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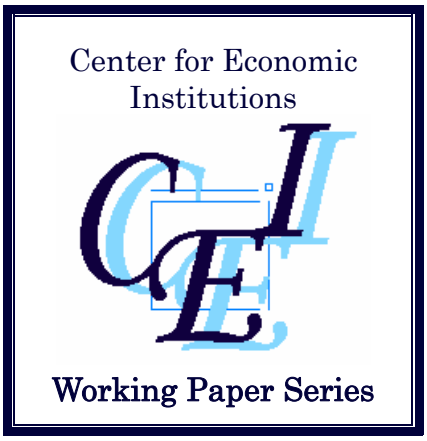
Pantisa Pavabutra and Sukanya Prangwattananon



Institute of Economic Research
Hitotsubashi University
2-1 Naka, Kunitachi, Tokyo, 186-8603 JAPAN
Tel: +81-42-580-8405
Fax: +81-42-580-8333
e-mail: cei-info@ier.hit-u.ac.jp

Tick Size Change on the Stock Exchange of Thailand

Pantisa Pavabutr[a,*] and Sukanya Prangwattananon [b]

[a] Thammasat University

[b] Stock Exchange of Thailand

January 31, 2008

Abstract

This paper explores the impact of exogenous tick size reduction on bid-ask spreads, depths, and trading volume on the Stock Exchange of Thailand (SET). On November 5, 2001, the SET implemented tick size reduction on stocks below THB 25. Even though trading on the Thai Exchange is largely dominated by retail investors, the tick reduction produces similar empirical results found in markets where institutional investors are more dominant. Tick reduction on the SET is associated with declines in spreads, quoted and accumulated market depths. The study finds no significant change in trading volume of the affected stock group.

* Corresponding author: School of Business, Thammasat University, Bangkok 10200, Tel: +662-225-2107
Email: pantisa@tu.ac.th

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JEL classification: G14; G18
Keywords: Tick size, Market microstructure, Transaction costs

1 Introduction

Tick size is the minimum price variation allowance for stock quotations. On one hand, the discreteness in the bid-ask spread created by regulated tick size helps reduce both bargaining time and costs from potential execution errors. The downside of a regulated tick size is that it can drive a wedge between the true price and the actual transaction price, resulting in additional costs for investors.

Yet, markets around the world have adopted smaller tick sizes in an attempt to reduce transaction costs and promote trading activities. In 1994, the Stock Exchange of Singapore (SES) reduced the minimum tick size for stocks that trade at and above SGD 25 from SGD 0.5 to SGD 0.10. The Toronto Stock Exchange (TSE) introduced pure decimal pricing in 1996; a change from mixed decimal and fractional pricing. It also reduced the minimum tick for stocks traded at or above CAD 5 from CAD 0.125 to CAD 0.05, and for those trading from CAD 3 to less than CAD 5 from CAD 0.05 to CAD 0.01. The American Stock Exchange (AMEX) cut the minimum price increment from USD 1/8 to USD 1/16 across the market in 1997 before introducing decimalization in early 2001. A line of empirical work evaluates the impact of these reductions on transaction costs and liquidity. The general

finding is that reduction in price increment leads to lower bid-ask spreads and quotes while there is ambiguous impact on trading volume.

This paper evaluates of the impact of tick size reduction for the Stock Exchange of Thailand (SET) on bid-ask spreads, depths, and trading volume. The tick rule change was implemented on stocks that trade below THB 25 on November 5, 2001.[1]

While there is a growing list of studies on the impact of exogenous tick size changes, the unique structure of the Thai market, as well as the intraday disclosure of trader type, contributes to the literature in various important ways. First, the Thai market is dominated by retail investors who account for approximately 70% of total trades. Data from the Association of Thai Brokerages indicate that small retail accounts of less than THB 1 million (approximately USD 30,000) take up 88% of total brokerage account records and around 40% of retail trading volume. Since the Thai exchange is a limit order market where traders must compete to gain order precedence, we explore whether the more wealth-constrained retail investors, who are likely to be more sensitive to discreteness, are induced to provide more liquidity after tick reform.

Second, the tick rule change resulted in a very fine tick size schedule which classifies stocks into groups according to their price; each group with different minimum price increments. Additionally, retail trading participation is monotonically decreasing in price. This allows us to examine whether there is an association between the size of tick reduction and spread reduction, and whether the impact on depths and trading activities is uniform across different price steps and levels of retail trading participation.

[1] For stocks trading below THB 2, the tick size was cut from THB 0.1 to THB 0.01. For those trading trading from THB 2 to less than THB 5, and for those trading from THB 5 to less than THB 10, tick size was reduced from THB 0.1 to THB 0.02 and THB 0.05, respectively. The last group affected by the tick reform included stocks trading from THB 10 to less than THB 25. The tick size for this group was reduced from THB 0.25 to THB 0.1.

Our paper contributes to existing literature by providing empirical evidence that tick reduction on the Thai market, which is predominantly retail-based, yields similar results to those observed in markets elsewhere. That is, the study documents a fall in bid-ask spreads, market quotes and finds that tick reduction has no significant impact on the trading volume of stocks affected by the rule change. This corroborates with existing theories that reduction in tick size may not necessarily enhance trading activity given informational risk concerns and limited profitability when tick size is too small. Angel (1997) and Anshuman and Kalay (2002) note that a tick size that is too small may not be sufficient to compensate liquidity provision in presence of informed traders. Seppi (1997) and Cordella and Foucault (1999) produce models to convey these concerns and show that the optimal tick size should not be zero. The finding also supports existing empirical work. See for example, Ahn et al. (1996; 2002), and Goldstein and Kavajecz (2000), all of whom document declines in quoted depths following tick reductions. The finding that tick size reduction has negative and significant impact on order exposure and no significant change in trading activity is likely due to two opposing effects. On the one hand, tick reduction helps reduce discreteness related costs and should induce more trading. On the other, smaller minimum price increments can discourage order exposure and hurt the profitability of limit order traders resulting in decreased liquidity demand and supply (see Harris, 1991; 1994). In this study, the profitability issue from price discreteness is likely to be more important than the information risk issue, particularly when we use a sample of liquid stocks with high visibility. Furthermore, trading activities is concentrated among retail investors who are likely to have similar information and strategy sets.[2]

The key findings in this study are as follows. First, we find that the effect of tick reduction on bid-ask spreads varies across the tick size schedule. So far, there have been few studies on the effects of tick reduction across tick size schedules.[3] Our results show that the size of bid-ask spread reduction is related to the proportion of effective tick reduction as spread reduction is steepest for the group that receives the largest cut in relative tick size whereas spread reductions are much more

