

**A NEW APPROACH TO THE BUSINESS CYCLE AND  
INSIGHTS FOR THE ALLOCATION OF INVESTMENT ASSET  
CLASSES AND SECTORAL STOCK RETURNS ALONG THE  
BUSINESS CYCLE**



**Korn Talhip**

**A Dissertation Submitted in Partial  
Fulfillment of the Requirements for the Degree of  
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**A NEW APPROACH TO THE BUSINESS CYCLE AND  
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**Korn Talthip**

**School of Development Economics**

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..... Major Advisor  
(Associate Professor Sorasart Sukcharoensin, D.B.A.)

..... Co-Advisor  
(Associate Professor Pariyada Sukcharoensin, D.B.A.)

..... Co-Advisor  
(Associate Professor Yuthana Sethapramote, Ph.D.)

The Examining Committee Approved This Dissertation Submitted in Partial  
Fulfillment of Requirements for the Degree of Doctor of Philosophy (Economics).

..... Committee Chairperson  
(Associate Professor Tanachote Boonvorachote, D.B.A.)

..... Committee  
(Associate Professor Pariyada Sukcharoensin, D.B.A.)

..... Committee  
(Associate Professor Yuthana Sethapramote, Ph.D.)

..... Committee  
(Associate Professor Sorasart Sukcharoensin, D.B.A.)

..... Dean  
(Associate Professor Amornrat Apinunmahakul, Ph.D.)

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## ABSTRACT

<b>Title of Dissertation</b>	A NEW APPROACH TO THE BUSINESS CYCLE AND INSIGHTS FOR THE ALLOCATION OF INVESTMENT ASSET CLASSES AND SECTORAL STOCK RETURNS ALONG THE BUSINESS CYCLE
<b>Author</b>	Korn Talthip
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Portfolio management strategy enables investors to reduce risk and maximize return. Investment in different stocks in equity market helps reducing non-systematic risk however systematic risk of portfolio obviously affected by macroeconomic conditions. Different stages of business cycle associates with changes in macroeconomic environment together with business sentiment and different market expectations which impact performance of specific asset classes in each stage. Equity in different stock sectors responses differently in various economic and business conditions according to the nature of industry. Understanding context of business environment and impact on sectoral stock returns helps investors to foresee potential systematic risk of portfolio and understanding association between business cycle stages and sectoral stock returns will provides insight to the investors on strategic portfolio allocation.

This study provides practical methodology on how to define the stages of business cycle using real GDP growth (YoY, Seasonally Adjusted) as a proxy of aggregated economic activities and using steady zero-growth line together with local maxima and local minima to divide business cycle into 4 stages (expansion, recession, depression, recovery). After defining the stages of business cycle, this study analyzes impact of business cycle on sectoral stock return through changes of market risk premium along the different stages using monthly sectoral stock data from The Stock Exchange of Thailand (SET) during period January 2002 to December 2019 . The analysis is based on Modified CAPM Model with interaction terms between business cycle stage dummies and excess market return over risk free asset to identify business cycle stage beta-value for each stock sector which further bring into Treynor ratio

calculation. Recommendations on sectoral stock investment in each stage of business cycle are based on risk-adjusted return perspective where the results also proven with portfolio simulation using Markowitz Portfolio Optimization Strategy to define optimal intersectoral allocation ratio in each business cycle stage. Using investment recommendation strategy in this study enables portfolio to achieve higher return than market while reducing volatility risk. The results from this study imply that recovery stage of business cycle is the best timing for investment in stock market due to positive expectation towards future firm earnings. Commerce is the only stock sector which provides positive risk-adjusted return over market performance across all stages of business cycle and it also performs best among all stock sectors in recovery stage. Tourism and Leisure sector performs best in the aspect of risk-adjusted return in expansion stage. Healthcare services is outstanding among other sectors in recession stage. In depression stage, most of stock sectors have negative average return where commerce and ICT are only two sectors with positive risk-adjusted return in this stage of business cycle.

In addition, this study also provides insight towards impact of key macroeconomic factors, business sentiment index and fund flow on sectoral stock returns. With sectoral approach, this study contributes to many controversial points regarding relationship of key macroeconomic factors on stock returns where conflicting results were found in the literatures where most of the studies were focusing on market level. This study also explore the relationship between expected business sentiment index in the different stages of business cycle on sectoral stock returns and found that expected business sentiment index has most influence on sectoral stock returns in depression stage of the business cycle.

Finally, the study analyzes relationship between net investment of different types of investors and sectoral stock returns which reveals that market return in expansion stage has significant causal relationship with net investment from domestic institutions and market return in recession stage also has significant causal relationship with net foreign investment while there is no significant causal relationship between net investment from any type of investors on sectoral stock returns. This imply direction of causal relationship between fund flow and stock

market return is more likely to be market return attracts fund flow rather than fund flow impact on stock market return.

This study contributes to the practical methodology of business cycle stage determination, investment recommendations based on risk-adjusted returns of stock sectors along different stages of business cycle, and additional insights on the influence of key macroeconomic factors and business sentiment on stock sector returns and relationship between fund flow from different types of investors and stock returns in both market and sector levels.

