Number of Shareholders and Stock Prices: Evidence from Japan

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ABSTRACT

Merton (1987) proposes that an increase in a firm's investor base increases the firm's value. In Japan, companies can reduce their stock's minimum trading unit—the number of shares in a "round lot"—which facilitates trading in the stock by small investors. We find that a reduction in the minimum trading unit greatly increases a firm's base of individual investors and its stock liquidity, and is associated with a significant increase in the stock price. Further, the stock price appreciation is positively related to an increase in the number of shareholders.

IN HIS *AMERICAN FINANCE ASSOCIATION* PRESIDENTIAL ADDRESS, Merton (1987) proposed:

> *Ceteris paribus*, . . . an increase in the relative size of the firm's investor base will reduce the firm's cost of capital and increase the market value of the firm. Thus, . . . managers of the firm have an incentive to expand the firm's investor base.

This proposition is tested in this paper.

Merton (1987) proposes a model in which investors limit the securities they hold in their portfolios to those they are "aware of."[1] This results in imperfect diversification of risk, which leads to a higher risk premium required by investors. An increase in the firm's investor base thus leads to a lower required return and a higher stock price.

Increasing the number of investors that hold a security also has a positive effect on its liquidity. Benston and Hagerman (1974) find a negative cross-sectional relationship between the number of stockholders and stocks' bid-ask spreads. Amihud and Mendelson (1986) show that a security's value is decreasing in its illiquidity costs because investors require compensation for these costs. Therefore, increasing the number of investors who can hold a security should be value-increasing. Merton's theory provides a rationale for

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[1] See also Levy (1978), who derives the capital market equilibrium under a constraint on the number of stocks in investors' portfolios.

the efforts of many companies, stock exchanges, and policymakers to increase share ownership: An increase in the number of investors holding a security should increase the company's value.

The setting of Japan's equity market enables us to test the proposition that an increase in the firm's investor base increases its stock value. In Japan, companies can expand the investor base of their stock by reducing their minimum trading unit (MTU) or lot size, which is the minimum number of shares that can be traded on an exchange. Small investors may be unable to trade the minimum unit if this requires a large amount of money, and odd-lot trading is forbidden on the Japanese stock exchanges. Investors who wish to diversify on their own (rather than through a mutual fund) would prefer to include in their portfolios a larger number of different stocks, each requiring a smaller outlay. A reduction in the MTU enables them to invest in stocks that they would otherwise avoid, resulting in an increase in the investor base.

To illustrate, the standard MTU in Japan is 1,000 shares, and the average price of a share on the Tokyo Stock Exchange's first section is about 800 yen. The corresponding average monetary value of an MTU is 800,000 yen (approximately $6,600), which is 30 percent higher than the monetary value of a round lot of an average stock traded on the New York Stock Exchange.[2] When a stock's price is high, reducing the MTU is necessary to enable a large number of small investors to buy the stock.

Stock splits provide another vehicle for increasing the investor base, by reducing the minimum monetary value necessary for trading a given lot size. This is indeed a prevalent managerial objective (Baker and Gallagher (1980))[3] that may have motivated stock splits in the United States. The evidence is that the number of shareholders increases following a split (Mukherji, Kim, and Walker (1997)), and that the increase is positively associated with the stock's abnormal return on the ex-split day, following which stockholders were not entitled to additional shares (Lamoureux and Poon (1987)).[4] Moreover, the ability to trade smaller units after the stock split enhances liquidity (Amihud and Mendelson (1986, 1988), Muscarella and Vetsuypens (1996)).

Stock splits, however, do not provide a natural test event for Merton's (1987) hypothesis because they are associated with other changes in stock characteristics. The lower price per share following the split has a number of consequences. Stock splits increase the proportional bid-ask spread (Copeland (1979)), and Brennan and Copeland (1988) suggest this is used by com-

[2] As we illustrate below, this effect is even more dramatic for stocks that actually reduce their MTU.

[3] See, for example, "International Business Machine Corp. announced plans for 2-for-1 split in its common shares, making the stock more attractive to small investors" in Ziegler (1997).

[4] Because of the positive correlation between the split factor, the increase in the number of stockholders and other changes in stock characteristics such as price, bid-ask spread, and volatility (see below), the findings of Mukherji et al. (1997) and Lamoureaux and Poon (1987) on the relationship between the price changes and changes in stockholder base may be confounded with the effects of other characteristics for which they could not control.

panies to signal improved performance, which explains the favorable price response to stock splits. Anshuman and Kalay (1997) propose that because stock splits increase the economic significance of the minimum tick, they also affect the economic incentives of some classes of market participants to provide greater liquidity for the stock. Ohlson and Penman (1985) find that a stock's returns show greater volatility after a split and they conjecture (citing private communication with Fischer Black) that the lower stock price attracts noise traders who cause greater volatility. Lamoureux and Poon (1987) propose that the greater post-split volatility increases the value of the tax-trading option, which leads to a higher stock price. Brennan and Hughes (1991) suggest that because brokerage commissions increase with the number of shares traded, stock splits increase brokers' revenues for a given dollar amount traded and consequently induce information gathering by investment analysts in brokerage firms about companies that split their stock. This motivates managers with favorable information about their companies to split their shares and bring about a positive price reaction.