[2] In terms of homogeneity of investors, stocks in the lowest price range in our study, i.e. those trading below THB 5 have over 90% retail type trading participation.
[3] Ahn et al. (2002) and Bourgelle and Declerck (2002) show the impact tick of reductions across different price range groups and tick schedules on the Japanese and French bourse, respectively. However, similar evidence from emerging markets where institutional structures are different, is limited.

modest for groups that receive lower tick size cuts.[4] More specifically, we find that tick size reduction has been effective in reducing the bid-ask spreads for all stock groups, particularly for stocks priced below THB 2 and for those from THB 2 but less than THB 5, where the cost of trading, measured by reduction in quoted spread, drops by THB 0.12 and THB 0.09 or by 57% and 32%, respectively. Reductions in quoted spreads for those with prices ranging from THB 5 to less than THB 10 and from THB 10 to less THB 25, are THB 0.05 and THB 0.15 or 13% and 18%, respectively. To confirm this relationship, we regress of the changes in spreads on changes in tick sizes controlling for changes in quoted depths, trading volume, and return standard deviation and find that the size of tick reduction has positive and significant impact on the size of bid-ask spread reduction.

Second, the study reveals that quoted depths (combined order flows at the best bid-ask prices), and market depths (combined order from entire limit order book) declined by 48% and 56%, respectively, subsequent to the split. At the same time, tick reduction shows no significant impact on trading volume. Although an increase in overall daily average volume is observed, this is mainly driven by the high daily average volume change of stocks trading from THB 10 to less than THB 25. The stocks in this group have relatively larger market capitalization and generally receive better trading interest. Outside this group, the daily average volume has, in fact, increased marginally. The cross-sectional regression indicates that it is indeed firm size, which proxies for stock price trading range, and not the reduction in tick size that leads to increased trading volume.

Third, we find that tick reduction has not significantly increased the level of retail trading volume in the affected stock group, but has significantly increased the trading volume of foreign and local funds. However, the increases in foreign and local institutional trading activities are limited to the trading of stocks priced from THB 10 and less than THB 25, which have relatively higher market capitalization. In addition, the result indicates that the tick reduction has not been able to induce any clientele group

[4] In a study of the Kuala Lumpur Stock Exchange (KLSE), Chung et al. (2005) find that stocks with larger mandatory tick sizes tend to have wider spreads. Like the SET, the KLSE is a limit order market that employs multiple tick sizes. Cai et al. (2008) studies the impact of tick size on spread on the Tokyo Stock Exchange, which also employs multiple tick size, but they focus only on endogenous tick changes from JPY 1 to JPY 10. Likewise, they find a positive association between tick size and spreads.

to significantly increase their trading interest in stocks trading below THB 5, where the size of percentage tick reduction is largest.

The next part of the paper reviews the literature relevant to the significance of tick size. In Section 3, we explain the market background and describe the data and data screening process. In Section 4, we describe the empirical methods used in this research and report the findings. Section 5 presents the conclusion.

2 The Significance of Tick Size

The existence of minimum price variation can be both costly and beneficial. Large tick size creates an additional transaction burden for traders. For example, assume a stock is currently trading at THB 20, a price at which the prevailing tick size is THB 0.25. Now, suppose public information arrives, which moves the new equilibrium price to THB 20.10 but the tick size remains THB 0.25. Only investors with a more extreme private valuation above THB 20.10 will be willing to buy at THB 20.25. For those with an equilibrium valuation at THB 20.10, an additional discreteness-related commission of 0.74% (20.25-20.10/20.10) must be paid for acquiring the stock. But, if discreteness were the only cost that traders are concerned with, then a zero tick to eliminate dealers' rents should minimize trading costs and consequently induce more trading activities.

Despite placing additional costs, a minimum price variation requirement does provide benefits. Limit order traders gain compensation from minimum price variation for supplying liquidity and to cover adverse selection costs, as the important works of Glosten and Milgrom (1985) and Kyle (1985) have demonstrated. In addition, non-zero tick size makes front-running expensive for those who want to take advantage of exposed order flow. Bourgelle and Declerck (2001) show that an increase in tick size discourages the use of hidden orders on the Paris bourse. Others discuss the existence of an optimal tick size. Angel (1997) and Anshuman and Kalay (2002) both conclude that the optimal tick size must minimize investors' trading costs. But while Angel's model indicates that the optimal tick

size is an increasing function of firms' market values and idiosyncratic risks, Anshuman and Kalay (2002) focus on the trade-off between adverse selection and discreteness related costs.

Liquidity traders in Anshuman and Kalay (2002) time their trades to occur in periods with high volume in order to reduce adverse selection and discreteness-related commissions. Therefore, a reduction in tick size may help cut transaction costs and boost trading volume but at the expense of lowering the profits of limit order investors as well as discouraging investors from exposing their orders. Seppi (1997) and Cordella and Foucault (1999) both show that the optimal tick size that minimizes trading cost must not be zero. In Seppi (1997), the relationship between tick size and liquidity is non-monotonic and discontinuous because both small and large investors have heterogeneous preferences about optimal tick size. The model shows that the optimal tick size for small investors is smaller than that for large investors because small investors can obtain priority at less cost. Cordella and Foucault (1999), use a model of sequential bidding to illustrate that a larger tick size helps raise the gap between competitive price and expected asset value, yielding greater profits. This encourages dealers' to post prices more quickly leading to faster price convergence that, in turn, reduces monitoring costs.

As suggested in Harris (1991) and Hollifield et al. (2004), quoted depth, which is the quantity bid or offered at the inside quote, is expected to decline along with tick size since large limit orders bear the risk of being "picked off" by informed traders seeking better quotes. For instance, Aitken et al. (2007) show that institutional investors tend to be much more aggressive in supplying liquidity. Besides the issue of picking-off risk, Lau and McInish (1995) notes that for normal demand and supply curves, the higher (lower) the purchase (sales) price for a higher (lower) bid (asks) the smaller the number of quotes. Therefore, depth should decline when tick is reduced.

Since minimum price variation can be both costly and beneficial and that some optimal tick level exists, studies on the impact of tick reduction have tended to find that its impact on trading volume ambiguous. For example, Lau and McInish (1995) document a reduction in aggregate quoted size following tick reduction on the Singapore Exchange but cannot confirm an increase in trading

volume. Ahn et al. (1996) make a similar conclusion for AMEX, Ahn et al. (2002) for the Tokyo Stock Exchange, and Chung et al. (2005) for KLSE. Others find that tick reduction lowers trading volume, for example, Chakravarty et al. (2004) in their study of decimalization on NYSE, and Bacidore (1997) in his study of decimalization of the Toronto Stock Exchange.

