ECONOMIC VARIABLES AS PREDICTORS OF STOCK MARKET PERFORMANCE: EVIDENCE FROM THE MARKET FOR ALTERNATIVE INVESTMENT (MAI)

ตัวแปรทางเศรษฐกิจในฐานะเครื่องมือคาดการณ์อัตราผลตอบแทนตลาดหลักทรัพย์: กรณีศึกษาตลาดหลักทรัพย์เอ็มเอไอ (MAI)

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Abstract

The primary aim of this research is to investigate the predictive ability of economic variables upon stock market performance in the case of the Market for Alternative Investment (MAI) in Thailand during 2002-2013. Using multiple regression analysis with monthly data, the results from this study reveal that the lagged return on the MAI index can be used to predict the MAI index return, in which MAI's return depends on its past performance in the similar direction. Moreover, it is found that interest rates have a negative impact upon MAI index returns, implying that rising interest rates can be predicted to lessen the performance of the MAI. The results from this study benefit both individual and institutional investors for managing their portfolio effectively when estimating trend movements of the market index. They also provide additional international evidence regarding investment in listed small and medium sized enterprises.

Keywords: Economic variable, Stock market performance, MAI index, Thailand

บทคัดย่อ

วัตถุประสงค์สำหรับการวิจัยนี้คือ เพื่อพิจารณาความสามารถเชิงคาดการณ์ของตัวแปรทางเศรษฐกิจที่ส่งผลต่ออัตราผลตอบแทนของตลาดหลักทรัพย์ ในกรณีศึกษาของตลาดหลักทรัพย์เอ็มเอไอ (MAI) ในประเทศไทยช่วงปี 2002 – 2013 จากการวิเคราะห์ทางสถิติโดยใช้

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เครื่องมือวิเคราะห์การถดถอยเชิงพหุและใช้ข้อมูลรายเดือน พบว่าผลตอบแทนของดัชนี หลักทรัพย์ MAI ในปัจจุบัน จะขึ้นอยู่กับผลตอบแทนของดัชนีหลักทรัพย์ MAI ในช่วงเดือนก่อน หน้า โดยมีทิศทางเดียวกัน ยิ่งกว่านั้นยังพบว่าอัตราดอกเบี้ยมีผลในทางลบต่อผลตอบแทนของ ดัชนีหลักทรัพย์ MAI ซึ่งแสดงให้เห็นว่าเมื่อมีการเพิ่มอัตราดอกเบี้ย จะทำให้ผู้ลงทุนสามารถ คาดการณ์ได้ว่า อัตราผลตอบแทนของตลาดหลักทรัพย์ MAI มีแนวโน้มลดลง อย่างไรก็ตามผล จากการศึกษานี้มีประโยชน์กับทั้งนักลงทุนรายบุคคลและสถาบัน ในการจัดการหลักทรัพย์ การลงทุนรวมอย่างมีประสิทธิภาพ เมื่อมีการประเมินการเคลื่อนไหวของดัชนีตลาด และ ผลการศึกษานี้ ยังเป็นหลักฐานเพิ่มเติมที่ใช้ในการศึกษาเกี่ยวกับการลงทุนในบริษัทขนาดกลาง และขนาดย่อมที่จดทะเบียนในตลาดหลักทรัพย์อีกด้วย

คำสำคัญ: ตัวแปรทางเศรษฐกิจ อัตราผลตอบแทนของตลาดหลักทรัพย์ ดัชนีหลักทรัพย์ MAI ประเทศไทย

Introduction

Stock market performance is one of the important aspects of the dynamics of economic activity. The performance of stock markets is dependent on both the internal and external economic environments. In terms of the internal economic environment, the wealth of investors and their consumption affects the performance of the stock market. The investors are prepared to invest more in the stock market if those investors observe an increase in returns from the stock market. In terms of the external economic environment, whenever an economic crisis occurs in one country, the effect of such a crisis would spread out to other countries. For example, during the US subprime financial crisis, many stock market indices around the world dramatically dropped causing stock markets, including the Thai stock market, to suffer a lack of liquidity. Therefore, economic activities have an important role to play in influencing the performance and the control of stock market movements.

Up to the present, many researchers have attempted to examine the nature of any relationships between the stock market and specific economic variables; nonetheless, the empirical results are inconclusive. Abugri (2008) found that implementation of government policies along with the influence of macroeconomic conditions are directly related to stock market movements. He revealed that investors are likely to make their decisions (e.g. making an investment) at times when their actions will result in maximized advantages. In making decisions, these investors consider macroeconomic variables as fundamental factors. In addition, Groenewold and Kang

(1993), Hogan, et al. (1982) and Saunders and Tress (1981) reported that there are several economic variables which can be applied in predicting stock market performance. In contrast, Türsoy, et al. (2008) asserted that economic variables do not significantly affect equity returns. Hence, due to the contradictory results; the investigation of the relationship between the economic variables is still essential to be explored.