Firms can also increase their investor base by listing on an exchange. Kadlec and McConnell (1994) find that for firms that move from the Nasdaq Stock Market to the New York Stock Exchange the increase in the stock price at the announcement is negatively related to the shadow cost of incomplete information. However, the price increase can be the result of other factors associated with listing on an exchange in addition to the increase in the number of shareholders. In particular, changes in value could result from changes in the market microstructure (Amihud, Mendelson, and Lauterbach (1997)), or from inside information that affected the listing decision.

In contrast, the reduction in stocks' MTU in Japan is not subject to any of these side effects. Since a reduction in MTU does not adjust the stock price, the relationship between the minimum tick and the stock price or the minimum relative bid-ask spread remains unaltered, and the effects of the lower price on volatility found in stock splits in the United States are absent in Japan. The stocks continue to be traded in the same environment and under the same trading mechanism—there is no change in the market microstructure. Further, brokerage commissions in Japan are a function of the monetary value of the transaction, not the number of shares.

We find that the reduction in MTU greatly increases the number of shareholders for virtually all stocks included in our sample. Thus, the reduction in MTU in Japanese stocks provides a way to test the effects of an increase in the shareholder base without the side effects that characterize stock splits or exchange listing. This enables us to test Merton's (1987) proposition that an increase in a firm's investor base reduces expected returns and increases the stock price. We further test whether this is associated with a liquidity effect. In fact, the increase in the investor base is directly related to the liquidity of the security and its trading environment, and thus favorably affects its value.

The remainder of the paper is organized as follows. Section I describes some institutional details associated with the minimum trading unit in the Japanese equity markets. Section II documents the effects of the reduction

in the MTU on stock ownership. Section III presents evidence on the effect of the reduction in MTU on stock prices, and Section IV describes the effect on stock liquidity. In Section V we discuss the trade-offs faced by a company that is considering increasing its stock ownership dispersion. We present our conclusions in Section VI.

I. Minimum Trading Units in the Japanese Equity Markets

In Japan, trading takes place in units of a specified number of shares. The common unit size is 1,000 shares. The MTU is required by law to be determined so that the company's book value per unit is at least 50,000 yen (approximately $400). A company whose trading unit is more than 50,000 yen in book value can reduce the number of shares in its trading unit, subject to some regulatory limitations.[5] For stocks listed on the Tokyo Stock Exchange, the Exchange recommends units of 1,000, 500, 100, 50, or 10 shares, but there are some rare cases with MTUs of 2,000 shares and 1 share.

The decision to reduce a stock's MTU is made in a meeting of the company's directors. It must be immediately reported to the stock exchange and to the shareholders, and it needs to be approved at the shareholders' meeting. The schedule of the new trading unit and the legal form to be submitted to the Japan Securities Depository Center are sent to shareholders one month prior to the actual change date. The direct costs associated with this process are minimal.

The importance of the reduction in MTU is underscored by the fact that, by law, odd-lot shares—that is, a number of shares less than the MTU—are not eligible for secondary market trading in Japan. Also, odd-lot shares are not entitled to voting and other shareholders' rights except for dividends. Odd-lot shares can be created by a stock split or a stock dividend. Then, if the number of additional shares due to a shareholder is less than the MTU, the company cannot register them, although the shareholder is entitled to the dividend. Such shares can be sold only to the issuing company. If, as the result of a reduction in MTU, the number of shares due to the shareholder is greater than the new, smaller unit, the company registers these shares for trading (subject to the new limit). These activities entail additional costs due to the reduction in trading unit, but these costs are negligible.

II. Minimum Trading Unit and Investor Base

Over the 1991–1996 period, 88 Japanese companies reduced their stock's MTU. Our data include all of these events, with the exception of cases in which the stocks are split (8 cases) or have insufficient data (14 cases). The final sample consists of 66 stocks that are traded on the Tokyo Stock Exchange. The extent of the reduction in MTU for the sample stocks is shown in Table I. For most stocks in our sample, the MTU is reduced by a factor of ten, from 1,000 to 100 shares.

[5] See Tokyo Stock Exchange (1996).

Table I

Reduction of the Minimum Trading Unit and its Effect on Number of Individual Shareholders (1991–1996)

The sample consists of 66 stocks on the Tokyo Stock Exchange for which the issuing company reduced the minimum unit of trading. The minimum trading unit pertains to year −1 ("before") and year 0 ("after") relative to the event. The stock price is the average closing price over days −15 to −6 before the announcement day. The increase in the number of individual shareholders is calculated as a percentage increase from year −1 to year 0, relative to the event. Source: Annual publications of the Tokyo Stock Exchange and the *Nihon Keizai Shimbun* NEEDS database.