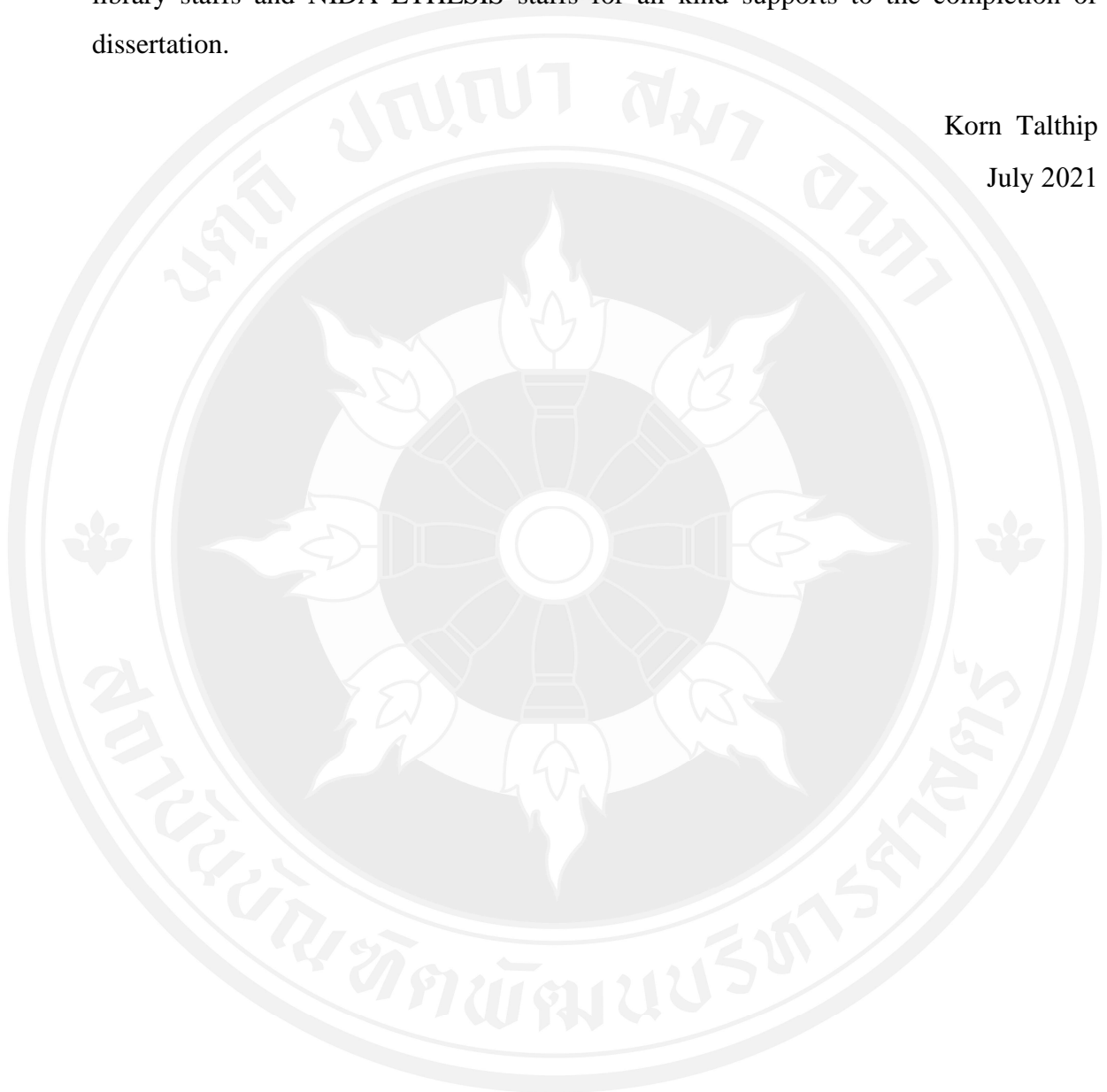


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## TABLE OF CONTENTS

	<b>Page</b>
ABSTRACT.....	iii
ACKNOWLEDGEMENTS.....	vi
TABLE OF CONTENTS.....	vii
LIST OF TABLES.....	ix
LIST OF FIGURES.....	xiv
CHAPTER 1 INTRODUCTION.....	1
1.1 Background and Importance of the Issue.....	1
1.2 Contributions of this Research Work.....	5
CHAPTER 2 LITERATURE REVIEW.....	7
2.1 Literature Review about Business Cycle and Impact of Business Cycles on Sectoral Stock Returns.....	7
2.2 Literature Review about Macroeconomic Factors and Sectoral Stock Return.....	15
2.3 Literature Review about Fund Flow to Stock Market and Sectoral Stock Return.....	23
CHAPTER 3 SECTORAL STOCK RETURN ALONG THE DIFFERENT STAGES OF BUSINESS CYCLE AND IMPLICATIONS FOR PORTFOLIO ALLOCATION STRATEGY.....	26
3.1 Scope of the study and data.....	26
3.2 Methodology in Defining Stages of Business Cycle.....	32
3.2.1 Defining the Business Cycle.....	32
3.2.2 Defining Stages of Business Cycle.....	41
3.3 Analysis of Sectoral Stock Return along the Different Stages of Business Cycle.....	56
3.4 Portfolio Simulation Using Recommendations on Sectoral Allocation Investment Strategy Along Different Stages of Business Cycle.....	70

CHAPTER 4 INFLUENCE OF MACROECONOMIC ENVIRONMENT AND EXPECTED BUSINESS SENTIMENT INDEX IN THE DIFFERENT STAGES OF BUSINESS CYCLE ON STOCK MARKET AND SECTORAL RETURNS .....	79
4.1 Influence of Key Macroeconomic Factors and Business Sentiment Index on the Stock Market and Sectoral Stock Return.....	79
4.2 Impact of Macroeconomic Factors and Expected Business Sentiment Index on Sectoral Stock Returns Using Multifactor APT Model.....	84
CHAPTER 5 EFFECT OF FUND FLOW BY INVESTOR TYPES ON MARKET AND SECTORAL STOCK RETURNS AND IMPACT OF KEY MACROECONOMIC FACTORS ON CHANGES OF STOCK MARKET INVESTMENT FROM DIFFERENT TYPES OF INVESTORS.....	92
5.1 Evaluation of Fund Flow by Different Investor Types and Their Impact on Market and Sectoral Stock Returns .....	93
5.2 Evaluation of Impact from Net Investment to Stock Market from Different Types of Investors on Market and Sectoral Stock Returns .....	96
5.3 Evaluation of Sectoral Stock Returns and Their Impact to Fund Flow by Different Investor Types.....	109
5.4 Relationship between Business Cycle and Net Investment from Different Types of Investors .....	124
CHAPTER 6 CONCLUSION DISCUSSION AND RECOMMENDATION .....	131
6.1 Defining Stages of Business Cycle and Association between Business Cycle and Sectoral Stock Returns.....	131
6.2 Influences of Macroeconomic factors and Business Sentiment Index along the Business Cycle on Sectoral Stock Return.....	136
6.3 Association between Fund Flows to Stock Market from Different Types of Investors on Market and Sectoral Stock Returns in Each Stage of Business Cycle.....	139
6.4 Contributions of this Study, Implications for Investment Allocation and Recommendations for Future Research.....	140
BIBLIOGRAPHY .....	150
BIOGRAPHY .....	156

## LIST OF TABLES

		<b>Page</b>
Table 3.1	Correlation Coefficients Between Market Return and Sector Returns (Ranking from Highest to Lowest Correlation)	28
Table 3.2	Correlations between Stock Sectors	29
Table 3.3	Stock Sectors with Strong Positive Correlation	30
Table 3.4	Comparison of the Three Business Cycle Proxies (real GDP growth, MPI growth, and CEI growth) for their Peaks and Through and Correlations with Stock Market Return	39
Table 3.5	Specified Month Period for Each Stage of Business Cycle using Steady Zero-Growth Line	44
Table 3.6	Important Global and Local Events which Create Positive and Negative Shocks to the Economy of Thailand	44
Table 3.7	Specified Month Period for Each Stage of Business Cycle using Long-Run Average Trend Line	47
Table 3.8	Correlations between Dummy Variables of Each Stage of Business Cycle	48
Table 3.9	Regression Analysis Results of Sectoral Stock Return and Dummy Variables Representing Stages of Business Cycle (Using Steady Zero-Growth Line in Business Cycle Stages Determination)	49
Table 3.10	Correlations between Dummy Variables of Each Stage of Business Cycle (Use Long-Run Average Trend Line in Identifying Business Cycle Stages)	51
Table 3.11	Regression Analysis Results of Sectoral Stock Return and Dummy Variables Representing Stages of Business Cycle (Using Long-Run Average Trend Line in Business Cycle Stages Determination)	52
Table 3.12	Model Comparison between Two Business Cycle Stages Identification Methods (Steady Zero-Growth Line vs. Long-Run Average Trend Line)	54

## LIST OF TABLES (Continued)

	<b>Page</b>
Table 3.13 Better Model Specification Rate Comparison between the Two Methods (Using Steady Zero-Growth Line vs. Long-Run Average Trend Line)	55
Table 3.14 Descriptive Statistics of Sectoral Stock Returns	58
Table 3.15 Regression Analysis Results of Sectoral Stock Return and Dummy Variables Representing Stages of Business Cycle (Using Modified CAPM Model with Business Cycle Stage Dummies interacting with Market Risk Premium)	61
Table 3.16 Summary of Results from Analysis of Sectoral Stock Returns with Modified CAPM Model (ranking from highest to lowest beta coefficient)	63
Table 3.17 Sectoral Stock Returns in Each Stage of Business Cycle (%) Compared with Market Performance (Ranking by Order)	65
Table 3.18 Treynor Ratio of Stock Sectors in Different Stages of Business Cycle	67
Table 3.19 Summary of Recommendations on Sectoral Allocation Investment Strategy Along Different Stages of Business Cycle (Ranked by highest Treynor ratio to lowest Treynor ratio from top to bottom)	69
Table 3.20 Portfolio Simulation Using Sectoral Allocation Along with The Business Cycle Recommendation Strategy (with No Inter-Sectoral Allocation Within Each Stage of Business Cycle)	71
Table 3.21 Optimum Inter-sectoral Portfolio Diversification Ratio to Maximize Overall Portfolio Sharpe Ratio According to Markowitz Mean-Variance Portfolio Optimization Theory	73
Table 3.22 Portfolio Simulation Using a Combination of Markowitz Mean-Variance Portfolio Optimization Strategy in addition to Sectoral Allocation Recommendation Strategy along each Stage of Business Cycle	74
Table 3.23 Comparison Between Portfolio Strategy Without and With Intersectoral Diversification in each Business Cycle Stage	76

## LIST OF TABLES (Continued)

		<b>Page</b>
Table 3.24	Comparison of Different Portfolio Strategies by each Stage of Business Cycle	77
Table 4.1	Mean and Variance of Changes in Business Sentiment Index and Expected Business Sentiment Index in each Stage of Business Cycle	80
Table 4.2	Correlation Coefficient between Business Sentiment Index (BSI), Expected Business Sentiment Index (BSI <sub>e</sub> ), Key Macroeconomic Indicators and Market Index (SETI)	81
Table 4.3	Correlation Coefficient between Changes in Business Sentiment Index (BSI), Expected Business Sentiment Index (BSI <sub>e</sub> ), Key Macroeconomic Indicators and Market Return (R <sub>m</sub> )	82
Table 4.4	Multiple Regression of Multifactor APT Model for Sectoral Stock Return and Key Macroeconomic Factors Incorporating Expected Business Sentiment Index (Result from Equation 2)	86
Table 4.5	Summary of Macroeconomic Factors Effect on Sensitivity of Sectoral Stock Return	90
Table 4.6	Influence of Expected Business Sentiment Index on Sectoral Stock Return in each Stage of Business Cycle	90
Table 5.1	Correlations Between Net Investment to Stock Market from Different Types of Investors and Market Return	93
Table 5.2	Variance and Sum-Squared Deviation of Net Investment to Stock Market from Different Types of Investors	94
Table 5.3	Results of VAR Estimation for First Quarter Lags of Net Investment to Stock Market from Different Types of Investors and Sectoral Stock Return (critical t-value $\pm 2.18$ , $p=0.05$ , t-statistics in [ ] and S.E. in ( ))	98
Table 5.4	VAR Granger Causality / Block Exogeneity Wald Test Using Sectoral Stock Returns as Dependent Variable and Net Foreign Investment as Exogenous Variable	103

