TOPIX stock index. Abnormal returns are calculated for each day in the interval starting twenty days before the pay-date, and ending twenty days after. Returns are from Datastream.

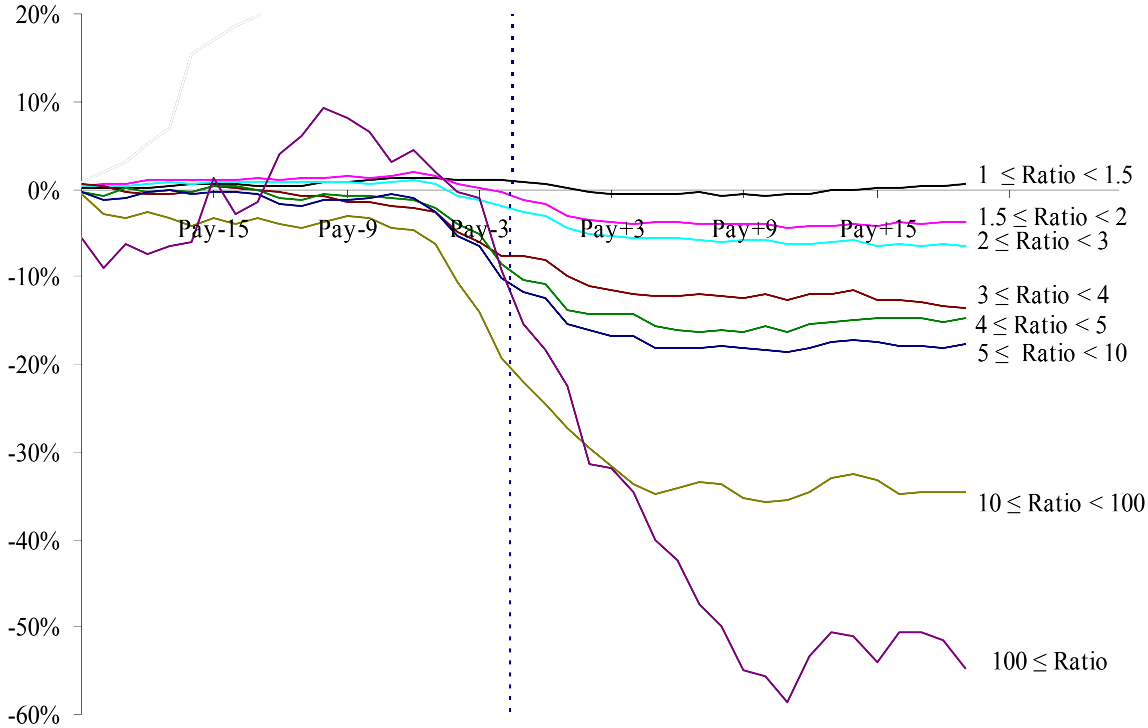
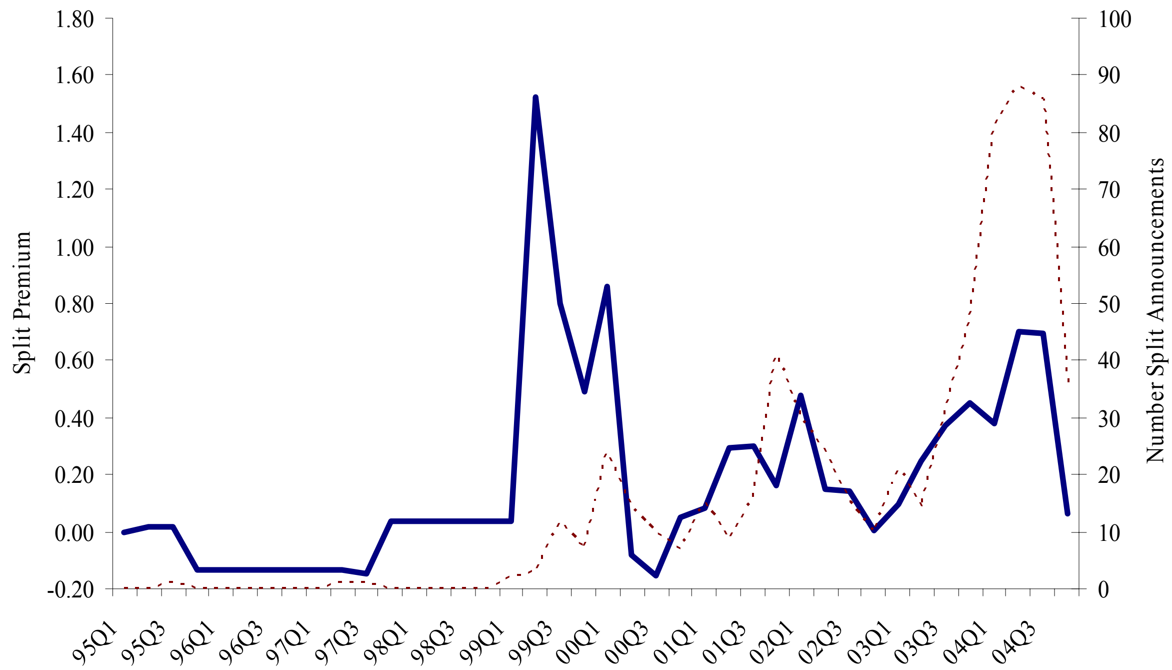