Number of Cases	Minimum Trading Unit: Number of Shares		Stock Price before Reduction (yen)		Increase in the Number of Individual Shareholders (%)	
	Before	After	Mean	Median	Mean	Median
1	2,000	1,000	373.8	373.8	13.3%	13.3%
6	1,000	500	881.6	841.6	43.2%	14.0%
58	1,000	100	3,764.3	2,842.0	258.0%	139.1%
1	100	10	25,610.0	25,610.0	152.7%	152.7%

The minimum monetary size of a transaction increases with the stock price. If the motivation for the reduction in trading unit is to enable small investors to invest in the stock, then the relief provided is more significant for higher-priced stocks, suggesting that our sample should include more high-priced stocks than the Tokyo Stock Exchange average. To investigate this proposition, we calculate the average price for each stock in our sample over a period of 10 days, from 15 days before to 6 days before the announcement of the reduction in trading unit. The average stock price in our sample is 3,781.8 yen and the median is 2,789 yen, well above the 970 yen that is the average stock price on the Tokyo Stock Exchange during the same period. Table I presents the price levels for the various groups. For example, for the group in which the minimum trading unit is reduced from 1,000 to 100 shares, the value of a trading lot for the median stock is 2.842 million yen or nearly $24,000. After the reduction in MTU, the value of a trading unit is cut to about $2,400, quite accessible for a small investor.

For each of the 66 stocks, we assign a control stock as follows. For each stock i that reduces its MTU, we consider as candidates all stocks j that do not reduce their own MTU and are traded on the same section of the Tokyo Stock Exchange (the first or the second section) throughout the period from 250 days before the announcement through 250 days following the change. We then calculate the average price and average volume for each candidate stock j over the period beginning 95 days before the announcement and ending 6 days before the announcement, and derive the absolute percentage deviation between the average price and average volume of stock j relative to stock i over that period. The stock j that minimizes the sum of the two absolute percentage deviations is selected as the control stock for i (denoted by $\xi(i)$). Once a stock is selected as a control stock, it is excluded from

Table II

Shareholding Statistics before and after the Reduction in the Minimum Trading Unit (1991–1996)

The sample consists of 66 stocks on the Tokyo Stock Exchange, for which the issuing company reduces the minimum unit of trading. The change in the number of all shareholders and individual shareholders is calculated as the percentage change in the respective variable from year −1 to year 0, relative to the event. The ratio of individual shareholders to the total number of shareholders is obtained by dividing for each company the first variable by the second variable for year −1 ("before") and year 0 ("after") relative to the event. The average number of shares held by individual shareholders is obtained by dividing for each company the number of shares held by individual shareholders by the number of individual shareholders on year −1 and 0 relative to the event. Panel A presents data for the stocks that reduced their minimum trading unit. Panel B presents the corresponding data for the control stocks, selected from the same section of the Tokyo Stock Exchange as the stocks that reduced their minimum trading unit, with the closest price and trading volume. Source: Annual publications of the Tokyo Stock Exchange and the *Nihon Keizai Shimbun* NEEDS database.

Statistic	Change in the Number of *All* Shareholders	Change in the Number of *Individual* Shareholders	Individual/ All Shareholders		Average Number of Shares Held by Individual Shareholders	
			Before	After	Before	After
Panel A: Stocks that Reduce Their MTU						
Mean	+135%	+234%	0.643	0.867	4,868	2,197
Median	+52%	+139%	0.656	0.882	3,487	1,787
1st quartile	+20%	+64%	0.532	0.844	2,405	1,181
3rd quartile	+195%	+329%	0.726	0.922	6,531	2,989
Panel B: Control Stocks						
Mean	+10%	+12%	0.647	0.655	4,382	4,092
Median	+2%	+3%	0.654	0.669	3,566	3,500
1st quartile	−3%	−6%	0.570	0.552	2,892	2,730
3rd quartile	+11%	+16%	0.726	0.760	5,627	4,980

consideration for all subsequent stocks. Hence, for each of the 66 stocks that reduces its MTU, we have a different control stock, matched on Tokyo Stock Exchange section, price, and trading volume.

If companies' objective in reducing their trading unit is to increase their investor base, this is successful. Using data from companies' annual reports (compiled in the *Nihon Keizai Shimbun* NEEDS database), we obtain the number of shareholders for each of the 66 stock pairs at the end of the (fiscal) year before the reduction in trading unit and at the end of the (fiscal) year of the reduction. As shown in Table II, there is a substantial increase in the number of investors for stocks that reduce their trading units: The mean increase in the number of shareholders over the event year is 135 percent and the median increase is 52 percent. By comparison, the mean increase in the number of shareholders for the control stocks is 10 percent, and the median increase is 2 percent.

The increase in the number of shareholders for companies that reduce their MTU is due to the increase in the number of *individual* shareholders, who benefit most from the change; the number of individual shareholders increases from an average of 2,210 per company to 5,517, and the average rate of increase is 234 percent. The corresponding median increase is 139 percent, with only 1 of the 66 stocks showing a reduction.[6] By comparison, in the control sample the average increase in the number of individual shareholders is only 12 percent and the median increase is only 3 percent. For as many as 26 of the 66 control stocks (39.4 percent of the control sample) the number of individual shareholders declines; the difference between the proportions is highly significant. Table I shows that the increase in the number of individual shareholders of stocks that reduced their MTU occurs in all reduction categories. Table II shows that the proportion of individual shareholders among all company shareholders increases on average by approximately 22 percent, which is about one-third of the pre-event proportion, whereas for the control stocks, the increase in the proportion of individual shareholders is only 0.8 percent. As can be expected, institutional investors do not benefit from the MTU reduction whereas individual investors do, and they indeed take advantage of their ability to hold smaller positions in these stocks. As Table II shows, the average number of shares held by an individual investor is approximately halved following the reduction in MTU, whereas for the control stocks the average shareholding per individual investor remains virtually the same.