## LIST OF TABLES (Continued)

		<b>Page</b>
Table 5.5	VAR Granger Causality / Block Exogeneity Wald Test Using Sectoral Stock Returns as Dependent Variable and Net Institution Investment as Exogenous Variable	104
Table 5.6	VAR Granger Causality / Block Exogeneity Wald Test Using Sectoral Stock Returns as Dependent Variable and Net Proprietary Trader Investment as Exogenous Variable	105
Table 5.7	VAR Granger Causality / Block Exogeneity Wald Test Using Sectoral Stock Returns as Dependent Variable and Net Retail Investment as Exogenous Variable	106
Table 5.8	Results of VAR Estimation for First Quarter Lags of Sectoral Stock Returns and Net Investment to Stock Market from Different Types of Investors (critical t-value 2.35, p = 0.05)	109
Table 5.9	VAR Granger Causality/ Block Exogeneity Wald Test Using Net Foreign Investment as Dependent Variable and Sectoral Stock Returns as Exogenous Variable	120
Table 5.10	VAR Granger Causality / Block Exogeneity Wald Test Using Net Institution Investment as Dependent Variable and Sectoral Stock Returns as Exogenous Variable	121
Table 5.11	VAR Granger Causality/ Block Exogeneity Wald Test Using Net Proprietary Trader Investment as Dependent Variable and Sectoral Stock Returns as Exogenous Variable	122
Table 5.12	VAR Granger Causality / Block Exogeneity Wald Test Using Net Retail Investment as Dependent Variable and Sectoral Stock Returns as Exogenous Variable	123
Table 5.13	ARDL Estimation, Long-Run Cointegration, and Granger Causality Analysis for Market Return in Each Stage of the Business Cycle and Net Investment from a Different Type of Investors	126

## LIST OF TABLES (Continued)

	<b>Page</b>
Table 5.14 ARDL estimation, long-run cointegration, and granger causality analysis for net investment from different types of investors in each stage of business cycle and market return	128
Table 6.1 Comparison of Pro and Con between Different Methodology of Business Cycle Stages Identification in Literatures and This Research Work	133
Table 6.2 Comparisons of Findings between Different Research Works about Macroeconomic Factors on Stock Market Returns	138
Table 6.3 Summary of Business Cycle, Relevant Business Sentiment, Fund Flows and Implications on Stock Sectors Investment Recommendations	147

## LIST OF FIGURES

	<b>Page</b>
Figure 2.1 Four stages of business cycles defined by DeStefano (2014)	9
Figure 2.2 Traditional Four Phases of Business Cycles	11
Figure 2.3 Vector Autoregressive (VAR) model to evaluate the impacts of macroeconomic shocks on sectoral stock returns	20
Figure 3.1 Cyclical movement pattern of Real GDP growth (YoY: Quarterly: Seasonally Adjusted) of Thailand during 2002 – 2019 C.E.	33
Figure 3.2 Real GDP Growth (QoQ), Thailand during 2002 – 2019 C.E.	33
Figure 3.3 Changes in Manufacturing Production Index (MPI), MoM, Thailand	34
Figure 3.4 Manufacturing Production Index (MPI) growth, YoY, Thailand (Thin line) compared with Real GDP growth, YoY, Thailand (Thick line)	35
Figure 3.5 Changes in Coincident Economic Index (CEI)	36
Figure 3.6 Coincident Economic Index (CEI) growth, YoY, Thailand (Thin line) compared with Real GDP growth, YoY, Thailand (Thick line)	37
Figure 3.7 Comparison between 3 Proxies of Output Growth for Business Cycle Identification which are Real GDP growth, YoY, Thailand (Thick line), Growth of Manufacturing Production Index or MPI, YoY, Thailand (Medium line) and Growth of Coincident Economic Index or CEI, YoY, Thailand (Thin line)	38
Figure 3.8 Phase of the Business Cycle using Steady Zero-Growth Line	43
Figure 3.9 Stages of Business Cycle around Steady Zero-Growth Line in Thailand During Period 2002-2019 Using Real GDP Growth	43
Figure 3.10 Phases of the Business Cycle	45

## LIST OF FIGURES (Continued)

	<b>Page</b>
Figure 3.11 Stages of Business Cycle around Long-Run Average Trend Line in Thailand During Period 2002-2019 Using Real GDP Growth	46
Figure 4.1 Cross Correlogram between Changes in Business Sentiment Index (CBSI) and Changes in Expected Business Sentiment Index (CBSIE)	83
Figure 4.2 Cross Correlogram between Changes in Business Sentiment Index, Changes in Expected Business Sentiment Index and Market Returns	83
Figure 5.1 Net Foreign Investment to Thailand Stock Exchange (Thin line) and Market Return (Thick Line) during 2002 – 2019 C.E.	94
Figure 5.2 Net Local Institution Investment to Thailand Stock Exchange (Thin Line) and Market Return (Thick Line) during 2002-2019 C.E.	95
Figure 5.3 Net Proprietary Trader Investment to Thailand Stock Exchange (Thin Line) and Market Return (Thick Line) during 2002-2019 C.E.	95
Figure 5.4 Net Retail Investment to Thailand Stock Exchange (Thin Line) and Market Return (Thick Line) during 2002-2019 C.E.	96
Figure 5.5 Impulse Response Function of Return of Stock in the Construction Sector to Cholesky One S.D. Shock to Net Investment from Proprietary Trader	107
Figure 5.6 Impulse Response Function of Return of Stock in Insurance Sector to Cholesky One S.D. Shock to Net Investment from Proprietary Trader	108
Figure 5.7 Impulse Response Function of Return of Stock in Tour & Leisure Sector to Cholesky One S.D. Shock to Net Investment from Proprietary Trader	108
Figure 5.8 Impulse Response Function of Net Investment from Retail Investor to Cholesky One S.D. Shock to Return of Stock in Home & Office Product Sector	124

# CHAPTER 1

## INTRODUCTION

### 1.1 Background and Importance of the Issue

Assets allocation to maximize portfolio return and risk minimization is an important strategy in portfolio management where various investment alternatives are available such as bonds, stocks, commodities, foreign exchange and cryptocurrencies. In financial literature, portfolio diversification with different stocks is a proven method to reduce non-systematic risk. However, the market environment influences the systematic risk, and it changes over time. Different business cycle stages associate with risk (volatility of return) and return of equities in different underlying industries. The business cycle progresses through a set, chronological series of events, and understanding of the characteristics of various asset classes can identify points in the business cycle when they traditionally do well (Pring, 1992).

Stock returns can respond differently to economic factors depending on the stage of the economy (DeStefano, 2004). Therefore, studying the impact of macroeconomic factors on sectoral stock returns and sectoral stock returns along the different stages of the business cycle will provide insights into how the macroeconomic environment impact sectoral stock returns. Many literatures studied the linkage of macroeconomic variables to stock market performance at both the market level and sector levels. In principle, different stock sectors have a different response to macroeconomic shocks depending on market conditions and industrial characteristics.

It is well known that stock returns are related to the business cycle or output variables (Fama & French, 1989 as cited in Law & Ibrahim, 2014, p.188). Output variables that can be measured through industrial production variables relate with expected future earning of firms and imply that its stock price is positively related to the manufacturing production index.

Consumer price index can drive a positive relationship with stock returns as a higher consumer price index may enable the business to generate more revenue, which can boost stock prices (Law & Ibrahim, 2014). However the continuous rise in the consumer price index indicates higher inflation which may trigger the anticipation of future interest rates and negative expectations towards the stock market. There was also some argument that increasing inflation rate reduces real value of money hence reducing expected cash inflow from an asset so should negatively affect stock prices.

The exchange rate is quite complex as it can impact business in different ways depending on industrial characteristics. Domestic currency depreciation makes export goods and services more competitive in the global market and the increase in firm's earning revenue leads to an increase in the stock price. On the other hand, domestic currency appreciation decreases production costs in the industries which rely on importation materials (inputs) or foreign capitals; therefore, domestic currency appreciation may associate with profit improvement of firms and their stock prices. Besides, the exchange rate can motivate or demotivates foreign investment as well.

Monetary policy of the central bank manipulating through interest rate mechanism and money supply can impact the stock market at both market and sector levels. Interest rate is a cost of capital in operating business. An increase in interest rate can impact anticipation of future earnings decline and lower interest rate associate with the expectation of better earning in the future. Changes in interest rates also affect money flow and reallocation between different asset classes. Decreasing interest rate encourages investors to shift investment towards the stock market. Therefore, the interest rate is expected to have a negative (inverse) relationship with the stock price. However, rising interest rates may attract foreign fund flow to the stock market which impacts stock price positively. Money supply, in principle, should have a positive relationship with stock price as increase money supply lead to increase fund flow to the stock market.

In the short-run, an efficient market incorporates new information quickly and completely (Kuwornu & Owusu-Nantwi, 2011). Many literatures mentioned that stock market returns reflect investors' expectations on future industrial performance and corporate earnings which theoretically vary among the different macroeconomic conditions and different business cycle stages

The first part of this research work will prove the methodology of defining stages of business cycle that can be applicable for further study in this area. The analysis of sectoral stock returns over the different stages of the business cycle using modified CAPM model with interaction terms of business cycles stage dummies to differentiate market risk premium in different stages of the business cycle. This method will provide beta values of different stock sectors in each stage of business cycle which further be used to compare Treynor's ratio to provides recommendations of sectoral stock allocation along the different stages of business cycle which is finally proven by portfolio simulation to reflects real investment situation.

