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TRANSACTION COSTS IN INDONESIA STOCK MARKET: A STUDY IN THE AUTOMATION PERIOD

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Abstract

We studied transaction costs in Indonesia market extended closely by Bonser-Neal et al. (1999). They investigated transaction costs in Jakarta Stock Exchange (JSX) using period before automation (May 1995). To match closely with Bonser-Neal et al. (1999), we used period right after JSX introduced trading automation (JATS or Jakarta Automated Trading System). We used period from May 1995 to March 2003. We found that transaction costs in the automation period were larger than those reported by Bonser-Neal et al. (1999). Automation did not seem to automatically reduce transaction costs as expected. We found that domestic investors had larger price impact than foreign investors. Similar to previous finding, we found that trade difficulty had a positive effect on price impacts. We also found transaction costs in crisis period were larger than those in normal period. We also found that size had a negative relationship with price impacts. Our paper provided evidence of the transaction costs in Indonesia market after the automated trading was introduced in Indonesia market.

Keywords*: automated trading, crisis period, domestic investors, foreign investors, transaction cost*

We study price impacts in Indonesia stock market, an emerging market. Indonesia stock market provides an interesting opportunity to study price impacts. First, the Indonesia stock market is considered an emerging market, which is characterized by small and thin trading. Second, regular market in The Indonesia Stock Market uses continuous auction, in which orders from investors are matched each other. Matched orders yield transaction. Unlike trading in US which is conducted through market makers, trading in Indonesia market is conducted without market makers. All transactions in Indonesia market come from underlying orders submitted by investors. This feature allows us to disentangle liquidity effects, since there is no formal mechanism in which market makers provide liquidity services (Ball & Finn, 1989). Our study covers a period in which the Indonesia Stock Market was organized by Jakarta Stock Exchange (JSX). In 2010 JSX merged with Surabaya Stock Exchange (SSX) to become Indonesia Stock Exchange (ISX).

Our study extends closely Bonser-Neal *et al*. (1999). However, there are several differences.

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First, Bonser-Neal *et al*. (1999) investigate transaction costs in the regular board from year 1992 to 1995, where trading in the JSXwas conducted manually. This paper investigates transaction costs in the JSX in the automation period (period after May 1995). Since May 1995, JSX uses electronic trading, in which all trading is conducted through JATS (Jakarta Automated Trading System). JATS stores buy and sell orders. Matched orders become transactions. Thus we could provide evidence of price impacts in the automation period. We choose the period right after the end of manual period (May 1995–mid of 2003) to obtain a more appropriate comparison, a comparison that minimize any possible confounding effects.

Second, Bonser-Neal *et al*. (1999) cover only period before 1995, in which JSX experienced a bull period. The period we cover, however, includes bull, crisis, and recovery periods in the JSX. The JSX experienced a bull period from 1995 to mid of 1997, before financial crisis hit Indonesia in the mid of 1997. In the mid of 1997, financial crisis hit Indonesia, and the JSX experienced bear market from the mid of 1997 until about the mid of year 2002. From that date, JSX experienced recovery period. Thus our paper covers a relatively full cycle period. Third, while Bonser-Neal*et al*. (1999) focus on regular market, in which tradings are conducted using continuous auction market, we also include negotiated market. In negotiated market, investors 'negotiate' their trading. Once they agree on the terms, the report their transaction to the exchange. There are 5 categories in the negotiated trades, they are cross trades, block trades, odd-lot trades, cash trades, and foreign trades.Cross market, which is similar to upstairs market in New York Stock Exchange,conducts transactions that are carried out by one exchange member who has buy and sell orders at the same price and quantity. Cross trading dominates the negotiated trades, accounting for over 85% of total negotiated trades (Chang *et al*., 1998). We focus on cross market, the largest negotiated market in JSX.

Like Bonser-Neal *et al*. (1999), this paper takes advantage of unique JSX dataset, that records identitiy of investors, whether foreign or domestic investors. Before mid 1997, JSX imposes restriction on foreign investors, ie. Forign investors ownership is limited to maximum of 49% total shares outstanding. To track foreign ownership, JSX requires that identitiy of investors be reported. This dataset offers us an opportunity to examine price impact for foreign and domestic invertors.Efficient market hypothesis suggests that identitiy of parties may carry information and have effect on price impact (Scholes, 1972). Overall, we believe that our paper provides more comprehensive evidence on price impacts in emerging market, which is represented by Indonesia.