The impact of tick size on bid-ask spreads has more conclusive empirical evidence. Since the minimum bid-ask spread sets the lower bound for quoted bid-ask spreads, these two variables should be positively related (see Harris, 1994).[5]

Previous studies find that a reduction in tick size decreased bid-ask spreads significantly on the AMEX and the NYSE (Harris, 1994; Ahn et al. 1996; Goldstein and Kavajecz, 2000). Bessembinder (2003) finds similar evidence on the NASDAQ. Niemeyer and Sandas (1994) and Lau and McInish (1995) document a positive relationship between tick size and bid-ask spread on the Swedish and Singaporean markets, respectively. In a study of endogenous tick size changes, Cai et al. (2008) finds this relationship holds in the Japanese market as well. Table 1 summarizes the degree of spread decline from tick size reduction based on selected studies. These existing studies show clear support that tick reductions result in narrowed spreads but not in increased volume.

3 The Stock Market in Thailand and Sample Data

3.1 Market and Trading Background

The Stock Exchange of Thailand (SET) is a pure order driven market where traders are classified into four groups; retail, local institutional, brokerage, and foreign investors. Trading is largely based on an Automated Order Matching (AOM) system under strict price and time priority. Another system is referred to as a Put-Through (PT) system which supports trading from direct negotiation among dealers for themselves or on behalf of clients. A call market determines the opening and closing prices for the Exchange. There are two trading sessions on the SET, 10.00 am.-12.30 pm and 2.30 pm-4.30

[5] To be more precise, tick size is binding for actively traded stocks.

pm. The system continuously matches the first buy and sell orders in queue order and confirms transaction to the brokers' terminal. The three best bids and offers from the limit order books are available to the public on trading screens.

The SET is dominated by small retail investors as they typically account for up to 70% of total market daily trading volume. According to the Association of Thai Brokerages, 52% of the trading accounts at brokerages engage in trading of no more than THB 100,000 (approximately USD3,000) and 88% engage in trading of no more than THB 1 million (USD 30,000). All together these fairly small accounts make up around 70% of total retail trading volume.

The SET imposes multiple tick sizes on stocks in different price ranges as shown in Table 2. The tick rule change implemented on November 5, 2001 created ten stock groups based on their price range and minimum price grid as shown in Table 2. Prior to the change, there were only seven price grids as stocks trading below THB 10 all had the equivalent tick size of THB 0.1. After the new rule, stocks trading below THB 2 received the largest relative tick cut of 90% from THB 0.1 to THB 0.01. The relative tick reductions of those trading from THB 2 to less than THB 5, from THB 5 to less than THB 10, and from THB 10 to less than THB 25 are 80%, 50%, and 60%, respectively. Analysis of trading activities by investor type indicates that retail clients favor stocks with small price denominations, whereas local fund managers and foreign investors prefer stocks with higher price ranges and market capitalization. As shown in Table 2, retail trading participation is monotonically decreasing in stock price levels.

3.2 Data Description

The SET provided the intraday dataset used in this study. The dataset consists of a limit order book file and a deal file. These files provide time-stamped order price, order volume, transaction price, transaction volume, order submission time, and transaction time of buyer and seller as well as trader identifiers. Traders are classified into brokerages, foreign, local funds, and retail. The rule change created a smaller minimum price grid for stocks below THB 25. As shown in Table 2, there are 10 stock groups (Groups I-X) separated according to the minimum price rule. To be included in the

sample, the stock must have at least three trades in every thirty-minute interval and must stay within the same tick price range from start to end of the study period (Oct 5, 2001 -Nov 30, 2001). This screening reduces the original file with 263 stocks to 93 stocks.[6] Only Groups I-IV, consisting of 79 stocks in total, are affected by the rule change. The tick size of stocks that are lower than THB 2 (Group I) is reduced by 90% from THB 0.1 to THB 0.01. The next group priced at THB 2 to less than THB 5 (Group II) received a reduction of 80% because the tick size is lowered from THB 0.1 to THB 0.02. Group III (THB 5 to less than THB 10) and Group IV (THB 10 to less than THB 25) have tick sizes reduced by 60% to THB 0.05 and by 50% to THB 0.10, respectively.

We use the stocks in Group V, consisting of 12 stocks priced from THB 25 to less than THB 50, which are not affected by the new rule implementation as our control sample. The four remaining stocks beyond this group trade at much higher price ranges and are thus less attractive candidates for comparisons. It is not possible to create a matched control group as average market capitalization per share and average daily trading volume per share tends to increase in price levels. For example, the average market capitalization of Group I and IV is THB 891 million, and THB 10,341 million, respectively. This leaves the 12 stocks in Group V, with average market capitalization of THB 20, 580 million, as the best control sample available. It is important to note that trading in the market is mostly concentrated in Group IV and Group V and that the median and average trading prices in the entire market are THB 11 and THB 26 fall in their trading range.

We define the pre-event date as 20 trading days prior to the day of the rule change (October 5, 2001 - November 2, 2001) and the post-event period as 20 trading days from the day of rule change (November 5, 2001 - November 30, 2001). A short event period is appropriate for our study because we need to avoid the end-of-year and turn-of-year trading effects and focus on the market's immediate response to the policy change.

Table 3 shows the combined trading value of the "affected" sample stock group in our study is worth THB 1,643 million in 2001, accounting for almost 56% of total market trading. The trading value of

[6] The use of this screening ensures that the spreads compiled in this paper are not stale and that we maintain a sample of stocks that have reasonable visibility and liquidity in the market.

the control group sample was THB 310 million or approximately 11% of the total market trading value. Thus, the combined trading value of all stocks in the study sample is 67% of the total market trading value. The Wilcoxon rank sum test indicates that the trading volume and value of Groups IV and V has significantly increased after the tick rule change.

