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IMPACT OF TICK SIZE REDUCTION ON SMALL CAPS PRICE EFFICIENCY AND EXECUTION COST ON THE INDONESIA STOCK EXCHANGE

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ABSTRACT

On 2 January 2007, the Indonesia Stock Exchange (IDX) implements a new tick size of Rp1 in addition to the extant Rp5, Rp10, Rp25 and Rp50 tick sizes. This research investigates the impact of tick size reduction on stock price efficiency and execution cost. The microstructure effect of the new tick size should only impact small caps traded at Rp200 or lower, for those shares were previously traded at Rp5 tick. Using OLS and quantile regressions, we find the new tick policy significantly improves small caps price efficiency and partially reduces execution cost. The new tick size moderately reduces the mean of execution cost but does not reduce the median.

Keywords: tick size, small caps, price efficiency, execution cost, Indonesia

INTRODUCTION

The Indonesia Stock Exchange (IDX), previously known as the Jakarta Stock Exchange, is a continuous auction order driven market. IDX implements an automated trading system known as Jakarta Automated Trading System (JATS) on 22 May 1995 to increase trading volume and liquidity. JATS is an electronic order book operating continuously in two trading sessions. First session is between 9:30 to 12:00 on Monday to Thursday and between 9:30 to 11:30 on Friday. Second session is between 13:30 to 16:00 on Monday to Thursday, and between 14:00 to 16:00 on Friday. To further improve liquidity, on 2 January 2007, IDX implements a new Rp1 (one Rupiah) tick size in addition to the existing Rp5, Rp10, Rp25 and Rp50 ticks. The new tick size affects small caps traded at Rp200 or lower. These stocks were previously traded at Rp5 tick.

The IDX has two categories of trading boards: The Regular Board and the Negotiated Boards. Orders in Regular Board must be in round lots of 500 shares, and they are matched continuously rendering to price and time priority. If not executed, orders may be amended or withdrawn, but only limit orders may be entered. If traders wish to trade immediately they can enter aggressive limit orders. It is possible to enter orders, which are only valid for one trading session, and all orders expire at the end of each trading day. This means that there is no order in JATS each morning at the opening of trading. During the lunchtime break, the order book remains unchanged as orders may not be amended or withdrawn until the market reopens for the second trading session.

Tick size reductions provide "natural experiments" environment, which most studies investigate their impact on liquidity measured with bid-ask spreads and quoted depths. U.S. studies generally find conflicting results since tick size reductions tend to reduce bid-ask spreads (transaction costs), but at the same time also lower quoted depths (Goldstein & Kavajecz, 2000; Harris, 1994). Moreover, Wu, Krehbiel and Brorsen (2011) find that 1997 NYSE tick reduction from $1/8s to $1/16ths increases instead of decreases effective bid-ask spreads of high-price low-volume shares.

In contrast with NYSE but similar to IDX, the Tokyo Stock Exchange is organised as a pure order driven automatic limit order market. It is also one of the largest limit order markets to apply multi tick sizes. In their study, Ahn, Cai, Chan and Hamao (2007) show that bid-ask spreads reductions are greater for stocks with larger tick size reductions and higher trading activity. Furthermore, Ascioglu, Commerton-Forde and McInish (2010) contend that tick size should be established based on trading activity and price, rather than price alone.

Similar to the U.S., studies in emerging order-driven markets also find conflicting results associated with tick reductions. Both bid-ask spreads and market depths decline after tick reductions (Pavabutr & Prangwattananon, 2009). Market depths decrease because quote-matchers tend to take advantage of large open orders by placing slightly better orders in front of the queued orders. To protect themselves, informed traders will divide their orders to smaller quantities and change from limit orders to market orders (Ekaputra & Ahmad, 2007). Furthermore, if the tick size is too small, market participants will be frustrated because of increasing negotiation time (Purwoto & Tandelilin, 2004).

Different from most studies, this research focuses the impact of tick size reduction on price efficiency and execution cost. Price efficiency is an important trait since capital needs to be allocated efficiently among economic participants. To measure price efficiency Hasbrouck and Schwartz (1988) introduce Market Efficiency Coefficient (MEC). They explicate that when price efficiency is high, execution cost tends to be low. They also show that stock price positively (negatively) affect price efficiency (execution cost).

A study of Porter and Weaver (1997) in the Toronto Stock Exchange finds that tick size reduction does not significantly improve price efficiency, but significantly reduces execution cost. Moreover, the study also finds that transaction volume negatively (positively) impact price efficiency (execution cost), and return variance positively affect both price efficiency and execution cost. Meanwhile, stock price level does not impact price efficiency, but negatively impact execution cost.