We hypothesize that the reduction in trading unit attracts individual investors who previously found the required monetary outlay prohibitive. To test this hypothesis, we calculate for each security i the logarithm of the relative change in the number of individual shareholders, $\Delta INDSH_i$, and the logarithm of the minimum monetary outlay required before the change in trading unit, $LMON_i$ (which equals the product of price by the MTU before the change, in millions of yen). Our reasoning suggests that $\Delta INDSH$ should be an increasing function of $LMON$. We thus estimate the regression model:

$$\Delta INDSH_i = \underset{(t=)}{0.633} + \underset{(4.67)}{0.334} \times LMON_i + \epsilon_i. \quad (1)$$
$$\qquad\qquad\quad (2.96)$$

These results show that the increase in the number of individual shareholders is positively related to the magnitude of the required monetary outlay before the MTU reduction, consistent with our reasoning.

III. Cumulative Abnormal Returns and the Increase in the Number of Shareholders

We next test Merton's (1987) hypothesis that the increase in the investor base increases stock values. For each event i, we identify two dates: the announcement date A_i, which is the day on which the change is decided by

[6] For that stock, the number of individual shareholders declines by 8.5 percent.

the company's board (the news appears on the following day in *Nihon Keizai Shimbun)*, and day C_i when the reduction in MTU actually takes place. The average number of trading days between the announcement and change is 75.8, with a median of 66.5 days.

We classify the stocks into three size groups and estimate the daily return model:

$$R_{it} = \alpha_i + \beta 1_i RM_t + \beta 2_i RSIZE_{it} + \epsilon_{it}, \tag{2}$$

where R_{it} is the return on stock i on day t, RM_t is the day-t return on the TOPIX index, and $RSIZE_{it}$ is the return on the appropriate size index for stock i (returns are the logarithms of relative price changes). We use three size indices according to the size group to which the stock belongs: Tokyo Stock Exchange first section medium-size stocks, Tokyo Stock Exchange first section small-size stocks, and Tokyo Stock Exchange second section stocks. In model (2), α_i, $\beta 1_i$, and $\beta 2_i$ are constant coefficients and ϵ_{it} are the residuals.

The model is estimated from post-event data, over days $C_i + 21$ to $C_i + 220$,[7] in order to avoid an ex post selection bias.[8] This is because pre-event behavior of the stock price, such as price increase, most likely affects the company's decision to reduce its MTU. We then calculate the abnormal returns $AR_{it} = R_{it} - (\alpha_i + \beta 1_i RM_t + \beta 2_i RSIZE_{it})$ for each day t in the period $A_i - 5$ through $C_i + 1$. We define the cumulative abnormal return for stock i as $CAR_i = \sum_{t=A_i-5}^{C_i+1} AR_{it}$. The (simple or weighted) average of CAR_i across all stocks results in the (simple or weighted) average CAR, the average cumulative abnormal return for the event. In the calculation of the weighted averages, the weight of each stock i is $1/\mathrm{Var}(\epsilon_i)^{1/2}$, where $\mathrm{Var}(\epsilon_i)$ is obtained from model (2).

The (simple) average CAR over the entire period is 4.43 percent ($t = 1.81$), the median CAR is 4.79 percent, and the weighted average CAR is 5.90 percent ($t = 2.65$). This result shows that the reduction in MTU, which in turn increases the stocks' investor base, leads to a significant value increase, consistent with Merton's (1987) hypothesis.

We next examine the behavior of the cumulative abnormal returns over the event intervals $[A_i - 5, C_i + 1]$. To account for the fact that the event intervals differ across stocks, we normalize them by dividing for each stock the period (A_i, C_i) between the announcement day and the actual MTU-reduction day into 10 equal-sized intervals numbered 1,2,3,...,10. The cumulative abnormal returns are then calculated for each stock i over 12 subperiods: the first corresponds to the preannouncement interval $[A_i - 5, A_i]$ (including the announcement day A_i), then 10 subperiods corresponding to the deciles of the period (A_i, C_i) between the announcement and the actual MTU-reduction day, and the last subperiod $[C_i, C_i + 1]$ includes the MTU-reduction day and the following trade day. In this way, the different periods

[7] The last transfer event has data available only through day $C_i + 131$.

[8] See a discussion of this issue in Amihud et al. (1997).

