The Impact of Minimum-Trading-Units on Stock Value and Price Volatility

by

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We study how minimum trading unit changes on the Tel-Aviv Stock Exchange impact stock's trading activity, price volatility, and value. The value effects are consistent with Merton (1987)'s model, that is, an increase in the investor base (trading volume) and a decrease in price noisiness affect stock value positively. Our results extend Amihud, Mendelson and Uno (1999)'s tests of Merton (1987) by demonstrating a clear relation between price noisiness changes and stock value changes, and by showing that the response to a minimum trading unit decrease becomes less favorable (and arguably even negative) in the thinnest trading stocks.

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Abstract

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I. Introduction

Many exchanges impose a minimum-trading unit (MTU) in a stock, that is require any submitted trading order to exceed a minimum size. The MTU can be set explicitly by stating the minimum number of shares or minimum monetary value of an order. Alternatively, an exchange may require trading in "round lots", in which case the MTU equals the number of shares in a round lot. The official objective of MTUs is to facilitate exchange operation and order execution. The fear is that without MTUs the number of submitted orders would explode, and order execution and information flow from the exchange would slow down considerably. There is evidence that when order flows were extreme (for example, during the October 1987 crash) there were problems in information dissemination which confused investors – see Greenwald and Stein (1988), and Blume, MacKinlay, and Terker (1989).

A recent study by Amihud, Mendelson and Uno (1999), AMU hereafter, examined MTU decreases in 66 stocks on the Tokyo Stock Exchange. AMU find that on average an MTU decrease increases stock value by more than 5%. Further, AMU show that the favorable stock price response is significantly positively correlated with the increase in the stock's investor base (number of shareholders) following the MTU decrease. These findings support Merton (1987)'s propositions on the relation between stock value and its investor base. According to Merton, when more investors hold the stock, it becomes more recognized and less problematic in terms of information availability, which reduces the cost of capital and contributes to stock value. The gain in stock liquidity upon increasing the investor base can also add to stock value.

This study extends the AMU evidence in two ways. First, within an MTU change context, we examine a second prediction of Merton (1987), not examined by AMU. According to Merton (1987), stock value should respond not only to the change in investor base, but also to the change in stock price accuracy. Second, we examine cross-sectional differences in the response to MTU changes, focusing on the differences between large actively traded stocks and small thinly traded stocks. It is reasonable to assume that the volume, hence volatility and value response would depend on the initial tradability of the stock. Thus, like previous microstructure studies (see Lauterbach (2001), for a recent example) we explore differences along the initial tradability dimension.

The sample comprises two changes in the minimum-trading unit (MTU) on the Tel-Aviv Stock Exchange. The first, on September 1, 1998, increased the MTU by 33%, while the second, on December 1, 1999, decreased the MTU by 62-81%. We show that decreasing the MTU promotes trading activity and stock value. The value response is consistent with Merton (1987), that is, stock price reacts favorably to an increase in trading activity and to an improvement in price accuracy. The trading volume, price noisiness and value responses also depend on the initial tradability of the stock, and, interestingly, thin-trading stocks gain less than other stocks (and arguably even lose) from the MTU decrease. The findings in the case of MTU increase are almost a mirror image of the findings for MTU decrease.

The paper is organized as follows. Section 2 analyzes the effects of an MTU decrease within the framework of Merton (1987)'s model. Section 3 describes the data and institutional details. Section 4 presents and discusses the results, and section 5 concludes.

II. Value Effects of MTU Decreases

To analyze the value effects of an MTU change we employ the Merton (1987) model. According to Merton (1987), in a world with incomplete information, investors build portfolios comprising only a limited number of stocks which they "know". Consequently, pricing may deviate from the CAPM in a way first discussed by Levy (1978). Specifically, Merton (1987) derives that:

$$\alpha_k = f(q_k, x_k, \sigma^2_k), \qquad (1)$$

where α_k is the expected excess return of stock k (relative to the CAPM predictions), q_k is the relative size of stock k's investor base (what fraction of investors recognize it), x_k is the relative size of the stock in the market portfolio, and σ^2_k is the firm-specific (non-systematic) variance of stock k's return. Merton (1987) further derives expressions for the partial derivatives (in equation (31) on page 496) indicating that:

$$\partial\alpha_k/\partial\sigma^2_k > 0 \ , \ \partial\alpha_k/\partial x_k > 0 \ , \ \text{and} \ \partial\alpha_k/\partial q_k < 0 \ . \qquad (2)$$

Applying the Merton (1987) formula to the case of an MTU decrease is somewhat treacherous. AMU find that the investor base, q_k, increases following the MTU decrease. Hence, based on AMU and equation (2), it is tempting to conclude that an MTU decrease would increase q_k, decrease α_k, and increase firm value. This is, however, only a partial analysis because an MTU decrease may also affect x_k and σ^2_k. Thus, the total derivative of α_k needs to be assessed. Merton (1987) (pages 496 and 497) highlights the importance of the total derivative calculation.