Figure 6. Split premium, the split ratio, and new split announcements

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 cumulative abnormal event return to all stock splits occurring in a quarter, lagged one period. In Panel A, the dotted line shows the number of firms that announce they will split during the quarter (although the effective 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. Lagged effective date returns and number of new split announcements



Panel B. Lagged effective date returns and mean split ratio

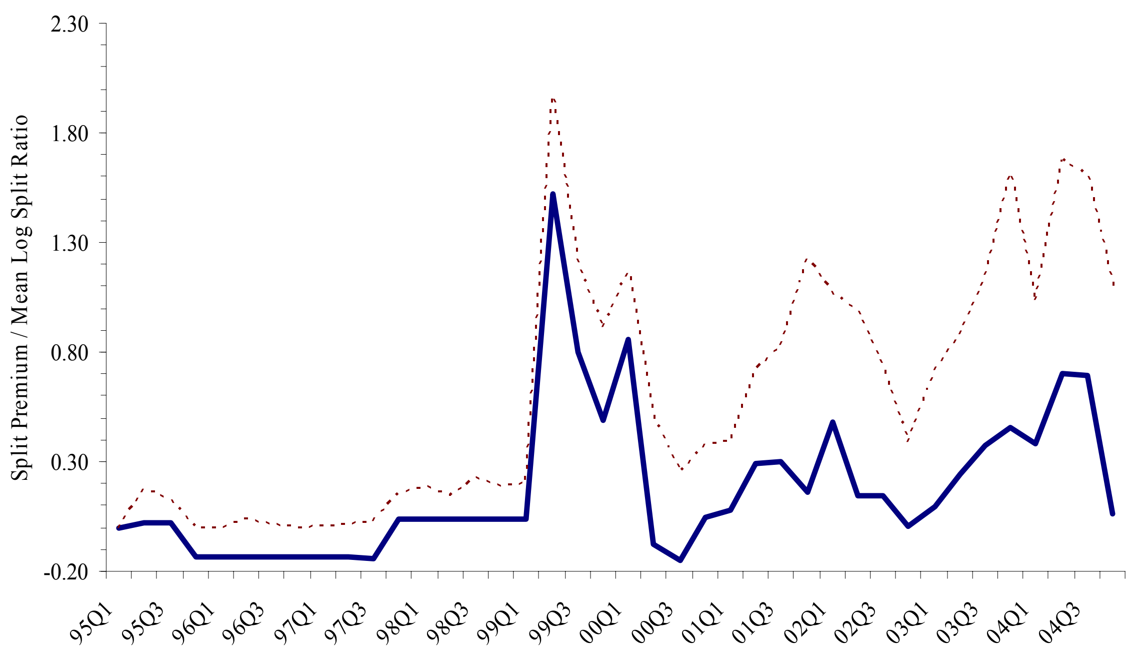


Table 1. Summary statistics

Mean, median, standard deviation, and extreme values of selected variables. The full sample contains 2094 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 millions 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.

