PERFORMANCE OF RETURN AND VOLUME MOMENTUM: ASEAN EQUITY PORTFOLIOS

BY

MR. POOM JEDSOMMA

AN INDEPENDENT STUDY SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE PROGRAM IN FINANCE (INTERNATIONAL PROGRAM) FACULTY OF COMMERCE AND ACCOUNTANCY THAMMASAT UNIVERSITY ACADEMIC YEAR 2016

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ABSTRACT

This research uses intraday data from three equity markets in ASEAN (Malaysia, Singapore, and Thailand) covering from 24th August 2016 to 26th January 2017 to examine intraday momentum trading strategies. Our momentum portfolios are created from ranking winners and losers at intervals of 15, 30 and 60 minutes. We also include intraday turnover momentum in our analysis. The study finds that momentum strategies of buy winner and sell loser do not generate positive excess returns. On the contrary, winner momentum portfolios lose money in the next time interval whereas loser momentum portfolios tend to show better returns instead. The empirical results suggest that past selling winners and past buying losers are less likely to lose money in the intraday trading

Keywords: Intraday, Momentum, Trading strategy

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Lastly, I would like to thank my family for keeping me motivated to surpass my depression and support me throughout writing this research. This research would be impossible to achieve without the supports from all of you. Thank you!

Mr. Poom Jedsomma

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CHAPTER 1
INTRODUCTION

Since Jegadeesh and Titman (1993) documented momentum trading strategies, finding that winner stocks tend to continue to be winners and loser stocks tend to continue to be losers. Many researchers tried to find and explained the momentum strategies with other factors such as earnings surprise (Chan et al, 1996), investor behavior (Hong and Stein, 1999), trading volume turnover (Lee and Swamninathan, 2000). However, most of momentums were conducted on the monthly frequency except for the study of Gao, Lei, et al. (2015) that claimed the evidence of the intraday momentum in the active trade S&P500 ETF.

Recently, many researchers have found the relationship of momentum and trading volume turnover such as the research of Rouwenhorst (1999) and Lee and Swamninathan (2000).

Nevertheless, there are less empirical studies on the momentum strategies in the emerging market. Rouwenhorst (1999) found the evidence of momentum strategies in 16 out of 20 emerging markets. Chan et al (2000) also indicated the significant evidence of momentum strategies in the international equity markets. Both researchers used Thailand and Malaysia as samples of the emerging markets.

In addition, the revolution of computer and technology changed the financial market dramatically. The algorithmic and high frequency trading became popular among the stock markets according to Hirschey (2016). He found that 40% of trades in the NASDAQ stock market is from HFT. Riordan (2014) reported that the volume from the algorithmic trading represents 52% of the market order. With speed and precision advantage of the computer, we can put the momentum strategies into an intraday level which cannot be done by human. With the advantage of computer, this raises the question if the intraday momentum strategies can be done via it or not.

In this study, we focus on 3 main emerging markets that represent the ASEAN market including Bursa Malaysia (MYX), Singapore Stock Exchange (SGX) and Stock Exchange of Thailand (SET). The data will cover from 24th August 2016 to 26th January 2017. By adopting the original work of “Intraday Momentum: The First Half-

Hour Return Predicts the last Half-hour Return" by Gao, Lei, et al. 2015, we change the investment horizon to the intraday with ranking and holding periods of 15, 30 and 60 minutes. This paper comes up with 2 main research questions. Firstly, we want to investigate whether the momentum strategies generate the excess returns with the intraday frequency. Secondly, can trading volume turnover predict the price momentum at the intraday level?

The empirical results reveal that the intraday momentum investment strategies with the ranking and the holding period of 15, 30 and 60 minutes across the three ASEAN equity markets do not yield a superior return. In contrast to a monthly momentum evidence, the research finds that the past intraday winners earn negative returns while the past intraday losers earn positive returns after the holding period. However, the intraday momentum based on turnover rankings tend to perform better than return rankings.

The result of this paper suggests that the intraday returns tend to revert from time interval to interval. Also, examining overnight momentum and intraday session break momentum (morning session ranking and buying/selling in the afternoon) do not alter the results.

CHAPTER 2
REVIEW OF LITERATURE

From the famous momentum strategy research paper of Jegadeesh and Titman (1993), they formed winner and loser portfolios based on the past 3, 6, 9 and 12-month returns and hold them for 3, 6, 9 and 12 months. This created the 4x4 trading strategy. They claimed that, over the short investment horizon of 3 to 12 months, the past winners outperform the past losers over next 3 to 12 months. This was followed by many evidences of momentum research such as Chan, et al (1996) which conclude that the price momentum occurred due to the market underreacting to information. For example, earnings surprise can explain the future returns. According to Moskowitz and Grinblatt (1999), they claimed that the industry portfolios exhibit the momentum even controlling the size and the book-to-market equity. Daniel, Hirshlefer, and Subrahmanyam (1998), Hong and Stein (1999) showed the model of the investor behavior and concluded that the price momentum was from the bias of an investor who interpreted information differently. Lately, the evidence of intraday momentum was found in the active trade S&P500 ETF by Gao, Lei, et al. (2015). In the paper, they found the strong evidence of the intraday momentum that the first half hour return could predict the last hour return. Also, they concluded that the momentum was stronger in the high trading volume day. Moreover, they reported that the intraday momentum was also strong for the other active traded ETFs.

In this paper we focus on the momentum strategy and the trading volume turnover. There are also many supporting researchers who found the relationship between the price momentum and the trading volume turnover. For example, Lee and Swamninathan (2000) found that momentum was stronger in the high trading volume turnover. Moreover, they found that the past trading volume could also predict the magnitude of the price momentum. They also suggested that the past performances led to mispricing of securities, linked to herd-like on overreaction and explained the part of the volume effect. Blume, Easley and O'Hara (1994) came up with the result that the relationship of the price and the trading volume could provide the information on the future price change. Glaser and Weber (2002) also concluded that the

momentum strategies could make more profits among the high turnover stocks. Rouwenhorst (1999) claimed that, with the momentum strategy, winners tend to have higher trading volume turnover than losers in the emerging market.

As you will see in section 3 of data fact and discussion, the intraday trading volume patterns can exhibit a U-shape pattern. The paper of Admati and Pfleiderer (1988) and Foster and Visawannathan (1990) explained this trading pattern by the information flow factor. The high trading volume in the morning was due to the information overnight, and the high trading volume in the end of the day was due to an active trader who intended to sell the unwanted securities and uncertainties (Vijh, 1988).

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Market Background and Trading System

In 2012, the ASEAN Exchange launched the ASEAN Trading Link. The purpose is for the investors to gain access to all stock markets in ASEAN. The ASEAN Exchange is a collaboration of 6 countries with 7 exchanges markets which are Bursa Malaysia (MYX), Hanoi Stock Exchange (HNX), HoChiminh Stock Exchange (HOSE), Indonesia Stock Exchange (IDX), Philippine Stock Exchange (PSE), Singapore Exchange (SGX) and The Stock Exchange of Thailand (SET). All in all, the total market value of ASEAN is approximately $2022 billion (February 2016). In our study, we will use the top 3 biggest market values that represent approximately 70% of the total market capitalization of ASEAN. They are Bursa Malaysia (MYX) with the market value of $380 billion, Singapore Exchange (SGX) with the market value of $639 billion and the Stock Exchange of Thailand (SET) with the market value of $368 billion.

All markets have almost the same trading system. It is 'Pre-open session' (also called 'Auction hour'). In this phase, the order can be placed, modified and cancelled. However, no order is matched in this phase.

Just before the end of the pre-open session, the order will be matched based on a single price that has been calculated by market mechanism to maximize the order match. Then the price will be used as the open-price in the main trading session. This system is for MYX and SET but there is a slight difference for SGX. After the pre-open session, it will be followed by a non-cancel phase. In this phase, orders cannot be placed, modified or cancelled. The unmatched order will be carried forward to the main trading phase for all markets.

For the main trading phase, order entry, modification and cancellation are permitted. The trading and matching orders will based on a continuous basis where each incoming and modified orders will look for the immediate possible execution. Unexecuted orders will be queued for matching based on price and then time priority.

After main trading session, MYX and SET will be followed by an intermission (launch break) and will go through the same procedure of pre-open and main trading session as in the morning and afternoon session while SGX does not have the intermission.

The pre-close phase starts immediately after the end of the main trading phase. All unmatched orders from the main trading session will be carried into this phase. The orders can be placed, modified and cancelled but no order will be matched.

At the end of the pre-close phase, the orders can be matched at a single price based on the market algorithm to maximize matched orders. Matching of orders will base on the price and then the time priority. The price will be the close price of the day.

After this phase, it will give some time depending on the market to do some specific tasks such as entering trade report for SET. For the market close, at this time all unmatched orders in the market will be clear, and there will be no further activity done in the market. All market sessions are shown below (Table 3.1).

Table 3.1 Trading hour for each country

	MYX (Local Time)	SGX (Local Time)	SET (Local Time)
Pre-Open Session I	8:30 – 9:00	8.30 – between 8:59 – 9:00	9:00 – between 9:55 – 10:00
Morning Session	9:00 – 12:30	9:00	10:00 – 12.30
Pre-Open Session II	14:00 – 14:30	-	14.00 - between 14.25 - 14.30
Afternoon Session	14:30 – 16:45	17:00	14:30 – 16:30
Pre-Close Session	16:45 – 16:50	17:00 – 17:05	16:30 – between 16:35 – 16:40
Closing Session	16:50 – 17:00	17:05 – 17.06	16:40 – 17:00
Market Close	17:00	17:06	17:00

3.2 Data Selection and Preparation

We use only the top 40 stocks form each market with the highest average trading volume turnover per day (From 1st July to 30th September 2016) to eliminate the liquidity problem. The raw intraday data is obtained from the 3 main markets to represent the ASEAN market including Bursa Malaysia (MYX), Singapore Stock Exchange (SGX) and Stock Exchange of Thailand (SET). The data used in this study will cover from 24th August 2016 to 26th January 2017. It consists of 5-minute close price, trading volume and daily number of common share outstanding, which all data is obtained from Router-Eikon. Since these 3 markets have different trading hours, we will have different numbers of observation per day for each country with 5-minute time stamp. Then the numbers of common share outstanding are used to calculate the trading volume turnover by dividing the trading volumes with the numbers of common share outstanding for each 5-minute trading volume data in each country.

To prepare the data, we use only the main trading session on each market and drop out the rest of data (e.g. pre-open and pre-close) that are not in the continuous trading session. We also design to drop the first 5-minute time stamp for each market because this period will count as a matched volume from the auction which does not reflect the real trading volume in the trading session. Thus, our first observation will be the following; price at 9:10 for MYX reflecting the trading volume from 9:05 to 9:10, 9:10 for SGX reflecting the trading volume from 9:05 to 9:10, price at 10:10 for SET reflecting the trading volume from 10:05 to 10:10. This is for preventing the unmatched orders form the auction at the pre-open session, which the orders will be carried forward into the continuous morning and continuous afternoon trading session for Thailand and Malaysia and continuous morning for Singapore. Thus, the analysis time for each country is shown below (Table 3.2).

Table 3.2 Analysis time frame for each market

	MYX (Local Time)	SGX (Local Time)	SET (Local Time)
Morning Session	9:10 – 12:30	9:10 – 17:00	10:10 – 12.30
Afternoon Session	14:40 – 16:45		14:40 – 16:30

From Table 3.2, we create portfolios based on 15 and 30 minutes from our analysis timeframe for both ranking and holding periods, and prepare the data to be 15 and 30-minute time stamp. We aggregate the trading volume of three 5 minute time stamps to create 15-time stamp data and six 5 minute time stamps to create 30-minute time stamp data from our analysis time. With different trading hours, this makes each country have different numbers of observation with 15 and 30-minute time stamp as shown (Table 3.3).