This study contributes to the tick size reduction domain at least in three ways. Firstly, this study is conducted in an emerging order-driven market which is structurally different from developed markets. Even if compared to five other largest Asia-Pacific exchanges, IDX has different market microstructures as documented in Commerton-Forde and Rydge (2006). Secondly, most tick size reduction studies focus its impact on bid-ask spreads and depths as liquidity measures (Goldstein & Kavajecz, 2000; Harris, 1994; Pavabutr & Prangwattananon, 2009). This study, however, focuses on price efficiency and execution cost as introduced in Hasbrouck and Schwartz (1988). Finally, this study emphasises on small caps stocks. Small caps are rarely traded and are mostly not covered by analysts. These circumstances make small caps prices less informational efficient. Hence, we can expect mispricing to occur quite frequently. The situation will be worsened if the tick size relative to stock price is high. This will force market participants to trade using coarse prices. Henceforth, traders who wish to trade immediately are compelled to trade with relatively high execution cost.

In summary, this study aims to investigate the impact of new tick size on price efficiency and execution cost of small caps. The stocks affected by the new policy are mostly thinly traded small caps stocks. The new policy is considered successful, if the price efficiency is improved and the execution cost is lower. Lower execution cost implies higher stock liquidity, and according to Chordia, Roll and Subrahmanyam (2008), higher stock liquidity will induce higher market efficiency.

DATA AND METHODOLOGY

Data, Sample Selection and Observation Period

This study utilises transaction data, daily closing price, and daily transaction volume. The data is acquired directly from IDX. The transaction data is time stamped until the nearest second, and we only use transaction prices from the Regular Board marked as " RG". To select stocks to be included in the sample we proceed as follows:

1. We select stocks that are always traded below Rp200 from 1 November 2006 until 28 February 2007. Based on this criterion, we find 98 eligible stocks.
2. We exclude stock experiencing any corporate action during the selection period. Following this criterion, we eliminate one stock undergoing reverse-split (share consolidation).
3. We sort the remaining 97 stocks based on total trading value.
4. We purposely take the top 60 stocks to avoid severe non-trading problems.

The observation period is different from the stock selection period. We divide the observation period into old tick and new tick regimes, with 30 trading days in each regime. To minimise end-of-year effect, we exclude five trading days prior and five trading days after the new tick is implemented. So, the old tick period starts on 9 November 2006 and ends on 20 December 2006; while the new tick period starts from 9 January 2007 until 19 February 2007.

During our research, unfortunately two more stocks must be excluded from the sample. One stock is excluded since it was never traded during the old tick regime. The other stock is excluded because the price never changes during the old tick regime. The constant price causes the variance of return to be zero, which subsequently makes the MEC non-calculable. Due to high probability of encountering more severe non-trading problems, we do not replace the two stocks. Henceforth, we end up with 58 stocks as our sample.

Price Efficiency and Execution Cost

To measure price efficiency we resort to Market Efficiency Coefficient (MEC) concept (Hasbrouck & Schwartz, 1988). MEC is derived from the fact that if we have a series of prices $P_0, P_1, P_2, \ldots, P_T$, we can calculate the return for T period using the following equation:

$$\frac{P_T}{p_O} = \frac{P_1}{p_O} \times \frac{P_2}{p_1} \times \ldots \times \frac{P_T}{p_{T-1}} \tag{1}$$

Since we use log returns, we can generalise long period return as the sum of shorter period returns within that period, as presented in the following equation:

$$R_L = \sum_{t=1}^{T} R_{S,t} \tag{2}$$

Where R_L is long term return and $R_{S,t}$ is short period returns within the long term period.

According to Hasbrouck and Schwartz (1988), if the stock price is informational efficient and assuming stock returns are identically and independently distributed, then variance of long term return should be equal to the sum of variance of its respective shorter period return. Therefore, the following equation should hold:

$$Var\left(R_L\right) = \sum_{t=1}^{T} Var\left(R_{S,t}\right) = T(Var(R_S)) \tag{3}$$

Var (R_L) is long term return variance, *Var* (R_S) is short term return variance, and T is the number of short term return within one day.