Now, the total derivative of α_k can be expressed as

$$d\alpha_k = \partial\alpha_k/\partial q_k \cdot dq_k + \partial\alpha_k/\partial x_k \cdot dx_k + \partial\alpha_k/\partial\sigma^2_k \cdot d\sigma^2_k \qquad (3)$$

In this expression, the first term is negative because $\partial\alpha_k/\partial q_k$ is negative (see Merton and above), and, in the case of MTU decrease, dq_k, the change in investor base is positive (see AMU).

The second term in (3) is positive for stocks that increased their weight in the market portfolio following the MTU decrease, and negative for stocks that lost weight in the market portfolio. This term essentially mitigates the total value response of the stock. Consider, for example, a stock whose expected return decreased ($d\alpha_k<0$) following the MTU decrease. The decrease in expected return increases stock value and its share in the market portfolio, hence $dx_k>0$. Thus, when $d\alpha_k<0$, $dx_k>0$, the second term in equation (3) is positive and it mitigates the decrease in α_k. Similarly, when $d\alpha_k>0$, stock value decreases, and the second term of (3) is negative, which mitigates the expected return increase. Because the second term in (3) is of a mitigating nature, the sign of $d\alpha_k$ is determined by the first and third terms of equation (3) only.

The last term in equation (3) is positive when price noisiness (hence σ^2_k) increases following the MTU decrease, and negative when price noisiness decreases. Thus, all other things equal, a decrease in price noisiness reduces the expected return and increases stock value.

Equation (3) implies that the change in price noisiness is of critical importance in determining the overall stock price response to MTU decreases. In the case of a MTU decrease the first term in (3) is negative (see above), and the second term is just mitigating the response. Thus, if price noisiness (σ^2_k) decreases, the last term in (3) is negative, $d\alpha_k$ is negative and stock price increases. To put it simply, if following the MTU decrease, price noisiness decreases and the investor base increases, the stock becomes more valuable. However, if price noisiness (σ^2_k) increases, the last term in (3) is positive, and the sign of $d\alpha_k$ becomes indeterminate. Essentially, the negative effect of the increase in price noisiness might sometimes overwhelm the positive effect of the increased investor base, causing stock price to decline.

According to Merton (1987) affording access to more investors improves available information on the stock and promotes price accuracy. Thus, we expect the investor base to expand ($dq_k>0$) and price accuracy to improve ($d\sigma^2_k<0$) upon MTU decreases. This implies, according to equation (3), a positive response to MTU decreases. However, there might be a problem with this prediction. A well-known empirical regularity (documented in Karpoff (1987), for example) is that stock volume and volatility are positively correlated. Hence, when MTU decreases the increase in trading activity and volume might be accompanied by increased price volatility. Such a volatility increase might affect stock price adversely. Thus, the ultimate effect of MTU decreases on price noisiness and stock value remains to be determined empirically.

The volume, volatility and ultimately value response to MTU changes might also depend on the initial tradability of the stock. For example, it could be argued that lowering the MTU would be particularly beneficial for small and thinly traded stocks because it enables small investors, who demand only small quantities of small and thinly traded stocks in their portfolios, to enter the small and thinly traded stocks' market. Previous empirical research on stock response to other microstructure events (see Kairys, Kruza and Kumpins

(1998) and Lauterbach (2001), for example) documents differences between thin and heavy trading stocks. Hence, we expect such differences in our sample as well.

Predictions similar to those above can be derived when the MTU change is perceived from the liquidity perspective. Many recent studies (see Madhavan (2000) for a review) establish that barriers to trade and illiquidity command an expected return premium. Thus, the prediction that decreasing the MTU is likely to increase stock volume, hence stock liquidity and stock value, can be obtained from liquidity theory as well. The more unique prediction above, implied directly by the Merton (1987) model, is that the stock price response also depends on the price accuracy change.

III. Institutional Background, Data, Methodology and Measures

A. Institutional Background

In 1997-1998 the Tel-Aviv Stock Exchange (TASE, hereafter) gradually moved all stocks to a fully computerized continuous trading platform similar to that of the Paris and Toronto stock exchanges. Kalay, Wei and Wohl (2002) describe this transfer process and its effects in detail. The new trading system consists of an opening auction followed by continuous trade. In the opening auction there were (are) no limits on the order size. However, the continuous trade phase, which is basically a computerized limit order book system, imposed a minimum-trading unit (MTU). In all stocks, orders had to exceed a minimum number of shares whose monetary value equaled 10000 New Israeli Shekels (about $3000 at the time). The minimum trading unit monetary value was (and is still) linked to the level of the general (all stocks) value-weighted TASE index, and was (is) updated by TASE at the end of each month.

After a few months of operation the TASE board, in consultation with the Israel Securities Authority (Israel's counterpart of the SEC), decided to increase the MTU by 33% for all stocks. At the time, the exchange board felt that small public orders are best executed at the opening auction, and that continuous trade should be designed to serve large professional traders mainly. The TASE thought that driving small investors out of the continuous trade stage would eliminate "irrational" prices and dampen intraday price volatility. The MTU increase entered into effect September 1, 1998.