Table 3.3 Numbers of observation with 15 and 30 time stamp in each country

Number of Observation	MYX	SGX	SET
15-minute Time Stamp	22	31	16
30-minute Time Stamp	10	15	7

3.3 Data Facts and Discussion

In this part, we will discuss the raw data from 40 stocks from each country that we obtain before completing analysis. We begin with the trading volume with 15 and 30-minute time stamp. We find a summation of the trading volume for each day and each time period, and then take a time series average for each time for every trading day. The results for every coutry trading volume show the similar reverse U-shape pattern for each country except for Malaysia with 30- minute time stamp. This may be explained by the loss of information. The trading session closes at 16:45, but the last 30 minutes define the aggregate trading volume from 16:00 to 16:30. According to all figures, the trading volume is the highest at the first period of the day. The high trading volume in the morning is due to the information overnight (Admati and Pfleiderer (1988) and Foster and Visawannathan (1990)), and high trading volume in the end of the day is due to the active traders who intend to sell the unwanted securities and uncertainties (Vijh, 1988). (Figures 3.1 to 3.6)

We also plot the return average 15-minute return of 40 stocks for each market to observe the pattern of the intraday average return for each country, covering period of 24th August to 11th November 2016. These graphs show that Malaysia seem to exhibit the reverse L-shape pattern return while Singapore and Thailand exhibit the

sideway pattern return. For 30-minute return intervals, Malaysia remains to exhibit the reverse L-shape return pattern whereas other two countries exhibit the random pattern. This may be due to the long interval between periods and may not provide any information to conclude the pattern. (Figures 3.7 to 3.12)

Form figures 3.13 to 3.15, we make an equal-weight daily return index for each country from 40 selected stocks from each market with the base value of 100, covering from 24th August 2016 to 26th January 2017 to observe the trend of return for 40 sample stocks in each market. These graphs show that during our study period (24th August 2016 to 26th January 2017), Malaysia index exhibit the sideway and then upward trend from December 2016 to the end of January 2017. On the other hand, Singapore index is on the upward trend during our study period. There is nothing much to observe for Thailand because our 40 sample stock of Thailand exhibit the sideway trends.