In this research, long term return is measured daily, while short term return is measured every 30 minutes. So, in this study T equals to ten since one IDX trading day consists of ten 30-minute intervals. MEC is then measured as the ratio of long term return variance relative to its short term return counterpart:

$$MEC = \frac{Var\left(R_L\right)}{10\left(Var\left(R_S\right)\right)} \tag{4}$$

If stock price is efficient (information is fully reflected in stock price), then MEC should equal to one. If MEC is less than one, it shows market over-reaction or overshooting of price discovery. On the contrary, if MEC is more than one, it indicates market under-reaction or undershooting of price discovery.

Once we find MEC value, we calculate execution cost using Equation (5) if MEC is less than one, or Equation (6) if MEC is greater than one.

$$C = \left[\tfrac{1}{2}\, Var\left(R_s\right) \left(1 - MEC\right) \right]^{1/2} > 0 \tag{5}$$

$$C = -\left[\tfrac{1}{2}\, Var\left(R_s\right) \left(MEC - 1\right) \right]^{1/2} < 0 \tag{6}$$

Negative execution cost occurs when MEC is greater than one. In economic context negative execution cost means another party in the market is subsidising the transaction. The party can be uninformed traders submitting a stale limit price, or traders selling at inefficient prices due to urgent liquidity needs. Basically, their trades dampen price discovery.

Besides investigating the impact of new tick on price efficiency, we also study the impact of the policy on price inefficiency. Price inefficiency (PINE) is the absolute deviation of MEC from unity as defined in Equation (7).

$$PINE = \left| MEC - 1 \right| \tag{7}$$

We do this because the use of MEC as a measure of price efficiency may still yield ambiguity. For example, before the new tick MEC is 0.9 and after the new tick it becomes 1.2. If we only look at MEC, we immediately confirm the new tick does improves stock price efficiency because it increases MEC. Examining closer, actually the new tick only changes price discovery from overshoot to undershoot with the same magnitude. Based on this line of argument, we also employ price inefficiency (PINE) to study the effectiveness of the new tick size. The new tick size is expected to reduce PINE.

Empirical Tests

In this study, we test the impact of new tick policy on market efficiency coefficient (MEC), price inefficiency (PINE), and execution cost (COST). The new policy is expected to increase MEC, reduce PINE and also reduce COST. Firstly, we will use ordinary least square (OLS) regression to perceive the impact of the new policy on the mean of MEC, PINE and COST. Secondly, as suggested by Koenker and Hallock (2001), to make the empirical results more complete and due to relatively small sample size, we also utilise quantile regression to learn the impact of the new policy on the median of MEC, PINE and COST.

Following Hasbrouck and Schwartz (1988) and Porter and Weaver (1997), we deduce that stock price level, stock return variance and transaction volume will impact price efficiency and execution cost. Thus, we need to control their influence in order to investigate the impact of tick size on price efficiency and execution cost. Similar to Porter and Weaver (1997), we use average stock price, variance of daily return, and transaction volume as control variables. The empirical models tested are presented in Equations (8), (9) and (10).

$$MEC_i = \beta_0 + \beta_1 PRICE_i + \beta_2 VARIANCE_i + \beta_3 VOLUME_i + \beta_4 NEWTICK_i + \varepsilon_I \quad (8)$$

$$PINE_i = \delta_0 + \delta_1 PRICE_i + \delta_2 VARIANCE_i + \delta_3 VOLUME_i + \delta_4 NEWTICK_i + \varepsilon_I \quad (9)$$

$$COST_i = \lambda_0 + \lambda_1 PRICE_i + \lambda_2 VARIANCE_i + \lambda_3 VOLUME_i + \lambda_4 NEWTICK_i + \varepsilon_I \quad (10)$$

MEC_i is Market Efficiency Coefficient of stock-*i* as described in Equation (4). $PINE_i$ is price inefficiency of stock-*i* as depicted in Equation (7). $COST_i$ is the execution cost as explained in Equations (5) and (6). $PRICE_i$ is the average closing price of stock-*i*. $VARIANCE_i$ is daily return variance of stock-*i*. $VOLUME_i$ is natural log of total transaction volume of stock-*i*. $NEWTICK_i$ is a dummy variable equals to 1 for the new tick period and 0 for the old tick period.