Figure 1 plots the SET index level and market trading volume from August 2001 to March 2002. The dotted lines indicate the sample period and the dark line marks the date of tick change implementation. The plot shows that the market takes off very strongly towards the end of the year and in the first few months of 2002, with the index rising to 378 by the end of March 2002 from 303 at the beginning of December 2001. Trading volume also increased significantly after the rule change, especially during the first week of trading in January. The dramatic rise in market performance and subsequently in trading volume during the end of the year to the turn of the year justifies our short sample period as the rising market conditions are likely to produce a lower spread regardless of the tick rule change. Thus, to control for the effects of market performance on spreads, quotes, and trading volume, we use Group V as the control group for comparisons with affected groups. Figures 2a-2d illustrate the price movement of each stock group with the market. For each group, an index based on an equal weight of relative price is created using the price index on October 5, 2001 as the base price. The pairwise correlation between each group price index and the market index is 0.68 (Group I), 0.60 (Group II), 0.80 (Group III), and 0.90 (Group IV). Similarly, the pairwise correlation between each group's trading volume and the market trading volume is between 0.48 for Group I and 0.88 for Group IV.

4 Empirical Findings

In this section, we first analyze the consequence of tick size on spreads, depths, and volume of stocks with different price ranges and minimum price variations using intergroup analysis whereby the “affected” group is compared to the control group

4.1 Intergroup comparisons

In a limit order market like the SET, most transactions occur at either the outstanding bid or ask; therefore the quoted spread, which is simply the difference between ask and bid, is the key measure of trading costs. Nevertheless, to account for the few stray executions that occur inside the bid-ask spread, we also compute the effective spread, which is defined as $2|p-q|$ where p is the transaction price and q is the midpoint derived from $(bid+ask)/2$. To compute the effective spread, we made sure that there is both bid and ask outstanding prior to the transaction price. We then obtain the percentage quoted spread and percentage effective spread by dividing the quoted spread and effective spread by the mid-point. The spreads are computed using all transaction data available. In each half hour of trading, the average spread is computed. The half-hour averages are then used to obtain daily averages over the period of interest, i.e. before rule change (pre-event) and after rule change (post-event).

The spread information is provided in Panel A of Table 4. As expected, the quoted spread and percentage quoted spread decline significantly for all groups. The degree of reduction is in the order of tick size change (see Table 2). Subsequent to relative tick size reduction of 90% and 80%, the percentage quoted spreads of Group I and Group II are down by 49% and 27%. On the other hand, the spreads of Group III and Group IV decline more moderately by, 14% and 19%, following 50% and 60% reductions in relative spreads, respectively. This result suggests an increasing and convex relationship between relative tick size reduction and relative spreads. To test the hypothesis that there is no difference between pre-event and post-event spreads, the non-parametric Wilcoxon rank sum test is used. As shown, the Wilcoxon test statistics indicate significant changes for quoted spreads of each group relative to pre-event changes as well as relative to control group quoted spreads and percentage quoted spreads. The savings for all stock groups in monetary terms are provided in Panel B of Table 4. To estimate the extent of financial savings from transaction cost reduction, we compute the difference between post-event and pre-event transaction costs. For each period, the transaction cost is estimated by multiplying the half quote spread by average daily trading volume after the tick change, the number of stocks within the group, and the number of trading days. For example, the total transaction costs (without brokerage fees and taxes) borne by investors trading in Group I before the rule change is approximately THB 38.7 million [$(0.21/2)\cdot 9\cdot 20\cdot 2{,}055{,}270$] using the average spread

before the rule change and the daily trading volume after the rule change. Using the new spread, the total transaction costs for Group I, II, III, and IV fall by approximately THB 22 million (57%), THB 43 million (32%), THB 31 million (13%) and THB 71 million (18%), respectively.

In Panel A of Table 5, we report various measures of depths and trading activities before and after the rule change of the affected group and the control group. The reduction in quotations to trades for the tick change for all groups suggests that traders use more hidden orders over the sample period. We also find that quoted and market depths of the affected group declined, whereas quoted and market depths of with the control group increased over the same period. The reduction in quoted depths is consistent with predictions in Harris (1991) and Lau and McInish (1995). Although not shown, the decline in depth is particularly significant for Groups I and II because they experience more substantial percentage tick reductions, which implies greater percentage reductions in dealing profit and relatively larger monitoring costs for investors. There is no significant improvement in trading volume of the affected group as a whole. Despite the notable percentage increase in trading volume documented for the entire group, this increase is mainly driven by large daily average volume of stocks in Group IV. Outside this group, average daily trading volume increased only marginally. Consequently, the Wilcoxon rank sum test statistics show that the trading volume change of the affected group as a whole is insignificant. In contrast, the control group experienced both statistically significant improvements in depth and average daily volume over the same period.

Panel B of Table 5 provides statistics on depths and trading activities of stocks in the affected group by clientele type. It shows that retail investors, foreigners, and local institutions, reduced the amount of order submissions evident from the significant declines in quoted and market depths by around 40%-50%. Although there is no significant change in retail investors' daily trading volume, there are significant increases in the average daily trading volume of foreign and local institutional investors. The average daily trading volume of foreign and local institutional investors rose by 80% and 118%, respectively. Yet the increase in institutional investors' average daily trading volume is not sufficient to raise the overall volume of the affected group since their increased participation is actually only

limited to the larger stocks in Group IV. By and large, retail investors still dominate all trading segments and their average daily trading volume at a more modest rate of 32%.

4.2 Cross-sectional analysis

For better assessment of the impact of tick change on spread, depth, and trading volume, we run multivariate cross-sectional regressions and report the results in Table 6. The regressions are estimated using both the OLS and 2SLS methods to account for endogeneity between spread and depth and between trading volume and depth. The set of regressions are described below.

$$DBAS_i = a_0 + a_1 \cdot DTICK_i + a_2 \cdot DLNQD_i + a_3 \cdot DLNVOL_i + a_4 \cdot DNOTRANS + a_5 \cdot DSTD_i + e_i^{(1)} \quad (1)$$

$$DLNQD_i = b_0 + b_1 \cdot DTICK_i + b_2 \cdot DBAS_i + b_3 \cdot DLNVOL_i + b_4 \cdot DLNMV + b_5 \cdot DSTD_i + e_i^{(2)} \quad (2)$$

$$DLNVOL_i = c_0 + c_1 \cdot DTICK_i + c_2 \cdot DLNQD_i + c_3 \cdot LNMV_i + e_i^{(3)} \quad (3)$$

where:

$DBAS_i$	=	the change in average posted percentage bid ask spread between pre- and post-event periods
$DTICK_i$	=	the change in relative tick between pre- and post-event periods, where relative tick is tick divided by the average transaction price
$DLNQD_i$	=	the natural log of post- to pre-event daily average quoted depth ratio of each stock
$DLNVOL_i$	=	the natural log of post- to pre-event daily average trading volume ratio of each stock
$DNOTRANS_i$	=	the natural log of post- to pre-event daily retail transactions of each stock

$DSTD_i$	=	the percentage change in average standard deviation computed from the square root of daily return variance in each period
$LNMV_i$	=	the natural log of average pre-event market capitalization

The vector of residuals $\mathbf{e_1}$, $\mathbf{e_2}$, and $\mathbf{e_3}$ are obtained from regressions of the dependent variables on the fitted values of the endogenous variables, and other explanatory variables. The t-stats reported are based on corrected standard errors.