Soon after, the TASE noticed another problem: small cap stocks traded only rarely in the continuous stage. This thin trading of small stocks is a well-known phenomenon in many other exchanges around the world. However, the TASE thought that it could alleviate the problem, i.e., encourage trading in these stocks, by decreasing the MTU. On December 1, 1999, MTU was decreased by 62% (to a monetary value of 5000 New Israeli Shekels) for the 25 largest TASE stocks and by 81% (to a monetary value of 2500 New Israeli Shekels) for the rest of the stocks.

B. Data

We study the two MTU changes described above. Daily data on stock closing prices, volume of trade and number of transactions, in the period June 1998 through February 2000, are collected from the databases of the Israel Securities Authority. In the empirical analysis we focus on the three months before and three months after each MTU change. Thus, sample starts on June 1998 (three months before the first MTU change) and ends on February 2000 (three months after the second MTU change).

For the first MTU change the sample comprises 339 stocks, while for the second MTU change the sample includes 648 stocks. This difference in sample size evolves mainly because on June 1, 1998 (the beginning of our sample for the first MTU change) not all stocks traded continuously – the transfer of all TASE stocks into continuous trade was completed on September 1998 only.

C. Methodology and Measures

We use four trading activity measures for each stock: average daily volume, average daily volume divided by average daily market (all stock) volume, percentage of days in which the stock traded, and average number of transactions per day. We also use two price noisiness measures: daily stock return standard deviation (σ_i), and the ratio of daily stock return standard deviation to daily market return standard deviation (σ_i/σ_m).

The Merton (1987) model suggests that if we examine an MTU change event, Ret_i, stock return in a window straddling the event, would depend positively on Δq_i, the change in the investor base, and negatively on $\Delta\sigma_i$, the change in firm-specific price noisiness. To test it we propose to run for each MTU change the cross-sectional regression:

$$Ret_i = \alpha_0 + \alpha_1 \Delta q_i + \alpha_2 \Delta\sigma_i + \varepsilon_i , \quad (4)$$

and predict that in such a regression α_1 is positive, and α_2 is negative.

In practice, we ran the regression:

$$Ret_i = a + b\, dRVOL_i + c\, d\sigma_i/\sigma_m + \nu_i , \quad (5)$$

where $dRVOL_i$ is the change in relative volume of the stock, $RVOL_i$ is the ratio of stock volume to market (all exchange stocks) volume, and $d\sigma_i/\sigma_m$ is the change in the ratio of stock return standard deviation to market return standard deviation. In regression (5) we use $dRVOL_i$ as a proxy for (or a variable positively correlated with) Δq_i, the change in investor base. It is likely that increasing the number of investors in a stock (investor base) would increase the trading activity in the stock, that is the stock volume and relative volume. Thus, the changes in volume and in relative volume are natural candidates for the role of a Δq_i proxy. We prefer the change in relative volume as our proxy because a change in volume can also emanate from exogenous general factors affecting overall market volume. Amihud, Mendelson and Uno (1999) report, on p. 1180, that MTU decreases increased both investor base and relative volume. Hence, there is some empirical basis for the use of the change in relative volume as a proxy for the change in investor base. Relative volume also served as an explanatory variable in previous empirical studies such as Amihud, Mendelson and Lauterbach (1997) and Muscarella and Piwowar (2001).

As a proxy for $\Delta\sigma_i$, the change in firm-specific price noisiness, we use $d\sigma_i/\sigma_m$, the change in σ_i/σ_m. This change may be a better proxy for the change in firm specific volatility than the change in σ_i because the calibration by σ_m cleans some of the effects of the overall-market volatility factors.

A second purpose of the empirical work is to examine cross-sectional differences in the response to MTU changes. Section II raises the possibility that thin- and heavy-trading stocks react differently to MTU changes. Thus, we examine, via Analysis of Variance (ANOVA) techniques, the difference between groups of stocks differing in their initial trading volumes, and test whether the volume, volatility and value of all stocks (heavy- and thin-trading) respond the same to MTU changes.

IV. Empirical Results

A. The Behavior of Value, Volume, and Volatility Around MTU Changes

Table 1 provides some general statistics on our key variables' behavior around the MTU changes. The MTU increase was accompanied by a decrease in stock values, while the MTU decrease was accompanied by an increase in stock values. On average, following the MTU increase, stock volume and the percentage of trading days decreased significantly, and individual stock daily standard deviation increased significantly. Following the MTU decrease, the average stock volume, percentage of trading days, and individual stock daily standard deviation increased significantly.

The only surprising finding in Table 1 is the increase in stock return standard deviation following the MTU decrease. This increase may be due to the large increase in trading activity following the MTU decrease and to some unaccounted for factors that are exogenous to the MTU decrease. In fact, the market return standard deviation also increased significantly following the MTU decrease. Our scaled volatility measure, σ_i/σ_m, corrects for the change in market volatility, and affords a better look at the firm specific change in volatility. In Table 1, the scaled volatility decreases significantly following the MTU decrease, suggesting an increase in individual stock price accuracy after the MTU decrease.