Although Equations (8)–(10) use the same independent variables, the expectations of the coefficients are different. For Models (8) and (9), the expectations are completely contradictory. We deduce that higher stock price reflects higher attention of analysts and market participants. If this is true, then stocks with higher prices should exhibit higher MEC since they are more informationally efficient. Thus, as in Hasbrouck and Schwartz (1988), we expect β_1 to be positive in (8) while δ_1 to be negative in (9). Subsequently, we construe that stock variance reflects information revelations. If more information is revealed, stock price should be more efficient (higher MEC, lower PINE), which leads us to expect β_2 to be positive in (8) and δ_2 to be negative in (9). Meanwhile, volume measures the arrival of utilitarian traders, which are assumed non-information driven traders. Higher uninformed trading will reduce price efficiency (lower MEC, higher PINE). Thus, we expect β_3 to be negative in (8) and δ_3 to be positive in (9). Finally, if indeed the new tick policy does improve price efficiency (higher MEC, lower PINE), β_4 should be positive in (8) and δ_4 should be negative in (9).

For Equation (10) we expect λ_1 to be negative because if minimum tick size is regulated, higher stock price tend to lower relative (percentage) execution cost. We expect λ_2 to be positive because higher stock volatility usually widens relative bid-ask spread and increases execution cost. We expect λ_3 to be positive for the same reason as δ_3 in Model (9). If more utilitarian traders enter the market, price inefficiency is expected to increase which will then increase execution cost. Finally, we expect λ_4 to be negative since we hope the new tick policy will decrease stock execution cost.

RESULTS AND DISCUSSIONS

From the descriptive statistics presented in Table 1, we learn that the average execution cost (COST) during the old tick regime is almost 125 basis points (bps) with a median of around 96 bps. Both mean and median of execution cost fall after the implementation of the new tick to around 79 bps and 51 bps. In both periods, there are still stocks with negative execution costs. This means some traders, for whatever reasons, still subsidise other traders by trading with stale prices. These trades dampen price discovery process and yield MEC value greater than one.

Table 1
Descriptive statistics

	COST	MEC	PINE	PRICE	VARIANCE	VOLUME
A.Old Tick						
Mean	0.0126	0.5738	0.4519	85.6533	0.0103	16.5186
Median	0.0096	0.5372	0.4628	79.3464	0.0024	16.3610
Maximum	0.0873	1.2008	1.0000	194.8333	0.1485	22.2146
Minimum	–0.0124	2.48E-30	0.0000	25.0000	2.24E-34	11.9283
Std. Dev.	0.0165	0.3037	0.2630	47.1712	0.0261	2.1620
Observations	58	58	58	58	58	58
B.New Tick						
Mean	0.0079	0.6488	0.4091	95.5165	0.0022	16.7683
Median	0.0051	0.6214	0.4030	88.5000	0.0011	16.7370
Maximum	0.0532	1.7347	0.9628	195.3462	0.0121	22.7346
Minimum	–0.0072	0.0372	0.0000	30.0667	4.46E-06	10.3417
Std. Dev.	0.0113	0.3611	0.2925	46.5529	0.0027	2.8229
Observations	58	58	58	58	58	58

Negatively correlated to execution cost, we find that mean and median of price efficiency (MEC) increase after the implementation of the new tick policy. During the old policy, MEC mean and median are about 0.57 and 0.54 respectively. After the new tick implementation, the mean and median increase to 0.65 and 0.62. In line with MEC, price inefficiency (PINE) mean and median drop after the implementation of the new policy. Mean of PINE drops from 0.45 to around 0.41, while the median plummets from 0.46 to 0.40.

After the new tick size, the average and median of stock prices (PRICE) tend to increase. PRICE mean increases from about 85.65 to 95.52, while PRICE median increases from around 79.35 to 88.50. Natural log of total transaction volume (VOLUME) mean and median also increases after the new policy. The mean increases from 16.52 to 16.77, while the median increases from 16.36 to 16.74. On the contrary, mean and median of daily stock return variance (VARIANCE) decrease after the implementation of the new tick size. The mean falls from 0.010 to 0.002 while the median drops from 0.002 to 0.001.

From the descriptive statistics, we see some improvements in small caps trading conditions after the implementation of the new policy. Price efficiency tends to increase while execution cost tends to decrease after the implementation of the new tick size. Furthermore, stock prices and transaction volume tend to increase while stock volatility seems to decrease.