The rationale for the selection of variables in the three regressions above has foundation from Harris (1994). Similar forms of estimation are used in Ahn et al. (2002), and Niemeyer and Sandas (1994), among others. In equation (1), the change in posted relative spread is determined by the change in tick size because tick size forms the lower bound for spreads. Changes in quote sizes, volume, and number of retail transactions, which are measures of trading activities, are expected to be related to spreads. We expect quotes and spreads to move together whereas spreads and volume should have an inverse relationship. The number of retail transactions is also included as an explanatory variable as retail investors are dominant in this market and their response to tick change may have an affect on bid-ask spreads. Return standard deviation measures idiosyncratic risk and the degree of asymmetric information; thus, the higher the return volatility, the higher the bid-ask spreads.

Equation (2) attempts to capture how the change in minimum price variation will affect quote sizes. The change in bid-ask spreads can also have an endogenous impact on quotes. The change in trading volume and firm size help control for firm characteristics. Return volatility captures price uncertainty and thus should be inversely related to the quote size.

In equation (3), we examine how a change in the natural log of volume is affected by tick reform after controlling for changes in quote size and firm size. As noted earlier in Table 2, firm size is a proxy for a firm's general price range and hence a good proxy to control for investors' preferred trading range. As firm size or market capitalization can change due to variation in price levels from news events, we use the pre-event firm size level to control for the firms' general price characteristics.

Using a window period of only 40 days, there is very small variation in firm size, and so we adopt the pre-event firm size in our regression for better estimation properties.

Table 6 reports the regression results of the three equations. Both OLS and 2SLS regressions deliver similar results. In equation (1), the change in tick size, quoted depth, and volatility has positive and significant impact on bid-ask spreads. A 1% reduction in relative tick (quoted depth) leads to around 0.2% (2%) reduction in relative quoted spreads, whereas a 1% decrease in return volatility leads relative bid-ask spreads to drop 0.1%.

Equation (2), shows positive association between change in bid-ask spreads and change in quotes and a negative association between and return volatility and change in quotes. However, the relationship between return volatility and change in quotes is not significant in the 2SLS.

In equation (3), where the dependent variable is the change in trading volume, we find that neither tick change nor the percentage quote change has significant economic or statistical impact. On the contrary, a 1% change in firm size leads to a 0.01% increase in trade volume. This result concurs with existing empirical work that finds tick reduction has no impact on volume. However, in this case, it is firm size which proxies for general firm characteristics and price levels, that turns out to be a major driver of volume changes.

As a robustness check, we re-estimate all regressions (OLS and 2SLS) by adding group dummies (D2, D3, and D4) for Group II, III, and IV in equations (1), (2), and (3) and then by excluding penny stocks in Group I. Our conclusions remain unchanged in both cases.

In sum, the findings from these regressions confirm that tick size reduction has a significant affect in reducing bid-ask spreads. There is clearly a strong positive relationship between bid-ask spreads and quoted depth. From the regressions, we do not find that changes in tick size and quoted depth have significant associations with volume change.

5 Conclusion

The intraday data set from the Thai Exchange, provides client identification by type- retail, local institutional, brokerage, and foreign investors. This feature of the data set allows us to examine not only how minimum price variation change can affect trading activities, but also allows us to explore how different clientele respond to such change. The dominance of retail traders in a limit order market like the Thai Exchange makes the study interesting as retail investors are expected to react favorably to tick reduction as they are likely to be more sensitive to discreteness related costs.

Yet our study finds that the impact of tick reduction on the Thai market is similar to other markets where institutional investors have more dominance. The study finds that tick reduction leads to a declines in spreads and quotes while having no significant impact on trading volume. As a matter of fact, the reduction in tick size has no significant impact on retail investors' trading activities. Consistent with the theoretical predictions of Cordella and Foucault (1999), reducing tick size can have adverse consequences on quotes and volume. In a market with sequential bidding like the Thai Exchange, quotes can drop as consequence of tick reduction because trading profits are reduced and monitoring costs are increased.

Acknowledgement

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Figure 1: SET Index and Market Volume

This figure plots the daily SET index on the left-hand scale and daily market trading volume in millions of shares on the right-hand scale. The dark line marks November 5, 2001, the day of the tick rule change while the dotted lines mark the beginning (October 5, 2001) and end (November 30, 2001) of the sample period.