(Insert Table 1 about here)

B. Tests of the Merton (1987) Model

According to the Merton (1987) model (our equation (3)), the MTU change affects value through its impact on two characteristics: the size of the investor base and price noisiness. In equation (5) we propose a regression of stock returns on $dRVOL_i$, the change in the stock's relative volume (our investor base estimate), and $d\sigma_i/\sigma_m$, the change in the stock's relative standard deviation (our price noisiness estimate), as a test of Merton's model.

Regressing Ret_i, individual stock return from one month before to one month after the MTU change, on $dRVOL_i$ and $d\sigma_i/\sigma_m$, we fit

in the MTU *increase* sample

$$\underset{}{Ret_i} = \underset{(0.000)}{-0.0769} + \underset{(0.065)}{0.0186}\, dRVOL_i - \underset{(0.001)}{0.0556}\, d\sigma_i/\sigma_m + \varepsilon_i \qquad \text{Adj. } R^2 = 0.028\,, \qquad (6)$$

and, in the MTU *decrease* sample

$$Ret_i = \underset{(0.000)}{0.1681} + \underset{(0.001)}{0.0331}\, dRVOL_i - \underset{(0.008)}{0.0606}\, d\sigma_i/\sigma_m + \varepsilon_i \qquad \text{Adj. } R^2 = 0.015\,, \qquad (7)$$

where *p*-values are presented in parentheses below the coefficients.

The regression results above are consistent with Merton (1987) and equations (3) and (5) predictions. An increase in relative volume influences value positively, while an increase in price noisiness (σ_i/σ_m) destroys value. We argue that the changes in relative volume and in price noisiness are due to the MTU changes. Thus, we conclude that the MTU changes also had some value repercussions.

Some robustness results are noteworthy. First, when we regress Ret_i on $dVOL_i$ and $d\sigma_i$ (unadjusted for the market) the regression coefficients and *p*-values remain the same as in equations (6) and (7) - only the regression intercept changes. This is because of our logarithmic formulation of changes. We define

$$dRVOL_i = Ln\,(VOL_i^{after} / VOL_m^{after}) - Ln\,(VOL_i^{before} / VOL_m^{before})$$

$$= Ln\,(VOL_i^{after} / VOL_i^{before}) - Ln\,(VOL_m^{after} / VOL_m^{before}) = dVOL_i - k\,, \qquad (8)$$

where VOL_i and VOL_m are stock and market volumes, respectively, and k is a constant (due to the fact that the MTU change occurred at the same date for all stocks). Equation (8) explains why the regression coefficients do not change when $dVOL_i$ and $d\sigma_i$ are used as explanatory variables. It also clarifies that using another market index or proxy won't change the key coefficients. Finally, changing the dependent variable in regressions (6) and (7) to $Ret_i - R_m$, net of market return, or to $Ret_i - mean(Ret_i)$, mean adjusted return, would not change the key coefficients. Thus, the main findings in regressions (6) and (7) do not depend on our choice to standardize or not to standardize the return, volume, and price noisiness variables.

Second, we examine problems introduced by non-trading. For example, our price noisiness measures (return standard deviation and σ_i/σ_m) are likely to be downward biased for thin-trading stocks because of the many zero return (no trade) days of these stocks. To alleviate the problem, we exclude from the regressions stocks that traded in less than half of the trading days in the sample. The fitted regressions become

in the MTU *increase* sample (number of observations = 227)

$$\underset{}{Ret_i} = \underset{(0.000)}{-0.0866} + \underset{(0.003)}{0.0447}\, dRVOL_i - \underset{(0.000)}{0.1367}\, d\sigma_i/\sigma_m + \varepsilon_i \qquad \text{Adj. } R^2 = 0.098\,, \tag{9}$$

and, in the MTU *decrease* sample (number of observations = 336)

$$Ret_i = \underset{(0.000)}{0.2612} + \underset{(0.000)}{0.1023}\, dRVOL_i - \underset{(0.010)}{0.0724}\, d\sigma_i/\sigma_m + \varepsilon_i \qquad \text{Adj. } R^2 = 0.129\,, \tag{10}$$

where *p*-values are presented in parentheses below the coefficients. Evidently, eliminating stocks with severe non-trading problems only strengthens our results and conclusions.

To illustrate the quantitative effects of the change in relative volume (dRVOL) and the change in price noisiness (σ_i/σ_m) we present Table 2. Table 2 compares the average mean-adjusted returns in subsamples differing in the signs of $d\sigma_i/\sigma_m$ and dRVOL. According to the Merton (1987) model (our equation (3)), when both $d\sigma_i/\sigma_m$ (our proxy of $d\sigma^2_k$) is negative and dRVOL (our proxy of dq_k) is positive, $d\alpha<0$ and stock value should increase. This is confirmed in Table 2. In both the MTU increase and MTU decrease samples, the mean adjusted return is positive and highest in the subsample of firms (cell in Table 2) where dRVOL>0 and $d\sigma_i/\sigma_m<0$. Likewise, Table 2 supports equation (3)'s prediction of a decline in stock value (relative to other stocks) when both dRVOL<0 and $d\sigma_i/\sigma_m>0$.