Table 2
OLS regression and quantile regression (median) results of MEC on PRICE, VARIANCE, VOLUME and NEWTICK dummy

	Expected sign	OLS coefficient	Quant. reg. coefficient
Intercept	none	1.3766***	1.4677***
PRICE	+	–0.0001	–0.0002
VARIANCE	+	3.1348***	3.2434***
VOLUME	–	–0.0499***	–0.0556***
NEWTICK	+	0.1141**	0.1515***
Adjusted-R^2		0.1594	0.1378
F Statistic		6.4533***	

*significant at 10% level; **significant at 5% level; ***significant at 1% level

To examine whether the new tick size significantly improves price efficiency, we run OLS and quantile regressions based on Model (8). OLS regression will check whether independent variables affect the mean of MEC as the dependent variable. Quantile regression will investigate whether independent variables affect the median of MEC. The complete result is presented in Table 2. As expected, the coefficients of NEWTICK dummy variable are significant in both regressions. This finding proves that the new tick size convincingly improve price efficiency. In line with Porter and Weaver (1997) but contradictory to Hasbrouck and Schwartz (1988), stock price does not seem to impact price efficiency. Other control variables, daily stock return variance and transaction volume, seem to affect price efficiency as expected.

As explained, the use of MEC as a measure of price efficiency could still yield uncertainty, since it might only reflect price discovery from overshoot to undershoot with the same magnitude. For this reason, we also use price inefficiency (PINE) to study the effectiveness of the new tick size. If the new policy is effective, it should significantly reduce PINE.

Table 3
OLS regression and quantile regression (median) results of PINE on PRICE, VARIANCE, VOLUME, and NEWTICK dummy.

	Expected sign	OLS coefficient	Quant. reg. coefficient
Intercept	none	–0.3832**	–0.4406***
PRICE	–	0.0004	0.0005
VARIANCE	–	–3.1320***	–3.1109***
VOLUME	+	0.0503***	0.0522***
NEWTICK	–	–0.0851**	–0.1441***
Adjusted-R^2		0.2530	0.2084
F Statistic		10.7390***	

*significant at 10% level; **significant at 5% level; ***significant at 1% level

To confirm whether the new tick size decreases price inefficiency, we run OLS and quintile regressions based on Model (15). The complete result is presented in Table 3. As expected, the coefficients of NEWTICK dummy variable are negative in both regressions. The finding supports the hypothesis that new tick size significantly reduces price inefficiency corroborating the notion that the new policy improves stock price efficiency. In line with our expectations, daily stock return variance negatively affects the mean and median of price efficiency, while transaction volume positively affects the mean and median of price inefficiency. Not different from previous result, stock price does not seem to impact price inefficiency.

The last part of the study is to investigate whether the tick size reduction reduces stock execution cost. To do this we also run OLS and quantile regressions based on Equation (10). The complete result is presented in Table 4. The coefficients of VARIANCE are both positive as expected but insignificant. Thus, daily return variance does not seem to impact the mean or median of execution cost. As expected, transaction volume positively affects the mean and median of execution cost, while stock price negatively affects only the mean of execution cost.

Looking at the NEWTICK dummy variable, we find that the OLS coefficient is negative and significant at 10% level. Meanwhile, the quantile regression coefficient is also negative but not significant. The result shows that the new tick size moderately reduces the mean of stock execution cost, but does not reduce the median. We deduce the moderate execution cost reduction may be caused by persistently high short-term return variance even after the implementation of the new policy. The high intraday volatility may be due to bid-ask spreads that are wider than the minimum tick. Hence, the cost of executing trades immediately is still relatively high due to relatively high bid-ask bounce.

Table 4
OLS regression and quantile regression (median) results of COST on PRICE, VARIANCE, VOLUME, and NEW TICK dummy.

	Expected sign	OLS coefficient	Quant. reg. coefficient
Intercept	none	–0.0111*	–0.0052
PRICE	–	–0.0001***	–4.77E-05
VARIANCE	+	0.1168	0.1871
VOLUME	+	0.0019***	0.0011***
NEW TICK	–	–0.0031*	–0.0029
Adjusted-R^2		0.2045	0.1378
F Statistic		8.3899***	

*significant at 10% level; **significant at 5% level; ***significant at 1% level

CONCLUDING REMARKS

After the implementation of the new Rp1 tick policy, in general we find some improvements in IDX small caps trading conditions. The descriptive statistics show that price efficiency tends to improve while execution cost tends to decrease under the new tick regime. Furthermore, stock prices and transaction volume tend to increase while daily stock return volatility seems to decrease.

To further investigate the impact of the new tick size on stock price efficiency and execution cost, we run OLS and quantile regression analyses. In these analyses we also control the influence of stock price, daily return variance, and transaction volume on stock price efficiency and execution cost. From the regressions, we find that the new policy significantly increases (reduces) stock price efficiency (inefficiency). Meanwhile, we only find weak support that the new policy reduces small caps execution cost. The new policy seems to moderately reduce the mean but fail to significantly reduce the median of execution cost. We think further research to investigate small caps execution cost is warranted.

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