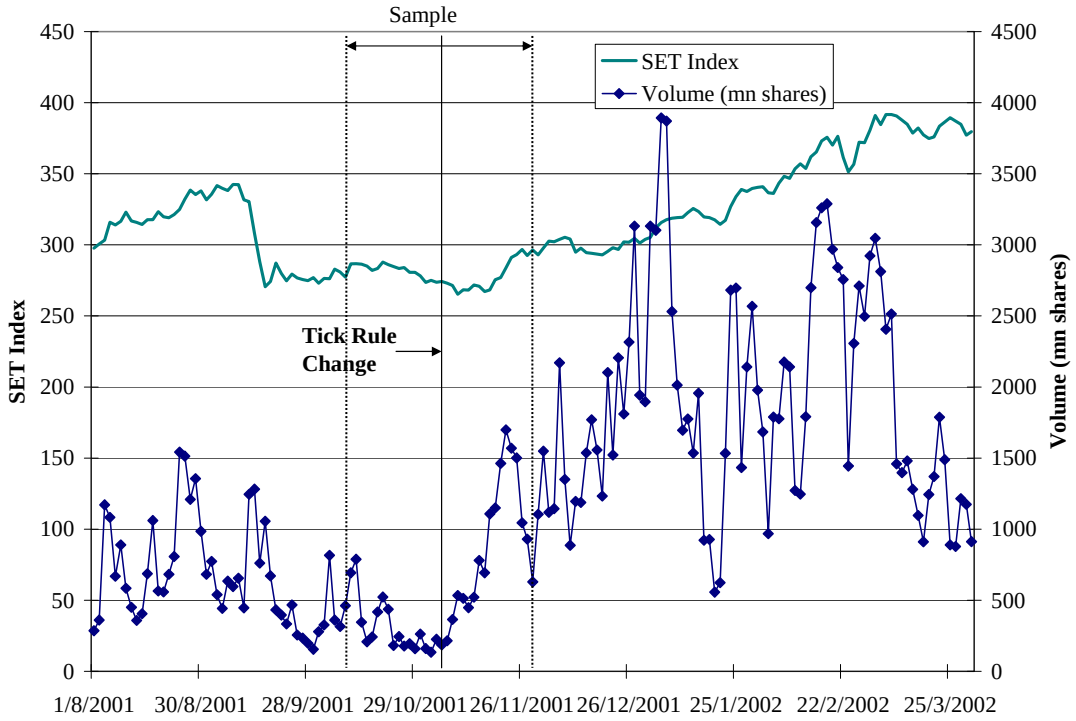

Figure 2: SET Index and Equal Weighted Price Index by Group

The left-hand scale of the following figures plots the SET index and the equal weighted price index for each stock group for the sample period October 5 – November 30, 2001. The dark line marks November 5, 2001, the date of the tick rule change. Both indices are scaled such that the base price is on October 5. Each stock group is classified according to its trading price range (see details in Table 2). The equal weighted price index at time *t* is computed from $I_t = \frac{\Sigma_{i=1}^{n}\left(p_{it} / p_{io}\right)}{n}$. The right hand scale plots the sum of the group's daily trading volume in millions of shares.

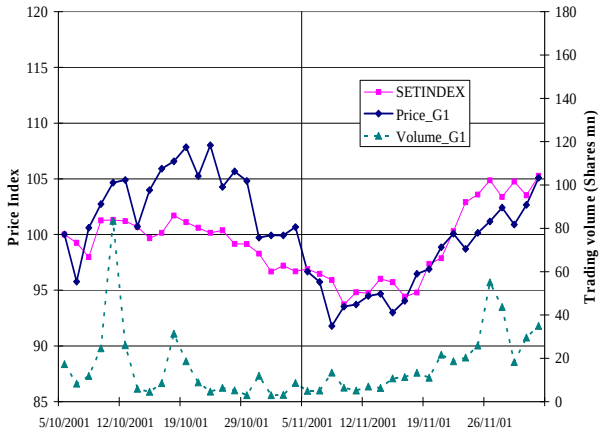

Figure 2a: Group 1

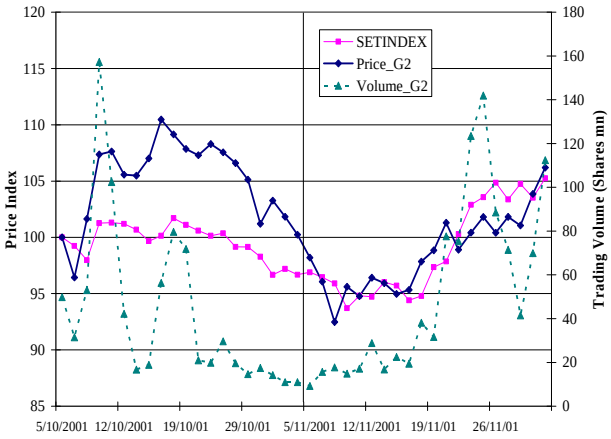

Figure 2b: Group 2

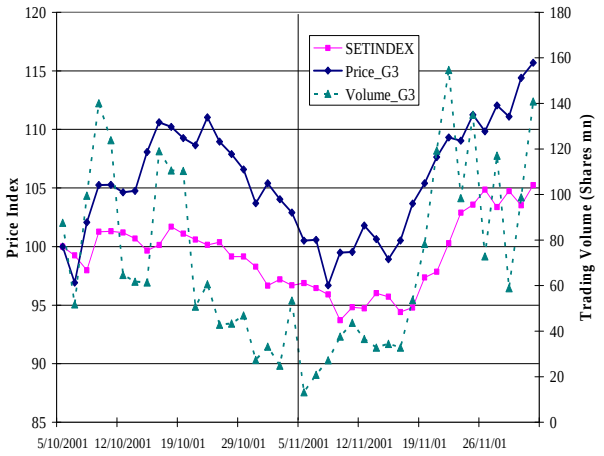

Figure 2c: Group 3

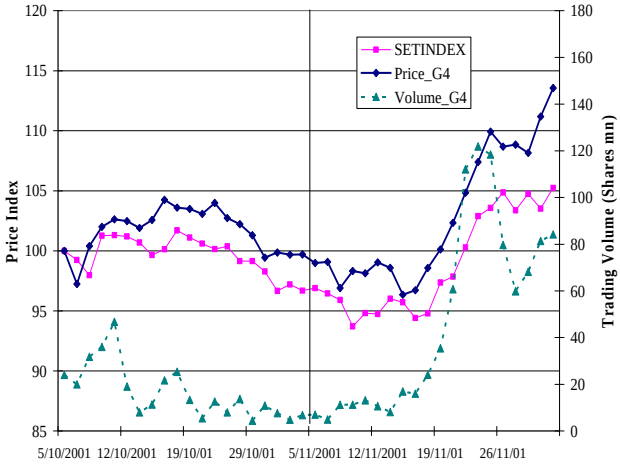

Figure 2d: Group 4

Table 1: Selected Empirical Studies on Tick Rule Changes

This table documents the impact of tick rule change on quoted spreads and share volume from selected existing works on the AMEX, Euronext Paris, NASDAQ, NYSE, Singapore Stock Exchange, Tokyo Stock Exchange and Toronto Stock Exchange.

Market	Source	Quoted Spread change in local ccy	% Quote spread change	% Tick change	Impact on Share Vol
AMEX	Ahn et al. (1996)	*(in cents)*			Unchanged
USD 1- USD 5 stocks		-1.71	-9%	-50%	
USD 5- USD 10 stocks		0.01	0%		
Euronext Paris	Bourgelle and				Unchanged
CAC 40	Declerck (2002)	*na*	-0.0027%	-0.05%	
SBF 250		*na*	-0.0231%	-0.05%	
NASDAQ	Bessimbinder (2002)	*(in cents)*			
Large cap stocks		-5.55	57%	-84%**	NA
Medium cap stocks		-4.68	27%	-84%	NA
Small cap stocks		-2.11	8%	-84%	NA
NYSE	Chakravarty, Wood,	*(in cents)*			
Quintile 1 Volume (Lowest)	and Van Ness (2004)	-4.1	-23%	-84%**	-69%
Quintile 2 Volume		-4.76	-29%	-84%	-64%
Quintile 3 Volume		-5.87	-36%	-84%	-67%
Quintile 4 Volume		-5.45	-43%	-84%	-70%
Quintile 5 Volume (Highest)		-4.84	-40%	-84%	-66%
*Singapore Stock Exchange**	Lau and McInish	*(in S$)*			Unchanged
Above SGD 25	(1995)	-0.54	-72%	-80%	
Tokyo Stock Exchange	Ahn et al. (2002)	*(in yen)*			Unchanged
JPY 101 – JPY 1,000 stocks		0.23	4%	-	
JPY 1,001 - JPY 2,000 stocks		-4.90	-28%	-90%	
JPY 2,001 – JPY 3,000 stocks		-4.24	-19%	-50%	
JPY 3,001 – JPY 10,000 stocks		-1.88	-5%	-	
JPY 10,001 – JPY 30,000 stocks		-73.83	-46%	-90%	
Toronto Stock Exchange	Bacidore (1997)	*(in cents)*			
CAD 3 -5 Not Cross listed		0.76	9%	- 80%	-17%
> CAD 5 Not cross-listed		- 3.8	-20%	-60%	-7%
> CAD 5 Cross-listed		-3.7	-27%	-60%	1%