Figure 3.1: 15-minute time stamp and trading volume of Malaysia

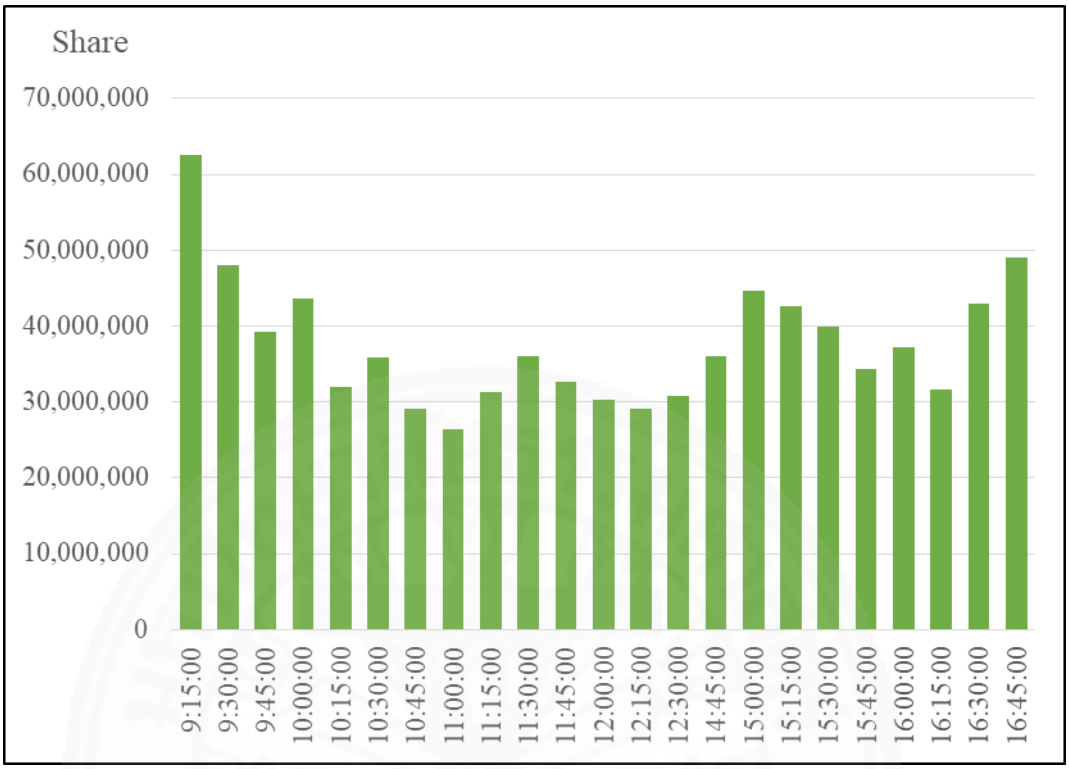


Figure 3.2: 30-minute time stamp and trading volume of Malaysia

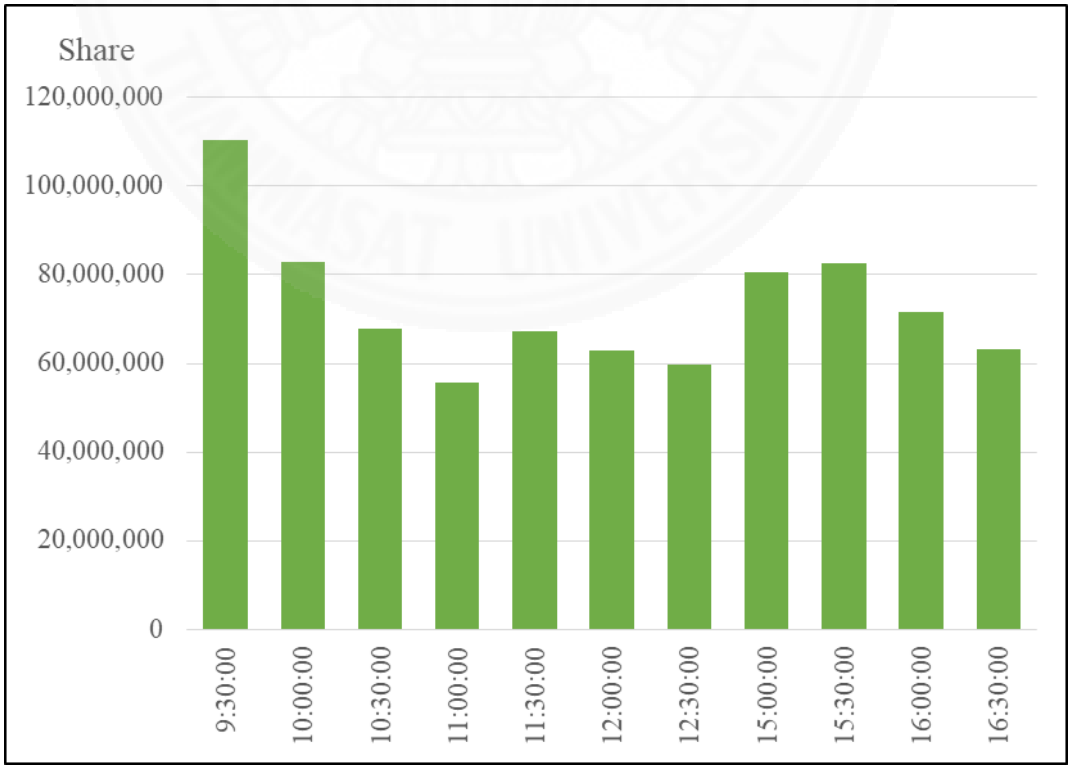


Figure 3.3: 15-minute time stamp and trading volume of Singapore

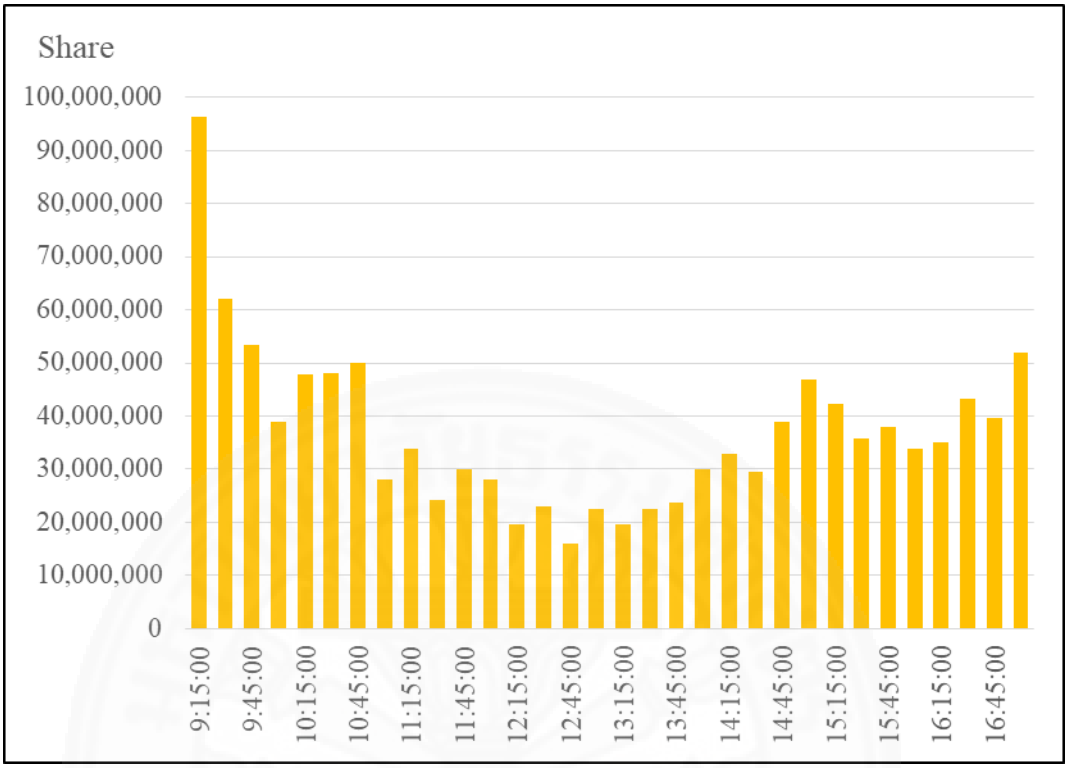


Figure 3.4: 30-minute time stamp and trading volume of Singapore

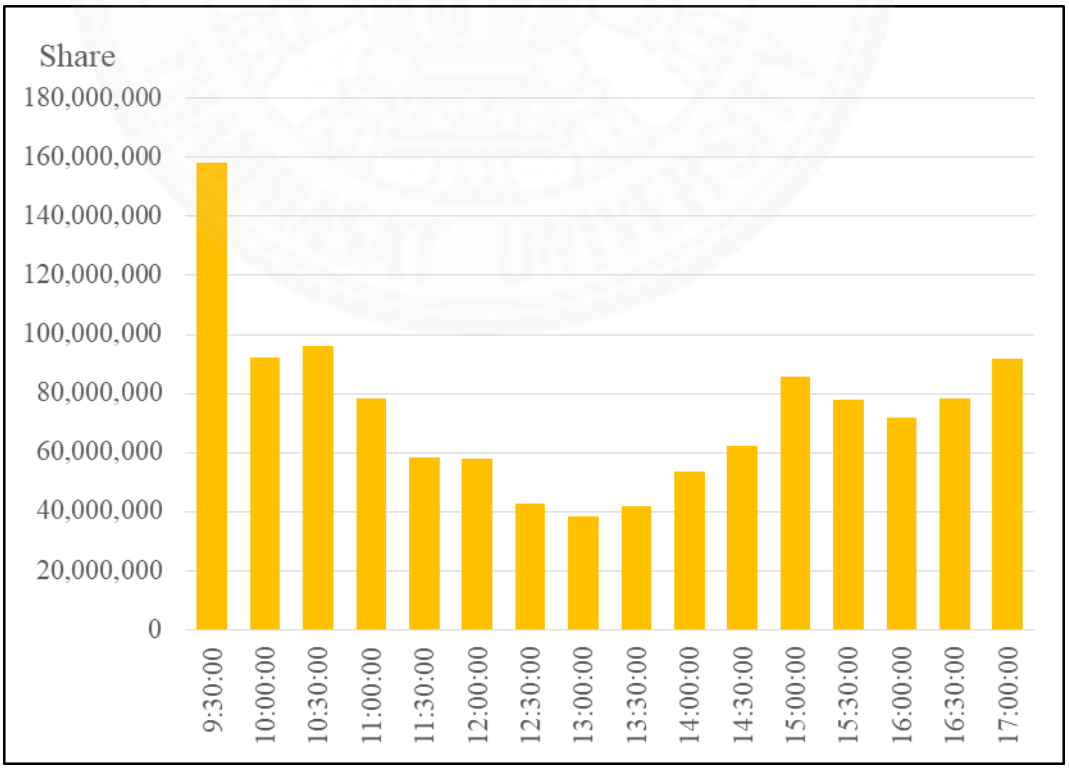


Figure 3.5: 15-minute time stamp and trading volume of Thailand

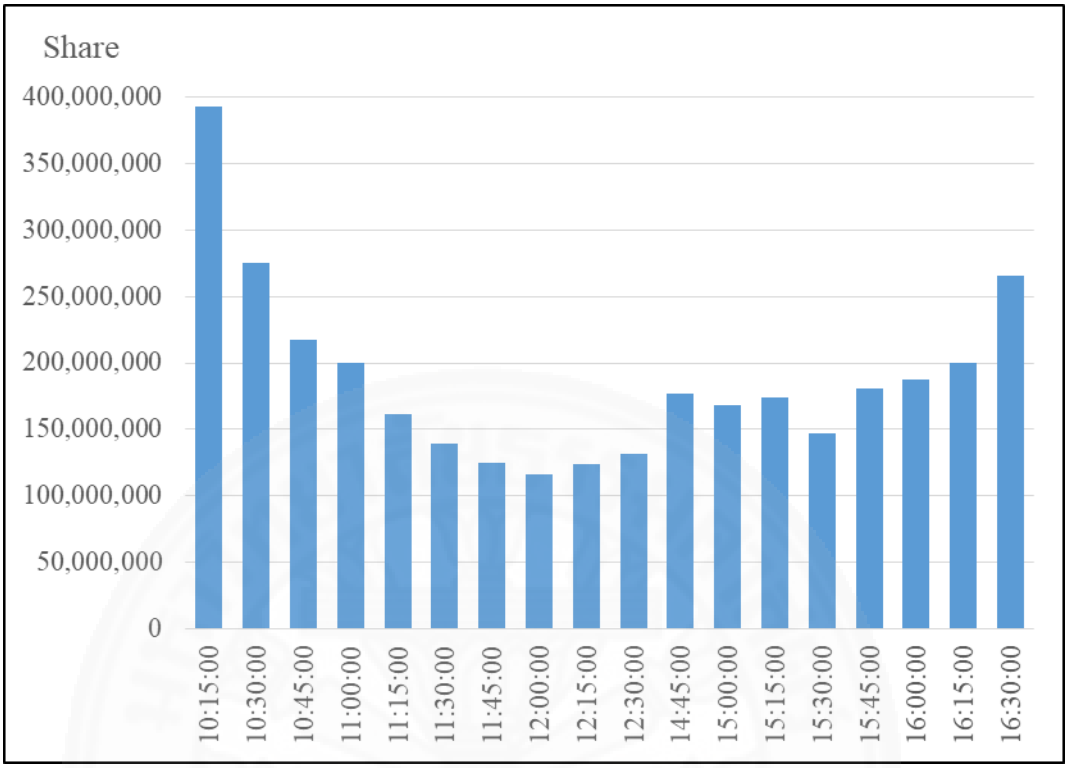


Figure 3.6: 30-minute time stamp and trading volume of Thailand

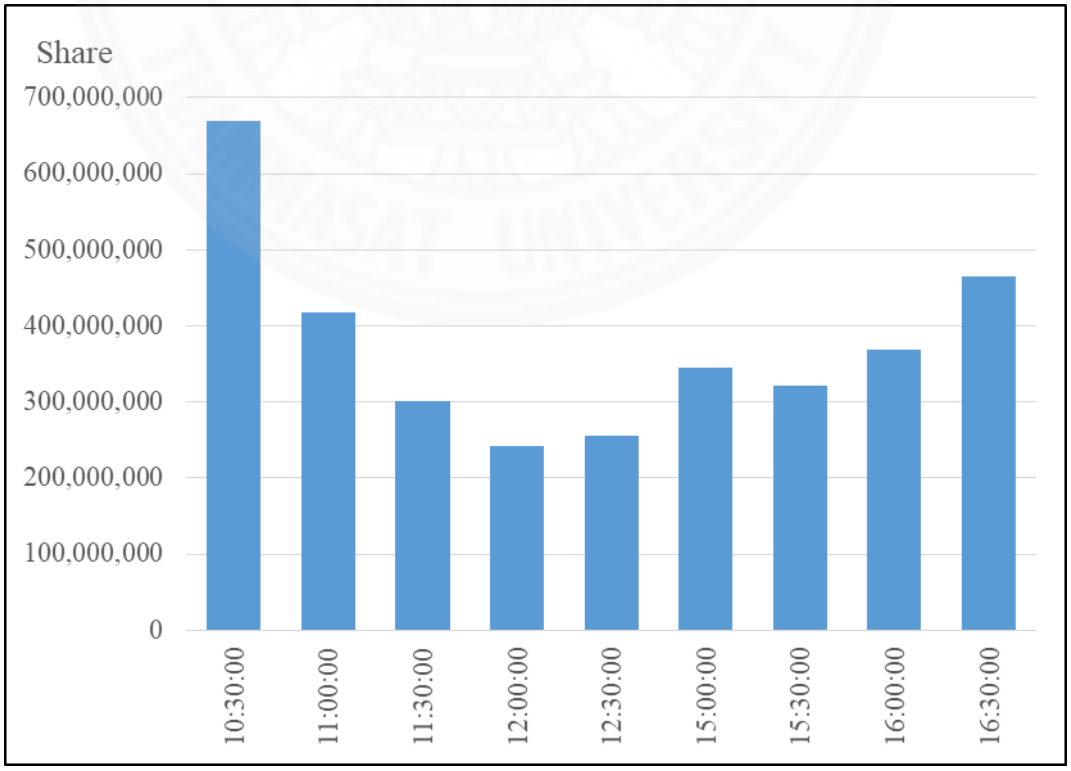


Figure 3.7: 15-minute average returns of 40 sample stocks in Malaysia

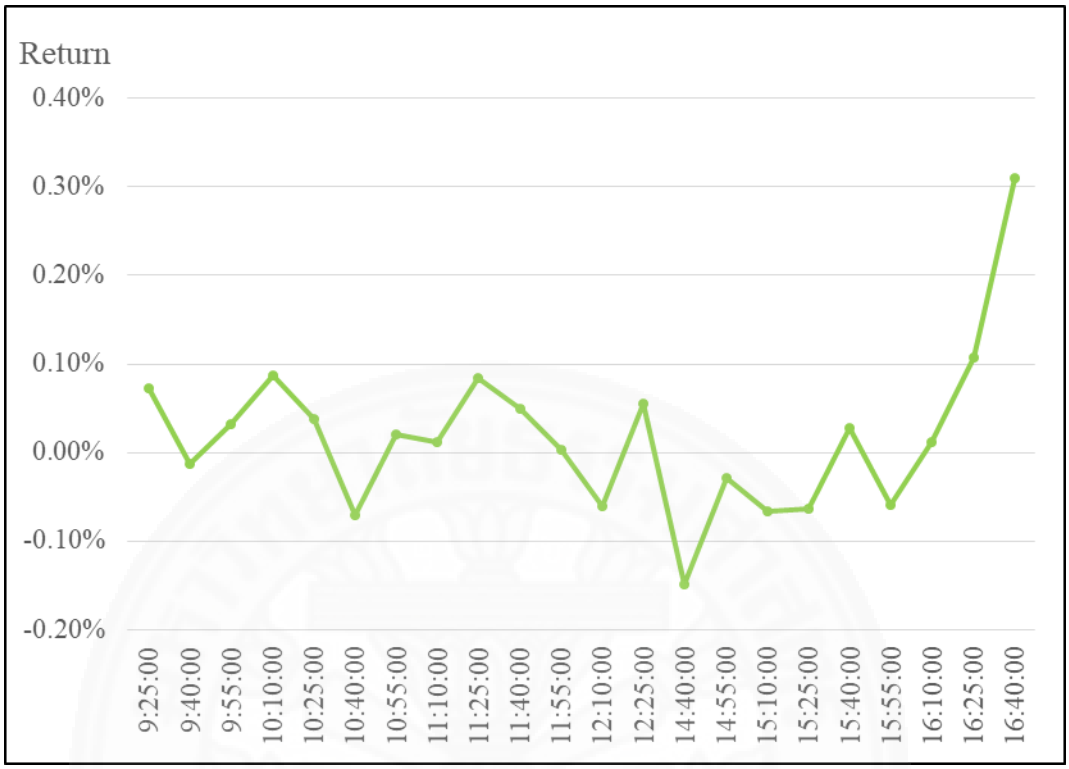


Figure 3.8: 30-minute average returns of 40 sample stocks in Malaysia

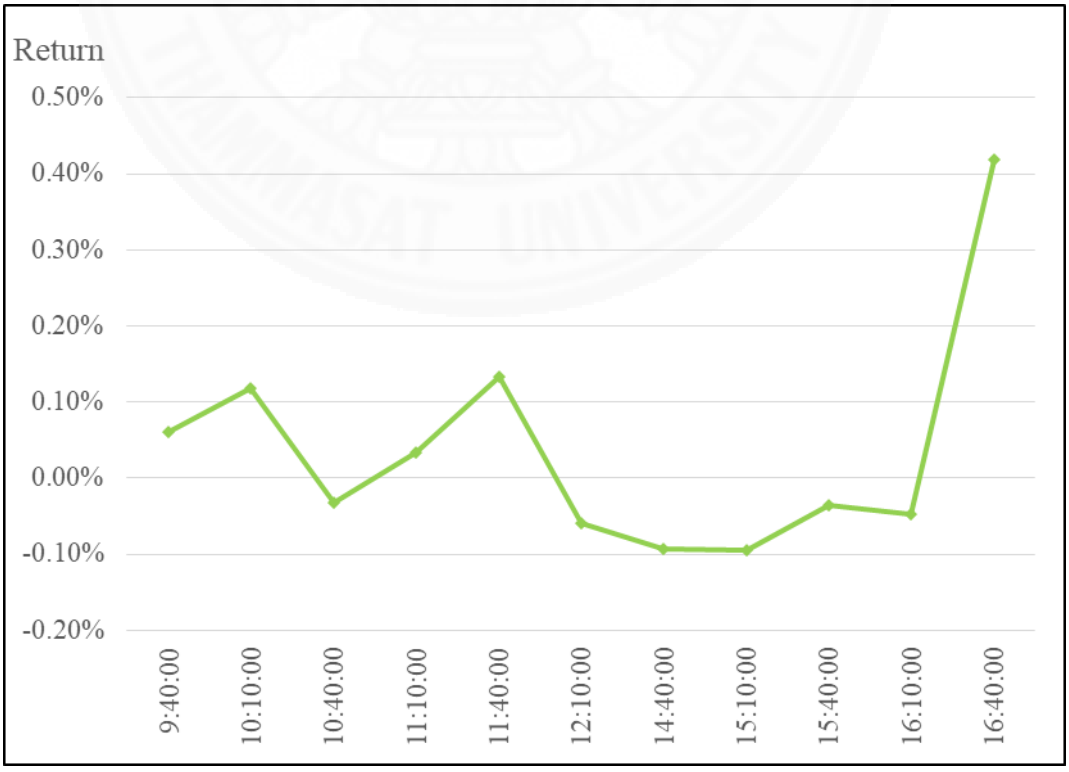


Figure 3.9: 15-minute average returns of 40 sample stocks in Singapore

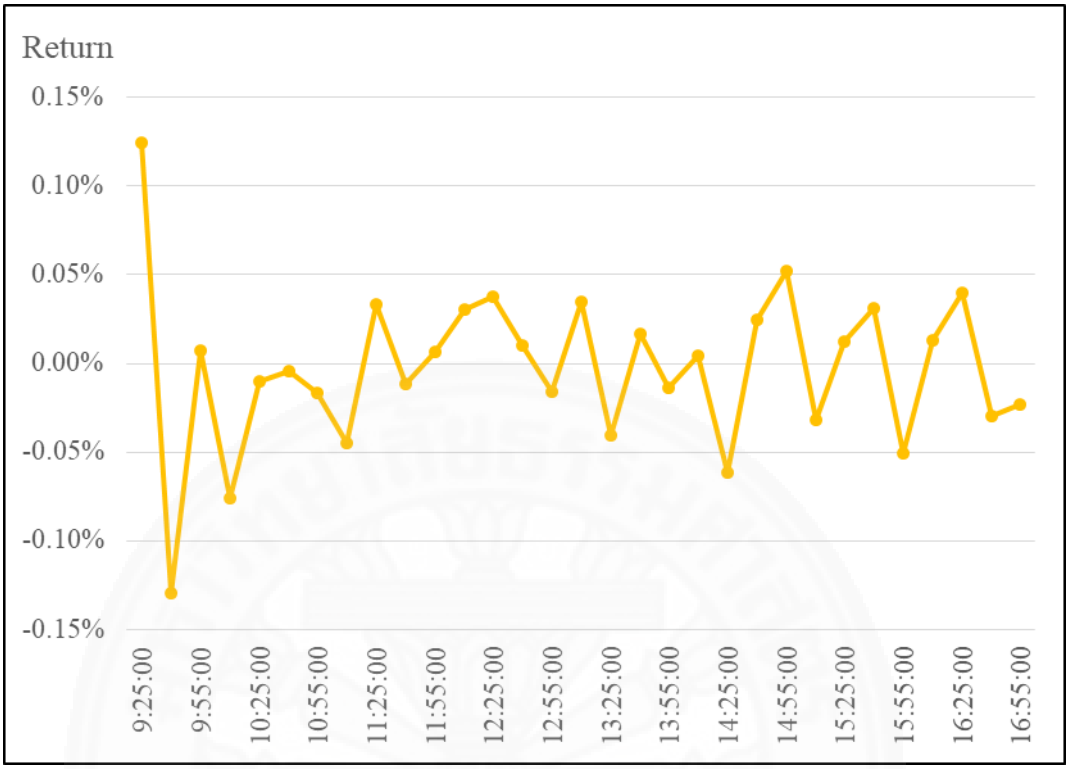


Figure 3.10: 30-minute average returns of 40 sample stocks in Singapore

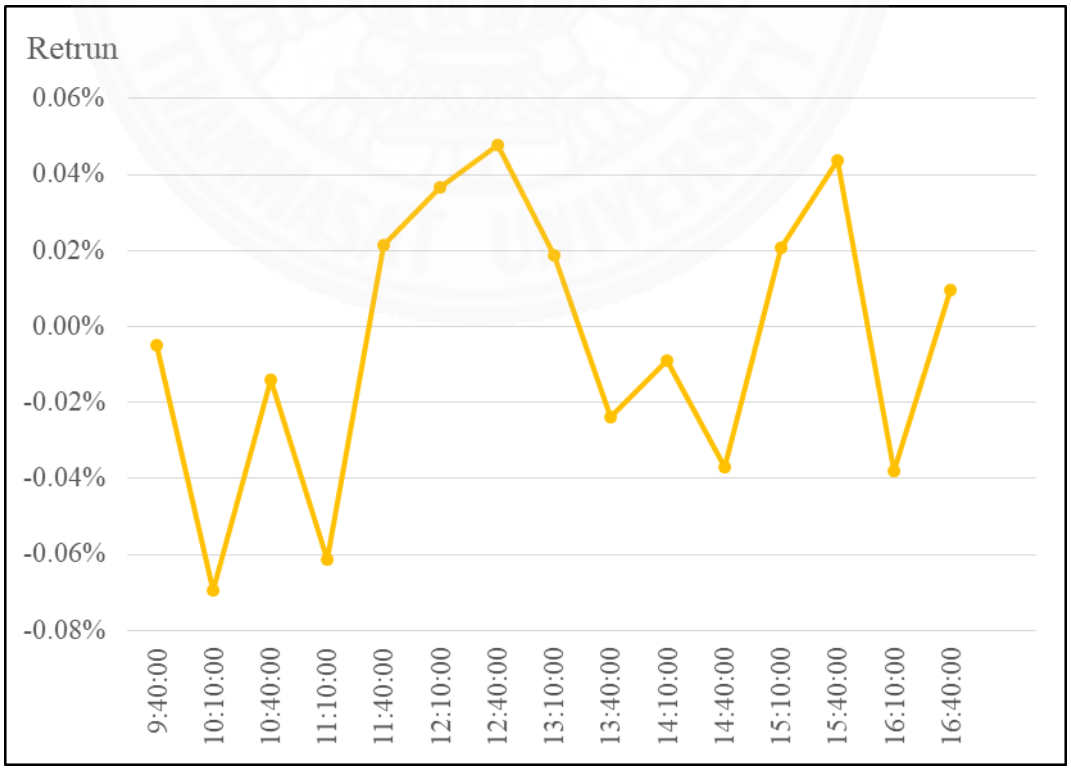


Figure 3.11: 15-minute average returns of 40 sample stocks in Thailand

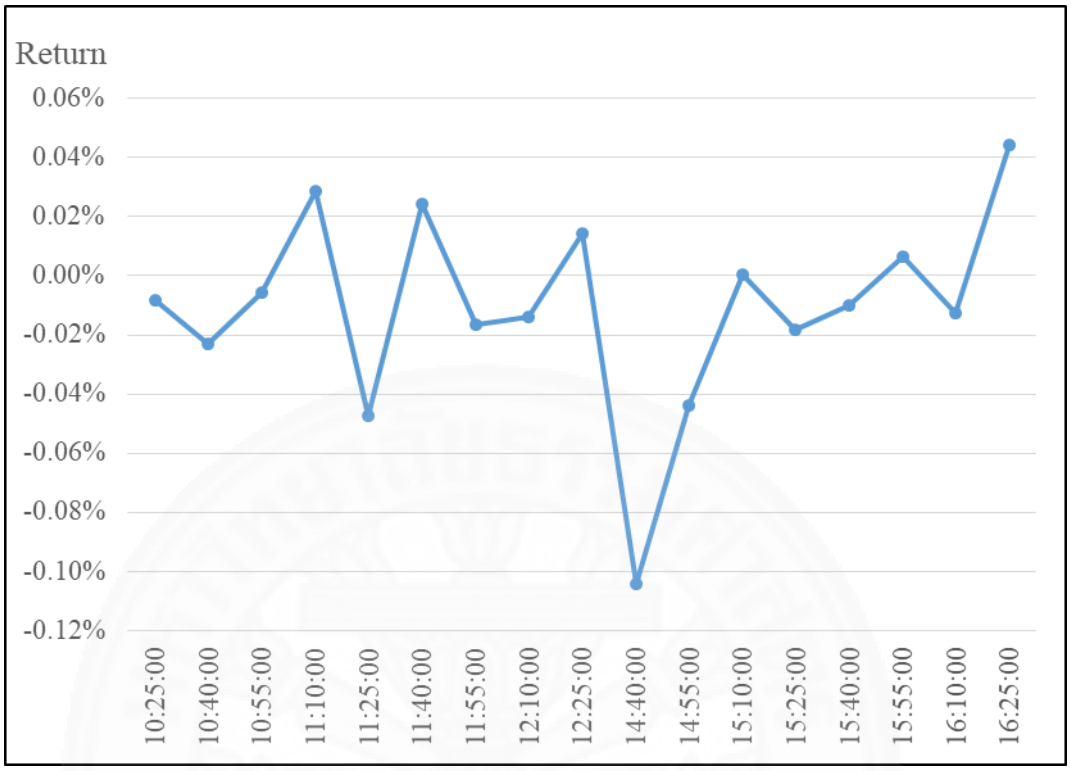


Figure 3.12: 30-minute average returns of 40 sample stocks in Thailand

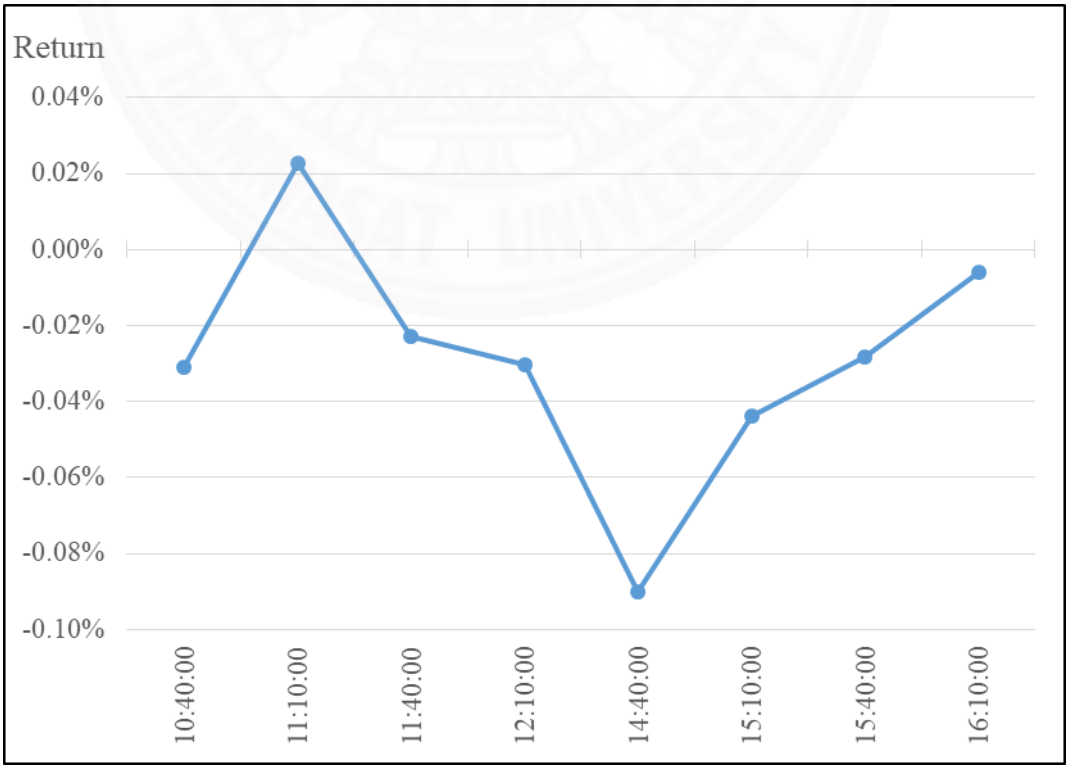


Figure 3.13: 40 sample stocks equal-weight returns index for Malaysia

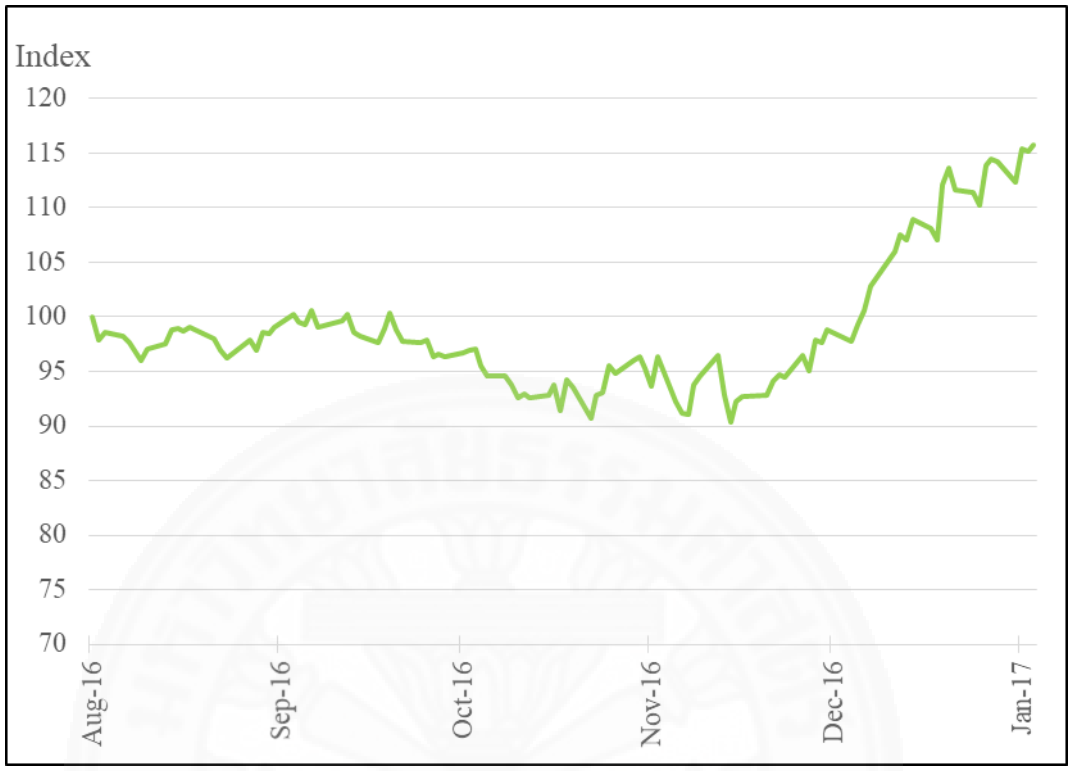


Figure 3.14: 40 sample stocks equal-weight return index for Singapore

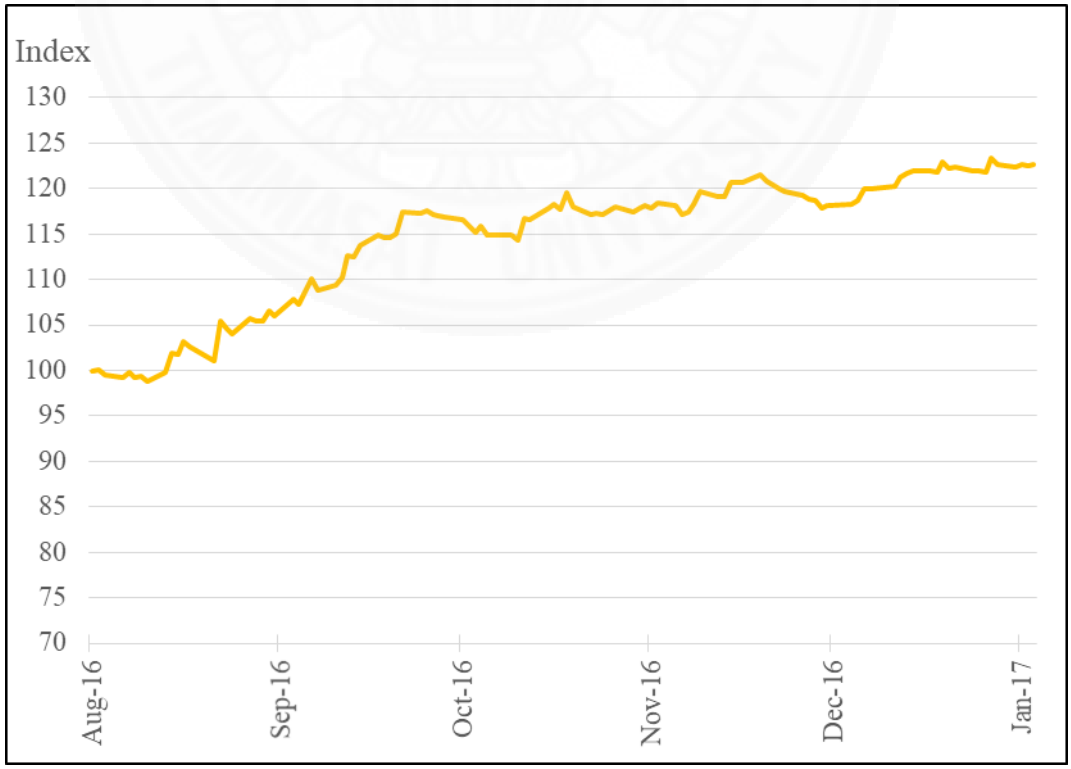
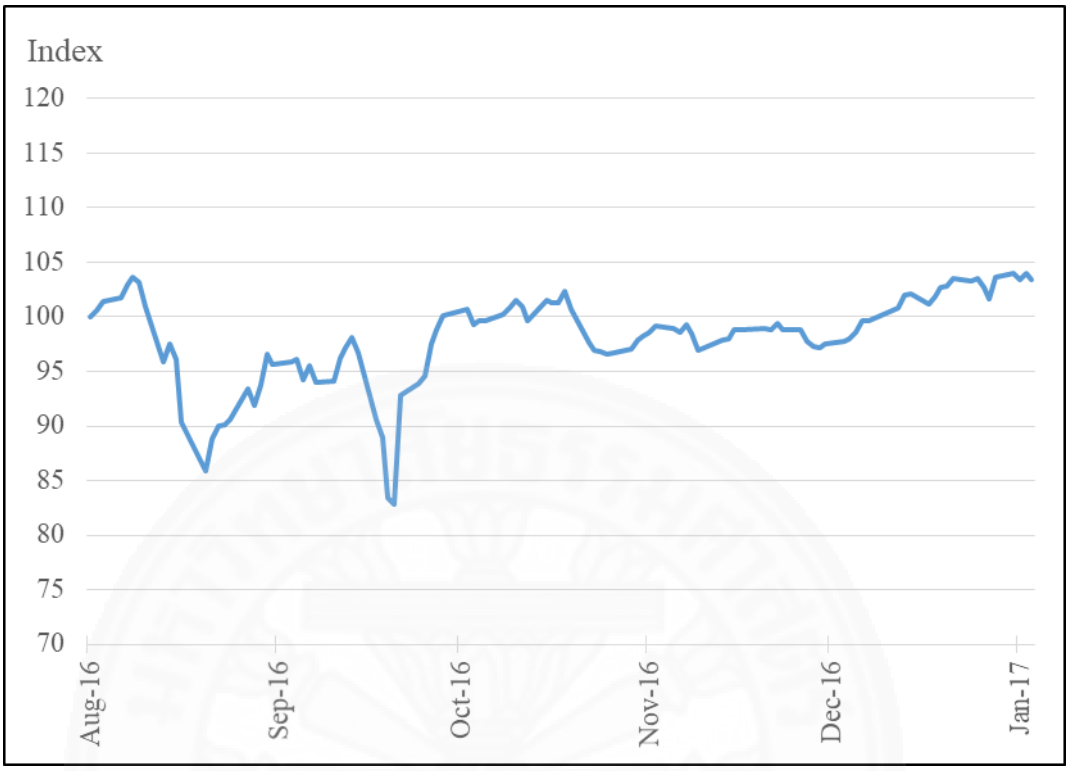


Figure 3.15: 40 sample stocks equal-weight return index for Thailand



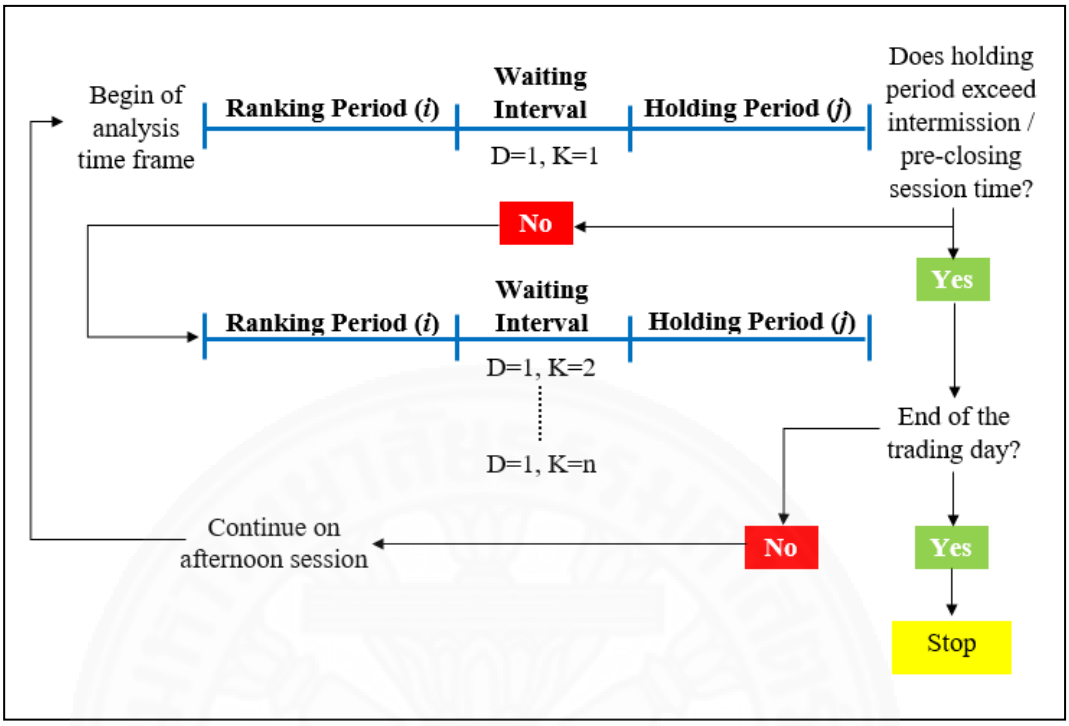
CHAPTER 4
METHODOLOGY