Interestingly, in the MTU decrease sample, stocks that clearly benefited from the MTU decrease, i.e., improved both their trading activity and their price accuracy (dRVOL>0 and $d\sigma_i/\sigma_m<0$), gain a mean adjusted excess return of 5.2%. This estimate of excess return is similar to the about 5% excess return found by AMU for MTU decreases in Japan.

(Insert Table 2 about here)

C. A Comparison of Thin and Actively Traded Stocks

Another goal of the empirical work is to examine whether the changes in stock value, investor base (relative volume) and price noisiness (σ_i/σ_m) depend on the initial tradability of the stock. Table 3 presents the cross-sectional evidence. The left side of the table reports results for the MTU increase, and the right side summarizes our findings for the MTU decrease. Regarding the MTU increase, we divide the 339 sample stocks into 3 portfolios according to their trading volume. Portfolio 1 comprises the 100 stocks with largest trading volumes in the pre-increase period (June-August 1998). These stocks are essentially the stocks included in the locally prestigious TASE_100 index. Portfolio 2 comprises 100 stocks with intermediate trading volumes, and portfolio 3 assembles 139 stocks with the lowest trading volumes in our sample in June-August 1998.

For each portfolio we examine several trading activity and price noisiness characteristics. The first is trading volume. The table reports for each portfolio the average daily trading volume of a stock in June-August 1998, and the average "percentage change" in daily volume between the pre-increase (June –August 1998) and post-increase (September-November 1998) periods. To calculate the average "percentage change", we calculate Ln (level after / level before) for each stock, multiply it by 100, and take an average across all stocks in the portfolio. Examining the evidence we observe that following the MTU increase trading volume has decreased. The percentage volume decline is not equal across all portfolios. On average, volume declined the least for the most heavily traded stocks (portfolio 1). The difference across portfolios in the average percentage volume decline is statistically significant at the 5% level, as is indicated by the *p*-value of the one-way Analysis of Variance (ANOVA) F-statistic. Hence, our volume findings suggest significant cross-sectional differences.

(Insert Table 3 about here)

The relative volume (stock volume divided by market volume), number of transactions per day, and percentage of trading days results in Table 3 support the conclusion of significant cross-sectional differences. In all trading activity measures, the average percentage decline differs significantly across portfolios (see the F-statistics' p-values), and the percentage drop in trading is mildest for the heavily traded stocks. It appears that the MTU increase hurt less the trading activity of heavily traded stocks.

Following the MTU increase, daily return standard deviation increased for most stocks. The percentage increase in return standard deviation differs significantly across the portfolios (see the *p*-values of the F-tests), and is largest for the heavily traded stocks. The standardized measure, σ_i/σ_m, also manifests a response that is monotonic in the initial tradability of the stock. It appears that the MTU increase increased the relative price noisiness of heavily traded stocks, where relative means vis a vis thin-trading stocks.

The MTU decrease results are presented on the right side of Table 3, and are based on a division of the 648 sample stocks into six portfolios according to the stocks' trading volume in the pre-decrease period (September-November 1999). Portfolios 1 through 5 include 100 stocks each, with portfolio 1 comprising the 100 most heavily traded stocks (basically the TASE_100 stocks), and portfolio 2 including the 100 stocks that are most heavily traded when portfolio 1 stocks are excluded. Portfolio 6 comprises the 148 lowest volume stocks in September-November 1999.

Following the MTU decrease, trading activity increases. Yet, significant cross-sectional differences exist. The average percentage increase in volume is mildest for the heavily traded stocks. Interestingly, the increase in volume of less heavily traded stocks is so large that the most heavily traded portfolio (portfolio 1) loses relative volume following the MTU decrease, i.e., its share in market trading decreases.

Daily return standard deviation increases following the MTU decrease. As discussed before (in Section IV.A), this may be due to the relatively large increase in trading activity following the MTU decrease. We regress the change in standard deviation ($d\sigma_i$) on the change in stock relative volume (dRVOL), and find that in the MTU decrease sample:

$$d\sigma_i = 0.257 + 0.240\ dRVOL_i + \varepsilon_i \qquad \text{Adj. } R^2 = 0.308 \qquad (11)$$
$$\qquad (0.000)\ \ (0.000)$$

where p-values appear in parentheses. Similarly, in the MTU increase sample:

$$d\sigma_i = 0.241 + 0.271\ dRVOL_i + \varepsilon_i \qquad \text{Adj. } R^2 = 0.192 \qquad (12)$$
$$\qquad (0.000)\ \ (0.000)$$

Evidently, trade and return volatility are positively correlated, as suggested before in the literature (see Karpoff (1987)). Thus, at least part of the increased stock volatility in the period following the MTU decrease can be attributed to the increase in trading volumes.