We find that transaction costs after automation period are slightly larger than those reported by Bonser-Neal *et al*. (1999). For example, in regular board, for buy orders, returns for opening to transaction, transaction to closing, opening to closing, and transaction prices to same day weighted average price are 2.016%,-0.37%, 1.63%, and -0.92%. For sell orders, the corresponding numbers are -0.69%, 0.69%, 0.023%, and 0.8%. The corresponsing numbers reported by Bonser-Neal*et al*. (1999), for buy transactions are 1.51%, 0.31%, 1.62%, and 0,32%; while for sell side are: -0.5%, 0.13%, 0.37%, and -0.34%.

Transaction costs in the cross board tend to be higher than in regular board. Corresponding numbers for buy transactions in the cross boards are 3.41%. -1.76%. 0.45%, and 1.95%.While for sell transactions. the corresponding numbers are -2.57%. 2.78%, -2.13%, and 2.223%. Trading mechanisms seem to affect transaction costs.Investor types affect transaction costs. Regression analysis shows that in regular board trades by domestic investors have larger transaction costs than trades by foreign investors. For example, using return of transaction to weighted average prices in the same days, price impacts of domestic investors are around 0.5% higher than those for foreign investors, for both buy and sell initiated trades. This result is not consistent with Bonser-Neal *et al*. (1999) who show that foreign ivestors have larger price impact than domestic investors.

We also investigate transaction costs in different periods, before crisis, during crisis, and after crisis (recovery period). In regular market, regression analysis shows that transaction costs tend to be smaller during before crisis period, which is characterized by bull period. Transaction costs tend to be larger in the crisis period, than those in post-crisis period. For example, using transaction price to weighted average prices in the same day, transaction costs for buy initiated trades in the pre and during the crisis periods are around 0.6% less and around 1.1% higher than those in the 'normal' period. The corresponding numbers for sell initiated trades are similar, around 0.6% less and 1.1% higher for crisis period and normal periods.

In cross board, the pattern as to which investor type has larger transaction costs, is not as clear as that in regular board. In some models, domestic investors have larger transaction costs, while in other specifications, foreign investors have larger transaction costs. The same pattern is also observed when we investigate the impact of different periods in the cross market. In some models, the price impacts are less in the pre-crisis, while in other models the impacts are higher. In general, the power of the tests in cross board tends to be weaker than that in regular board. Consistent with previous studies, our analysis also shows that, in regular market, size is inversely related to transaction costs, and trading difficulty is positively related to transaction costs. We do not find clear pattern in the cross market.

We organize this paper as follows.Section 2 discusses literature review, section 3 presents data and sample selection, section 4 presents emprical findings, and last section section offers conclusion.

Transaction cost can be defined as an excess to prices paid to supplier. Transaction cost covers implicit and explicit costs. Implicit cost generally covers larger proportion of the total transaction cost. For example, Perold & Sirri (1994) find that implicit transaction cost is 0.99%, compared to taxes and commission cost of around 0.3%. Explicit cost such as taxes and commission is relatively easy to calculate. Implicit cost is more difficult to calculate.

Previous literature on transaction cost discusses price impact of stock transaction (Scholes, 1972; Mikkelson & Partch, 1985; Harris & Gurrel, 1986; Shleifer, 1986; and Berkowitz *et al*., 1988). At least, there are 3 explanations to the price impact, short-term liquidity costs, imperfect substitution, and information effect. Short-term liquidity cost results from difficulty in finding counterparty (finding sellers or buyers). To induce seller (buyer) to transact, price concession is given to them. In imperfect substitution explanation, transactions impact prices if there are no perfect substitute. In this situation, buyers face an upward slope curve, while sellers face a downward slope curve. Transaction may have impact on prices if the transactions carry information which later is incorporated into prices. Buyers believe that prices could be lower than equilibrium prices, while sellers believe that prices is higher than equilibrium prices.

Short-term liquidity hypothesis predict that price impact is temporary. After the transaction, prices will move to normal or equilibrium prices. Imperfect substitution hypothesis predicts more permanent price impact, or prices will revert to normal price more slowly than predicted by short-term liquidity hypothesis. Information hypothesis also predict permanent price impact if the transactions carry new information. Furthermore, information hypothesis predicts that price impact depends on the identity of the party conducting transactions.

Chan &Lakonishok (1993) calculate price impact from transactions by institutions by calculating return from transaction to opening prices, closing to transaction prices, and closing to opening prices. These measures correspond to total price effect, temporary price effect, and permanent price effect of Holthausen *et al*. (1987). Chan & Lakonishok (1993) also calculate return from transaction to weighted average of prices in the same day. For buy transactions, Chan & Lakonishok (1993) report that returns from transaction to opening prices are around 0,22%, returns from closing to transaction prices are around 0,12%, and returnsfrom closing to opening prices are around 0,34%. These numbers are lower than those reported by previous studies (Kraus & Stoll, 1972 and Holthausen *et al*., 1990). An interesting finding is an asymmetry between buy and sell transactions (Chiyachantana *et al*., 2004). Buy transactions show continuation, while sell transactions show revesal pattern. Using data from 37 countries, Chiyachantana *et al*. (2004) show that institutional purchases have larger impact than sell in bullish markets, however, in bearish market, institutional sells have larger impact than purchases. Moreover, they shows that various factors affect price impacts, such as order characteristics, firm-specific, and country factors.