*Average across stock group, authors' computation

** Percentage change from $1/16 to pennies.

Table 2: Tick Size Schedule

This table displays the minimum price variation for stocks in different price ranges before and after tick reform on November 5, 2001. The number of stocks in each group represents the post-screening sample that must have at least 3 trades every 30 minute interval. The total number of sample firms in the tick change sample is 79. The number of firms in the control group V, which is unaffected by the tick reform, is 12.

Group	Price Category	Old Tick Size (THB)	New Tick Size (THB)	% Tick reduction	Avg Mkt Cap (THB mil.)	Avg daily Trading Value/shr (THB mil.)	% Retail participation	Number of common stocks
I	Lower than THB 2	0.1	0.01	90%	891	5	93%	9
II	From THB 2 but lower than THB 5	0.1	0.02	80%	1,853	16	91%	19
III	From THB 5 but lower than THB10	0.1	0.05	50%	2,545	24	87%	23
IV	From THB 10 but lower than THB25	0.25	0.1	60%	10,341	27	83%	28
V	From THB 25 but lower than THB 50	0.25	0.25	None	20,580	26	80%	12
VI	From THB 50 but lower than THB 100	0.5	0.5	None	2,964	17	75%	2
VII	From THB 100 but lower than THB 200	1	1	None	36,204	72	67%	2
VIII	From THB 200 but lower than THB 400	2	2	None	None	None	None	None
IX	From THB 400 but lower than THB 800	4	4	None	None	None	None	None
X	Above THB 800	6	6	None	None	None	None	None

Table 3: Sample Characteristics: Tick Size, Trading, and Clientele Participation

This table shows the contribution of each stock group's average daily trading volume (millions of shares) and value (millions of THB) and as percentage of total market before and after tick rule change. Define "before" as 20 trading days before the rule change (October 5-November 2, 2001) and "after" as 20 trading days after the rule change (November 5, - November 30, 2001). The p-values are from the non-parametric Wilcoxon rank sum test statistics.

	Year total Jan 2- Dec 28	**Before Oct 5-Nov 2**	**After Nov 5-Nov 30**	**p-value Wilcoxon**
Group I				
Trading Volume (mil. shares)	21.31	12.77	18.50	0.030
% of market	8.08	7.76	5.68	0.005
Trading Value (THB mil.)	48.79	18.31	26.02	0.042
% of market	1.67	1.27	0.88	0.829
Group II				
Trading Volume (mil. shares)	60.35	37.03	47.46	0.245
% of market	22.87	22.51	14.58	0.000
Trading Value (THB mil.)	294.65	123.88	158.30	0.465
% of market	10.06	8.56	5.37	0.008
Group III				
Trading Volume (mil. shares)	61.27	59.90	62.66	0.871
% of market	23.23	36.41	19.25	0.000
Trading Value (THB mil.)	562.80	420.54	459.79	0.871
% of market	19.22	29.07	15.61	0.000
Group IV				
Trading Volume (mil. shares)	39.46	14.83	47.05	0.014
% of market	14.96	9.02	14.45	0.371
Trading Value (THB mil.)	736.40	223.92	752.46	0.016
% of market	25.14	15.48	25.54	0.019
Group V (Control)				
Trading Volume (mil. shares)	8.68	4.41	8.28	0.007
% of market	3.29	2.68	2.54	0.001
Trading Value (THB mil.)	310.20	151.14	277.09	0.009
% of market	10.59	10.45	9.40	0.665

Table 4: Quoted Spread and Effective Spread Before and After Tick Rule Change

Panel A of the table reports quoted spreads and effective spreads in THB terms and in percentages by stock group 20 trading days before and after the tick rule change. Define "before" as 20 trading days before the rule change (October 5-November 2, 2001) and "after" as 20 trading days after the rule change (November 5, - November 30, 2001). The Wilcoxon rank sum test is used for assessing differences in distribution of spreads before and after tick rule change and the post-event differences in distribution of the affected group and the control group. *, **, and *** denotes significance at the 10%, 5%, and 1% levels. Panel B reports the transaction cost savings from spread reduction. This is derived from multiplying the half quote spread by the number of stocks in each group, the number of trading days, and the average daily share volume after the tick rule change.

Panel A: Quoted spreads and effective spreads by stock group

		Before Oct 5-Nov 2	After Nov 5-Nov 30	% Change (After-Before)	Post- event % Change (Affected-Control)
Group I	Quoted Spread (THB)	0.21	0.09	-57%***	-93%***
	% Quoted spread	15.44	7.93	-49%***	101%***
	Effective Spread	0.10	0.06	-36%***	-93%***
	% Effective Spread	7.47	5.47	-27%***	110%***
Group II	Quoted Spread (THB)	0.28	0.19	-32%***	-86%***
	% Quoted spread	8.5	6.19	-27%***	57%***
	Effective Spread	0.11	0.1	-9%	-89%***
	% Effective Spread	3.57	3.33	-7%	28%***
Group III	Quoted Spread (THB)	0.39	0.34	-13%***	-74%***
	% Quoted spread	5.45	4.71	-14%***	19%**
	Effective Spread	0.15	0.19	27%***	-78%***
	% Effective Spread	2.11	2.78	32%**	6%**
Group IV	Quoted Spread (THB)	0.85	0.7	-18%***	-47%***
	% Quoted spread	5.62	4.58	-19%***	16%**
	Effective Spread	0.42	0.4	-5%	-54%***
	% Effective Spread	2.73	2.63	-4%	1%
Group V (Control)	Quoted Spread (THB)	1.41	1.33	-6%	na
	% Quoted spread	4.15	3.95	-5%	na
	Effective Spread	0.88	0.87	-1%	na
	% Effective Spread	2.55	2.61	2%	na

*, **, and *** Indicates significance levels at the 10%, 5%, and 1%, respectively.