In Thailand, there are two main stock markets; one is the Stock Exchange of Thailand (SET) and the other is the Market for Alternative Investment (MAI). The SET is the major stock index of Thailand which consisted of 645 listed companies in 2013; the MAI is a Thai young stock market for listing small and medium sized enterprises (SMEs). The MAI was established in 1998. In 2001, the MAI had only 3 listed securities. Until 2013, the MAI contained 85 listed securities, accounting for 14% of the total number of securities listed on Thai stock markets. Figure 1 shows the increasing trend in the total numbers of listed securities on the MAI from 2001-2013.
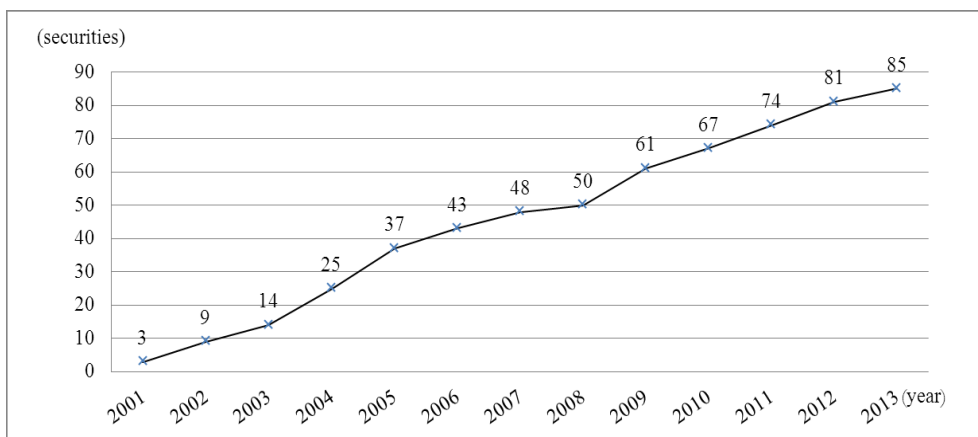

Figure 1: Number of listed securities in MAI
Source: Market for Alternative Investment Website (2013)

The size of the MAI has been growing. As shown in the following Table 1, the increase in the MAI Index from 127.49 to 415.68 during the period from the year 2002 until 2012 is mirrored by the rise in the total number of securities listed. Furthermore, the market capitalization and trading volume in the MAI are progressive. The market capitalization in the MAI increased from 427 million baht in 2001 to 124,255 million baht in September 2012, or by almost 300 times. Furthermore, the total value of trading in this particular market has increased annually to reach 245,076 million baht by 2012, or an

increase of 123 times from the year 2001. In terms of trading volume, it is increasing markedly from 588 million shares in the year 2001 to 89,510 million shares in the year 2012.

Table 1: MAI statistics

Year	MAI Index	Market Capital (Million Baht)	Trading Volume (Million Shares)	Trading Value (Million Baht)
2001	-	427	588	1,993
2002	127.49	3,798	5,336	14,200
2003	343.70	13,691	6,479	30,191
2004	188.07	11,703	4,875	34,221
2005	158.23	14,314	9,871	35,941
2006	193.43	21,810	9,389	27,414
2007	272.37	38,269	25,202	83,043
2008	162.93	22,153	22,999	61,356
2009	215.30	39,131	50,289	90,500
2010	272.79	55,128	67,003	96,058
2011	264.23	77,310	66,432	151,023
2012	415.68	124,255	89,510	245,076

Source: Market for Alternative Investment Website (2013)

To top it all, the Thai government has recently expressed its willingness to support small and medium sized enterprises (SMEs) with the aim of developing a stronger economic foundation to drive Thailand's growth. The Thai government has implemented a range of strategies designed to strengthen SMEs because these small and medium sized listed firms can serve to maintain Thai traditions and culture in addition to developing the economy throughout the country (Royal Thai Government, 2013). With the support from the government, SMEs may generate more competitiveness and develop ease in raising funds from both local and international financial markets regarding debt and capital financing.

As a result, a continuous increase in the market capitalization, trading volume, trading value and number of securities listed on the MAI, indicates the importance of this young stock capital market in Thailand. Furthermore, the support from the Thai government is likely to raise the number of listed companies on the MAI in the near future. This will further increase capital value and liquidity, resulting in continuing growth

in the financial markets and the economy in Thailand. As a consequence, a study regarding the MAI market is interesting and challenging.

Nonetheless, in case of Thailand, empirical studies relating to this young market are limited. A number of studies in the past mainly attempted to examine the performance of SET stock market by using economic variables as the determinants (Sutheebanjard and Premchaiswadi, 2009; Sopipan, Sattayatham and Chongcharoen, 2013; Chaigusin, Chirathamjaree and Clayden, 2008). Hence, this study aims to investigate the extent to which economic variables are able to predict the stock market performance of the MAI in Thailand. Results from this study can assist investors who would like to take advantage of investing in the MAI, an alternative stock market, besides the SET.