Using the same methology as Chan & Lakonishok (1972), Bonser-Neal *et al*. (1999) investigate transaction costs in JSX, using regular market, in the period before 1995. In this period, JSX conducted trading manually. Bonser-Neal *et al*. (1999) report higher price impacts than those reported by Chan & Lakonishok (1993), but almost similar to those reported by Kraus & Stoll (1972). In general Bonser-Neal *et al*. (1999) conclude that in JSX, an emerging market, transaction costs are similar to those in developed countries.

Transaction costs are affected by trade difficulties and market capitalization (Stoll & Whaley, 1983 and Keim & Madhavan, 1996), and the size of transaction (Easley & O'Hara, 1987). However, Chan & Lakonishok (1993) report that transaction costs are not affected by market capitalization and trade difficulty. Using Indonesia data, Bonser-Neal *et al*. (1999) find that, for buy transactions, trade difficulty affects transaction costs, while market capitalization does not affect transaction costs. For sell transactions, the pattern is not clear.

Information hypothesis predicts that investor identity has effect on price impact. Prediction from information hypothesis is consistent with efficient market hypothesis. Chan & Lakonishok (1993) show that fund managers' identity affects price impacts. Initial investigation shows that style and strategy of fund managers affect price impacts. Using Indonesia data, Bonser-Neal *et al*. (1999) show that brokers' identitity has effect on price impacts. This result suggests that invetsor identitiy seems to have effect on price impact. Moreover, Bonser-Neal *et al*. (1999) compare price impact of foreign and domestic investors. They report that transactions conducted by foreign investors have larger price impacts than those by domestic investors. This finding raises question whether foreign investors receive poor services, or whether they have better information. Further analysis shows that probability that foreign buy order will be followed by buy transaction is 0,91, which is higher than that of domestic investor (0,72). For sell transactions, the corresponding numbers are 0,89 for foreign investors and 0,88 for domestic investors. Price impacts for foreign investors are followed by continuation, not reversal. This result seems to show that foreign investors have better information than domestic investors.

The issue of price impact seems to gain more attention in asset pricing and efficiency literature recently. Huh (2014) shows that price impact is the best measure for liquidity, and in asset pricing context, price impact is priced even after controlling for risk factors, firm characteristics, and other popular illiquidity measures found in current the literature, although risk measures are still controversial (Goyenko & Trzcinka, 2009 and Frazzini*et al*., 2012). Dasgupta *et al*. (2011) showthat price impact is a result of an interaction between money managers and market makers. More specifically, the interaction results in institutional herding which can be captured by price impacts. Institutional herding positively predicts return in the short-run, while in predict negatively in the long-run. Thus institutional herding has stabilizing effect in the short-term, while destabilizing effect in the long-term. Thus price impacts have an important implication for market efficiency. Transaction cost is also relevant to trading strategies. High frequency trading may result in high transaction costs. Interestingly, Avramov *et al*. (2014) report that momentum profits are larger in liquid market states, which suggests that high frequency trading may provide better profits.

METHOD

To match closely with Bonser-Neal *et al*. (1999), we use transaction data obtained from JSX, from May 1995 until March 2003. JATS stores each transaction electronically.The information recorded in each transacatin includes time of transaction, stock code, transaction number, order number, transaction price, transaction volume, sell and buy code, investor identity (foreign or domestic), broker code, broker identitiy (foreign or domestic), and board of transaction. As explained above, boards of transaction basically consist of non-negotiated (regular) and negotiated trading.

The data do not record whether they are individual or institutional investors. However, the data record whether they are foreign or domestic investors. Prior to July 1997, JSX imposed restriction on foreign investors. Foreign investors are allowed to own a maximum of 49% of total outstanding shares. To track foreign ownership information, JSX records whether a transaction is originated by foreign or domestic investors. When foreign ownership reaches the limit, foreign investors have to buy shares from other foreign investors. Foreign board facilitates this trading.