Panel A: All splits (N= 2,094)

	Mean	**Median**	**SD**	**Min**	**Max**
Split Ratio	3.53	1.20	49.23	1.001	2000.00
Log(Split Ratio)	0.44	0.18	0.56	0.00	7.60
Float Reduction = 1 – 1/Split Ratio	0.29	0.17	0.23	0.001	0.9995
Market Value pre-split (¥ billion)	122.44	23.54	680.21	0.84	13790.40
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
Pre-split 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	38.30	-171.24	801.14
[Pay-date-10,Pay-date+5]	-3.33	-2.06	14.79	-139.54	147.53
Volume (Turnover)					
Daily Avg [Ann-50,Ann-1]	0.61	0.17	1.44	0.00	15.5
Daily Avg [Ann-date,Ex-date]	0.54	0.19	1.19	0.00	19.4
Daily Avg [Ex-date,Pay-date-1]	0.36	0.15	0.79	0.00	19.4
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)

	Mean	**Median**	**SD**	**Min**	**Max**
Split Ratio	8.74	2.00	88.07	2.00	2000.00
Log(Split Ratio)	0.47	0.18	0.61	-2.30	7.60
Float Reduction = 1 – 1/Split Ratio (%)	0.60	0.50	0.14	0.50	0.9995
Market Value pre-split (¥ billion)	193.08	19.80	995.40	0.84	13548.60
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
Pre-split 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
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

Table 2. Announcement and ex-date returns

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 1 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 one day before the announcement date and ending ten days after. In Panel B, accumulation of returns begins one day before the ex-date and ends ten 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 two, and the sample of splits with ratios greater than or equal to 2. T-statistics are in brackets.

	Full sample			1995 – 1999			2000 – 2005			Ratio < 2			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	[7.36]
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]
Eff-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]
Eff+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]
Eff+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]
Eff+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]
Eff+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]
Eff+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]
Eff+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]
Eff+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]
Eff+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]
Eff+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]
Eff+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]

Table 3. Pay-date returns

Cumulative abnormal returns around the pay date for stock splits in Japan occurring between 1995 and March 2005. 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 ten days before the pay date and ending ten 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 two, and the sample of splits with ratios greater than or equal to 2.

	Full sample			1995 – 1999			2000 – 2005			Ratio < 2			Ratio ≥ 2		
	AR %	**CAR %**	**[t]**	**AR %**	**CAR %**	**[t]**	**AR %**	**CAR %**	**[t]**	**AR %**	**CAR %**	**[t]**	**AR %**	**CAR %**	**[t]**
Pay – 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 -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 – 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-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-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-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-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-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-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-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+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+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+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+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+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+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+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+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+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+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]

Table 4. Determinants of turnover changes

OLS regressions of announcement and ex-date to pay-date period abnormal turnover on the split ratio

$$V_{it} - \overline{V}_i = a + bS_i + u_{it}$$

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 before the announcement. In the regressions, S is measured alternately as the log of the split ratio, or as one minus the reciprocal of the split ratio. T-statistics are presented in brackets.

Panel A: Announcement period abnormal trading volume

	Full sample		Ratio ≥ 2	
a	-0.13	-0.03	-0.61	-0.65
	[-3.35]	[-0.65]	[-4.07]	[-1.77]
Log(Ratio)	0.16		0.47	
	[3.24]		[3.96]	
1-1/Ratio		-0.06		0.89
		[-0.51]		[1.51]
R^2	0.005	0.000		0.003

Panel B: [Ex-date,Pay-date-1] period volume

	Full sample		Ratio ≥ 2	
a	-0.10	0.06	-0.51	0.27
	[-2.29]	[1.12]	[-2.78]	[0.59]
Log(Ratio)	-0.30		-0.03	
	[-4.92]		[-0.21]	
1-1/Ratio		-1.01		-1.35
		[-6.98]		[-1.85]
R^2	0.013	0.026	0.000	0.006