The remainder of this paper is arranged as follows: the following section presents the prior studies regarding the economic variables that impact the performance of stock markets; the third section displays the data collection and multiple linear regression analysis; the fourth section contains the results and discussion and the final section provides a conclusion and suggestions for further studies.

Literature Review

Theory related to the study

One of the most important theories that motivates and challenges for this study is the Efficient Market Hypothesis (EMH). Malkiel and Fama (1970) defined the term "efficient market" and proposed that in the efficient market, security prices adjust quickly to the new information. Fama (1991) has made the significant contribution by proposing the efficient market hypothesis. Fama (1995) suggested that there are three forms of Efficient Market Hypothesis (EMH). First is the weak form in which only the past prices are the information. Investors who apply trading rules based on past prices and/ or return pattern are unable to gain the abnormal return. However, this EMH will be violated if the historical prices tend to repeat again in the future, meaning that the past information can be used to estimate the future changes in the stock prices movement. Next is the semi-strong form in which public information reflects the efficiency of market. As prices are efficiently adjusted to publicly available information, such as annual earnings reports, dividend changes and stock split, investors are less likely to obtain the abnormal returns (Fama, 1995). However, Groenewold and Kang (1993) showed that there are few macroeconomic variables that are able to predict the Australian stock market. Their

results therefore were against the EMH for semi-strong form level. Last is the strong form, the monopolized information is included in this form. The investors are impossible to gain the abnormal return based on both public information and private information since it believed that the prices adjusted quickly to all information (Fama, 1995). Nonetheless, Jaffe (1974) and Seyhun (1986) indicated that there is the relationship between executives and directors' trading and their firm stock performance. Their results contradict to the assertion of the strong form of EMH.

Review of economic variables that impact stock market performance

1. Foreign stock indices

The interdependence between stock markets reflects the current nature of the global structure of the world's financial system. Many empirical studies reported the interdependence between stock markets worldwide. Agmon (1972) indicated that the markets are reasonably well integrated internationally. Particularly, during the financial crisis, the degree of interdependence of the stock markets was higher than usual (Avouyi-Dovi and Neto, 2004). In addition, Pattarathammas and Khanthavit (2009) found that stock markets in the same region will have similar movement patterns. The stock markets outside the region should affect the local stock markets as well. Evidence showed that there existed financial linkages among five member countries of ASEAN, except Indonesia, from 1987-1995 (Palac-McMiken, 1997). Moreover, the ASEAN markets were significantly co-integrated in the short term, rather than in the long term during 1988-1995 (Roca, et al., 1998), consistent with Hee Ng (2002) who reported that long run relationships among ASEAN stock markets did not exist. Notably, Wongbangpo and Sharma (2002) presented a counter proposal that in the long run co-movement among ASEAN stock markets from 1985-1996 did exist, indicating that the long run international diversification among ASEAN stock markets would not be perfectly diversified. In addition, Chaigusin, et al. (2008) and Sutheebanjard and Premchaiswadi (2009) revealed that in case of Thailand, foreign stock indices, such as Dow Jones index and Nikkei index significantly impact the SET index; hence they can be used as important predictors of Thai stock market movement.

In contrast, Hilliard (1979) argued that correlations across countries are insignificant. Such a finding is in accordance with Hassan (2003) who asserted that no co-integration with developed economies' stock markets could be found in the case of

the local stock markets of the Gulf Cooperation Council (GCC) countries, implying that international investors would be able to earn benefits from diversifying their portfolios.

In conclusion, the empirical results regarding the interdependence between stock markets are not consistent. Hence, this study attempted to examine whether international stock markets influence the movements of the Thai stock market.

2. Exchange rates

The expansion of world trade and capital movement has emphasized the importance of exchange rates as a significant factor driving company profits and stock performance (Kim, 2003). Choi, et al. (1998) noted the importance of the exchange rate in terms of stock returns in Japan. Kwon and Shin (1999) also found a relationship between currency exchange rates and stock returns in Korea. Furthermore, Maysami, Lee and Hamzah (2005) studied the correlation between stocks return and exchange rate in Singapore and found definitely significant relationship between these two variables. In addition, Mohammad, Hussain and Ali (2009) asserted that foreign exchange rate have strong degree of significant relationship with the stock market in Pakistan. Importantly, Chen, Wang and Cheng (2009) could find that the currency exchange rate significantly affect the equity market return in China. However, Hamao (1988) indicated that the exchange rate was insignificantly related to stock markets in Japan.

Based on the given literature, there are some arguments regarding the relationship between stock markets and exchange rates. In this study, the exchange rates of Thai baht against various international currencies were examined to measure the relativity level with stock market performance.