The process starts by ranking stock with *i* period which consist of 15 and 30 minutes and holding *j* period which consist of 15 and 30minutes. This will generate 4 strategies. The ranking period will start at the beginning of testing timeframe (i.e. 10:10 for Thailand, 9:10 for Malaysia and 9:10 for Singapore). The ranking period will keep rolling until last holding period exceed continue trading session time. Which is intermission and close session for Thailand and Malaysia and close session for Singapore. After each ranking period, each stock will be sort ranking by highest return on top and lowest return will be at the bottom. Afterward, the portfolio will be form into 10 equally-weighted portfolios and each portfolio will consist of 4 stocks. Winner Portfolio will represent with top 4 highest return stocks, While Loser portfolio will represent 4 lowest return stocks. After that the winner portfolio will take long position, while the loser portfolio will take short position. At the end of each holding period both portfolio will close position and realize the return simultaneously (Figure 4.1.1).

We will not hold winner and loser portfolio across market intermission to prevent carrier forward volume form pre-open auction phase in afternoon session. The assumption of 0.1% transactional cost will be include on both buy and sell position of stocks.

There is a waiting interval period between ranking and holding period to ensure that winner and loser portfolio will acquire all specific stocks on each portfolio. The appropriate proxy waiting interval time between ranking and holder period is 5 minute, due to the assumption that small investor will trade in small round lots (e.g. 1 lot = 100 shares) that never exceed the 5 minute maximum trading volume available. Thus, the maximum waiting interval that we assume will never be in 5 minute range.