We select stocks that are consistently included in LQ45 index. The LQ45 index includes the 45 most active stocks in previous 6 months. The composition of the index is evaluated every 6 months, hence the composition of stocks may change every 6 months. Since we choose stocks that are consistently included in the LQ45 index during several periods (during May 1995 until March 2003), we may have several stocks that are concistently included in the LQ45 index, while other stocks are on and off in the index. The final sample consists of 48 stocks.The criteria we use leave us with the most liquid stocks in the JSX. The sample we use is similar to with Bonser-Neal *et al*. (1999), in terms of its liquidity, although the criteria used is different. Bonser-Neal *et al*. (1999) require that stocks are traded at least 20 days, stocks are 'seasoned' stocks (IPO stocks are eliminated), and stocks trade at least3 times a day. Although the criteria used are different, we believe that our stocks are comparable to Bonser-Neal *et al*. (1999) in term of liquidity.

To define purchase and sell transaction, we use tick test (Lee & Ready, 1991). If a transaction is recorded at an up (down) tick, we define the transaction as buy (sell) initiated transaction.An alternative measurement is to compare order numbers. Order that comes later is defined as a more aggressive and hence an initiated trade (Odders-White, 2000). We read 12 million records in our dataset. Next, we exclude transactions recorded at zero ticks. This restriction removes the bulk of our records, leaves us with around 1.2 million records to read.

EMPIRICAL FINDINGS

Price Impact in Regular and Cross Markets

To calculate price impacts, we follow Chan & Lakonsihok (1993) and Bonser-Neal *et al*. (1999). Specifically, we calculate return transaction to opening prices, closing to transaction prices, closing to opening prices, and transaction to weighted average prices on the same days. These methods measure, respectively, the total, temporary, and permanent effects on the stock price on the trade date, asdiscussed in Holthausen *et al*. (1987). Opening and closing prices for each board are used to calculate price impacts for associated board.

Table 1 summarizes price impacts for buy initiated trades for regular market. The table shows that, for buy initiated trades, price impact relative to opeing price is around 1.79%, The positive impact is followed by reversal as shown by negative number of around 0.31% in return of closing to transaction prices. Return for closing to opening prices averages around 1.48%. Average of price impact relative to weighted average of prices on the same days is around 0.74%.

Table 2 summarizes price impacts for sell initiated trades. Similar to Chan & Lakonsihok (1993) and Bonser-Neal *et al*. (1999), we find that price impact for sell initiated trades is smaller than that for buy initiated trades. For example, price impact relative to opening price is -0.68%. This impact is followed by reversal around 0.69%. Interestingly, the net effect of the impact, as calculated by return closing to open, shows positive numbers of 0.02%. Price impact relative to weighted average prices on the same day shows negative numbers of 0.8%. Similar to buy trades, the dispersion for return for sell initiated trades is also high. The standard deviation for price impact relative to opening prices is around 5.9%. Price im-

Table 1. Price Impact for Buy Initiated Trades In Regular Market

	Return Transaction to Open (%)	Return Closing to Transaction (%)	Return Closing to Open (%)	Return Transaction Price to Weighted Average Price(%)
Mean	1.792	-0.312	1.481	0.744
Prob-value	0.000	0.000	0.000	0.000
Median	0.985	0.000	0.627	0.451
Standard Deviation	5.737	4.464	7.260	3.078
Number of Observations	463.166	463.166	463.166	463166
Minimum	-48.835	-69.314	-69.314	-37.477
Maximum	91.629	64.869	91.629	41.246
Percentile 5%	-5.236	-6.899	-8.004	-3.169
Percentile 10%	-3.027	-4.124	-4.879	-1.777
Percentile 20%	-1.058	-2.061	-2.375	-0.697
Percentile 25%	-0.270	-1.476	-1.591	-0.398
Percentile 50%	0.985	0.000	0.627	0.451
Percentile 75%	3.540	0.829	3.922	1.657
Percentile 80%	4.445	1.354	4.879	2.086
Percentile 90%	7.622	3.259	8.894	3.621
Percentile 95%	11.719	5.715	13.826	5.559

This table shows price impacts in JSX. Price impacts are calculated using different measures. Return transaction to open is calculated as ((Price in transaction (t) – Opening Price) / Opening Price). Return Closing to Transaction is calculated as (Closing Price – Transaction Price)/Transaction Price)). Return Closing to Open is calculated as (Closing Price – Opening Price)/Opening Price). Return transaction to weighted average price is calculated as ((Transaction Price – Weighted Price)/Weighted Price). Weighted price is calculated for all prices in the same day.

pact relative to weighted average of prices shows smallest standard deviation.