3. Gold prices

Gold is generally considered a highly liquid asset during economic downturns as individuals are likely to invest in such a valuable metal. Moreover, gold presents a store of value, whereas stocks offer a return on value (Levin, et al., 2006). Several studies provide empirical evidence regarding the relationship between gold prices and stock markets. Moore (1990), Büyükşalvarcı (2010) and Sharma and Mahendru (2010) reported that there was a negative relationship between the gold price return and stock market performances. In other words, as gold prices rise, the stock markets have a tendency to fall. The primary reason is that gold is considered an alternative investment for the investors. The stock price falls because the investors invest more in gold markets and less in stock markets.

Nonetheless, the insignificant relationship between gold prices and stock markets is also found. Smith (2001) researched both long term and short term links between the US stock market and gold prices during the period 1991-2001 and found an insignificant relationship in the long term. Gilmore, et al. (2009) also found neither co-integration nor any long term relationship between gold prices and the US stock market.

To conclude, it seems likely that the findings regarding the effect of gold prices and stock performance are contradictory. It is more interesting to investigate the effects of the gold price upon the performance of the Thai stock market.

4. Oil prices

Oil price is one of the most important macroeconomic factors as the productivity of most countries is based on petroleum. Empirical evidence showed that the oil market can impact stock returns and create stock market linkages due to worldwide petroleum consumption. In particular, the price of oil is demonstrably the leading indicator of the stock price of oil firms (Huang, et al., 1996). Moreover, the oil price is an important factor used to predict the technology stock market (Sandusky, 1999). However, Hamilton (1983) argued that oil prices are not significant sources for the economic situation and the stock market. Furthermore, oil prices did not significantly affect the stock market after 1999 due to the bubbles in oil prices in the early 2000's (Miller and Ratti, 2009).

Therefore, according to prior studies, there exists an element of disagreement over the relationship between oil prices and the stock market. This study then attempted to explore such relationships in the case of the Thai market.

5. Interest rates

Interest rates are related to economic growth and can be viewed as the discount factor which can be used to determine the value of stock prices (Alam and Uddin, 2009). Fama (1991) stated that interest rates influence cash flows of businesses and discount rates, implying a relationship with the valuation of the stock. Any fluctuations in stock returns can therefore be linked to changes in the interest rate.

Many prior studies examined the effects of interest rates. Apergis and Eleftheriou (2002) asserted that the relationship between interest rates and stock markets is governed by bond holders and stock investors. At higher interest rates, investors are willing to hold bonds, resulting in a decline in stock market performance (Gjerde and Saettem, 1999; Wongbangpo and Sharma, 2002). Such a negative relationship between the interest rate and stock markets is also found by Lobo (2002) who mentioned that the

major influencing factor upon the stock market is change in central bank monetary policy. The surprises associated with the decrease in target interest rates significantly causes rising stock performance. In contrast, Hogan, et al. (1982) reported that the relationship between Australian stock returns and medium-term government security yields was positive.

Since the interest rate seems to be an important variable affecting stock market performance, this study aimed to investigate such impacts.

6. Inflation

There are several academic studies examining how the inflation rate and returns on the stock market are related. Miller, et al. (1976) investigated the relationship between inflation and US equity markets and found a negative relationship over the short term. As an increase in inflation reduces the purchasing power of money, it further leads to a decrease in stock market performance. The finding of a negative relationship between these two variables was supported by many researchers such as Fama and Schwert (1977), Saunders and Tress (1981) and Kim and Shukla (2006).

However, Miller, et al. (1976) found a positive long term relationship between stock market returns and inflation. In addition, Boudoukh and Richardson (1993) asserted that there is a significantly positive relationship between US stock market returns and inflation when investigating such relationships over 1802-1990. Their results showed that the slope coefficients between variables are increasing in magnitude in the long term. Moreover, Hasan (2008) applied a co-integration method and a vector error correction model to explore the co-integration of returns on the stock market and the inflation rate in the UK by using the data between 1968 and 2003. The results indicated that there is a reliable long term relationship between stock returns and inflation. Nonetheless, an insignificant relationship between stock returns and inflation was demonstrated by Gultekin (1983) and Floros (2004) .

In all, as the inflation rate is likely to play a role in determining stock performance, this study attempted to investigate whether the interest rate can be a predictor of market performance.

Data and methodology

1. Data collection

The data were gathered from the SETSMART and Bloomberg databases. The monthly data during the period from October 2002 until June 2013 were employed. Data were the closing index values of stock markets, currencies, gold prices, oil prices, interest rates and inflation rates. Table 2 presents the list of economic variables examined in this study. Note that for the purpose of regression analysis, all of the independent variables were expressed as lagged variables.