The second part of this study will explore the impact of key macroeconomic factors, including business sentiment index in the different stages of the business cycle on sectoral stock returns using the Multifactor Arbitrage Pricing Theory (APT) model for the analysis.

A theoretical framework to study the association between macroeconomic factors and stock returns in the literature consists of the Dividend Discount Model (DDM), Capital Asset Pricing Model (CAPM), and Arbitrage Pricing Theory (APT) framework.

In the DDC model, the current stock price is equal to the present value of all future cash flows denoted as:

$$P_t = \sum_{i=1}^t \frac{CF_t}{(r-g)^t}$$

where  $P_t$  is the current stock price,  $CF_t$  is the expected cash flows,  $r$  is the required rate of return, and  $g$  is the growth rate.

CAPM is the foundation concept of relationship between risk and return in asset pricing implying that its level of risk determines different level of stock return. For two equities with the same risk level, their expected returns should theoretically be the same. In the CAPM equation, Expected Return of stock  $i$  or  $E(R_i)$  is determined by a risk premium over the risk-free asset, which can be written as:

$$E(R_i) - R_f = \beta * E(R_m - R_f)$$

where  $R_f$  is the rate of a risk-free asset,  $R_m$  is market return, and  $\beta$  coefficient is a systematic risk of stock  $i$  in responses with changes in the market.

The APT framework developed as an alternative to CAPM with the objective to enable multiple macroeconomic risk factors into a structure. In the APT framework, capital asset pricing is under the assumption that in equilibrium prices offer no arbitrage opportunities so expected returns on assets are linearly related to factor loadings. (Huberman & Wang, 2005) The APT equation can be introduced as:

$$E(r_i) - r_f = \beta_{i1}RF_1 + \beta_{i2}RF_2 + \beta_{i3}RF_3 + \dots + \beta_{ik}RF_k$$

where  $\beta_{ik}$  is the sensitivity of return of stock  $i$  to risk factor  $k$  ( $RF_k$ ) and  $k$  is the number of factor loadings.

Many studies applied Arbitrage Pricing Theory (APT) framework which enables the evaluation of macroeconomic factors impact on stock returns under the assumption that macroeconomic factors impact future cash flows and future earnings of stocks therefore macroeconomic variables that possibly impact industry's performance are selected into APT framework model. N.-F. Chen, Roll, and Ross (1986) suggested some macroeconomic factors that should affect systematic risk of stock market returns: industrial production, expected and unexpected inflation, spread between long and short interest rates and spread between high- and low-grade bonds.

Fund flow is also another component in the stock market. Increasing demand for stock purchase from foreign and domestic equity funds can push the stock price higher (Ndei, Muchina, & Waweru, 2019) and investor sentiment effects across industries are not similar (Dash & Mahakud, 2013). Some studies also documented that various investment institutions have different trading behaviors (Guercio, 1996; Cohen, 1999; Dennis & Strikland, 2002; Barber, Lee, Liu, & Odean, 2005 as cited in Boyer & Zheng, 2009, p.3). Besides, Fund flow to the stock market may be differ across stages of the business cycle as the prosperity stage may attract fund flow to the stock market but possibly end upon the expectation of a decline in future earning at the late expansion stage where inflation and interest rates are progressively rising. On the contrary, the depression

stage discourages investors according to negative output growth lead to company earnings decline.

The last part of this study will be an analysis of the effect of fund flow from different types of investors to sectoral stock returns in different stages of the business cycle and vice versa as there might be bidirectional effects (increasing in sectoral stock return attracts investors and increasing demand from investors pushing stock price higher lead to increasing in return from equity). This study will investigate fund flow from different types of investors and return on sectoral stock market investment using Vector Autoregression (VAR), Block Exogeneity Test, and Impulse Response Analysis.

## **1.2 Contributions of this Research Work**

1) This study provides the suggestive methodology of how to define the stages of the business cycle in practice by using real GDP growth (YoY, seasonally adjusted data) and steady zero-growth line to divide positive and negative growth and use local maxima and local minima between steady zero-growth line crossing points to define peak and trough. This study also proved its applicability on the study of sectoral stock returns along different stages of the business cycle using modified CAPM model with business cycle stage dummies interacting with market risk premium which represents different systematic risk level in the different stages of the business cycle.

2) This study provides investment recommendation on the strategic reallocation of equities among different stock sectors in the different business cycle stages. The investment recommendations are based on comparing Treynor's ratio among stock sectors in the different stages of business cycle according to the fact that sectoral stock returns and their beta values vary across different stages of business cycle. The beta values of stock sectors can be obtained from modified CAPM model with business cycle stage dummies interacting with market risk premium representing different systematic risk levels in the different stages of the business cycle.

3) This study also proves investment recommendation strategy by using portfolio simulation, which reallocates investment in suggested stock sectors in each stage of the business cycle together with the incorporation of Markowitz Portfolio Optimization strategy to suggest the optimum ratio of each stock sector to invest at each stage of the

business cycle. This study approaches broader categories than the literature including 28 stock sectors in The Stock Exchange of Thailand with 18 years of monthly data in the 2002-2019 period.

4) This research work provides insight into how Expected Business Sentiment Index (BSIe) varies across different stages of the business cycle and explore the impact of Expected Business Sentiment Index in each stage of the business cycle on sectoral stock returns using Multifactor APT Model incorporating key macroeconomic factors (real GDP growth, changes in Manufacturing Production Index, Consumer Price Index, Interest Rate, Real Effective Exchange Rate and Broad Money).

5) This study explores the relationship between sectoral stock returns in the different stages of the business cycle and net investment from different types of investors in The Stock Exchange of Thailand.

In summary, this study provides insights from comprehensive analysis on the influence of macroeconomic environment (focusing on stages of business cycle) on sectoral stock returns and investment recommendations proven by portfolio simulation analysis and understanding the context of fund flow to the stock market.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Literature Review about Business Cycle and Impact of Business Cycles on Sectoral Stock Returns

Theoretically, the business cycle is defined by a change in a country's economic activity during a period that consists of two directions: growth or expansion and decline and contraction. The Gross Domestic Product (GDP) is a good measure of economic activity and is commonly used to determine the business cycle. The fluctuation of the business cycle is a result of fluctuation in aggregate economic activity of the country. Duration of the business cycle varies from more than one year to 10-12 years (Škare & Tomić, 2015). The famous definition of the business cycle includes identifying the aggregate economic activity and the existence of synchronization among different variables during certain phases of the business cycle (Burns & Mitchells, 1946 as cited in Diebold & Rudebusch, 1994). Škare and Stjepanović (2016) described the business cycle or economic cycle as a change in the economic activity during a particular period where real gross domestic product (GDP) is a common way of measuring and determining the business cycle. Škare and Stjepanović (2016) also mentioned that measuring business cycle is to locate the turning point, and one of the most practical solutions is that the peaks are local maxima in the time series and consider that GDP is a good measure of economic activity.

Most of the literature use Gross Domestic Product (GDP) or Manufacturing production Index (MPI) as a proxy of aggregated economic activities measurement (Alqaralleh, 2019; Antolin-Diaz, Drechsel, & Petrella, 2017; Kim, Morley, & Piger, 2005; Neftci, 1984; Sarantis, 2001). The Gross Domestic Product (GDP) is a good measure of economic activity and is commonly used to determine the business cycle. The fluctuation of the business cycle is a result of fluctuation in aggregate economic

activity of the country. The duration of the business cycle varies from more than one year to over ten years (Škare & Tomić, 2015).

In addition to GDP and MPI, the composite economic index such as Coincident Economic Index (CEI) can measure fluctuations and turning points of economic activity growth rates. CEI also has expansion and contraction swings according to changes in economic activity. Ideally, it is possible that the Coincident Economic Index (CEI) can also be used for business cycle assessment. Bilan, Gavurova, Stanislav, and Tkacova (2017) had an extensive review of using Coincident Composite Indicator (CCI) for monitoring the cyclical movement of the economy and studied its applicability for Slovakia, which showed its capability to monitor the Slovak economic cycle over time. Composite Leading Indicator (CLI) was also proposed for monitoring and predicting business cycle by Andrea, Beata, and Marcel (2017) and found that generated CLI can predict the German economy cycle for two quarters ahead with a cross correlation value of 0.867.