Figure 4.1: Logical flowchart of methodology



The return of each individual stock at ranking period will be calculate from

$$r_{a,k,c} = \ln\left(\frac{P_{a,t}}{P_{a,t-1}}\right) \quad (1)$$

Where

$r_{a,k,c}$ = Return of stock a at time k of country c

$P_{a,t}$ = Price of the stock a at period t

$P_{a,t-1}$ = Price of the stock a at period t-1

From equation (1), we use log return instead of normal return to calculate return of each stock because we assume that with our data the time horizon is very short to continuous. Thus, we suggest that log return is appropriate to calculate intraday return.

The average return of winner portfolio after holding period will be calculate from

$$r_{W,k,c} = \left(\frac{1}{A}\right) \sum_{a=1}^{A} \ln\left(\frac{P_{a,t}(1-\tau)}{P_{a,t-1}(1+\tau)}\right) \quad (2)$$

Where

$r_{W,k,c}$ = Average return of winner portfolio at time *k* of country *c*
A = Number of stock in portfolio (4 stocks)
$P_{a,t}$ = Price of the stock *a* at period *t*
$P_{a,t-1}$ = Price of the stock *a* at period *t*-1
τ = Transactional cost (0.1%)

The average return of loser portfolio after holding period will be calculate from

$$r_{L,k,c} = \left(\frac{1}{A}\right) \sum_{a=1}^{A} \ln\left(\frac{P_{a,t}(1+\tau)}{P_{a,t-1}(1-\tau)}\right) \quad (3)$$

Where

$r_{L,k,c}$ = Average return of loser portfolio at time *k* of country *c*
A = Number of stock in portfolio (4 stocks)
$P_{a,t}$ = Price of the stock a at period *t*
$P_{a,t-1}$ = Price of the stock a at period *t*-1
τ = Transactional cost (0.1%)

From equation (3), cost of short selling may consider of transactional and cost of borrowing but since we assume very short time of borrowing. Thus, we assume that cost of borrowing to be zero and take only transactional cost into account for short selling.