Our dataset allows us to investigate price impacts in negotiated markets. We focus on the largest board in the negotiated market, which is cross market. Table 3 summarizes price impacts in the cross market for buy initiated trades.The table shows, for buy initiated trades, price impacts in the cross market tend to be higher than those in regular market. For buy trades, price impact relative to opening price is 3.4%. This return is followed by a reversal as shown by negative number of 1.76% for return closing to transaction. The net effect is 0.45%. Price impacts in cross market show much larger dispersion than those in regular market. Standard deviation for price impacts relative to opening prices is 11.9%. This number is almost twice as large as standard deviation for regular market. The maximum value is 454%, while the minimum value is -56%. This impact is reversed in the next trades, as shown by negative number, -1.76%, for return closing prices to transaction prices. The total effect show positive number of 0.45%. Price impacts relative to weighted average of prices on the same day yield smaller standard deviation.

Table 2. Price Impact for Sell Initiated Trades in Regular Market

	Return Transaction to Open (%)	Return Closing to Transaction (%)	Return Closing to Open (%)	Return Transaction Price to Weighted Average Price(%)
Mean	-0.651	0.578	-0.073	-0.755
Prob-value	0.0001	0.000	0.0004	0.0000
Median	-0.301	0.000	0.000	-0.406
Standard Deviation	5.632	4.618	7.076	3.076
Number of Observations	455.847	455.847	455.847	455.847
Minimum	-69.314	-69.314	-69.314	-74.345
Maximum	51.082	91.629	91.629	49.247
Percentile 5%	-8.961	-5.264	-9.844	-5.533
Percentile 10%	-5.766	-3.031	-6.595	-3.562
Percentile 20%	-3.338	-1.325	-3.636	-1.983
Percentile 25%	-2.646	-0.829	-2.857	-1.558
Percentile 50%	-0.301	0.000	0.000	-0.406
Percentile 75%	1.219	1.709	2.353	0.416
Percentile 80%	1.980	2.299	3.315	0.709
Percentile 90%	4.522	4.445	6.669	1.716
Percentile 95%	7.598	7.411	11.123	2.927

This table shows price impacts in JSX. Price impacts are calculated using different measures. Return transaction to open is calculated as ((Price in transaction (t) – Opening Price) / Opening Price). Return Closing to Transaction is calculated as (Closing Price – Transaction Price)/Transaction Price)). Return Closing to Open is calculated as (Closing Price – Opening Price)/Opening Price). Return transaction to weighted average price is calculated as ((Transaction Price – Weighted Price)/Weighted Price). Weighted price is calculated for all prices in the same day.

Table 4 summarizes price impacts of sell initiated trades in cross market. For sell initiated trades, price impacts relative to opening prices show negative numbers of -2.57%. Similar to previous findings, we observe a reversal in the next trades, as evidenced by positive number of 2.7% for price impacts relative to closing prices. Total effect shows negative number of -2.13%. Price impacts relative to weighted average of prices on the same day show negative number of 2.2%. We also find consistent findings that the dispersion of price impacts in cross market are much larger than those in regular market.Price impacts relative to weighted average of prices on the same days yield lower dispersion than for other methods to calculate price impacts.

The Effect of Investor Types, Crisis Period, Trade Difficulty, and Size on Price Impacts

We investigate further the effect of investor types (foreign or domestic), the crisis period, trade difficulty, and size on the price impacts. As mentioned above, our dataset records whether a transaction, buy or sell, is originated by domestic or foreign investors. Bonser-Neal *et al*. (1999) find that

Tabel 3. Price Impact for Buy Initiated Trades in Cross Market (%)

	Return Transaction to Open (%)	Return Closing to Transaction (%)	Return Closing to Open (%)	Return Transaction Price to Weighted Average Price(%)
Mean	2.481	-1.546	0.934	1.658
Prob-value	0	0	1.3E-188	0
Median	0.619	0	0	0.856
Standard Deviation	7.877	8.713	10.244	4.762
Number of Observations	107.394	107.394	107.394	107.394
Minimum	-188.273	-621.461	-424.053	-468.048
Maximum	621.461	145.528	454.329	288.968
Percentile 5%	-3.083	-11.778	-9.531	-2.469
Percentile 10%	-1.183	-6.669	-5.064	-1.1599
Percentile 20%	0	-3.252	-2.197	-0.1667
Percentile 25%	0	-2.353	-1.360	0
Percentile 50%	0.619	0	0	0.856
Percentile 75%	3.390	0	3.175	2.553
Percentile 80%	4.445	0.677	4.255	3.187
Percentile 90%	8.455	2.739	8.288	5.651
Percentile 95%	13.353	5.284	13.353	8.664

This table shows price impacts in Jakarta Stock Exchange. Price impacts are calculated using different measures. Return transaction to open is calculated as ((Price in transaction (t) – Opening Price) / Opening Price). Return Closing to Transaction is calculated as (Closing Price – Transaction Price)/Transaction Price)). Return Closing to Open is calculated as (Closing Price – Opening Price)/Opening Price). Return transaction to weighted average price is calculated as ((Transaction Price – Weighted Price)/Weighted Price). Weighted price is calculated for all prices in the same day. Opening, Closing, and Weighted Average Prices are calculated using Prices in Regular Market.

the price impact of foreign investors is larger than that of domestic investors. This finding raises question whether foreign investors receive poor service or they possess better information. Further analysis shows that foreign investors possess better information than domestic investors.