A more indicative measure of the firm-specific change in volatility is the scaled standard deviation (σ_i/σ_m) measure. It demonstrates an interesting cross-sectional variation. Scaled standard deviation decreased significantly for heavily traded stocks, and increases for the thinnest trading stocks. Thus, MTU decreases appear to increase the relative price noisiness of thin trading stocks.

The standard deviation results deserve two further comments. First, when we omit the thinnest trading stocks (portfolio 6) from the analysis, the difference across portfolios 1 through 5 in the percentage change of standard deviation remains statistically significant (*p*-value of 0.001). This suggests that the problem of non-trading, which impairs the daily standard deviation estimation, is not responsible for the finding that the change in standard deviation following an MTU decrease depends on the initial tradability of the stock. Second, note that in 5 out of our 6 portfolios σ_i/σ_m declines following the MTU decrease. The measure σ_i/σ_m can decline for most stocks when the idiosyncratic noise in individual stock return declines (σ_m is unaffected by idiosyncratic noise). Thus, the finding that for most stocks σ_i/σ_m declined after the MTU decrease supports the view that for most stocks the MTU decrease reduced firm-specific price noisiness.

Table 4 shows the raw returns of the stock portfolios established in Table 3 in two windows around the MTU change: months -1 through 1, and months –3 through 1. The first window is designed to capture the response from a month before to a month after the MTU change, while the second window starts earlier to capture possible leaks during the process of debating and approving the MTU change.

(Insert Table 4 about here)

The raw returns of stocks are negative on average around the MTU increase and positive on average around the MTU decrease. This is consistent with AMU's findings that MTU decreases add value. However, like in Table 3, a significant cross-sectional variation exists. Interestingly, thin trading stocks react the least to MTU changes – their value decreases the least when MTU increases, and increases the least when MTU decreases.

Table 4 also presents average mean-adjusted and net of market returns. These results support the finding that large and liquid stocks gain the most from the MTU decrease and lose the most from the MTU increase.

Last, we explore the response of Portfolio 6 (the 148 thinnest trading stocks) to the MTU decrease. Portfolio 6 stands out in Table 3 as the (only) group of stocks whose return volatility and scaled return volatility both increased following the MTU decrease. Thus, the price accuracy of Portfolio 6's stocks has deteriorated following the MTU decrease. According to Merton (1987) and our findings in regressions (7) and (10), stock prices are negatively affected by this price accuracy decrease. In theory, the negative value impact of the price accuracy decrease could overwhelm the positive value impact of the investor base (trading volume) increase. Is there evidence in our sample that some stocks reacted negatively to the MTU decrease?

We divide Portfolio 6 into three smaller portfolios of about 50 stocks each, based on the initial tradability of the stocks. Portfolio 6a comprises the 50 most active stocks of Portfolio 6, i.e., thin trading stocks that are slightly more active. Likewise, Portfolio 6c comprises the 49 least actively traded stocks of Portfolio 6, that is the thinnest trading stocks in our sample. The average returns of the portfolios are reported at the bottom of Table 4.

Portfolios 6a through 6c demonstrate a monotonic decrease in average raw return and other stock performance measures. Most interestingly, the mean raw return of Portfolio 6c (the thinnest trading stocks) in the two months straddling the MTU decrease is 0.26% only, much below the concurrent stock market return of 19.6%, and below the concurrent two-month risk-free (Israeli T-bill) rate of 1.8%. Apparently, these extremely thin trading stocks lost value upon the MTU decrease. Notably, most of the stocks in Portfolio 6c literally lost value, as evidenced by the finding that the median raw return of these stocks in the two months straddling the MTU decrease is –1.9%.

The evidence above highlights the merit of Merton's (1987) model. The Merton model does not necessarily imply that increasing the investor base would always increase stock value. Our findings, based on Merton (1987), illustrate that in some cases, when the increase in investor base is accompanied by a significant decrease in price accuracy, stock price response could be negative. The question to ask is why does the price quality of thinly traded stocks deteriorate after the MTU decrease? And, could it be that the joining traders are predominantly small speculators or noise traders (see Black (1986)) who merely increase price noisiness? These questions are left for future research.

V. Conclusions

The new finding of the study is that changing Minimum Trading Units (MTU) affects not only the size of the investor base, but also price noisiness. These price noisiness changes are important because they are priced. As predicted by Merton (1987), an increase in price noisiness decreases stock value.

The data also manifest large cross-sectional variations in the response to MTU changes. The changes in volume (investor base), stock value, and price noisiness depend on the initial tradability of the stock. Most importantly, heavily traded stocks appear to gain the most from MTU decreases and lose the most from MTU increases.