Table 2: List of economic variables applied

Symbol	Economic Variables	Symbol	Economic Variables
MAI	Market for Alternative Investment Index	HKD	Exchange rate of Baht to HK Dollar
DJI	Dow Jones Industrial Average Index	EUR	Exchange rate of Baht to Euro
UK	FTSE 100 Index	GBP	Exchange rate of Baht to Pound
DAX	Frankfurt Stock Exchange Index	JPY	Exchange rate of Baht to Yen
SPX	S&P500 Index	PHP	Exchange rate of Baht to Peso
NKY	Nikkei-225 Stock Average Index	GOLD	Gold price
HIS	Hang Seng Index	OIL	Oil price
PSE	Philippine Stock Exchange PSEi Index	MLR	Interest rate
USD	Exchange rate of Baht to US Dollar	CPI	Inflation rate

According to Table 2, in terms of interest rates, the minimum loan rate (MLR) is used as the proxy for interest rates. The average MLRs of 5 Thai commercial banks were used. The MLR was preferred as it represents the cost of borrowing for private investment and relates to economic activity (Charoenseang, & Manakit, 2007). In addition, for inflation, the Thai Consumer Price Index (CPI) on base year 2011 was employed as it shows a price index derived from the weighted average of price compiled from a basket of goods and services (Bryan, & Cecchetti, 1993). Most of the time, CPI is a broadly accepted indicator of general price levels within the economy and thus can be used to represent the rate of inflation.

Besides, this study classified a set of data to be in-the-sample and out-of-sample data. According to Young and Karr (2011), the in-the-sample data was 80% of

the data, while the out-of-sample data was the remaining 20% of the entire data set. Hence, the former set of data consisted of monthly data from September 2002 to July 2011, whereas the latter data set contained monthly data from August 2011 to June 2013. The in-the-sample data were then used to develop the estimated model, whereas the out-of-sample data were employed to test the model accuracy for the prediction purpose.

2. Methodology

In order to assess the predictive ability of economic variables on MAI index returns, the following testing procedures were employed. Firstly, the Augmented Dicky-Fuller Test (ADF test) was used to test the stationarity of the time series data of each variable. According to ADF test, all variables were statistically significant at the 0.05 confidence level, meaning that the data series contained covariance stationary[1]. Secondly, the White test and Breusch-Godfrey LM test were implemented to check heteroskedasticity and serial correlation, respectively. Table 3 shows that a heteroskedasticity problem existed since the probability of the F-Statistic (0.00009) is less than 0.05. However, the serial correlation problem was not found as the probability of the test is equal to 0.5059 which is greater than 0.05. Therefore, the White's heteroskedasticity consistent standard error was employed to solve only the heteroskedasticity problem.

Table 3: Results from the White test and Breusch-Godfrey LM-test

	White test	Breusch-Godfrey LM-test
F-Statistic	2.8596	0.9472
Prob. F(36,68)	0.00009	0.5059
Prob. Chi square(36)	0.0033	0.3019

After correcting the heteroskedasticity problem, the variance inflation factor (VIF) test was utilized to observe multicollinearity. If the VIF is greater than 10, then multicollinearity may be serious for the least squares estimation and should be excluded from the model. Table 4 shows the VIF of each variable and indicates that the variables of *DJI*, *UK*, *SPX, HKD* and *JPY* have VIF greater than 10. Hence, to avoid the

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[1] The statistical results of ADF are available upon request.

multicollinearity problem, these variables were initially eliminated from the regression model. Therefore, for the multiple regression analysis, 13 variables which were *MAI*, *DAX*, *NKY*, *HIS*, *PSE*, *USD*, *EUR*, *GBP*, *PHP*, *GOLD*, *OIL*, *MLR* and *CPI* remained for examination.

Table 4: Results from the variance inflation factor (VIF) test

Variable	Coefficient	VIF	Decision	Variable	Coefficient	VIF	Decision
MAI	0.0253	3.7184		HKD	0.7563	11.8307	Remove
DJI	0.9450	56.6538	Remove	EUR	0.1115	3.7736	
UK	0.3624	13.6784	Remove	GBP	0.1988	5.6103	
DAX	0.0654	8.4462		JPY	0.2357	10.1205	Remove
SPX	0.6369	43.1802	Remove	PHP	0.2931	3.6078	
NKY	0.0863	9.1901		GOLD	0.0303	2.9565	
HIS	0.0541	6.0045		OIL	0.0081	2.3147	
PSE	0.0336	4.0637		MLR	0.1432	1.7086	
USD	0.5868	6.1800		CPI	2.1420	2.4361	

Next, using in-the-sample data, the multiple linear regression analysis was implemented to obtain the most proper model to use for predicting the performance of MAI index returns. The following is the multiple regression model (1) .

$$MAI_{i,t} = \gamma_0 + \gamma_1 MAI_{i,t-1} + \gamma_2 DAX_{i,t-1} + \gamma_3 NKY_{i,t-1} + \gamma_4 HIS_{i,t-1} + \gamma_5 PSE_{i,t-1}$$
$$+ \gamma_6 USD_{i,t-1} + \gamma_7 EUR_{i,t-1} + \gamma_8 GBP_{i,t-1} + \gamma_9 PHP_{i,t-1} + \gamma_{10} GOLD_{i,t-1}$$
$$+ \gamma_{11} OIL_{i,t-1} + \gamma_{12} MLR_{i,t-1} + \gamma_{13} CPI_{i,t-1} + \varepsilon_i \qquad (1)$$