Then, we will find excess return by

$$ER_{D,k,c}(i,j) = r_{W,k,c} - r_{L,k,c} \quad (4)$$

Where

$ER_{D,k,c}$ = excess return at day *D* and time *k* with ranking period *i* and holding period *j* of country *c*

$r_{W,k,c}$ = Average return of winner portfolio at time *k* of country *c*

$r_{L,k,c}$ = Average return of loser portfolio at time *k* of country *c*

k = number of time portfolio are form in one day

i = ranking period

j = holding period

After that we apply one tail t-test on both side of the distribution to examine if excess return is statistically greater than or less than zero. The hypothesis setting is below

Hypothesis 1:

1.1 Hypothesis testing for excess return greater than zero:

H_0: $ER_{D,k,c} \leq 0$

H_a: $ER_{D,k,c} > 0$

1.2 Hypothesis testing for excess return less than zero:

H_0: $ER_{D,k,c} \geq 0$

H_a: $ER_{D,k,c} < 0$

From hypothesis 1, the rejection of hypothesis 1.1 implies the existence momentum effect. Nevertheless, there is the possibility that excess return can be negative (hypothesis 1.2) which indicate non-existence of momentum profit.

To analyze momentum strategy with trading volume turnover, after the ranking period winner and loser portfolio will divide in 2 sub-portfolio that contain 2 stocks in each. These portfolio will be ranked from high trading volume to low trading volume. This will create 4 portfolios which is winner-high turnover (W-H), winner-low turnover (W-L), loser-high turnover (L-H) and loser-low turnover (L-L). First we calculate average return of each portfolio from equation (2) and (3). Then, we obtain the following equation

$$ERH_{D,k,c}(i,j) = r_{W-H,k} - r_{L-H,k} \quad (5)$$

$$ERL_{D,k,c}(i,j) = r_{W-L,k} - r_{L-L,k} \quad (6)$$

Where

$ERH_{D,k,c}$ = excess return of high volume turnover at day *D* and time *k* of country *c*

$ERL_{D,k,c}$ = excess return of low volume turnover at day *D* and time *k* of county *c*

In the manner, we employ one tail t-test on both side to test weather excess return with volume turnover is greater or less than zero with hypothesis below.

Hypothesis 2:

2.1 Hypothesis testing for greater than zero excess return for high volume turnover:

H_0: $ERH_{D,k,c} \leq 0$

H_a: $ERH_{D,k,c} > 0$

2.2 Hypothesis testing for less than zero excess return for high volume turnover:

H_0: $ERH_{D,k,c} \geq 0$

H_a: $ERH_{D,k,c} < 0$

Hypothesis 3:

3.1 Hypothesis testing for greater than zero excess return for low volume turnover:

H_0: $ERL_{D,k,c} \leq 0$

H_a: $ERL_{D,k,c} > 0$

3.2 Hypothesis testing for less than zero excess return for low volume turnover:

H_0: $ERL_{D,k,c} \geq 0$

H_a: $ERL_{D,k,c} < 0$

CHAPTER 5
RESULTS

From tables 5.1 to 5.3, they represent the average momentum return on 15, 30 and 60 minutes on the ranking period (i), followed by 15, 30 and 60 minutes on the holding period (j) for all three countries. For all strategies, we found that the past winners will yield negative returns after the holding period. In contrast, the past losers will yield positive returns in all countries, based on momentum zero investment strategy (winner minus loser) with transaction cost of 0.1 % for both long and short positions. With the negative returns, this can imply that the price reversal and the momentum strategies do not generate any positive return across the three ASEAN equity markets. The study also found that the winner portfolios tend to get worse for the longer ranking and also the holding period while the loser portfolios gain more positive returns with the longer ranking and holding period. This makes the momentum strategies (winner minus loser) worse for the longer ranking and holding period of time. The results tend to support that the past buying losers and the past selling winners (known as contrarian) may earn the positive returns. All of the results are statistically different from zero at 95 % confidential level.

Tables 5.4 to 5.6 show that, with the momentum strategies, the result still yields the negative returns on the momentum portfolios (winner minus loser) with volume turnover included. The returns are negative on both high volume turnover and low volume turnover. However, the returns on the winner and the loser portfolios with the high volume turnover are better compared to the result without the volume turnover (winners tend to have less negative returns and losers tend to have less positive returns) for all markets. This result shows the stronger momentum returns which is similar to the work of Rouwenhorst (1999), Lee and Swamninathan (2000). On the contrary, the return from low volume turnover is inconclusive compared to the return without volume turnover. The result also shows that the returns tend to get worse for the longer ranking and holding period of time on both high volume turnover and low volume turnover in all countries. All of the results are statistically different from zero at 95 % confidential level.

When we compare these results across all countries, Singapore yields a superior momentum return whereas Malaysia and Thailand tend to perform indifferently to each other. This may be relevant to the index of 40 sample stocks (Figures 3.13 to 3.15) that Singapore index exhibits up the trend in the study period, but Malaysia and Thailand index show the sideway trend.

Table 5.1 Average Returns of Momentum Strategies for Malaysia

Ranking Period, i (minutes)	Portfolios	Returns	Holding Period, j (minutes)	Portfolios	Returns
15	Winner	0.0321	15	Winner	-0.0083
	Loser	-0.0312		Loser	0.0103
				Winner-Loser	-0.0186
				T-Statistic	-29.0931*
	Winner	0.0318	30	Winner	-0.0098
	Loser	-0.0308		Loser	0.0128
				Winner-Loser	-0.0226
				T-Statistic	-26.9010*
	Winner	0.0314	60	Winner	-0.0113
	Loser	-0.0305		Loser	0.0131
				Winner-Loser	-0.0244
				T-Statistic	-25.0315*
30	Winner	0.0462	15	Winner	-0.0099
	Loser	-0.0444		Loser	0.0141
				Winner-Loser	-0.0240
				T-Statistic	-19.4254*
	Winner	0.0472	30	Winner	-0.0111
	Loser	-0.0446		Loser	0.0172
				Winner-Loser	-0.0283
				T-Statistic	-19.4782*
	Winner	0.0452	60	Winner	-0.0141
	Loser	-0.0442		Loser	0.0177
				Winner-Loser	-0.0318
				T-Statistic	-18.3705*
60	Winner	0.0637	15	Winner	-0.0124
	Loser	-0.0597		Loser	0.0137
				Winner-Loser	-0.0261
				T-Statistic	-13.2841*
	Winner	0.0621	30	Winner	-0.0139
	Loser	-0.0600		Loser	0.0160
				Winner-Loser	-0.0299
				T-Statistic	-13.3465*
	Winner	0.0621	60	Winner	-0.0173
	Loser	-0.0600		Loser	0.0226
				Winner-Loser	-0.0399
				T-Statistic	-13.9333*

Table 5.2 Average Returns of Momentum Strategies for Singapore

Ranking Period, i (minutes)	Portfolios	Returns	Holding Period, j (minutes)	Portfolios	Returns
15	Winner	0.0167	15	Winner	-0.0045
	Loser	-0.0168		Loser	0.0051
				Winner-Loser	-0.0097
				T-Statistic	-23.4983*
	Winner	0.0168	30	Winner	-0.0046
	Loser	-0.0168		Loser	0.0056
				Winner-Loser	-0.0102
				T-Statistic	-20.7902*
	Winner	0.0166	60	Winner	-0.0047
	Loser	-0.0168		Loser	0.0069
				Winner-Loser	-0.0115
				T-Statistic	-18.1959*
30	Winner	0.0237	15	Winner	-0.0042
	Loser	-0.0239		Loser	0.0052
				Winner-Loser	-0.0095
				T-Statistic	-13.4554*
	Winner	0.0238	30	Winner	-0.0049
	Loser	-0.0241		Loser	0.0066
				Winner-Loser	-0.0114
				T-Statistic	-12.2397*
	Winner	0.0238	60	Winner	-0.0051
	Loser	-0.0239		Loser	0.0089
				Winner-Loser	-0.0139
				T-Statistic	-11.5400*
60	Winner	0.0348	15	Winner	-0.0049
	Loser	-0.0355		Loser	0.0057
				Winner-Loser	-0.0106
				T-Statistic	-8.7966*
	Winner	0.0348	30	Winner	-0.0054
	Loser	-0.0355		Loser	0.0070
				Winner-Loser	-0.0123
				T-Statistic	-8.1561*
	Winner	0.0343	60	Winner	-0.0061
	Loser	-0.0352		Loser	0.0100
				Winner-Loser	-0.0161
				T-Statistic	-7.7195*

Table 5.3 Average Returns of Momentum Strategies for Thailand

Ranking Period, i (minutes)	Portfolios	Returns	Holding Period, j (minutes)	Portfolios	Returns
15	Winner	0.0217	15	Winner	-0.0089
	Loser	-0.0215		Loser	0.0097
				Winner-Loser	-0.0186
				T-Statistic	-51.9288*
	Winner	0.0218	30	Winner	-0.0095
	Loser	-0.0215		Loser	0.0102
				Winner-Loser	-0.0196
				T-Statistic	-49.9214*
	Winner	0.0223	60	Winner	-0.0098
	Loser	-0.0221		Loser	0.0103
				Winner-Loser	-0.0201
				T-Statistic	-39.1841*
30	Winner	0.0250	15	Winner	-0.0090
	Loser	-0.0247		Loser	0.0101
				Winner-Loser	-0.0191
				T-Statistic	-35.4090*
	Winner	0.0251	30	Winner	-0.0099
	Loser	-0.0251		Loser	0.0107
				Winner-Loser	-0.0206
				T-Statistic	-33.6982*
	Winner	0.0269	60	Winner	-0.0103
	Loser	-0.0255		Loser	0.0102
				Winner-Loser	-0.0204
				T-Statistic	-22.6387*
60	Winner	0.0286	15	Winner	-0.0082
	Loser	-0.0285		Loser	0.0102
				Winner-Loser	-0.0185
				T-Statistic	-22.4725*
	Winner	0.0295	30	Winner	-0.0089
	Loser	-0.0291		Loser	0.0102
				Winner-Loser	-0.0191
				T-Statistic	-18.5287*
	Winner	0.0329	60	Winner	-0.0099
	Loser	-0.0280		Loser	0.0084
				Winner-Loser	-0.0182
				T-Statistic	-12.9144*

Note: All portfolios are created based on the returns at the end of the ranking period (i). The strategy will group 4 stocks into both the winner and loser portfolios after the ranking period (i). Winner portfolios will consist of the top 4 highest returns after the ranking period (i) while the loser portfolios will consist of the bottom 4 lowest returns after the ranking period (i). All tables report the average returns of each ranking period return (i) for each winner and loser portfolio, and then hold that 4 stocks on each winner and loser with the holding period (j). After the end of the holding period (j), we figure out the returns on each holding period (j). Tables 5.1 to 5.3 report the average returns of the winners and the losers after the holding period (j) on each country. The T-Statistics for the momentum (winner – loser) demonstrate that the returns on momentum are significantly different form zero at 95 % confidential level (indicated by *). The sample data covers from 24th August 2016 to 26th January 2017.