Regarding the MTU itself, we find, like Amihud, Mendelson and Uno (1999), that a decrease in MTU encourages trading activity and generates value. Thus, in general, MTUs should be abated. Exchanges that fear from technical problems such as a flood of small orders slowing down operation and information dissemination can maintain a small MTU, preferably in monetary value, or use a small fixed trading commission to discipline traders.

The only caution about our recommendation to abate MTUs relates to small and thin trading stocks. In our sample, extremely thin-trading stocks appear to lose value upon the MTU decrease, and for many other small and thin-traded stocks price noisiness increased following the MTU decrease. Thus, MTU decreases may not be able to improve price accuracy and value for all stocks. Future studies should try to identify the mechanism by which MTU changes affect price noisiness and stock value.

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Table 1: The response to minimum trading unit changes

Two minimum trading unit (MTU) changes on the Tel-Aviv Stock Exchange (TASE) are reviewed: an MTU increase on September 1, 1998 and an MTU decrease on December 1, 1999.

	MTU increase	MTU decrease
Number of firms in our sample	339	648
Mean raw return from one month before to one month after	-8.53%	19.64%
Mean raw return from three months before to one month after	-12.20%	20.50%

	MTU increase			MTU decrease		
	Mean before	Mean change (in %) following the MTU increase[a]	p-value of percentage change[b]	Mean before	Mean change (in %) following the MTU decrease[a]	p-value of percentage change[b]
Daily volume (in New Israeli Shekels)	477,633	-27.4%	0.000	439,395	117.5%	0.000
Percentage of trading pays	75.3	-20.2%	0.000	55.2	47.8%	0.000
σi = daily return standard deviation	2.65	12.2%	0.000	2.75	41.5%	0.000
σi/σm = daily return standard deviation divided by market return standard deviation	2.14	0.7%	0.81	3.25	-10.8%	0.000

[a] Calculated as the mean across stocks of Ln (after/before) multiplied by 100.

[b] A low p-value rejects the null hypothesis of no change in the mean.

Table 2: Stock price reaction to changes in trading activity and in price efficiency

The table presents tests of Merton (1987). dRVOL is the change in relative volume of the stock following the minimum trading unit (MTU) modification, where relative volume is stock volume divided by market volume (both in monetary units). $d\sigma i/\sigma m$ is the corresponding change in the ratio of stock return daily standard deviation to market return daily standard deviation. MARet (-1,1) is the sample-mean adjusted return of the stock, calculated as the return on the stock from one month before to one month after the MTU change minus the mean return on all sample stocks in the same interval.

	Average MARet across stocks (number of observations)		t-statistic of difference (p-value)
	dRVOL < 0	dRVOL > 0	
MTU increase (339 stocks)			
$d\sigma i/\sigma m < 0$	0.0342 (113)	0.0674 (29)	0.92 (0.360)
$d\sigma i/\sigma m > 0$	-0.0422 (125)	-0.0075 (72)	1.66 (0.099)
t-statistic of difference (p-value)	4.72 (0.00)	1.95 (0.057)	
MTU decrease (648 stocks)			
$d\sigma i/\sigma m < 0$	-0.0423 (173)	0.0520 (251)	3.75 (0.000)
$d\sigma i/\sigma m > 0$	-0.1523 (35)	-0.0022 (189)	4.52 (0.000)
t-statistic of difference (p-value)	3.97 (0.000)	1.74 (0.082)	

Table 3: The cross-sectional effects of changing the minimum trading unit on trading activity and price volatility

Two minimum trading unit (MTU) changes in the Tel Aviv Stock Exchange (TASE) are reviewed: an MTU increase on September 1, 1998, and an MTU decrease on December 1, 1999. For each change we compute daily trading activity and price volatility measures in the three months before and three months after the MTU change. The table reports the average level of each measure before the MTU change and the average percentage change in the measure following the MTU change.

The MTU increase sample comprises 339 stocks that are divided into three portfolios according to their trading volumes before the change. Portfolio 1 includes the 100 most actively traded stocks, and portfolio 3 assembles the 139 least actively traded (thin trading) stocks in the sample. Similarly, the MTU decrease sample comprises 648 stocks that are divided into six portfolios, with portfolio 1 comprising the 100 most actively traded stocks, and portfolio 6 including the 148 least actively traded stocks.

		MTU increase		MTU decrease	
	Portfolio	Mean before	Mean percentage change following the MTU increase[a]	Mean before	Mean percentage change following the MTU decrease[a]
Daily volume (in New Israeli Shekels)	1	1,518,578	-10.7%	2,591,503	45.7%
	2	76,070	-42.9	177,173	57.7
	3	17,646	-28.3	51,035	68.9
	4			18,669	110.5
	5			6,408	127.1
	6			1,684	237.5
p-value of difference[b]		0.000	0.023	0.000	0.000
Relative volume (stok volume divided by market volume)[c]	1	0.9379	-26.2%	0.9101	-5.6%
	2	0.0470	-58.4	0.0622	6.5
	3	0.0109	-43.8	0.0179	17.7
	4			0.0066	59.3
	5			0.0023	75.9
	6			0.0006	186.3
p-value of difference[b]		0.000	0.023	0.000	0.000