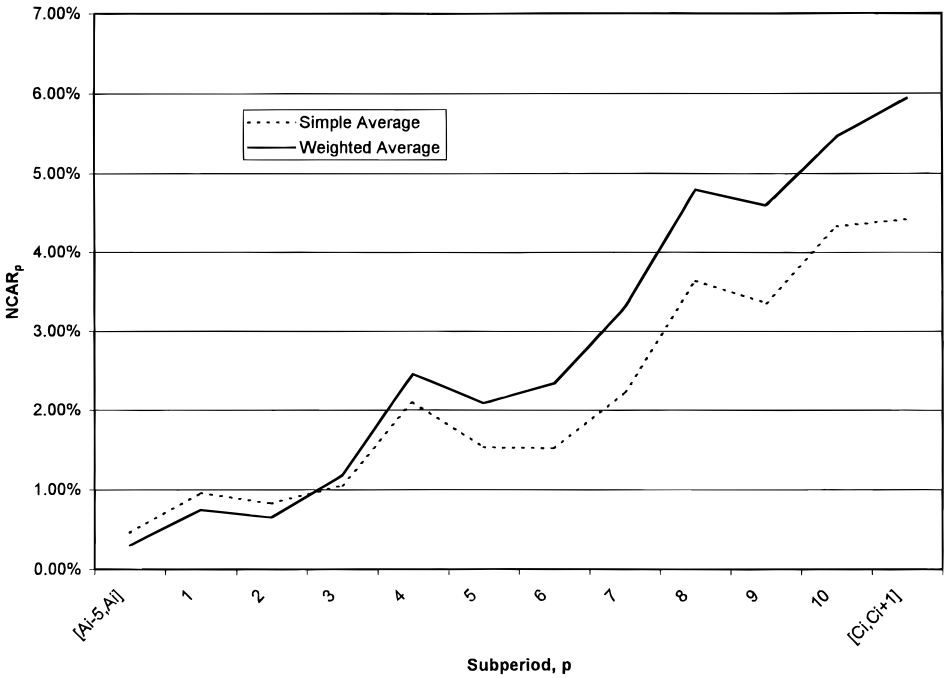

Figure 1. Normalized cumulative abnormal returns (CARs) over 12 subperiods. The first subperiod is $A_i - 5$ to A_i (A_i is the announcement day for company i), and the last subperiod is from day C_i to day $C_i + 1$ (C_i is the day of the reduction in the minimum trading unit). The interim period is divided into 10 equal subperiods. CAR_i is calculated for each stock i over the 12 subperiods and averaged across stocks to provide $NCAR_p$, the normalized average *CAR* for period p, $p = 1,2,\ldots 12$. The weighted *NCAR* uses as weights the inverses of the residual standard deviations from the market model regression (2).

between the announcement and actual reduction day are normalized across events, and we obtain $NCAR_p$, the normalized CAR, over the 12 subperiods $p = 1,2,\ldots 12$.

Figure 1 shows the behavior of the average normalized cumulative abnormal returns over the 12 subperiods, both for simple $NCAR_p$ and for weighted $NCAR_p$. The increase is gradual and peaks at the last interval, $[C_i, C_i + 1]$. This is consistent with the findings in Amihud, et al. (1997) on the value effect of improving the trading mechanism and stock liquidity on the Tel Aviv Stock Exchange. There, the prices of stocks that are transferred to an improved trading mechanism continue to rise following the announcement day through the actual transfer day, a period that ranges from one to six days for different stocks. This is because the benefits of enhanced liquidity cannot be fully consummated until the actual improvement in liquidity takes place. As we show below, the reduction in the MTU can be viewed as a liquidity-enhancement event similar to the one in Amihud et al. (1997), and its benefits could be fully consummated only after the actual day of reduc-

tion in the MTU. Also, according to Merton's (1987) model, investors could not take advantage of the greater diversification afforded by a smaller MTU until the actual reduction occurs. As Figure 1 clearly shows, the value effect of the MTU reduction on stock prices is gradual. In particular, the announcement interval $[A_i - 5, A_i]$ captures only a small fraction of the price effect.[9]

We next test whether the increase in the number of shareholders has a positive effect on stock prices, as hypothesized by Merton (1987), using the following cross-sectional model,

$$CAR_i = \delta_0 + \delta_1 \times \Delta SH_i + \nu_i, \tag{3}$$

where ΔSH_i is the logarithm of the relative change in the number of shareholders. By Merton's (1987) hypothesis, we should obtain $\delta_1 > 0$.

In estimating model (3), we use two measures for the relative change in the number of shareholders: total shareholders, $\Delta TOTSH_i$, and individual shareholders, $\Delta INDSH_i$. The estimation is performed using weighted least squares, with the residual variances from the market model regressions (equation (2)) serving as weights.[10] The results are as follows:

$$\begin{aligned} CAR_i &= 0.004 + 0.081 \times \Delta TOTSH_i + \nu_i, \\ (t =)\quad & (0.12) \quad (2.40) \end{aligned} \tag{4}$$

and

$$\begin{aligned} CAR_i &= -0.031 + 0.088 \times \Delta INDSH_i + \nu_i. \\ (t =)\quad & (0.81) \quad (2.83) \end{aligned} \tag{5}$$

These results significantly support Merton's hypothesis that the increase in the firm's investor base increases its value.

Recognition of the value of increasing the investor base in Japan is evident from the introduction of mini-trading programs by brokerage firms at the end of 1995. Daiwa was the first to launch a program that enables investors to trade units of at least one-tenth of the MTU with the brokerage firm at the market opening price on the day following the submission of an order. (Clearly, this program does not provide daytime liquidity.) The balance of unmatched orders is traded by the brokerage firm either in the market or for its own account. The brokerage commissions are proportional to those that would be paid on an MTU. The other big three brokerage firms—Nomura, Nikko, and Yamaichi—considered these programs too costly to operate but reluctantly initiated their own mini-trading programs. Their programs, however, do not include all stocks covered by Daiwa's program,

[9] Similar to other liquidity events, the arbitrage opportunities presented by this phenomenon are limited, because arbitrage requires buying and holding the stock before its liquidity actually increases. Further, such arbitrage would not be riskless.