We also want to investigate the effect of crisis period on the price impacts. In mid of 1997, financial crisis hits Indonesia market. The crisis lasts for about 4 year. We define formally the crisis as follows from May 1995 until the end of June, we define the period as normal.From July 1997 until August 2002, we define the period as crisis period.And from September 2002 until the end of data, we define the period as recovery (normal) period. In crisis period, we expect to have larger price impacts, suggesting that liquidity in the crisis period decreases. We also investigate the effect of trade difficulty on the price impacts. Chan & Lakonishok (1993) and Bonser-Neal *et al.* (1999) find that trade difficulty has negative effect on the price impacts. Stocks that are difficult to trade have larger price impact. We use the following regression model to investigate the issue:

Tabel 4. Price Impact for Sell Initiated Trades In Cross Market (%)

	Return Transaction to Open (%)	Return Closing to Transaction (%)	Return Closing to Open (%)	Return Transaction Price to Weighted Average Price(%)
Mean	-2.039	1.571	-0.46961	-2.177
Prob-value	0	0	7.04E-42	0
Median	-0.286	0	0	-0.772
Standard deviation	9.776	9.758	10.352	8.171
Number of Observations	107.269	107.269	107.269	107.269
Minimum	-43.094	-36.243	-42.405	-48.346
Maximum	299.573	454.329	454.329	39.541
Percentile 5%	-13.353	-4.785	-11.778	-10.536
Percentile 10%	-7.696	-2.469	-6.899	-6.263
Percentile 20%	-3.846	-0.643	-3.509	-3.231
Percentile 25%	-2.898	0	-2.597	-2.507
Percentile 50%	-0.286	0	0	-0.772
Percentile 75%	0	2.150	1.652	0
Percentile 80%	0	3.120	2.643	0.185
Percentile 90%	2.298	7.062	6.322	1.136
Percentile 95%	5.043	12.783	10.981	2.361

This table shows price impacts in Jakarta Stock Exchange. Price impacts are calculated using different measures. Return transaction to open is calculated as ((Price in transaction (t) – Opening Price) / Opening Price). Return Closing to Transaction is calculated as (Closing Price – Transaction Price)/Transaction Price)). Return Closing to Open is calculated as (Closing Price – Opening Price)/Opening Price). Return transaction to weighted average price is calculated as ((Transaction Price – Weighted Price)/Weighted Price). Weighted price is calculated for all prices in the same day. Opening, Closing, and Weighted Average Prices are calculated using Prices in Regular Market.

$$\text{Price Impact} = \alpha_0 + \alpha_1 \text{Investor Type} + \alpha_2 \text{ Dum97} + \alpha_3 \text{ Dum00} + \alpha_4 \text{ Trade Difficulty} + \alpha_5 \text{ Size} + e \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where:

Investor Type = 1 for trading by domestic investors, and 0 for trading by foreign investors

Dum97 = 1 forMay 1995 < Period < July 1997, and 0 otherwise

Dum00 = 1 for period >August 2002, and 0 otherwise

Trade difficulty is calculated as transaction volume divided by average of dialy trading volume. We also use ranking of trade of difficulty for robustness check. We create quintile of trade difficulty and assign the value of 1 to 5 according to the quintile of trade difficulties. Size is calculated as number of outstanding shares multiplied by market price at the end of the year. The base in equation above, when all dummies are 0, is post-crisis period.

Table 5 shows regression results for regular market. The table shows that domestic investors

Table 5. The Effect of Investor Types, Crisis Period, Trade Difficulty, and Size on Price Impact in Regular Market

	Buy Initiated			Sell Initiated		
Intercept	0.01491 (< 0.0001)	0.01809 (<0.0001)	0.01998 (<0.0001)	0.01490 (< 0.0001)	0.01601 (<0.0001)	0.01735 (<0.0001)
Investor Types	0.00546 (<0.0001)	0.00543 (<0.001)	0.00501 (<0.0001)	0.00553 (<0.0001)	0.00501 (<0.001)	0.00480 (<0.0001)
Dum97	-0.00556 (<0.0001)	-0.00675 (<0.0001)	-0.00663 (<0.0001)	-0.00606 (<0.0001)	-0.00618 (<0.0001)	-0.00618 (<0.0001)
Dum00	0.01043 (<0.0001)	0.01072 (<0.0001)	0.01068 (<0.0001)	0.01473 (<0.0001)	0.01143 (<0.0001)	0.01144 (<0.0001)
Trade difficulty		-0.000332 (<0.0001)	--		-0.000313 (<0.0001)	--
Ranking Trade Difficulty		---	-0.00104 (<0.0001)		---	-0.0007589 (<0.0001)
Size		-7.5E-17 (<0.001)	-7.58E-17 (<0.0001)		-5.93E-17 (<0.001)	-6.026E-17 (<0.0001)
Adj-R-sqr	0.0291	0.0532	0.0559	0.0063	0.0517	0.0530
F-value	1879***	2030***	2137 ***	2447***	1899 ***	1948 ***