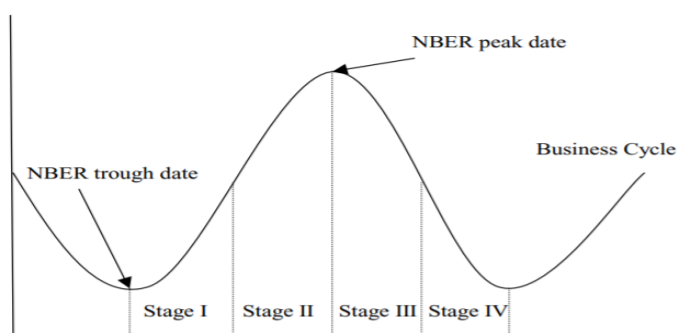
Škare and Stjepanović (2016) also reviewed the business cycle identification methods and key determinants of business cycles. From this review, the idea of technology shock as the main driver of business cycles remains controversial. Prescott (1986, as cited in Škare and Stjepanović, 2016) calculates Total Factor Productivity (TFP) and use it as a measurement for exogenous technological shocks. However, TFP introduced by Prescott (1986) is not pure exogenous shock as some studies showed significant differences between TFP and actual technology shocks. Fisher (2003, as cited in Škare & Stjepanović, 2016) mentioned that technological shocks affect less than 10 percent of the output variation. Later studies introduce other variables instead of technological progress as the factor contributing to changes in the business cycle through fluctuation and volatility of output changes. These variables include oil shock, fiscal shock, and monetary policy shock (Skare, 2015).

Some research works observed oil shock instead of technology progress due to its volatility but energy costs represent too small share to significantly impact economic activity (Škare & Stjepanović, 2016). Some researchers observed the effect of fiscal shocks, but according to the lack of cyclical variation in taxes and government spending; therefore, cyclical movement in fiscal changes is relatively small to be a primary cause of business fluctuation. Škare and Stjepanović (2016) also mentioned some

studies on the impact of monetary shocks. RBC monetary models' new generation can generate impulse response functions to monetary shocks similarly to VAR technique. Škare and Stjepanović (2016) mentioned that technological shocks are still significant, but financial forces play an increasingly important role in creating an economic response to technology shocks.

Most of the studies in the area of sectoral stock return and business cycle using U.S. market data refer to The National Bureau of Economic Research (NBER) in defining business cycle stages. The National Bureau of Economic Research (NBER) identifies business cycle based on changes in the general level of production by two-step process starting from identifying cyclical peaks and troughs in the observed economic variables and then determining whether these changes are common in all observed data. NBER publishes periods of recess and expansion by using peak and trough dates where expansion begins at trough date and end at peak date and period of recession begins at peak date and end at trough date (DeStefano, 2004). To identify the stages of the business cycle, it is important to detect a cycle then identify the turning points to measure repeatable cycle features. The practical approach uses peaks or local maxima and troughs or local minima of time series  $y_t$ .

DeStefano (2004, p. 531) divided the business cycle into 4 stages using NBER defined peak date and trough date, then further divided expansion into early and late expansion and divided recession into early and late recession.



**Figure 2.1** Four stages of business cycles defined by DeStefano (2014)

**Source:** DeStefano, 2004.

The famous model of business cycle assessment considers both trend component and cyclical component in its approach.

$$Y_t = T_t + C_t$$

$Y_t$  is output time series,  $T_t$  represents trend component, and  $C_t$  represents a cyclical component

Stangl, Jacobsen, and Visaltanachoti (2008) studied sector rotation strategy over different business cycles stages to maximize annual performance outperforming the market using U.S. stock market data. The business cycle was determined by peak and trough dates from NBER, which enable to separate expansion and recession phases then Stangl et al. (2008, p. 10) defined business cycle stages into five referencing Stovall (1996) which were early expansion (stage 1), middle expansion (stage 2), late expansion (stage 3), early recession (stage 4) and late recession (stage 5). Industry performance per business cycle stage was analyzed with the following equation:

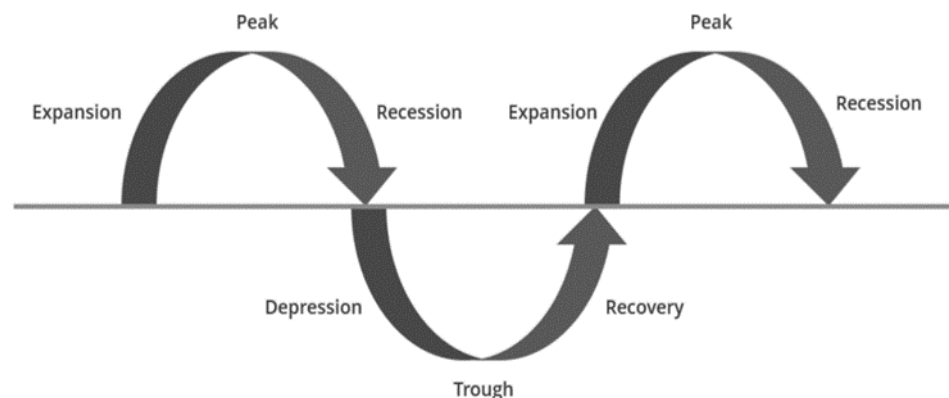
$$r_{i,t} = \sum_{s=1}^5 \mu_{i,s} D_{s,t} + \varepsilon_t$$

$r_{i,t}$  is the return of stock in the industry  $i$  at time  $t$ ,  $D_s$  is a dummy variable of business stages ( $s = 1-5$ ), and  $\mu_{i,s}$  is coefficient of industry  $i$  returns for respective business stage  $s^{\text{th}}$ . However, the results showed that average performance comes from the late expansion stage. However, none of the differences is significant therefore, the authors estimated excess market industry performance across business cycle and regression coefficient  $\alpha_{i,s}$  is market outperformance for the industry  $i$  during business cycle stage  $s$  and report Jensen's alpha which is used for each stage of business cycle under modified market model as follow:

$$r_{i,t} - r_{f,t} = \sum_{s=1}^5 \alpha_{J,i,s} D_{s,t} + \beta_{1,i,s} (r_{m,t} - r_{f,t}) D_{s,t} + \varepsilon_t$$

where  $r_i - r_f$  is excess industry stock return over one-month Treasury bill,  $D_s$  is one of five business cycle dummy variables, and  $r_{mkt} - r_f$  represents market risk premium. Unfortunately, regardless of what measure being used, there was very little evidence of significant industry outperformance in business cycle stages when they should perform according to conventional wisdom. Only 5 industries with significant outperformance in the stage where they should perform. The authors also implemented sector rotation by one month, two months, and three months before NBER business turning points.

Practically, the business cycles consist of four phases, which are recovery, expansion, recession, and depression. This method has been selected to use in this study due to its simplified process, ability to apply in a standard way among different studies and applicability in analysis of sectoral stock return in an empirical setting.



**Figure 2.2** Traditional Four Phases of Business Cycles

**Source:** Corporate Finance Institute (CFI), n.d.

Some studies in the literature attempted to explore the influence of the business cycle on the stock market and sectoral stock return.

DeStefano (2004, pp. 527-547) investigated sectoral stock returns in the U.S. stock market and business cycle using dummy variables for each of the four business cycle stages (early expansion, late expansion, early recession, and late recession) and dividend discount model (DDM) and found that stock returns decrease throughout the economic expansion and become negative during the first half of recession. The largest stock returns were found in the late recession stage, which suggested possible expected

earnings effect where the investors expect future increasing earnings in the late recession stage; similarly, to the late expansion stage, investors expect a future decline in earnings, therefore, stock returns slow down. These results support Fama and French (1989, as cited in DeStefano, 2004) that expected returns move inversely with business conditions.

Defrizal, Wirasasmita, and Nidar (2015) studied the determinant factors of sectoral stock return in bullish and bearish conditions at the Indonesian capital market by using Markov regime-switching models to identify bullish and bearish conditions based on Indonesian market stock returns. The two-state (bullish and bearish) Markov Switching Model is as follows:

$$r_t = \mu_1 S_t + \mu_2 (1 - S_t) + [\sigma_1 S_t + \sigma_2 (1 - S_t)] \varepsilon_t$$

Where

$r_t$  = stock market return at time t calculated from the logarithmic change of market index return using formula  $r_t = 100 * \ln(Y_{it}/Y_{it-1})$

$S_t$  = i, is variable market conditions,  $i = 1; 2$

$S_t = 1$ , bullish condition

$S_t = 2$ , bearish condition

$\varepsilon_t$  = error term

$S_t$  is assumed and governed by first-order Markov chain process with transition probabilities given  $p_{11}$  indicates the possibility of starting in a bullish condition and  $p_{22}$  is the probability of a bearish condition considering that previous condition is also bearish

Defrizal et al. (2015) estimate the influence of stock market return, interest rate, and exchange rate to sectoral stock return either bullish or bearish condition

Bullish condition:  $[r_{it}]_{\text{bullish}} = \beta_{i,0} + \beta_{i,1}MR_t + \beta_{i,2}IR_t + \beta_{i,3}ER_t + \varepsilon_t$

Bearish condition:  $[r_{it}]_{\text{bearish}} = \alpha_{i,0} + \alpha_{i,1}MR_t + \alpha_{i,2}IR_t + \alpha_{i,3}ER_t + \varepsilon_t$

Where

- $r_t$  = sectoral stocks return  
 $MR$  = stock market return  
 $IR$  = Interest rate  
 $ER$  = Exchange rates  
 Sector 1 = Finance Sector  
 Sector 2 = Trade and service sector

A similar approach also mentioned in the literature examined the effect of bull and bear market conditions on interested variables.