Table 3 (continued)

	Portfolio	MTU increase: Mean before	MTU increase: Mean percentage change following the MTU increase[a]	MTU decrease: Mean before	MTU decrease: Mean percentage change following the MTU decrease[a]
Number of transactions per day	1	37.17	-18.3%	49.81	70.2%
	2	3.63	-50.4	5.07	101.6
	3	1.13	-36.7	1.72	114.9
	4			0.74	164.2
	5			0.32	187.8
	6			0.11	264.4
p-value of difference[b]		0.000	0.003	0.000	0.000
Percentage of trading days	1	98.0	-4.0%	97.9	2.1%
	2	83.9	-20.4	86.3	11.1
	3	52.8	-31.7	65.2	25.6
	4			47.9	47.4
	5			33.2	60.4
	6			18.3	110.3
p-value of difference[b]		0.000	0.000	0.000	0.000
σi = daily return standard deviation	1	2.22%	24.5%	2.67%	21.7%
	2	2.66	13.5	2.70	20.2
	3	2.94	2.7	2.99	20.8
	4			2.96	36.0
	5			3.15	42.0
	6			2.26	86.3
p-value of difference[b]		0.000	0.004	0.000	0.000
$\sigma i/\sigma m$ = daily return standard deviation divided by market return standard dev.[c]	1	1.80	13.0%	3.15	-30.8%
	2	2.15	1.6	3.19	-32.2
	3	2.38	-8.8	3.52	-31.6
	4			3.50	-15.3
	5			3.70	-10.4
	6			2.67	33.9
p-value of difference[b]		0.000	0.012	0.000	0.000

[a] Calculated as the mean across stocks of Ln (after/before) multiplied by 100.

[b] Analysis of Variance is used to compute F-statistics that test the differences in mean across the portfolios above. A low p-value rejects the null hypothesis that all means are equal.

[c] Market volume is total volume of all stocks traded on the Tel-Aviv Stock Exchange, and market return is the value-weighted return of all stocks traded on the Tel-Aviv Stock exchange.

Table 4: The cross-sectional behavior of stock returns around minimum trading unit changes

Ret (-1,1), the return on the stock from one month before to one month after the minimum trading unit (MTU) change, is calculated as Ln (price one month after/price one month before). Ret (-3,1) is the corresponding measure for the period from three months before to one month after the MTU change.

The MTU increase sample comprises 339 stocks that are divided into three portfolios according to their trading volumes before the change. Portfolio 1 includes the 100 most actively traded stocks, and portfolio 3 assembles the 139 least actively traded (thin trading) stocks in the sample. Similarly, the MTU decrease sample comprises 648 stocks that are divided into six portfolios, with portfolio 1 comprising the 100 most actively traded stocks, and portfolio 6 including the 148 least actively traded stocks.

In the last part of our analysis (bottom part of the table), portfolio 6 is further divided into three: portfolio 6a (comprising the 50 heaviest trading stocks of portfolio 6) through portfolio 6c (comprising the 49 thinnest trading stocks in portfolio 6, which are also the thinnest trading stocks of our sample).

	The average of			
	Ret(-1,1)	Mean adjusted Ret(-1,1)[a]	Net of market Ret(-1,1)[b]	Ret(-3,1)
MTU increase				
Portfolio 1	-0.1319	-0.0467	-0.0171	-0.1567
Portfolio 2	-0.0891	-0.0038	0.0258	-0.1166
Portfolio 3	-0.0489	0.0363	0.0659	-0.1026
p-value of difference[c]	0.000	0.000	0.000	0.105
MTU decrease				
Portfolio 1	0.2700	0.0736	0.0959	0.3676
Portfolio 2	0.2682	0.0718	0.0941	0.2945
Portfolio 3	0.2405	0.0441	0.0664	0.2640
Portfolio 4	0.2465	0.0501	0.0723	0.2560
Portfolio 5	0.1552	-0.0412	-0.0189	0.1328
Portfolio 6	0.0624	-0.1340	-0.1118	0.0461
p-value of difference[c]	0.000	0.000	0.000	0.000
MTU decrease – further decomposition of portfolio 6 (thinnest trading stocks)				
Portfolio 6a	0.1245	-0.0749	-0.0497	0.0967
Portfolio 6b	0.0589	-0.1376	-0.1153	0.0311
Portfolio 6c	0.0026	-0.1939	-0.1716	0.0110
p-value of difference[c]	0.038	0.038	0.038	0.250

Table 4 (continued)

[a] Mean adjusted Ret(-1,1) equals Ret(-1,1) minus the mean of Ret(-1,1) across all sample stocks.

[b] Net of market Ret(-1,1) equals Ret(-1,1) minus the value-weighted return of all stocks on the Tel-Aviv Stock Exchange.

[c] Analysis of Variance is used to compute F-statistics that test the differences in mean across the portfolios above. A low p-value rejects the null hypothesis that all means are equal.