This table shows regression coefficients for the following model:
Price Impact = a_0+ a_1Investor Type + a_2 Dum97 + a_3 Dum00 + a_4 Trade Difficulty + a_5 Size + e
We use return from transaction price to average of prices in the same day for price impact. Investor type has value of 1 for domestic investors and 0 for foreign investors. Dum97 has value of 1 for trading between May 1995 and July 1997, and 0 otherwise. Dum00 has a value of 1 for trading after August 2002, and 0 otherwise. Trade difficulty is calculated as transaction volume divided by average of daily trading. Ranking trade difficulty is calculated by creating quintile of trade difficulty, and assign the value of 1-5 according to the quintile. Size is calculated as market price at the end of year multiplied by number of shares outstanding. We take absolute value for the price impact. P-values are in parenthesis.

have larger price impacts than do foreign investors, for both buy and sell initiated trades. For both buy and sell initiated trades, regression coefficients for investor type are significantly positive. Table 6 shows regression coefficients for cross market. Unlike regular market, the cross markets do not show consistent findings as to which investor type (domestic or foreign) has larger price impacts.

DISCUSSION

In regular market, price impacts we observed here are generally larger than those reported by Bonser-Neal *et al*. (1999). For example, for buy transactions, they report price impact relative to opening prices is around 1,51% and price impact relative to weighted prices on the same day is around 0,32%. The numbers we report here are also larger than those reported by other studies.For example, Domowitz *et al*. (2001) report market impact costs, computed by comparing the trade price to a benchmark price on the day of the trade, which is similar to price impact relative to weighted prices on the same day, for several countries from period of September 1996-December 1998. For Indonesia, the number is 15.7 basis points.

Table 6. The Effect of Investor Types, Crisis Period, Trade Difficulty, and Size on Price Impact in Cross Market

	Buy Initiated			Sell Initiated		
Intercept	-0.00910 (< 0.0001)	-0.01186 (<0.0001)	-0.01550 (<0.0001)	-0.00604 (< 0.0001)	-0.00504 (<0.0001)	0.01133 (<0.0001)
Investor Types	-0.00493 (<0.0001)	-0.00385 (<0.001)	-0.00290 (<0.0001)	0.02576 (<0.0001)	0.02687 (<0.001)	0.02165 (<0.0001)
Dum97	-0.00450 (<0.0001)	-0.00289 (0.0001)	-0.00260 (0.0006)	0.02314 (<0.0001)	0.02411 (<0.0001)	0.02233 (<0.0001)
Dum00	-0.00597 (<0.0001)	-0.00676 (<0.0001)	-0.00667 (<0.0001)	-0.00744 (<0.0001)	-0.00785 (<0.0001)	-0.00773 (<0.0001)
Trade difficulty		0.0000425 (0.0002)	--		-0.0000437 (<0.0001)	--
Ranking Trade Difficulty		---	0.00118 (<0.0001)		---	-0.00491 (<0.0001)
Size		3.319E-17 (<0.001)	3.294E-17 (<0.0001)		-3.85E-17 (0.0099)	-3.505E-17 (<0.0001)
Adj-R-sqr	0.0029	0.0042	0.0047	0.0121	0.0140	0.0197
F-value	52.14***	43.05***	48.12***	209 ***	141 ***	199 ***

This table shows regression coefficients for the following model:
Price Impact = $\alpha_0 + \alpha_1$Investor Type + α_2 Dum97 + α_3 Dum00 + α_4 Trade Difficulty + α_5 Size + e
We use return from transaction price to average of prices in the same day for price impact. Investor type has value of 1 for domestic investors and 0 for foreign investors. Dum97 has value of 1 for trading between May 1995 and July 1997, and 0 otherwise. Dum00 has a value of 1 for trading after August 2002, and 0 otherwise. Trade difficulty is calculated as transaction volume divided by average of daily trading. Ranking trade difficulty is calculated by creating quintile of trade difficulty, and assign the value of 1-5 according to the quintile. Size is calculated as market price at the end of year multiplied by number of shares outstanding. We take absolute value for the price impact. P-values are in parenthesis.