[10] The results are similar for ordinary (unweighted) least squares estimation.

and these brokers collect a fixed account-keeping fee from investors.[11] Medium and small brokers were also concerned about the cost of developing and operating the mini-trading programs, but some offer their own programs.[12] Today, mini-trading programs are offered by 19 of the 129 exchange member firms, but most firms limit the stocks for which they are offered. Given that handling small orders entails a fixed cost, the operation of mini-trading programs may not be profitable for brokers, who are therefore reluctant to offer them.

Because of these limitations, the mini-trading programs are by no means perfect substitutes for a reduction in MTU. Even for a stock that participated in such a program, a reduction in MTU still reduces the minimum unit that can be traded in the mini-trading programs, enabling even smaller investors to join. Nevertheless, the introduction of these programs might have diminished the importance of the reduction in MTU. To examine this possibility, we estimate the CAR separately for the 50 stocks that reduced their trading units before the introduction of mini-trading programs (up to October 1995), and for the 16 stocks that changed their MTU following the introduction of these programs (the first event in this group took place in February 1996). The weighted mean CAR for the first group is indeed higher than that of the second: 6.73 percent ($t = 2.62$) for the first group and 3.24 percent ($t = 0.69$) for the second (1996) group. The respective simple (unweighted) means are 4.88 percent and 3.01 percent. However, the difference between the two groups is not statistically significant. Also, our estimates show that the slope coefficient in the cross-sectional model (equation (3)) does not decline in 1996, when mini-trading programs became available.

The continuing benefit from a reduction in the MTU explains why the Japanese government encourages it by waiving the stamp duty on printing new shares created when the company reduces its MTU. As further encouragement the Tokyo Stock Exchange promotes reductions in MTU by advertising and giving special recognition in its publications to companies that reduce their MTU.[13] According to Merton's (1987) model, making more investors aware of a stock increases its investor base. Also, broad awareness of a stock and greater facility in trading it improves its liquidity, as we show in the next section.

IV. Liquidity Effects

Increasing the number of shareholders is positively associated both with investors' recognition, or awareness, of the stock, and with its liquidity. The two factors are intricately related because illiquidity is the direct result of

[11] Daiwa does not collect this fee.

[12] See *Nikkei Financial Daily*, February 20, 1996, "The mini stock program vs. the accumulating investment account." Such an account enables a small investor to accumulate a stock position by making small, fixed monthly payments.

[13] These companies can also be eligible sooner for trading on the first section of the Tokyo Stock Exchange and they qualify sooner for margin transactions (see Tokyo Stock Exchange (1996)).

asymmetric information problems (Bagehot (1971), Kyle (1985)). Indeed, Benston and Hagerman (1974) find that the bid-ask spread on stocks, a measure of illiquidity, is a declining function of the number of shareholders. In this section we examine the direct liquidity effects of reducing the MTU.

We compare the liquidity of each stock i and its control stock $\xi(i)$, before and after the reduction in MTU. Specifically, we define the "BEFORE" interval for stock i as the interval from day $(A_i - 220)$ through day $(A_i - 21)$, and the "AFTER" interval as the interval from day $(C_i + 21)$ through $(C_i + 220)$. We then study the effect of a reduction in the MTU on two measures of liquidity: trading volume and liquidity ratio (Amihud et al. (1997)).

We calculate the total trading volumes over the BEFORE and AFTER periods for both the stocks i whose MTUs were reduced and the corresponding control stocks, $\xi(i)$. Let V_i denote the total trading volume (in yen) of stock i and let $V_{\xi(i)}$ be the corresponding volume for its control stock. We calculate V_i and $V_{\xi(i)}$ over the BEFORE and AFTER periods for each stock i and then calculate the change in relative volume, given by

$$DV_i = \log(V_i/V_{\xi(i)})_{\text{AFTER}} - \log(V_i/V_{\xi(i)})_{\text{BEFORE}}. \tag{6}$$

The mean of DV_i is 0.420, with $t = 2.71$. This suggests that the reduction in the MTU brought about a statistically significant increase in trading volume compared to the control stocks.

To check the robustness of this effect, we also estimate the effect of a reduction in the MTU on the ratio of the two stocks' trading volumes, day by day. Specifically, we calculate for each day on which both stocks i and $\xi(i)$ are traded the ratio of the trading volume of stock i to the trading volume of stock $\xi(i)$. We then average the daily volume ratios over the trading days in the BEFORE and AFTER periods, and calculate the logarithms of the ratios of the two averages. The mean of these ratios is 0.125, with $t = 2.41$, confirming that the reduction in MTU is associated with a relative increase in trading volume.

The impact of the reduction in MTU on liquidity can also be studied by considering its effect on the liquidity ratio (LR) studied in Amihud et al. (1997). The liquidity ratio for stock i is defined as $LR_i = \Sigma_t V_{it}/\Sigma_t|R_{it}|$, where V_{it} and R_{it} are, respectively, the trading volume and return for stock i on day t, and the summation is over the days in the estimation period (BEFORE or AFTER). We then calculate the relative improvement in the liquidity ratio,

$$\Delta LR_i = \log(LR_i/LR_{\xi(i)})_{\text{AFTER}} - \log(LR_i/LR_{\xi(i)})_{\text{BEFORE}}, \tag{7}$$

a measure of liquidity improvement relative to the control stock.[14] ΔLR has a mean of 0.366 with $t = 2.31$, strongly supporting the proposition that the MTU reduction is associated with an increase in stock liquidity.