Table 5.4 Average Returns of Momentum Strategies with Trading Volume Turnover for Malaysia

Ranking Period, i (minutes)	Holding Period, j (minutes)	Portfolios	High Volume Turnover	Low Volume Turnover
15	15	Winner	-0.0061	-0.0084
		Loser	0.0065	0.0121
		Winner-Loser	-0.0127	-0.0205
		T-Statistic	-29.7372*	-16.1415*
	30	Winner	-0.0072	-0.0096
		Loser	0.0075	0.0161
		Winner-Loser	-0.0148	-0.0258
		T-Statistic	-30.0751*	-15.4415*
	60	Winner	-0.0085	-0.0111
		Loser	0.0072	0.0171
		Winner-Loser	-0.0156	-0.0282
		T-Statistic	-25.4470*	-14.6843*
30	15	Winner	-0.0079	-0.01
		Loser	0.0084	0.0178
		Winner-Loser	-0.0164	-0.0277
		T-Statistic	-23.1810*	-11.2552*
	30	Winner	-0.0096	-0.0119
		Loser	0.0096	0.0228
		Winner-Loser	-0.0192	-0.0347
		T-Statistic	-22.4985*	-11.8616*
	60	Winner	-0.0103	-0.0149
		Loser	0.01	0.0234
		Winner-Loser	-0.0204	-0.0384
		T-Statistic	-19.0096*	-11.4310*
60	15	Winner	-0.0089	-0.0146
		Loser	0.0074	0.0181
		Winner-Loser	-0.0163	-0.0327
		T-Statistic	-12.3848*	-7.8211*
	30	Winner	-0.0106	-0.0162
		Loser	0.0092	0.0208
		Winner-Loser	-0.0198	-0.037
		T-Statistic	-14.0407*	-7.8680*
	60	Winner	-0.0119	-0.0185
		Loser	0.0129	0.0303
		Winner-Loser	-0.0248	-0.0488
		T-Statistic	-10.7703*	-8.6241*

Table 5.5 Average Returns of Momentum Strategies with Trading Volume Turnover for Singapore

Ranking Period, i (minutes)	Holding Period, j (minutes)	Portfolios	High Volume Turnover	Low Volume Turnover
15	15	Winner	-0.0031	-0.0036
		Loser	0.0039	0.0044
		Winner-Loser	-0.0069	-0.008
		T-Statistic	-13.3870*	-11.0714*
	30	Winner	-0.0033	-0.0029
		Loser	0.004	0.0052
		Winner-Loser	-0.0072	-0.0082
		T-Statistic	-13.2149*	-9.3569*
	60	Winner	-0.0032	-0.003
		Loser	0.0045	0.0072
		Winner-Loser	-0.0078	-0.0102
		T-Statistic	-12.5697*	-8.6296*
30	15	Winner	-0.003	-0.0034
		Loser	0.0035	0.005
		Winner-Loser	-0.0064	-0.0083
		T-Statistic	-10.3426*	-6.3464*
	30	Winner	-0.0034	-0.0041
		Loser	0.0041	0.007
		Winner-Loser	-0.0075	-0.0112
		T-Statistic	-11.1717*	-6.0436*
	60	Winner	-0.0036	-0.0045
		Loser	0.0045	0.0111
		Winner-Loser	-0.0081	-0.0157
		T-Statistic	-10.3168*	-6.4911*
60	15	Winner	-0.0045	-0.0044
		Loser	0.0058	0.0036
		Winner-Loser	-0.0103	-0.008
		T-Statistic	-5.3463*	-4.1172*
	30	Winner	-0.0045	-0.0049
		Loser	0.0081	0.0038
		Winner-Loser	-0.0126	-0.0087
		T-Statistic	-4.9424*	-4.2726*
	60	Winner	-0.0049	-0.0052
		Loser	0.0121	0.006
		Winner-Loser	-0.017	-0.0112
		T-Statistic	-4.8174*	-3.9932*

Table 5.6 Average Returns of Momentum Strategies with Trading Volume Turnover for Thailand

Ranking Period, i (minutes)	Holding Period, j (minutes)	Portfolios	High Volume Turnover	Low Volume Turnover
15	15	Winner	-0.0074	-0.0084
		Loser	0.0081	0.0093
		Winner-Loser	-0.0155	-0.0178
		T-Statistic	-30.7023*	-30.4069*
	30	Winner	-0.0076	-0.0091
		Loser	0.0084	0.01
		Winner-Loser	-0.016	-0.0191
		T-Statistic	-28.6006*	-29.3992*
	60	Winner	-0.008	-0.0099
		Loser	0.0088	0.0098
		Winner-Loser	-0.0168	-0.0198
		T-Statistic	-23.2627*	-22.7745*
30	15	Winner	-0.0072	-0.0092
		Loser	0.0083	0.0099
		Winner-Loser	-0.0155	-0.0191
		T-Statistic	-20.1437*	-21.2791*
	30	Winner	-0.0077	-0.0103
		Loser	0.0083	0.011
		Winner-Loser	-0.0159	-0.0214
		T-Statistic	-18.2259*	-19.5595*
	60	Winner	-0.0076	-0.0122
		Loser	0.0073	0.011
		Winner-Loser	-0.0149	-0.0232
		T-Statistic	-12.1946*	-15.0978*
60	15	Winner	-0.0074	-0.0082
		Loser	0.008	0.0105
		Winner-Loser	-0.0154	-0.0187
		T-Statistic	-13.1938*	-13.2245*
	30	Winner	-0.0072	-0.0082
		Loser	0.0061	0.0123
		Winner-Loser	-0.0133	-0.0204
		T-Statistic	-9.4485*	-11.9713*
	60	Winner	-0.0084	-0.0087
		Loser	0.0052	0.0096
		Winner-Loser	-0.0135	-0.0182
		T-Statistic	-6.5382*	-7.6815*

Note: The volume turnovers defined by the trading volume divided by numbers of share outstanding in every 5 minute in each stock in all markets. To select high and low volume turnover stocks, we firstly sort the stocks according to the returns after the ranking period (i) and then make the winner and loser portfolios. After that, we sort the winner and loser portfolios according to their cumulative volume turnovers (e.g. with 15-minutes ranking period, we sort volume turnover according to 15-minute cumulative volume turnover). Tables 5.4 to 5.6 report the average returns of winners and losers with high and low volume turnovers on each country. High/(Low) volume turnovers of the winners represent the average returns of the top/(bottom) 2 stocks of the previous winners with the highest/(lowest) cumulative volume turnovers after the holding period (j). In the meanwhile, high/(low) volume turnovers of the losers represent the average returns of the top/(bottom) 2 stocks of the previous losers with the highest/(lowest) cumulative volume turnovers after the holding period (j). The T-Statistics for the momentum (winner – loser) demonstrate that the return on momentums are significantly different form zero at 95 % confidential level (indicated by *). The sample data covers from 24th August 2016 to 26th January 2017.

CHAPTER 6
ROBUSNESS CHECK

Our results reveal that the intraday-momentum strategy cannot make excess return across the three markets. Therefore, we implement the robustness check with 4 more methods, which are ranked by the volume turnover, intraday session break momentum, overnight momentum strategy and one-stock intraday momentum to examine and support the evidence for the intraday momentum result in these ASEAN equity markets.

Ranked by the volume turnover results, it shows that most of the results are statistically not different form zero and some results that are significant will earn very less returns. This could imply that the momentum with the volume turnover ranking tend to perform better than the return ranking. Also, ranking only the volume turnover by the ranking period (i) does not give any information for stock price. (Tables 6.1 to 6.3)

The intraday session break momentum method intends to capture the information that occurs during the morning to the afternoon before the market close, which it can be an effect on the equity price. The results reveal that there is no evidence that the ranking (i) minutes after the market open trading session and holding the winners and the losers until market close on each market can generate the positive excess returns on the momentum portfolios in all markets. The study also found that, with longer ranking period (i), there are the weaker momentums in the winner and the loser portfolios. (Tables 6.4 to 6.6)

The overnight momentum strategy method intends to capture the information that occurs overnight, which it can be an effect on the equity price in the next morning. The results show that when we rank the stocks with the ranking period (i), then buy winner and sell loser simultaneously at 5 minutes before the market closing time, and close all the positions in the next morning, the trading session also yields the negative momentum portfolio returns in all ranking periods (i) and all markets. (Tables 6.7 to 6.9)

For one-stock intraday momentum (Tables 6.10 to 6.12), we use one stock in each portfolio to represent the extreme winner and loser portfolios. Then, we rank the stocks for i minute and hold for j minute. The result shows that it earns negative returns on the momentums' (winner minus loser) portfolios. The result also shows that the momentum tend to become worse with the longer period on ranking and holding.

All four robustness methods give supports to the main results in Part 5 that we cannot earn the positive excess return on the intraday level with these simple momentum investment strategies.

Table 6.1 Average Returns of Malaysia Ranked by the Volume Turnover

Ranking Period, i (minutes)	Holding Period, j (minutes)	Portfolios	Returns
15	15	Winner	0.0003
		Loser	0.0000
		Winner-Loser	0.0003
		T-Statistic	1.1491
	30	Winner	0.0002
		Loser	0.0000
		Winner-Loser	0.0002
		T-Statistic	0.7759
	60	Winner	-0.0007
		Loser	-0.0001
		Winner-Loser	-0.0005
		T-Statistic	-1.4534
30	15	Winner	0.0001
		Loser	0.000
		Winner-Loser	0.0002
		T-Statistic	0.6011
	30	Winner	0.0001
		Loser	0.000
		Winner-Loser	0.0001
		T-Statistic	0.2879
	60	Winner	-0.0006
		Loser	-0.0002
		Winner-Loser	-0.0005
		T-Statistic	-1.2072
60	15	Winner	-0.0006
		Loser	0.0091
		Winner-Loser	-0.0098
		T-Statistic	-3.7033*
	30	Winner	-0.0008
		Loser	0.0086
		Winner-Loser	-0.0094
		T-Statistic	-2.6621*
	60	Winner	0.0014
		Loser	0.0101
		Winner-Loser	-0.0086
		T-Statistic	-2.2407*

Table 6.2 Average Returns of Singapore Ranked by the Volume Turnover

Ranking Period, i (minutes)	Holding Period, j (minutes)	Portfolios	Returns
15	15	Winner	0.0000
		Loser	-0.0001
		Winner-Loser	0.0001
		T-Statistic	0.2661
	30	Winner	-0.0004
		Loser	0.0000
		Winner-Loser	-0.0004
		T-Statistic	-1.4471
	60	Winner	-0.0003
		Loser	-0.0004
		Winner-Loser	0.0001
		T-Statistic	0.2356
30	15	Winner	-0.0003
		Loser	0.0004
		Winner-Loser	-0.0007
		T-Statistic	-2.1016*
	30	Winner	-0.0007
		Loser	0.0001
		Winner-Loser	-0.0008
		T-Statistic	-2.1309*
	60	Winner	-0.0009
		Loser	0.0000
		Winner-Loser	-0.0009
		T-Statistic	-1.5937
60	15	Winner	0.0000
		Loser	0.0003
		Winner-Loser	-0.0003
		T-Statistic	-0.5835
	30	Winner	0.0000
		Loser	-0.0001
		Winner-Loser	0.0001
		T-Statistic	0.1991
	60	Winner	-0.0016
		Loser	-0.0015
		Winner-Loser	-0.0001
		T-Statistic	-0.0968

Table 6.3 Average Returns of Thailand Ranked by the Volume Turnover

Ranking Period, i (minutes)	Holding Period, j (minutes)	Portfolios	Returns
15	15	Winner	-0.0003
		Loser	0.0022
		Winner-Loser	-0.0025
		T-Statistic	-2.7067*
	30	Winner	0.0003
		Loser	0.0021
		Winner-Loser	-0.0018
		T-Statistic	-1.5229
	60	Winner	0.0008
		Loser	0.0038
		Winner-Loser	-0.003
		T-Statistic	-1.8719
30	15	Winner	0.0005
		Loser	0.0025
		Winner-Loser	-0.0021
		T-Statistic	-1.4576
	30	Winner	0.0008
		Loser	0.0023
		Winner-Loser	-0.0015
		T-Statistic	-0.8683
	60	Winner	0.0018
		Loser	0.0039
		Winner-Loser	-0.0021
		T-Statistic	-0.8982
60	15	Winner	-0.0004
		Loser	0.0028
		Winner-Loser	-0.0032
		T-Statistic	-1.7132
	30	Winner	0.0001
		Loser	0.0038
		Winner-Loser	-0.0037
		T-Statistic	-1.6412
	60	Winner	0.0013
		Loser	0.0045
		Winner-Loser	-0.0032
		T-Statistic	-0.9653

Note: The portfolios are created by cumulating the volume turnover first until i minute form 5-minute time stamp data. We rank all stocks after i minute, based on the volume turnover, and create 10 portfolios. The winner portfolios consist of the top 4 highest volume turnovers. However, the loser portfolios consist of the bottom 4 lowest volume turnovers after the ranking period (i). After that, we hold both winner and loser portfolios for the holding period (j). Then, we close the position at the end of the holding period. Tables 6.1 to 6.3 represent the average returns of winner, loser and momentums' (winner minus loser) portfolios on each country. With the ranking period of 15, 30 and 60 minutes and the holding period of 15, 30 and 60 minutes, the T-Statistics for the momentum (winner – loser) illustrate that the returns on momentum are significantly different form zero at 95 % confidential level (indicated by *).