Chan & Lakonishok (1993) report price impact of 37 large institutional money management firms in US. For buy transactions, price impacts relative to opening prices, price impact relative to closing prices, return for closing to opening prices, and price impact relative to weighted average of prices on the same days are 0.22%. 0.1%. 0.34%. and 0.02%. For sell tranasaction. the corresponding numbers are -0.14%. 0.10%. - 0.04%. and -0.07%.

The pattern of reversal for buy initiated trades is not consistent with previous findings (Chan & Lakonsihok, 1993). The net price impact, however, still shows positive number of around 1,48%. Price impact relative to weighted average prices on the same days shows positive number of around 0,91%.

Our results show a much larger dispersion for price impacts than those reported by Bonser-Neal *et al*. (1999). For example, the standard deviation for returns relative to opening prices are around 6%, which is twice as large as that reported by previous study (around 3%). Standard deviation is much smaller for price impacts measured by return relative to weighted average prices on the same days. This pattern is consistent with Bonser–Neal *et al*. (1999).

How large are the price impacts in Indonesia cross market? Keim & Madhavan (1996) report price impact for upstairs market in NYSE as follows. For seller initiated trades, temporary impact is -2,84%, while permanent impacts measured by different methods are -1,5%, -4,32%, and -7,4%.For buy initiated trades, temporary impact is -0,15%, while permanent impacts are -1,6%, 2,82%, and 4,66%. Altough direct comparison should be exercised carefully, this comparison seems to show that price impacts in Indonesia cross market are larger than those in upstairs market in NYSE.

In regular market, our results from regression analysis show that domestic investors have larger price impact than foreign investors (positive regression coefficients for investor types). This result is in sharp contrast with Bonser-Neal *et al*. (1999). Price impacts tend to be smaller in pre-crisis period. Regression coefficients for Dum97 consistently show negative numbers. For example, price impact relative to opening prices for buy initiated trades, in pre-crisis period is about 0,6% lower than that in post-crisis period. In the crisis period, price impacts tend to be higher than those in post-crisis period. Regression coefficients for Dum00 consistently show positive numbers. For example, using price impacts relative weighted average of the prices, price impacts in the crisis period is around 1% higher than those in post-crisis period, for both buy and sell initiated trades. As expected, trade difficulty and size show negative relationship with price impact. These results are consistent with previous literature by Chan & Lakonishok (1993) and Bonser-Neal *et al*. (1999).

In cross market, we do not find consistent pattern on the effect of crisis period on the price impact. For example, for buy initiated trades, we obtain negative regression coefficients, while for sell initiated trades, we have positive regression coefficients. The same pattern is observed for trade difficulty, we have inconsistent regression coefficients for buy and sell initiated trades. Even for size, we have positive regression coefficients, which is inconsistent with literature in finance. Since we use large observations, we have quite strong statistical power. However, economical meaning from the results in cross market is not clear. In general, results from cross markets are weaker than those in regular market, although the statistical power in the cross market is still strong.

CONCLUSION AND SUGGESTIONS

Conclusion

We investigate transaction in Jakarta Stock Exchange. We closely extend Bonser-Neal *et al*. (1999) study. While Bonser-Neal *et al*. (1999) use period pre-automation (before 1995), we use period right after automation period (after 1995). The use of this period hopefully ensures a close match with the period used by Bonser-Neal *et al*. (1999). Therefore, we can also expect to be able to compare the effect of trading automation on transaction costs.

Overall, our results can be summarized as follows. In regular market, price impacts observed in this paper seem to be higher than reported by previous studies. Since our study is conducted during automation period, automation does not seem to automatically reduce transaction costs. Domestic investors have larger price impact than foreign investors. Price impact in crisis period is higher than in the non-crisis period. Trade difficulty and size show negative relationship with price impact, consistent with previous findings.In cross market, we do not observe consistent findings. Cross market also shows weaker results.

Suggestions

We believe there are several implications from this research. From practical implications, higher transaction costs in Indonesia seem to suggest that trading strategy that minimizes trading frequency (such as buy and hold strategy) is probably more optimal in Indonesia market.Moorman (2014) investigates various methods to reduce transaction costs, which may be relevant for high frequency trading strategy.

For future research, we believe there are several directions that can be pursued. First, automation seems to increase transaction cost and volatility. We believe that this is not necessarily bad. Automation may improve efficiency (i.e. news travels more quickly), and hence increase volatility. Next research may investigate the effect of automation on efficiency and volatility. Second, cross market shows different results. Next research may investigate furthermore the effect of different trading mechanism, such as negotiated market in cross market, on trading behavior and characteristics. We leave these issues for next research.

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