[14] Another way to write equation (7) is $\Delta LR_i = \log(LR_{i,\text{AFTER}}/LR_{i,\text{BEFORE}}) - \log(LR_{\xi(i),\text{AFTER}}/LR_{\xi(i),\text{BEFORE}})$; that is, it is the relative change in LR (Amihud et al. (1997)) minus that of the control stock.

The liquidity perspective suggests an additional test. The liquidity of a security should be positively related to the intensity of "liquidity-motivated" (Bagehot (1971)) or "noise" trading (Black (1986), Kyle(1985)). Such informationless trades are typically associated with small, individual shareholders who buy or sell small quantities of the stock. Since the reduction in trading unit attracts smaller investors to the investor base, it increases the percentage of "noise" trades—increasing the liquidity of the stock and hence the stock value (Amihud and Mendelson (1986)). This leads to the proposition that the price increase should be an increasing function of the increase in the *proportion* of the firm's shareholders who are individual investors.

To test this proposition, we estimate the model

$$CAR_i = -0.037 + 0.277 \times \Delta PRINDSH_i + \nu_i, \quad (8)$$
$$(t =) \qquad (0.76) \qquad (2.21)$$

where $\Delta PRINDSH_i$ is the change in the proportion of individual shareholders among all shareholders of firm i. The results in model (8) show that the composition of the shareholder base has an effect on stock prices,[15] consistent with the notion that a higher proportion of "noise" trades leads to greater liquidity and higher stock values.

V. Trade-Offs

The substantial value increase following the reduction in trading unit and the associated increase in the investor base raise the question of why some companies do not reduce their MTU, especially given the very small out-of-pocket cost of doing so. However, there are indirect costs associated with the increased dispersion of stock ownership that follows a reduction in MTU: the dispersion of stock ownership raises problems associated with corporate control. Fama and Jensen (1985) and Amihud and Mendelson (1988) suggest that there is a trade-off between liquidity and control. For example, when a company goes public, it increases the liquidity of its stock and enables investors' easy exit from their investment, but there is also an increase in the agency costs resulting from the separation between ownership and control and the conflict of interests between managers and shareholders. The effect is similar when a company increases the dispersion of its ownership, as highly concentrated ownership can reduce agency costs due to a mitigation of the collective action problem (Coffee (1991), Bhide (1993)). Unlike small individual investors, large stockholders have an incentive to monitor corporate management, and institutional investors have the ability to perform that function effectively. In contrast, small individual stockholders have neither the incentive nor the ability to effectively monitor management (see Jensen and

[15] Other variables that could potentially affect stock values were also included in the model, but they do not have a significant effect. These variables include the stock price, the relative change in trading unit, and the relative change in market-adjusted volatility.

Meckling (1976)). The result is that more concentrated ownership improves corporate governance[16] but, by our findings, it also reduces liquidity. Thus, each company faces a trade-off: greater ownership dispersion provides a liquidity benefit, but it also increases agency costs and raises problems of efficient management control. Bolton and von Thadden (1998) explicitly model this trade-off.

The above analysis suggests that increasing the ownership dispersion through the reduction in the minimum trading unit is not beneficial to all companies. Although an increase in the investor base and the greater liquidity have their benefits, they may also generate greater governance costs.[17] The companies that decide to reduce their MTU are those that considered the added governance costs to be relatively small compared with the benefits of greater stock dispersion and liquidity.

VI. Conclusion

In this paper, we test Merton's (1987) hypothesis that securities' values increase with their investor base due to the better diversification of risk. Also, by Amihud and Mendelson (1986), making it feasible for more investors to trade in smaller units increases a security's liquidity and thus increases its value.

Our study utilizes a unique feature of the Japanese equity market, where companies can reduce the minimum trading unit (or lot size) of their stock. We find that this reduction in MTU increases the number of shareholders and the stock prices. Testing Merton's (1987) hypothesis, we find that the stock price appreciation is positively and significantly associated with the increase in the stock's investor base.

Merton proposes that the beneficial value effects of increasing a company's investor base has implications for its corporate finance policies. For example, underwritten stock offerings increase the investor base more than do rights offerings, and this may explain why companies are willing to bear the higher costs of underwriting. Our estimations provide a measure of the benefits that could be matched against costs in a cost-benefit analysis. Our

[16] However, Holmstrom and Tirole (1993) argue that increasing the ownership dispersion and the number of liquidity traders increases the gathering of, and trading on, information by some investors, which improves the information content of the stock price, which in turn is beneficial to the company. Because the gains of informed traders are eventually at the expense of the issuing company, some degree of ownership concentration is desirable. In the context of this paper, it is not optimal for every company to reduce the MTU of its stock.