Song and Qian (2017) used 3 methodologies to investigate the relationship between sectoral stock returns over 10 sectors of the U.S. stock market (by Dow Jones Sectoral Indexes system) and the U.S. business cycle, which consists of:

- 1) correlation coefficients to represent the relationship between the business cycle and stock returns
- 2) DCC GARCH to estimate time-varying (dynamic) correlation coefficients between each pair of the business cycle and sectoral stock returns
- 3) Use regression analysis of sectoral stock returns on dummy variables of 4 stages of the business cycle. In this part, Song and Qian (2017) use GDP to represent the business cycle and dummy variables of each stage of business cycle

To evaluate sectoral stock return behavior over the business cycles, Song and Qian (2017: 84) using the similar method with DeStefano (2014) in identifying the stages in business cycle. Song and Qian (2017) also use NBER defined peak and trough dates, then using the middle point of the time span divided expansion into recovery and prosperity and divided contraction into recession and depression. After defining stages of the business cycles, Song and Qian (2017) used four dummy variables corresponding to each stage of business cycle and set up a regression model to investigate the varying performance of sectoral stock returns over business cycles as follows:

$$SR_{i,t} = c_{11}D_1 + c_{12}D_2 + c_{13}D_3 + c_{14}D_4 + \varepsilon_{i,t}$$

where D1 to D4 are dummy variables for the four stages and  $c_i$  are their relevant parameters. The results found positive and significant parameters were detected with finance, energy, industrial and consumer goods (ranked in order of magnitude of dummy variable coefficient respectively) in recovery stage. In prosperity stage, positive and significant parameters were detected with energy, basic materials, industrials and technology (ranked in the magnitude of the dummy variable coefficient respectively). In the recession stage, negative and significant parameters were detected with telecommunication and utilities (ranked in order of magnitude dummy variable coefficient respectively). In the depression stage, negative and significant parameters were detected with finance, industrials, energy, utility, and U.S. whole market (ranked in order of magnitude of dummy variable coefficient respectively). Song and Qian (2017) concluded that it was apparent that the business cycle and sectoral stock returns have a close relationship.

Maniam and Lee (2018) examined the market liberalization policy in Malaysia on the sectoral stock market using Dynamic Fixed Effect (DFE) method. According to stock market liberalization in Malaysia in December 1988, Maniam and Lee (2018) aim to analyze the efficiency and effectiveness of stock market liberalization policy on market performance using stock return in finance sector and service sector. The empirical model was specified as follows:

$$R_{it} = \alpha_0 + \beta_1 \text{Lib}_{it} + \beta_2 \log \text{Size}_{it} + \beta_3 \log \text{Vol}_{it} + \beta_4 \log \text{Liq}_{it} + \mu_{it}$$

where  $R_{it}$  is stock market returns at time  $t$ ,  $\text{Lib}_{it}$  is dummy variable for stock market liberalization (=1 from a week of market liberalization announcement to week 9 and =0 otherwise),  $\text{Size}_{it}$  is stock market size,  $\text{Vol}_{it}$  is stock market volatility, and  $\text{Liq}_{it}$  is stock market liquidity. The assumption is expected positive sign on the coefficient of liberalization dummy or  $\beta_1$ . The results revealed that liberalization policy has a positive significant impact on the service sector but not significant on finance stock sector return. According to stock market characteristics in the studied model, the only the stock market size has a significant positive relationship with a stock return in both financial and service sectors.

## 2.2 Literature Review about Macroeconomic Factors and Sectoral Stock Return

Many researchers attempt to find out macroeconomic factors influencing sectoral stock returns. The literature in this area had explored various macroeconomic factors and their influence on the market and sectoral stock returns.

Chen, Roll, and Ross (1986, as cited in Chen & Jin, 2004) and Amtiran, Indiatuti, Nidar, and Masyita (2017) found that most of the studied macroeconomic variables (inflation, interest rate, long-term government debt, industrial production index, consumption, oil price, low-grade bonds, equally with equities and value-weighted equities) have a significant influence on stock returns.

Wei and Wong (1992) found that expected inflation positively associates with sectoral stock returns.

Flannery and Protopapadakis (2002) found that equity returns are affected by inflation, but conditional volatility of stock returns is affected by employment, trade balance, and housing starts.

Ewing, Forbes, and Payne (2003) explored how different sectors in the U.S. stock market respond to real output shock, monetary policy and risk premium and found similar changes pattern in the U.S. stock sector indices. The difference in effect mainly in terms of initial impact size and degree of overshooting. Shock in monetary policy has the largest effect on financial and capital goods, short but dramatic cyclical volatility in utility sectors.

Chen and Jin (2004) studied a robust test on the multifactor pricing model and found that excess return rate can be explained by previously expected inflation, unexpected premium in prior periods, and changes in the interest rate.

Avouyi-Dovi and Matheron (2005) studied co-movement between stock market indices, real activity and interest rate, over the business cycle and found no significant relationship between business cycle related components of excess market return and money market rates.

Berdot, Goyeau, and Leonard (2006) incorporated exchange rate in the analysis of sectoral stock returns in French investigating the effect of exchange rate on French

stock returns by calculation of calculating covariations between U.S. business cycle and sectoral stock returns.

Kutan and Muradoglu (n.d.) investigated the impact of IMF-related news on stock returns at sector level using daily returns of stock sectors in Thailand, Indonesia, and South Korea during the Asian Financial Crisis (January 1997 to July 1998) to perform event-study and time-varying GARCH estimation to figure out dynamic adjustment of stock prices to IMF news. Kutan and Muradoglu (n.d.) found that for Thailand, in response to the announcement called on IMF help, Bank and Finance sectors react positively while Basic Materials and Non-Cyclical Services react negatively. Cyclical Services and General Industries do not have a significant reaction to the news. For Indonesia, reaction is asymmetric in all cases supporting Thailand's results in overall, negative news hurt Cyclical Services and Finance Sector most. For South Korea, the IMF rescue package was associated with a positive response in Basic Material, Finance, and Non-Cyclical Services Sectors.

Gay Jr (2008) studied time-series relationship between stock market returns in four emerging countries (Brazil, Russia, India, and China) and macroeconomic variables including exchange rate and oil price during March 1993 to June 2006 period (monthly data) to see whether macroeconomic factors significantly explain stock market returns using Box-Jenkins ARIMA model to describe the relationship between stock market price as dependent variable and exchange rate and oil price as independent variables. MA(1), MA(3), MA(6), and MA(12) were used in this study. This study's analysis did not show a significant relationship between stock market returns and two studied macroeconomic factors which were exchange rate and oil price. The relationship between exchange rates and stock index prices were found in Brazil, India, and China but not for Russia until MA(12) level. The relationship between stock market index and oil prices was not consistent (alternating between positive and negative) with different timeframes for all BRIC countries except for India at MA(1). However, this study did not include other macroeconomic variables such as inflation, production, interest rate, trade balance, etc.

Meric, Ratner, and Meric (2008) studied co-movement of sectoral stock indices and conditioning benchmark of a bull and bear market using principal analysis and Granger causality test. The study found that investing in different countries (global

diversification) is better than investing in different sectors within the same country (sectoral diversification) in bull market. However, sectoral diversification is much better in a bear market.

Tursoy, Gunsul, and Rjoub (2008) conducted a study on macroeconomic factors, the APT and Istanbul stock market including 13 various macroeconomic variables which are Money Supply (M2), industrial production, crude oil price, consumer price index (CPI), import, export, gold price, exchange rate, interest rate, GDP, foreign reserve, unemployment rate, and market pressure index which constructed by authors. Finding was significant APT regression coefficient between basic metal industry, wood production, fabric, transportation, and communication. The gold price was significant with manufacturing of non-metallic mineral products.

Benaković and Posedel (2010) investigated APT model on stock returns from 14 sectors of the Croatian capital market period from January 2004 to October 2009 with macroeconomic variables including inflation, industrial production, interest rates, market index, and oil prices. The econometric model was given by:

$$R_{i,t} = \alpha_i + \beta_{i,1}F_{1,t} + \beta_{i,2}F_{2,t} + \dots + \beta_{i,k}F_{k,t} + \varepsilon_{i,t}$$

where  $R_{i,t}$  is the return on stock  $i$  at time  $t$ ,  $F_n$  represents economic factors, and  $\beta_i$  represents the sensitivity of stock  $i$  to  $k$ th macroeconomic factors. In an empirical study, (Benaković & Posedel, 2010) used the following equation:

$$R_{i,t} = \alpha_i + \beta_I I_t + \beta_{AIP} AIP_t + \beta_{IR} IR_t + \beta_{MI} MI_t + \beta_O O_t + \varepsilon_{i,t}$$

$i$  = annual change in CPI, AIP = annual change in industrial production volume, IR = 3-month ZIBOR (interest rate), MI = monthly change in CROBEX stock market index. and O = annual change in oil prices.

The largest statistical significance estimated parameters monthly change of CROBEX stock market index for all stock sectors. Interest rate showed significant positive regression coefficients, changes in CPI had negative sign in regression coefficients, oil prices had non-significant small value positive sign of regression coefficients, and

industrial production had no statistically significant regression coefficients with stock sector returns.