Panel B: Transaction cost savings from spread reduction

Group	Cost with old spread (THB '000)	Cost with new spread (THB '000)	Savings (THB'000)	% Change (After-Before)	Cost savings as % of Mkt Cap
Group I	38,659.63	16,740.17	21,919.45	-56.70%	2.46%
Group II	133,022.34	90,265.16	42,757.18	-32.14%	2.31%
Group III	244,843.33	213,453.16	31,390.17	-12.82%	1.23%
Group IV	403,267.20	332,102.40	71,164.80	-17.65%	0.69%

Table 5: Depths and Trading Activities Before and After Tick Reform

Panel A of the table reports depth (order at best bid-ask price), market depth (combined order from entire limit order book) in terms of volume (shares) and value (THB), and average trading activity for each group. All units are in thousands of shares for volume and in thousands of THB for value except for the ratio "quotations to trades" which measures outstanding market depth to trading value. Define "before" as 20 trading days before the rule change (October 5-November 2, 2001) and "after" as 20 trading days after the rule change (November 5, - November 30, 2001). The Wilcoxon rank sum test is used for assessing differences in distribution of spreads before and after tick rule change. *, **, and *** denotes significance at the 10%, 5%, and 1% levels. Panel B reports the same set of statistics separated by investor type. Investors are classified into retail, foreign, and local institutions (funds and brokerages).

Panel A: Depths and trading activities of affected stock group

Unit in thousands	**Affected Group Before Oct 5-Nov 2**	**Affected Group After Nov 5-Nov 30**	**Control Group Before Oct 5-Nov 2**	**Control Group After Nov 5-Nov 30**	**Affected Group % Change (After-Before)**	**Control Group % Change (After-Before)**
Depth Volume	691.71	358.87	55.80	70.62	-48%***	27%**
Depth Value	3,869.45	2,354.19	1,831.68	2,339.10	-39%***	28%***
Market Depth Volume	2,496.51	1,086.46	297.11	402.85	-56%***	36%**
Market Depth Value	14,826.71	7,606.45	9,879.16	13,313.10	-49%***	35%**
Avg Daily Trading Volume	1,626.14	2,244.92	367.45	690.23	88%	88%***
Avg Daily Trading Value	8,718.31	14,587.30	12,594.59	23,091.05	67%	83%***
Quotations to trades	0.53	0.23	0.92	0.71	-56%***	-23%**

Table 5: Depth and Trading Activity Before and After Tick Reform (Continued)

Panel B: Depths and trading activities of affected group by investor type

Investor Type	*Unit in thousands*	Affected Group Before Oct 5-Nov 2	Affected Group After Nov 5-Nov 30	% Change (After-Before)
Retail	Depth Volume	619.33	322.03	-48%***
	Depth Value	3,306.24	1,970.12	-40%***
	Market Depth Volume	2,262.09	981.94	-57%***
	Market Depth Value	13,046.13	6,516.34	-50%***
	Avg Daily Trading Volume	1,461.23	1,935.35	32%
	Avg Daily Trading Value	7,627.84	12,117.18	59%
	Quotations to trades	0.54	0.25	-54%***
Foreign	Depth Volume	48.34	22.73	-53%***
	Depth Value	348.49	223.51	-36%***
	Market Depth Volume	156,446.89	66,342.31	-58%***
	Market Depth Value	1,082,407.01	661,569.41	-39%***
	Avg Daily Trading Volume	124.50	221.36	78%***
	Avg Daily Trading Value	814.85	1,792.82	120%***
	Quotations to trades	0.48	0.13	-73%***
Funds & Broker	Depth Volume	24.04	14.12	-41%**
	Depth Value	214.72	160.56	-25%*
	Market Depth Volume	77,980.26	38,172.01	-51%***
	Market Depth Value	698,173.80	428,545.30	-39%**
	Avg Daily Trading Volume	40.41	88.21	118%***
	Avg Daily Trading Value	275.62	677.30	146%***
	Quotations to trades	0.75	0.24	-68%***

Table 6: Cross Sectional Regressions of Changes in Spread, Depth, and Trading Volume

The following reports coefficients from the OLS and 2SLS regressions. The dependent variables in equations (1), (2), and (3) are changes in percentage bid-ask spreads (DBAS), the natural log of post- to pre-event daily average quoted depth ratio (DLNQD), and the natural log of post- to pre-event daily average volume ratio (DLNVOL). To account for endogeneity between spread and depth , in equations (1) and (2) DTICK, DLNVOL, the natural log of post-to-pre number of retail transactions (DNTRANS), change in standard deviation (DSTD), are used as instrumental variables. To estimate equation (3), DTICK, DBAS, and the natural log of pre-event market capitalization (LNMV) are used as instrumental variables. The t-stats reported are based on corrected standard errors.

Dependent var	**OLS**		**2SLS**	
DBAS	**Estimate**	**t Value**	**Estimate**	**t Value**
DTICK	**0.211*** **	**3.33**	**0.180** **	**2.05**
DLNQD	**2.304*** **	**3.01**	**2.314**	**1.98** **
DLNVOL	-0.045	-0.05	-0.459	-0.42
DNTRANS	0.038	0.75	0.044	0.71
DSTD	**0.111*** **	**4.51**	**0.140*** **	**2.66**
Adj Rsq	0.403		0.284	
Dependent var	**OLS**		**2SLS**	
DLNQD	**Estimate**	**t Value**	**Estimate**	**t Value**
DTICK	-0.009	-0.78	-0.031	-0.91
DBAS	**0.048*** **	**3.01**	**0.142**	**1.97** **
DLNVOL	0.058	0.51	0.018	0.12
LNMV	0.003	0.82	0.003	0.73
DSTD	**-0.010** **	**-2.42**	-0.018	-1.26
Adj Rsq	0.152		0.033	
Dependent var	**OLS**		**2SLS**	
DLNVOL	**Estimate**	**t Value**	**Estimate**	**t Value**
DTICK	0.002	0.19	-0.003	-0.23
DLNQD	0.113	0.98	-0.461	-0.79
LNMV	**0.009*** **	**2.92**	**0.013** **	**2.39**
Adj Rsq	0.138		0.098	

*, **, *** Indicates significance levels of 10%, 5%, and 1%, respectively.