Table 5. Determinants of event returns

OLS regressions of announcement and ex-date abnormal returns on the split ratio, disagreement H, and the interaction of H and the split ratio:

$$R_{it} = a + bS_i + cH_i + dS_iH_i + u_{it}$$

S is one minus one over the split ratio. Disagreement, *H*, is alternately the average turnover during the 50 trading days before announcement of the split (H_1), or as the abnormal turnover between the announcement date and ex-date (H_2). In Panel A, the dependent variable is the cumulative abnormal return between one day before the announcement and the ex-date. In Panel B, the dependent variable is the same as in Panel A, but the sample is reduced to only splits with ratios of 2-for-1 or greater. In Panel C, the dependent variable is the cumulative abnormal return between one day before the ex-date and 20 days after. In Panel D, the dependent variable is the same as in Panel C but the sample is reduced to include only splits with ratios of 2-for-1 or greater.

Panel A: Y= Event return [Announcement day – 1, Ex-date + 10], full sample							
a	-0.05	0.10	0.13	-0.05	-0.05	-0.03	-0.05
	[-4.44]	[11.10]	[15.73]	[-4.43]	[-4.40]	[-2.24]	[-4.38]
S=1-1/Ratio	0.64			0.63	0.64	0.45	0.64
	[19.53]			[17.79]	[19.88]	[11.75]	[19.72]
H_1*=Pre-turnover*		4.58		0.35		9.51	
		[7.52]		[0.57]		[11.37]	
H_2*=Abnormal turnover*			4.53		4.71		7.77
			[6.51]		[7.37]		[2.79]
S x H_1						10.28	
						[8.68]	
S x H_2							-0.74
							[-0.36]
R^2	0.15	0.03	0.02	0.15	0.18	0.20	0.18

Panel B: Y= Event return [Announcement day – 1, Ex-date + 10], Split ratio>=2							
a	-0.73	0.26	0.30	-0.73	-0.70	-0.57	-0.68
	[-7.18]	[9.41]	[12.64]	[-7.14]	[-6.97]	[-5.34]	[-6.73]
S=1-1/Ratio	1.69			1.70	1.65	1.35	1.61
	[10.35]			[10.06]	[10.21]	[7.29]	[9.89]
H_1*=Pre-turnover*		2.50		-0.13		7.67	
		[2.25]		[-0.13]		[5.02]	
H_2*=Abnormal turnover*			4.80		4.15		-7.36
			[4.10]		[3.81]		[-1.37]
S x H_1						6.89	
						[3.26]	
S x H_2							15.23
							[2.19]
R^2	0.14	0.01	0.03	0.14	0.16	0.17	0.17

Panel C and Panel D overleaf

Table 5 continued.

$$R_{it} = a + bS_i + cH_i + dS_iH_i + u_{it}$$

Panel C: Y= Ex-date return [Ex-date – 1, Ex-date + 20], Full sample

a	-0.03	0.06	0.09	-0.03	-0.03	-0.01	-0.03
	[-2.79]	[7.86]	[12.44]	[-2.75]	[-2.78]	[-1.04]	[-2.79]
S=1-1/Ratio	0.42			0.37	0.42	0.28	0.42
	[14.37]			[11.74]	[14.38]	[8.04]	[14.42]
H_1=*Pre-turnover*		4.67		2.20		3.95	
		[9.01]		[4.05]		[5.22]	
H_2=*Abnormal turnover*			0.36		0.48		2.47
			[0.60]		[0.83]		[1.33]
S x H_1						7.45	
						[6.94]	
S x H_2							-2.84
							[-1.13]
R^2	0.09	0.04	0.00	0.10	0.10	0.11	0.09