Arouri (2011) tested the effect of crude oil price fluctuations on European stock indices at sectoral level and national stock index level. Results suggested that choosing stocks across sectors is more efficient than within sectors confirming the concept of portfolio diversification at sectoral level.

Andersson, D'Agostino, de Bondt, and Roma (2011) examined the inverse relationship between stock market valuation and macroeconomic condition that whether stock market and stock prices valuation metrics (stock price returns, dividend yields, and Price/Earnings ratios) can help prediction of future (4 quarters ahead) real GDP, private consumption and investment or not by using U.S. and Euro area data during period 1985 – 2009 under the assumption that introduction of the monetary union has helped to sharpen the linkages between stock market indicators and aggregate economic activities. Andersson et al. (2011) found that sectoral stock prices are better at predicting cyclical investment rather than consumption and the predictive content of sectoral stock market indicators is potentially strong particularly for the financial sector.

Balli and Balli (2011) explored the dependency of stock sectors on the whole market index in the Euro area and found that returns from stocks in financial sector is affected by the Euro stock index but some sectors such as basic industrial materials, food and beverage, oil and gas are less dependent on whole market index.

Kuwornu and Owusu-Nantwi (2011) examined the impact of macroeconomic variables on stock market returns using the APT framework from monthly data of Ghana stock market during the period January 1992 to December 2008. they found a statistically significant relationship between stock market returns and consumer price index (positive significant effect), exchange rate (negative significant effect) and treasury bill rate (negative significant effect). Crude oil prices did not show any significant effect on stock returns.

Singh, Mehta, and Varsha (2011) examined the causal relationship between stock market return in Taiwan and macroeconomic variable including employment rate, exchange rate, GDP, inflation, and money supply using regression analysis and found that employment rate, inflation, and money supply have a negative relationship

with a stock return while GDP and exchange rate have a positive relationship with stock returns.

Zhu (2012) studied the effects of nine macroeconomic factors (inflation, money supply M2, exchange rate, industrial production, bond, export, import, foreign reserve, and unemployment rate) to monthly observations of stock prices of 10 companies from energy sector in Shanghai Stock Market during period January 2005 to December 2011 using multifactor APT model:

$$R_i = b_{i0} + b_{i1}F_{1i} + b_{i2}F_{2i} + b_{i3}F_{3i} + \dots + b_{i9}F_{9i} + \varepsilon_i$$

$R_i$  is the return on portfolio  $i$ ,  $b_i$  is the coefficient of change in portfolio return in risk factors and,  $F_i$  represents macroeconomic variables. The conclusion was exchange rate, exports, foreign reserve, and unemployment rate have a statistically significant impact on stock return in the energy sector on the Shanghai stock exchange.

Gencer and Demiralay (2013) also investigated the relationship between crude oil prices and sectoral returns of 18 sub-indices from Borsa Istanbul stock market using monthly data in period the between January 2002 to April 2013. They found a long-run equilibrium relation and a uni-directional causality from oil prices to chemical-petroleum-plastic sub-index, but for other sub-indices, the empirical results suggest no long-run equilibrium relation. Gencer et al. (2013) also concluded that there was a cointegrating relationship between oil prices and stocks in sector banks, food & beverage, chemical, petroleum, plastic, and industrials.

Alam and Rashid (2014) analyzed the relationship between macroeconomic factors and stock returns in Karachi stock market in Pakistan using Johnson cointegration test to see the long-term relationship between the stock market and 5 macroeconomic factors (exchange rate, inflation rate, industrial production index, money supply M2 and interest rate) in the regression model.

$$KSE_{it} = \alpha + \beta_1 EXR_{it} + \beta_2 INF_{it} + \beta_3 IPI_{it} + \beta_4 M2_{it} + \beta_5 IR_{it} + \mu_t$$

Where KSE is the market return of KSE-100. The results showed that industrial production had a positive relationship with stock market returns while interest rate,

exchange rate, money supply and inflation were negatively associated with stock returns.

Law and Ibrahim (2014) examined the responses of sectoral stock returns in 5 sectors (Industrial, Finance, Property, Tin, and Plantation) of Malaysian Stock Market to shocks in 5 macroeconomic indicators (Money Supply M3, Interest rate, Consumer Price Index, Exchange rate and Industrial Production). Law and Ibrahim (2014) used standard deviation to measure stock return volatility and examined correlations between sectoral stock returns and macroeconomic variables. Law and Ibrahim (2014) used six-variable Vector Autoregressive (VAR) from which Impulse-Response Functions (IRFs) can be stimulated to evaluate impacts of macroeconomic shocks on sectoral stock returns.

$$\begin{bmatrix} MACRO_t \\ IND_t \\ FIN_t \\ PRO_t \\ TIN_t \\ PLT_t \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \\ \alpha_4 \\ \alpha_5 \\ \alpha_6 \end{bmatrix} + \begin{bmatrix} \beta_{1,1}(L) & \kappa & \beta_{1,6}(L) \\ M & \Lambda & \Lambda \\ M & \Lambda & \Lambda \\ M & \Lambda & \Lambda \\ \beta_{6,1}(L) & \Lambda & \beta_{6,6}(L) \end{bmatrix} \begin{bmatrix} MACRO_t \\ IND_t \\ FIN_t \\ PRO_t \\ TIN_t \\ PLT_t \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \\ \varepsilon_5 \\ \varepsilon_6 \end{bmatrix}$$

**Figure 2.3** Vector Autoregressive (VAR) model to evaluate the impacts of macroeconomic shocks on sectoral stock returns

**Source:** Law and Ibrahim, 2014.

Where MACRO denotes a macroeconomic variable of interest (which are industrial production, exchange rate, money supply, interest rate, and consumer price index); IND is the industrial index; FIN is finance index; PRO is property index; TIN is tin index, PLT is plantation index, and  $\beta(L)$  is a matrix of polynomial in the lag operator L.

The empirical findings are (1) temporal responses of sectoral stock returns to macroeconomic shocks are relatively identical, but their initial responses are slightly different. (2) Monetary policy and exchange rate shocks have the largest effect on the financial sector (3) Output and exchange rate shocks have the most influences on the property sector (4) monetary shocks (interest rate, exchange rate, and money supply shocks) have more influence on sectoral stock returns than output market shocks or

consumer price shock. All stock sector indices respond positively and statistically significant to a shock in broad money M3, which sectoral stock prices increase in six periods following the shock. The financial sector has the most significant responses, but the industrial sector has the lowest response. Finding suggests that monetary expansion leads to increase in sectoral stock returns. Also, sectoral stock returns respond more with monetary indicators (interest rate, exchange rate, and money supply) and less response with output indicators (industrial production and consumer price index).

Defrizal et al. (2015) studied the determinant factors (market returns, interest rate, and exchange rate) of sectoral stock return in bullish and bearish condition in the Indonesian stock market. They found that (1) stock market return positively affect sectoral stock returns in all 2 sectors in the study which are finance sector and trade and services sector in either bullish or bearish condition (2) on bullish conditions, the effect of interest rates are not significant to stock return in both finance and trade and service sector, but in bearish conditions, sectoral stock return in trade and service sector is significantly and negatively affected by interest rate. (3) on the bullish condition, the exchange rates did not significantly influence on the stock return of both finance and trade and service sector in the contrary negative and significant impact of exchange rates against the stock return of both finance sector and trade and service sector in bearish condition (4) bearish period shows a higher standard deviation of the variables than the bullish period which means that all variables have higher volatility in the bearish period.

Amtiran et al. (2017) used the APT model to study the differences in sensitivity of macroeconomic factors and stock returns of 80 companies listed on the Indonesia Stock Exchange during the period January 2007 to December 2014 using two stages of analysis. The first stage was time series regression between macroeconomic factors and stock returns for estimating the beta value of each macroeconomic factor then, the second stage was performing regression of cross-section between the beta value from the first stage with an average return of each stock. The APT model in this study was given as:

$$R_{it} = \alpha_0 + \beta_1 \text{GDP}_{it} + \beta_2 \text{INF}_{it} + \beta_3 \text{IR}_{it} + \beta_4 \text{EXRATE}_{it} + \varepsilon_{it}$$

Rit is stock return and macroeconomic variables included in this study were GDP, inflation rate, interest rate and exchange rate and beta is sensitivity of stock  $i$  to annual changes in macroeconomic variables. The first stage regression showed that most of the stock value were associated with significant positive beta for GDP, non-significant negative small beta value for inflation, both positive and negative beta value for interest rate and some stock had negative beta value for exchange rate. The second stage cross-sectional regression analysis showed that only interest rate and exchange rate have positive and significant correlations to stock returns.