[17] Additionally, the particular situation in Japan may discourage some companies from reducing their MTU and increasing the number of individual shareholders. By the Japanese Commerce Code, shareholders can claim damages in court against directors' misconduct. The fees for such claims are very low, 8,200 yen (about $66), which may induce frivolous suits by small shareholders. This may also discourage companies from increasing their investor base. See Fukao and Morita (1997).

results also suggest that underwriters should opt for a greater distribution of stocks among investors because of the accompanying increase in the value of the stock issued.[18]

It is worth noting that trading in "round lots" on the Tokyo Stock Exchange (and in many other exchanges) is a relic of the days of manual trading, when the technological trade-offs were different from today's. Then, the simplification that resulted from trading in "round lots" was probably well worth 5 percent of stock values. But with current technology, this is unlikely to continue to hold. Amihud and Mendelson (1985) propose that automated trading systems should allow investors to trade any number of shares, and that they should in fact be able to quote orders in monetary values of any denomination. It is difficult to estimate the value of such improvements, whereas the costs of implementing them are quite tangible. Merton's (1987) theory provides a way to assess the impact of such improvements, and our empirical results show that the effect on stock values is substantial.

REFERENCES

Amihud, Yakov and Haim Mendelson, 1985, An integrated computerized trading system; in Yakov Amihud, Tom Ho, and Robert A. Schwartz, eds.: *Market Making and the Changing Structure of the Securities Industry* (Lexington Heath, Lexington, Mass.).

Amihud, Yakov, and Haim Mendelson, 1986, Asset pricing and the bid-ask spread, *Journal of Financial Economics* 17, 223–249.

Amihud, Yakov, and Haim Mendelson, 1988, Liquidity and asset prices: Financial management implications, *Financial Management* 17, 5–15.

Amihud, Yakov, Haim Mendelson, and Beni Lauterbach, 1997, Market microstructure and securities values: Evidence from the Tel Aviv Stock Exchange, *Journal of Financial Economics* 45, 365–390.

Anshuman, V. Ravi, and Avner Kalay, 1997, Can splits create market liquidity? Theory and evidence. Working paper, University of Utah.

Bagehot, Walter, 1971, The only game in town, *Financial Analysts Journal* 27, 12–14.

Baker, H., and P. Gallagher, 1980, Management view of stock splits, *Financial Management* 9, 73–77.

Benston, George J., and Robert L. Hagerman, 1974, Determinants of bid-asked spreads in the over-the-counter market, *Journal of Financial Economics* 1, 353–364.

Bhide, Amar, 1993, The hidden costs of stock market liquidity, *Journal of Financial Economics* 34, 31–51.

Black, Fischer, 1986, Noise, *Journal of Finance* 41, 529–543.

Bolton, Patrick, and Ernst von Thadden, 1998, Blocks, liquidity and corporate control, *Journal of Finance* 53, 1–25.

Booth, James R., and Lena Chua, 1996, Ownership dispersion, costly information and IPO underpricing, *Journal of Financial Economics* 41, 291–310.

Brennan, Michael J., and Thomas E. Copeland, 1988, Stock splits, stock prices and transaction costs, *Journal of Financial Economics* 22, 83–101.

Brennan, Michael J., and Patricia J. Hughes, 1991, Stock prices and the supply of information, *Journal of Finance* 46, 1665–1691.

[18] Booth and Chua (1996) suggest that the underpricing of IPOs is intended to increase ownership dispersion.

Coffee, John C., 1991, Liquidity versus control: The institutional investor as corporate monitor, *Columbia Law Review* 91, 1277–1367.

Copeland, Thomas E., 1979, Liquidity changes following stock splits, *Journal of Finance* 37, 115–142.

Fama, Eugene F., and Michael C. Jensen, 1985, Organizational forms and investment decisions, *Journal of Financial Economics* 19, 101–119.

Fukao, Mitsuhiro, and Yasuko Morita, 1997, *International Comparison of Corporate Governance Structure* (in Japanese) (Nihon Keizai Shimbun, Tokyo, Japan).

Holmström, Bengt, and Jean Tirole, 1993, Market liquidity and performance monitoring, *Journal of Political Economy* 101, 678–709.

Jensen, Michael C., and William H. Meckling, 1976, Theory of the firm: Managerial behavior, agency costs and ownership structure, *Journal of Financial Economics* 3, 306–360.

Kadlec, Gregory B., and John J. McConnell, 1994, The effect of market segmentation and illiquidity on asset prices: Evidence from exchange listings, *Journal of Finance* 49, 611–636.

Kyle, Albert P., 1985, Continuous auctions and insider trading, *Econometrica* 53, 1315–1336.

Lamoureux, Christopher G., and Percy Poon, 1987, The market reaction to stock splits, *Journal of Finance* 42, 1347–1370.

Levy, Haim, 1978, Equilibrium in an imperfect market: Constraint on the number of securities in the portfolio, *American Economic Review* 68, 643–658.

Merton, Robert C., 1987, A simple model of capital market equilibrium with incomplete information, *Journal of Finance* 42, 483–511.

Mukherji, Sandip, Yong H. Kim, and Michael C. Walker, 1997, The effect of stock splits on the ownership structure of firms, *Journal of Corporate Finance* 3, 167–188.

Muscarella, Chris J, and Michael R. Vetsuypens, 1996, Stock splits: Signaling or liquidity? The case of SDR "Solo-Splits," *Journal of Financial Economics* 42, 3–26.

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

Tokyo Stock Exchange, 1996, *Reduction of Minimum Investment Unit: The Guide for Stock Split and Reduction of Trading Unit* (in Japanese) (Tokyo Stock Exchange).

Ziegler, Bart, 1997, Confident IBM plans 2-for-1 stock split, *Wall Street Journal*, January 29, A3.