Where:

MAI_t	=	return on Market for Alternative Investment Index
MAI_{t-1}	=	lagged return on MAI Index
DAX_{t-1}	=	lagged return on Frankfurt Stock Exchange Index
NKY_{t-1}	=	lagged return on Nikkei-225 Stock Average Index
HIS_{t-1}	=	lagged return on Hang Seng Index
PSE_{t-1}	=	lagged return on Philippine Stock Exchange Index
USD_{t-1}	=	lagged return on exchange rate of THB to USD
EUR_{t-1}	=	lagged return on exchange rate of THB to EUR
GBP_{t-1}	=	lagged return on exchange rate of THB to GBP
PHP_{t-1}	=	lagged return on exchange rate of THB to PHP
$GOLD_{t-1}$	=	lagged return on gold price
OIL_{t-1}	=	lagged return on oil price

MLR_{i-1}	=	lagged return on interest rate	
CPI_{t-1}	=	lagged return on inflation rate	
γ_0	=	the intercept of the regression equation	
γ_n (n=1,2,..,13)	=	coefficient of independent variables	
i	=	error term	

Lastly, to ensure that the final estimated model performs effectively, the binomial test proportion in count data was utilized in which the results from the estimated model were compared with the actual results by using the out-of-sample data.

Conclusions and Discussion

Initially, there were 18 independent variables proposed. After correcting for all heteroskedasticity and multicollinearity problems, only 13 independent variables were employed in the multiple regression analysis according to the aforementioned model (1). Table 5 presents the multiple regression results.

Table 5: Results from multiple regression analysis of model (1)

Variables	Coefficients	T-stat	Prob.
γ_0	0.0026	0.3263	0.7749
MAI_{t-1}	0.2633**	1.6690	0.0986
DAX_{t-1}	0.0377	0.1699	0.8655
NKY_{t-1}	0.0674	0.2971	0.7671
HIS_{t-1}	0.1197	0.5057	0.6143
PSE_{t-1}	0.0424	0.2594	0.7959
USD_{t-1}	-0.5595	-1.1236	0.2641
EUR_{t-1}	0.1512	0.5012	0.6174
GBP_{t-1}	-0.1225	-0.3537	0.7244
PHP_{t-1}	0.0286	0.0686	0.9454
$GOLD_{t-1}$	-0.1161	-0.7548	0.4523
OIL_{t-1}	-0.1605**	-1.7786	0.0786
MLR_{t-1}	-0.8481*	-2.4156	0.0177
CPI_{t-1}	1.1964	0.8739	0.3845
R^2	0.2733		
F-stat.	2.6327*		
Prob.(F-stat)	0.0036		

* indicates significance at the 0.05 level of confidence.

** indicates significance at the 0.10 level of confidence.

Results from Table 5 reveal that the lagged return on the MAI index (MAI_{t-1}) and lagged return on oil price (OIL_{t-1}) were significantly related to the MAI stock market performance at the 0.10 level of confidence. Besides, lagged return on interest rate (MLR_{i-1}) has a significant relationship with MAI performance at the 0.05 level of confidence. Hence, only MAI_{t-1}, OIL_{t-1} and MLR_{t-1} were utilized in the next step to develop the possible models used to predict the MAI stock market performance.

The following models are 7 possible models that can be constructed from the 3 significant variables found from the prior processes.

$$MAI_{i,t} = \beta_0 + \beta_1 MAI_{i,t-1} + \varepsilon_i \tag{2}$$

$$MAI_{i,t} = \alpha_0 + \alpha_1 OIL_{i,t-1} + \varepsilon_i \tag{3}$$

$$MAI_{i,t} = \delta_0 + \delta_1 MLR_{i,t-1} + \varepsilon_i \tag{4}$$

$$MAI_{i,t} = \lambda_0 + \lambda_1 MAI_{i,t-1} + \lambda_2 OIL_{i,t-1} + \varepsilon_i \tag{5}$$

$$MAI_{i,t} = \pi_0 + \pi_1 MAI_{i,t-1} + \pi_2 MLR_{i,t-1} + \varepsilon_i \tag{6}$$

$$MAI_{i,t} = \varphi_0 + \varphi_1 OIL_{i,t-1} + \varphi_2 MLR_{i,t-1} + \varepsilon_i \tag{7}$$

$$MAI_{i,t} = T_0 + T_1 MAI_{i,t-1} + T_2 OIL_{i,t-1} + T_3 MLR_{i,t-1} + \varepsilon_i \tag{8}$$

Table 6 presents the results from the multiple regression analysis of the above possible models (2) -(8). Results indicate that all models, except model (3), fit well with the data because the probability of the F-statistic is less than 0.05. In addition, results show that only 2 variables, which are lagged return of the MAI Index (MAI_{t-1}) and lagged return of interest rate (MLR_{t-1}), are statistically significant at the 0.05 confidence level, whereas lagged return of oil price (OIL_{t-1}) was statistically insignificant at the 0.05 confidence level.