Panel D: Y= Ex-date return [Ex-date – 1, Ex-date + 20], Split ratio>=2

a	-0.39	0.16	0.20	-0.37	-0.39	-0.29	-0.39
	[-4.20]	[6.38]	[9.61]	[-3.93]	[-4.20]	[-2.92]	[-4.20]
S=1-1/Ratio	0.98			0.89	0.98	0.74	0.99
	[6.55]			[5.80]	[6.54]	[4.32]	[6.51]
H_1=*Pre-turnover*		3.65		2.27		2.62	
		[3.78]		[2.33]		[1.84]	
H_2=*Abnormal turnover*			0.24				0.95
			[0.23]				[0.19]
S x H_1					-0.14	5.41	
					[-0.14]	[2.75]	
S x H_2							-1.45
							[-0.22]
R^2	0.06	0.02	0.00	0.07	0.06	0.07	0.06

Table 6. Determinants of Pay-date returns

OLS regressions of pay-date abnormal returns on the split ratio, disagreement H, and the interaction of H and the split ratio:

$$R_{it} = a + bS_i + cH_i + dS_iH_i + u_{it}$$

S is one minus one over the split ratio. Disagreement, *H*, is alternately the average turnover during the 50 trading days before announcement of the split (H_1), or as the abnormal turnover between the announcement date and ex-date (H_2). The dependent variable is cumulative abnormal returns starting ten days before the pay-date and ending ten-days after. Results are shown separately for the full-sample (Panel A) and for those splits with split ratios of 2-for-1 or greater (Panel B).

Panel A: Full sample							
a	0.02	-0.02	-0.03	0.02	0.02	0.01	0.02
	[4.56]	[-6.18]	[-10.35]	[4.53]	[4.54]	[2.99]	[4.50]
S=1-1/Ratio	-0.19			-0.18	-0.19	-0.14	-0.19
	[-14.84]			[-12.57]	[-14.87]	[-8.99]	[-14.63]
H_1*=Pre-turnover*		-1.92		-0.73		-1.85	
		[-8.17]		[-2.97]		[-5.41]	
H_2*=Abnormal turnover*			-0.46		-0.51		4.11
			[-1.68]		[-1.98]		[4.98]
S x H_1						-2.86	
						[-5.93]	
S x H_2							-6.60
							[-5.89]
R^2	0.10	0.03	0.00	0.10	0.10	0.11	0.11
	0.02	-0.02	-0.03	0.02	0.02	0.01	0.02
Panel B: Split ratio>=2							
a	0.16	-0.07	-0.09	0.15	0.16	0.11	0.14
	[4.78]	[-8.38]	[-11.58]	[4.62]	[4.66]	[3.09]	[4.24]
S=1-1/Ratio	-0.41			-0.39	-0.40	-0.29	-0.37
	[-7.60]			[-7.07]	[-7.50]	[-4.79]	[-6.97]
H_1*=Pre-turnover*		-1.03		-0.42		-1.86	
		[-2.92]		[-1.20]		[-3.67]	
H_2*=Abnormal turnover*			-0.76		-0.60		7.48
			[-2.01]		[-1.65]		[4.25]
S x H_1						-2.47	
						[-3.52]	
S x H_2							-10.68
							[-4.68]
R^2	0.08	0.01	0.01	0.08	0.09	0.10	0.12

Table 7. Equity issuance around stock splits

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. Panel B shows the relation between blockholder redemptions and the split ratio. Blockholders are primarily insiders holding large control stakes of a firm's equity. Changes in their aggregate holdings are calculated using data on the investable weight factor, obtained from Standard and Poors. The table shows the results of a cross-sectional regression of redemptions on *S*, where *S* denotes 1 minus 1 over the split ratio.

Panel A. % Splitters Issuing Equity

	N	Before	After	After - Before	[t]
All splits	2092	0.07	0.12	0.05	[5.14]
Matched Sample	2092	0.04	0.06	0.02	[3.07]
Difference	2092	0.02	0.07	0.04	[3.79]
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]

Panel B. Blockholder redemptions. $\% \, Redemptions = a + bS + u_t$

a	0.013
	[2.54]
b	0.063
	[4.26]
N	531
R^2	0.03

Table 8. Corporate responses to the split premium

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.

$$Y = a + b\overline{R}_{Event,t-1} + u_t$$

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, and the average of the log split ratio in that quarter.

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