Table 6.4 Average Returns of Session Break Momentum Strategy in Malaysia

Portfolios	**Ranking Period, i (minutes)**		
	15	30	60
Winner	-0.0132	-0.0170	-0.0213
Loser	0.0082	0.0139	0.0147
Winner-Loser	-0.0214	-0.0309	-0.0360
T-Statistic	-5.1439*	-6.2157*	-7.3654*

Table 6.5 Average Returns of Session Break Momentum Strategy in Singapore

Portfolios	**Ranking Period, i (minutes)**		
	15	30	60
Winner	-0.0095	-0.0128	-0.0156
Loser	0.0277	0.0401	0.0286
Winner-Loser	-0.0372	-0.0530	-0.0442
T-Statistic	-2.9152*	-3.5194*	-3.6996*

Table 6.6 Average Returns of Session Break Momentum Strategy in Thailand

Portfolios	**Ranking Period, i (minutes)**		
	15	30	60
Winner	-0.0120	-0.0103	-0.0096
Loser	0.0077	0.0086	0.0043
Winner-Loser	-0.0197	-0.0188	-0.0139
T-Statistic	-9.5506*	-8.8319*	-6.9278*

Note: All portfolios are ranked, based on return after the opening of the morning trading session (i.e. 9:05 for Malaysia, 9:05 for Singapore and 10:05 for Thailand) on each country for the ranking period (i) from the highest to the lowest returns. The winners represent the top 4 highest return stocks after the ranking period (i) while losers represent the bottom 4 lowest return stocks. Then, we buy winner/sell loser portfolios and hold them until the end of the afternoon trading session (5 minutes before the trading session close) to realize the returns. Tables 6.4 to 6.6 represent the average returns on winner, loser and momentums' portfolios of the ranking period (i) for each country. The T-Statistics of the momentum portfolios (winner – loser) are significant at 5 % level (indicated by *).

Table 6.7 Average Overnight Returns of Momentum Strategy in Malaysia

Portfolios	**Ranking Period, i (minutes)**		
	15	30	60
Winner	-0.0307	-0.0419	-0.0448
Loser	0.0232	0.0275	0.0303
Winner-Loser	-0.0539	-0.0695	-0.0752
T-Statistic	-7.3979*	-8.8804*	-9.7531*

Table 6.8 Average Overnight Returns of Momentum Strategy in Singapore

Portfolios	**Ranking Period, i (minutes)**		
	15	30	60
Winner	-0.0029	-0.0015	-0.0032
Loser	0.0069	0.0115	0.0163
Winner-Loser	-0.0098	-0.0129	-0.0196
T-Statistic	-5.3318*	-2.8295*	-2.8586*

Table 6.9 Average Overnight Returns of Momentum Strategy in Thailand

Portfolios	**Ranking Period, i (minutes)**		
	15	30	60
Winner	-0.0052	-0.0048	-0.0060
Loser	0.0130	0.0135	0.0171
Winner-Loser	-0.0182	-0.0183	-0.0231
T-Statistic	-8.1695*	-8.3281*	-8.8557*

Note: The portfolio are created by ranking the stocks based on the returns with the ranking period (i) minutes with 5 minutes before the trading session close (i.e. 16:40 for Malaysia, 16:55 for Singapore and 16:25 for Thailand). Then, we hold the winners and the losers overnight and close all the positions at the next morning open trading session. The winner portfolios represent the top 4 highest return stocks after the ranking period (i) while the loser portfolios represent the bottom 4 lowest return stocks after the ranking period (i). Tables 6.7 to 6.9 report the average returns of winner, loser and momentums' portfolios of the overnight returns for each country. The T-Statistics for the momentum portfolios (winner – loser) indicate that the returns on momentum are significantly different form zero at 95 % confidential level (given by *).

Table 6.10 Average Returns of One-Stock Intraday Momentum Strategy in Malaysia

Ranking Period, i (minutes)	Portfolios	Returns	Holding Period, j (minutes)	Portfolios	Returns
15	Winner	0.0824	15	Winner	-0.0160
	Loser	-0.0767		Loser	0.0235
				Winner-Loser	-0.0395
				T-Statistic	-17.2946*
	Winner	0.0816	30	Winner	-0.0210
	Loser	-0.0757		Loser	0.0323
				Winner-Loser	-0.0533
				T-Statistic	-17.2368*
	Winner	0.0801	60	Winner	-0.0241
	Loser	-0.0744		Loser	0.0342
				Winner-Loser	-0.0583
				T-Statistic	-16.4011*
30	Winner	0.1148	15	Winner	-0.0186
	Loser	-0.1038		Loser	0.0345
				Winner-Loser	-0.0531
				T-Statistic	-11.5455*
	Winner	0.1169	30	Winner	-0.0205
	Loser	-0.1040		Loser	0.0433
				Winner-Loser	-0.0637
				T-Statistic	-11.8380*
	Winner	0.1090	60	Winner	-0.0292
	Loser	-0.1026		Loser	0.0457
				Winner-Loser	-0.0749
				T-Statistic	-11.9773*
60	Winner	0.1558	15	Winner	-0.0255
	Loser	-0.1348		Loser	0.0325
				Winner-Loser	-0.0581
				T-Statistic	-7.6529*
	Winner	0.1468	30	Winner	-0.0268
	Loser	-0.1347		Loser	0.0366
				Winner-Loser	-0.0634
				T-Statistic	-7.5382*
	Winner	0.1468	60	Winner	-0.0367
	Loser	-0.1347		Loser	0.0577
				Winner-Loser	-0.0944
				T-Statistic	-9.0248*

Table 6.11 Average Returns of One-Stock Intraday Momentum Strategy in Singapore

Ranking period, i (minutes)	Portfolio	Return	Holding period, j (minutes)	Portfolio	Return
15	Winner	0.0414	15	Winner	-0.0077
	Loser	-0.0428		Loser	0.0102
				Winner-Loser	-0.0179
				T-Statistic	-11.3204*
	Winner	0.0417	30	Winner	-0.0081
	Loser	-0.0431		Loser	0.0121
				Winner-Loser	-0.0202
				T-Statistic	-10.7422*
	Winner	0.0409	60	Winner	-0.0085
	Loser	-0.0429		Loser	0.0160
				Winner-Loser	-0.0245
				T-Statistic	-10.0110*
30	Winner	0.0619	15	Winner	-0.0067
	Loser	-0.0642		Loser	0.0115
				Winner-Loser	-0.0181
				T-Statistic	-6.7605*
	Winner	0.0619	30	Winner	-0.0083
	Loser	-0.0650		Loser	0.0152
				Winner-Loser	-0.0236
				T-Statistic	-6.5326*
	Winner	0.0617	60	Winner	-0.0087
	Loser	-0.0642		Loser	0.0228
				Winner-Loser	-0.0315
				T-Statistic	-6.8523*
60	Winner	0.0946	15	Winner	-0.0085
	Loser	-0.0988		Loser	0.0108
				Winner-Loser	-0.0192
				T-Statistic	-4.2176*
	Winner	0.0946	30	Winner	-0.0099
	Loser	-0.0988		Loser	0.0155
				Winner-Loser	-0.0253
				T-Statistic	-4.3982*
	Winner	0.0920	60	Winner	-0.0125
	Loser	-0.0968		Loser	0.0267
				Winner-Loser	-0.0392
				T-Statistic	-4.8685*

Table 6.12 Average Returns of One-Stock Intraday Momentum Strategy in Thailand

Ranking period, i (minutes)	Portfolio	Return	Holding period, j (minutes)	Portfolio	Return
15	Winner	0.0452	15	Winner	-0.0180
	Loser	-0.0445		Loser	0.0206
				Winner-Loser	-0.0386
				T-Statistic	-32.9924*
	Winner	0.0451	30	Winner	-0.0188
	Loser	-0.0445		Loser	0.0226
				Winner-Loser	-0.0414
				T-Statistic	-32.4957*
	Winner	0.0460	60	Winner	-0.0201
	Loser	-0.0452		Loser	0.0227
				Winner-Loser	-0.0428
				T-Statistic	-26.9297*
30	Winner	0.0499	15	Winner	-0.0192
	Loser	-0.0487		Loser	0.0211
				Winner-Loser	-0.0403
				T-Statistic	-24.0397*
	Winner	0.0497	30	Winner	-0.0220
	Loser	-0.0495		Loser	0.0239
				Winner-Loser	-0.0459
				T-Statistic	-23.0607*
	Winner	0.0534	60	Winner	-0.0219
	Loser	-0.0490		Loser	0.0198
				Winner-Loser	-0.0417
				T-Statistic	-15.9885*
60	Winner	0.0541	15	Winner	-0.0161
	Loser	-0.0540		Loser	0.0238
				Winner-Loser	-0.0399
				T-Statistic	-15.6974*
	Winner	0.0553	30	Winner	-0.0173
	Loser	-0.0550		Loser	0.0237
				Winner-Loser	-0.0409
				T-Statistic	-12.8447*
	Winner	0.0619	60	Winner	-0.0169
	Loser	-0.0504		Loser	0.0202
				Winner-Loser	-0.0371
				T-Statistic	-8.8364*

Note: These tables represent the average returns from one stock in each portfolio with the ranking period (i) and the holding period (j). Winner/ (Loser) portfolios will consist of 1 highest/ (lowest) previous return stock. Then, we close the position at the end of the holding period (j). Tables 6.10 to 6.12 report the average return winner, loser and momentums' portfolios. We also report the winner and the loser average returns right after the ranking period. The T-Statistics indicate that the momentums' portfolios (winner – loser) are significantly different from zero (given by *).

CHAPTER 7
CONCLUSION

Since there was the discovery of the intraday momentum effect from Gao, Lei, et al. (2015) and with the revolution of technology that allowed an individual investor to easily access to the algorithmic trading. Our research aims to use the benefits of technology by shortening the time down to the intraday level with 15, 30 and 60 minutes. Unfortunately, our empirical results reveal that the momentum investment strategy with the ranking and the holding period of 15, 30 and 60 minute do not generate the positive returns across the three countries that represent ASEAN equity markets. The results show the negative returns for the past winners and the positive returns for the past losers after the holding period (j) with 0.01% transactional cost on both long and short positions. This can be defined as the price reversal from time interval to another interval. The study also found that, with trading volume turnover including the momentum effect, it is stronger but the return does not still generate the positive returns. The robustness check also tells us that, with the overnight momentum returns and the session break momentum, it still yields the negative results. Furthermore, we try the robustness check with one stock in each winner and loser portfolio, but it does not alter the result.

From this study, we found that simple momentum strategy will not generate the excess return in the intraday level. The more complex strategy for the intraday trading strategy used, the more information needs to be examined. Moreover, the result of the intraday returns reversion from the interval to another interval can be related to bid-ask bounce and need to be examined. The finding in this study can be navigation to individual investors and traders who are interested in the momentum and the algorithmic trading strategies.

There are many issues that our research does not cover. Individual investors have short sell constrains. There is a slight difference in the transactional cost for each country on the long and short positions. Our data only covers a short period of time (roughly from mid-August 2016 to the end of January 2017). However, a longer time horizon has to be examined for more accurate result. This research ignores the

importance of firms' specific news and firms' fundamental information that should be a part of pricing equity. These issues are left for our future research.

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