Table 6: Results from multiple regression analysis of model (2) – (8)

Model	Variables	Coefficients	t-statistic		R^2	F-statistic	
			t-stat.	prob.		F-stat.	prob.
2	β_0	0.0057	0.8274	0.4099	0.1650	20.3552*	0.0000
	MAI_{t-1}	0.4018*	2.8219	0.0057			
3	α_0	0.0105	0.9219	0.3587	0.0022	0.2267	0.6357
	OIL_{t-1}	-0.0394	-0.4062	0.6854			

Table 6 (continued)

Model	Variables	Coefficients	t-statistic		R^2	F-statistic	
			t-stat.	prob.		F-stat.	prob.
4	δ_0	0.0091	1.2127	0.2280	0.1210	14.1782*	0.0002
	MLR_{t-1}	-1.1718*	-3.7653	0.0003			
5	λ_0	0.0065	0.9278	0.3557	0.1764	10.9217*	0.0000
	MAI_{t-1}	0.4172*	2.9196	0.0043			
	OIL_{t-1}	-0.0908	-1.1820	0.2399			
6	π_0	0.0056	0.8441	0.4006	0.1944	15.2037*	0.0000
	MAI_{t-1}	0.3368*	2.4088	0.0178			
	MLR_{t-1}	-0.8846*	-2.8131	0.0059			
7	φ_0	0.0094	1.2427	0.2168	0.2297	7.1017*	0.0013
	OIL_{t-1}	-0.0296	-0.3783	0.7059			
	MLR_{t-1}	-1.1678*	-3.7348	0.0003			
8	τ_0	0.0063	0.9260	0.3567	0.2375	10.4836*	0.0000
	MAI_{t-1}	0.3512*	2.4988	0.0141			
	OIL_{t-1}	-0.0755	-1.0247	0.3079			
	MLR_{t-1}	-0.8622*	-2.7618	0.0068			

* indicates significance at the 0.05 level of confidence.

To examine which model is the best possible model that should be used to predict the performance of the MAI stock market, the Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), Root Mean Square Error (RMSE), Mean Absolute Error (MAE) and Root Mean Absolute Percent Error (MAPE) were applied. When these criteria reflect a lower number, it indicates that the model has more power in estimation. The results from Table 7 show that the estimated model (6), which comprises lagged return of the MAI Index (MAI_{t-1}) and lagged return of interest rate (MLR_{t-1}) can obtain the three lowest values for AIC, SIC and RMSE. Hence, it can be concluded that these two economic variables were the most suitable variables used to predict the performance of the MAI Index.

Table 7: Comparison of criteria for possible models

Model	AIC	SIC	RMSE	MAE	MAPE
2	-2.3320	-2.2715	0.0711	0.0581	118.4011
3	-2.1439	-2.0933	0.0774	0.0582	87.4318
4	-2.2707	-2.2201	0.0749	**0.0554**	80.8703
5	-2.3167	-2.2409	0.0723	0.0578	109.9124
6	**-2.3835**	**-2.3077**	**0.0703**	0.0566	111.3671
7	-2.2530	-2.1772	0.0755	0.0556	**80.3240**
8	-2.3747	-2.2736	0.0712	0.0565	105.1411

Note: AIC = Akaike Information Criterion, SIC = Schwarz Information Criterion,

RMSE = Root Mean Square Error, MAE = Mean Absolute Error,

MAPE = Root Mean Percent Error.

Moreover, to ensure the consistency of return direction and the efficacy of economic variables to predict future stock market performance, the Binomial Test Proportion in Count Data was implemented. With this test, the sign of return on the estimated model and actual return on the MAI index were compared. Using the out-of-sample data to ensure the predictive ability, the results from Table 8 show that the model (6) can estimate the return direction on the MAI index correctly at 82.61% which is the highest proportion compared to others.

Table 8: Binomial test proportion in count data

Model	Unequal Sign		Equal Sign	
	N	%	N	%
2	6	26.09	17	73.91
3	7	30.43	16	69.57
4	5	21.74	18	78.26
5	6	26.09	17	73.91
6	**4**	**17.39**	**19**	**82.61**
7	5	21.74	18	78.26
8	5	21.74	18	78.26

In conclusion, in accordance with the statistical tests above, this study suggests that model (6) is the most appropriate model to estimate returns on the MAI index. The prediction model was finally constructed as follows:

$$MAI_{i,t} = \pi_0 + \pi_1 MAI_{i,t-1} + \pi_2 MLR_{i,t-1} + \varepsilon_i \quad (6)$$

$$MAI_{i,t} = 0.0056 + 0.3367 \, MAI_{i,t-1} - 0.884 \, MLR_{i,t-1} + \varepsilon_i$$

According to the final results, lagged return of MAI Index ($MAI_{t-1)}$) has a positive significant relationship to MAI returns at the 0.05 confidence level and lagged return of interest rate ($MLR_{t-1)}$) has a negative significant relationship to MAI returns at the 0.05 confidence level. These results indicate that the MAI return can be estimated by its past performances with the same direction.

Moreover, there exists an inverse relationship between interest rate and MAI index returns, implying that MAI performance is forecasted to drop during periods when the market lending rates rise. This results of this study are consistent with those of Gjerde, & Saettem (1999), Apergis, & Eleftheriou (2002), Wongbangpo, & Sharma (2002), Lobo (2002), Hogan, et al. (1982) and Fama (1991) in that the interest rate and stock performance have a negative relationship. As the interest rate is important for economic growth and capital structure, the interest rate influences the cash flow of firms, further affecting the valuation model in the stock markets. In addition, such negative relationship indicates that the investors are willing to hold other securities, such as debt securities, during periods of high interest rates as they can earn higher returns. This causes the stock market to decline.

In addition, this study reports that the performance of foreign stock markets would not statistically impact that of the MAI stock market, implying that this young developing market is not co-integrated with developed ones, consistent with the results of Hassan (2003). Moreover, similar to Hamao (1988), the exchange rate of various countries is found to be statistically insignificant, implying that movements in exchange rates would not significantly influence the performance of the MAI market. In terms of gold price, this economic variable is also statistically insignificant, supporting the study of Gilmore, et al. (2009). Additionally, this study reveals that the price of oil is also insignificantly related to MAI performance, consistent with Hamilton (1983) and Miller and Ratti (2009). Although Thailand is one of the petroleum-based countries, a change in oil price would have no impact on the performance of the MAI market. Lastly, results from this study show that changes in inflation would not be regarded as an effective predictor of MAI stock market performance. The insignificant finding of inflation is in line with that of Gultekin (1983) and Floros (2004) .

Moreover, the results from this study suggest that historical stock return and public economic information are important information for investors as they could be used to predict the future stock return. Therefore, these findings are against with the efficient market hypothesis (EMH), consisting with the study of Groenewold, & Kang (1993) .

Conclusion

The Market for Alternative Investment (MAI) is one of the stock markets in Thailand. With the potential growth in this young market, it is interesting to examine whether the MAI market return can be forecasted by any movement of economic variables. Hence, the purpose of this study is to explore the ability of economic variables to predict the MAI stock market performance. By using the monthly data during 2002-2013 with multiple regression analysis, the results indicate that the MAI index return can be predicted by using its past returns. In addition, it reveals that the interest rate negatively affects MAI performance. However, the performance of foreign stock markets, exchange rate, gold price, oil price and inflation showed an insignificant relationship to MAI performance.

The findings regarding significant variables from this study suggest that stakeholders should consider the historical performance of this market. Stakeholders are more likely to gain satisfactory returns by following the trend of the MAI's past returns in order to make investment decisions. Furthermore, those stakeholders should consider any change in interest rates when investing in the MAI. When there is an announcement regarding a decrease in interest rates, stakeholders should adjust their investment portfolios by allocating their funds to invest in this young market in a higher proportion than usual. As the interest rate is considered a cost of capital which can be further used as a discount factor in determining the value of stock (Alam, & Uddin, 2009), a decrease in interest rates increases the value of stocks in the market, resulting in a favorable return from the investment.

The results from this research provide more understanding about the impact of economic factors on stock market performance, which is one of the keystones for both risk management and portfolio allocation decisions. Furthermore, this research contributes to the knowledge of forecasting the stock market through the application of a different set of economic data in determining the direction impact of economic variables upon the stock market performance. In addition, this study assists both individual investors and institutional investors in managing their portfolios effectively and helps

prevent the risk of loss from investment through the use of a model developed from estimation of trend movements of the market index.

In terms of academic contribution, the results from this study indicate that the efficient market hypothesis is violated in case of MAI stock market. Past information and publically available information are important information the investors are able to use to gain benefits over. Moreover, the results from this study provide additional international evidence regarding investment in alternative stock markets for small and medium sized enterprises and add contemporary empirical evidence to the financial literature detailing Thai stock market predictions. Lastly, the study helps in the promotion of alternative stock markets.

For further studies, it would be interesting to include more macroeconomic variables such as gross domestic product, money supply, unemployment rate and the financial situation if monthly data is available. In addition, further studies should consider more than one lagged return on the variables, such as two lagged return on the MAI, two lagged return on interest rate, etc. This may allow the investors to identify the proper time to adjust their portfolios.

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