Assagaf, Murwaningsari, Gunawan, and Mayangsari (2019) studied the effect of macroeconomic variables (including inflation rate, interest rate, money supply, and exchange rate) on stock return in Indonesia stock market during the period November 2016 to June 2018 (20 monthly observation data) using Arbitrage Pricing Theory (APT) framework as the following model.

$$YR_i = \beta_0 + \beta_1 X_1 INF_i + \beta_2 X_2 INT_i + \beta_3 X_3 MNS_i + \beta_4 X_4 EXC_i + e_i$$

and found that increase inflation takes a positive and significant effect on increase in stock returns, interest rate has a significant negative effect on stock returns, amount of money outstanding has positive and significant to stock returns, and exchange rate have a significant negative effect on stock return.

Celebi and Hönig (2019) investigated the impact of macroeconomic factors including Composite Leading Indicator (CLI) for Germany provided by the OECD, Business Confidence Index (BCI), and money supply on German stock index (DAX30) on a quarterly data basis (transform monthly data to quarterly data by using the end of quarter values) between period 1991 to 2018 with special exploration on the data around the financial and European sovereign debt crisis which defined as pre-crisis period (Q1 2001 – Q2 2007), crisis period (Q3 2007 – Q3 2012) and the post-crisis period (Q4 2012 – Q2 2018). Celebi and Hönig (2019) used OLS with Newey-West heteroscedasticity and autocorrelation consistent (HAC) standard errors to correct the bias of test statistics and measured the lagged impact of macroeconomic factors on the German stock index with a maximum of four lags. The OLS model also included lagged variables as follow:

$$r_t = \beta_0 + \beta_1 MF_{t-1} + \beta_2 MF_{t-2} + \dots + \beta_k MF_{t-k} + \varepsilon_t$$

where  $r_t$  represents stock return (DAX30 index), which is modeled by last  $k$  periods of macroeconomic factors (MF). The authors used Akaike information criterion to define the lag length of  $k$  in each model. They performed Wald test with the null hypothesis that  $\beta_1 + \beta_2 + \dots + \beta_k = 0$  to measure the joint impact of lagged macroeconomic factors and use Ir-test, which indicates significant joint impact with measurement of increasing goodness of fit by adding lagged factors to compare the explanatory power of the macroeconomic factors.

The results revealed a significant impact of lagged quarterly growth rates of CLI on DAX stock returns from both Wald test and Ir-test. BCI and GDP had first lagged quarter positive and second lagged quarter negative significant impact from t-test. Only CLI showed a significant impact on German stock returns in the pre-crisis period and CLI had the highest explanatory power compared with other macroeconomic factors. In the crisis period, two quarter lagged of CLI had the strongest impact. BCI had no impact on stock returns according to Wald test. CPI had a negative a significant impact on stock returns which the authors explained that higher inflation leads to increasing discount rates. None of the money supply (M1 M2 M3) had significant impact on stock returns in the pre-crisis period but in the crisis period, two quarter lagged of M1 had a positive impact on stock return in Germany while M2 and M3 revealed a negative impact. The positive impact of M1 is clearly implied by excess liquidity to the stock market from expansionary monetary policy during the crisis period, but the negative impact of M2 and M3 can only be explained by the components of longer-term deposits and less liquid assets.

### **2.3 Literature Review about Fund Flow to Stock Market and Sectoral Stock Return**

Some literature had mentioned about the significant association between equity fund flow and stock market returns. Equity Fund purchases will lead to a temporary increase in stock price, causing increase stock returns (Harris & Gurel, 1986 as cited in Ndei et al., 2019, p.23).

Zeckhauser (1994) studied mutual fund data during the period 1975-1987 in the U.S. stock market by using the model:

$$F_t = \beta_0 + \beta_1 F_{t-1} + \beta_2 B_{t-1} + \beta_3 E_{t-1} + e_t$$

$F_t$  is the rough investment flow into the U.S. stock market in month  $t$ ,  $B_{t-1}$  is total return on long-term high-grade U.S. corporate bonds in month  $t-1$  and  $E_{t-1}$  is total return on S&P 500 index in month  $t-1$ . The results had been concluded that the recent returns of the assets significantly influence investment flows. Mutual fund flows are more related to the ranking of performance rather than to absolute performance. Results also showed less variation of international purchases of U.S. equities and bonds.

Baker and Wurgler (2007) mentioned two investor sentiment approaches, which are the bottom-up approach to explain how investors under-react or over-react to past returns or fundamental elements of stocks and the top-down approach, which takes investor sentiment as an exogenous factor and focus on its effects on the stock market.

Boyer and Zheng (2009) analyzed the relationship between cash flows to the stock market by net equity purchase from broad investor groups and stock market returns using U.S. stock market data between period 1952-2004 and tested with first-order Vector Autoregressive model. Boyer and Zheng (2009) found a statistically significant relationship between stock market returns and investor groups' fund flow with positive feedback at a quarterly frequency. In addition, fund flows are highly autocorrelated within each investor group. Mutual Funds and Foreign Investors move together with stock market returns.

Kopsch and Song (2015) studied the relationship between mutual fund flows and stock market returns to determine whether the relationship follows the feedback-trader hypothesis (market returns affect fund flows), the price-pressure hypothesis (mutual fund flows affect market returns) or the information-response hypothesis (both mutual fund flows and market returns react to new information without any direct causal linkage between them) using Swedish quarterly data on mutual fund flows and market return data on OMX Stockholm 30 (OMXS30) from 1998 to 2013. The methodology tested was structural autoregressive model AR(1) to measure the relationship between lagged values of fund flows and determinants (including stock market return, T-bill,

expected inflation and outflow from interest funds) and Granger causality Wald test in order to determine the sequence of the relationship. The study found that the correlation coefficient of 0.39 confirms a co-movement of fund flows and stock market return. The results suggested that market return does not Granger-cause mutual fund flow, which implied that VAR estimates do not support the feedback-trader hypothesis. In addition, market return is not Granger-caused by flow, which against the price-pressure hypothesis. However, the market return had an impact on equity fund flows indirectly through the information-response mechanism. The overall results rejected both the feedback-trader hypothesis and the price-pressure hypothesis and only support for information-response hypothesis.

Kang and Suh (2015) discussed reverse spillover effects of fund flow. During period of financial turmoil in 2013-2014 there was reduction of portfolio fund flow from emerging market to advanced economies, but the influence of emerging markets on the global financial market increased during this period.

Babalos, Caporale, and Spagnolo (2019) studied the relationship between equity fund flows and stock market returns and the volatility spillovers from stock market returns to equity fund flows before and after the 2008-2009 global financial crisis using VAR-GARCH (1,1)-in-mean model with a BEKK representation. They found causality-in-mean from stock market returns to equity fund flows, which supports the feedback-trading hypothesis only in the post-September 2008 period and volatility spillovers from stock market return to equity fund flows both before and after the crisis. However, the relationship is not stable and weaker in the crisis period.

Ndei et al. (2019) explored the relationship between equity unit trust fund flows (purchases and sales) and stock market returns in Kenya during the period January 2010 – December 2017 using the Vector Autoregressive model, Granger causality and Impulse Response information. The results found that equity fund purchases have a predominantly positive relationship with the stock market return. In contrast, equity fund sales have negative relationship with stock market returns.

## **CHAPTER 3**

### **SECTORAL STOCK RETURN ALONG THE DIFFERENT STAGES OF BUSINESS CYCLE AND IMPLICATIONS FOR PORTFOLIO ALLOCATION STRATEGY**

#### **3.1 Scope of the study and data**

The study period in this research work is from January 2002 to December 2019, analyzing on a monthly data basis. According to the start analysis from January 2002, PTT Public Company Limited (leading energy company) has been privatized to public company on 1 October 2001 and PTT stock officially traded in The Stock Exchange of Thailand in December 2001. PTT has the highest market capitalization in The Stock Exchange of Thailand; therefore, PTT should be fully included in the analysis period. Studies in the literature were industrial-group level approach; therefore, this study aim for sectoral level exploration to provides additional empirical contribution.

Many studies in the past used the Dow Jones Sectoral Indexes system for categorization of sectors in the stock market, which divides into 10 sectors, which are consumer goods, financials, industrials, technology, utility, basic materials, consumer service, Health care, Oil & Gas, and Telecommunication. This study uses 28 sectors from The Stock Exchange of Thailand (SET), where the primarily analysis of sectoral stock returns in this study is based on Thailand stock market, which has never been studied on this subject.

The list of 28 stock sectors in The Stock Exchange of Thailand (SET) are as follows:

- 1) Agribusiness (.SETA, AGRI)
- 2) Automotive (.SETAU, AUTO)
- 3) Banking (.SETB, BANK)

- 4) Commerce (.SETC, COMM)
- 5) Construction Materials (.SETCO, CONMAT)
- 6) Construction Services (.SETCS, CONS)
- 7) Electrical Components (.SETEC, ETRON)
- 8) Energy and Utility (.SETEN, ENER)
- 9) Fashion (.SETFA, FASHION)
- 10) Finance & Securities (.SETF, FIN)
- 11) Food and Beverages (.SETFB, FOOD)
- 12) Healthcare Services (.SETHC, HELTH)
- 13) Home and Office Products (.SETHM, HOME)
- 14) Information and Communication Technology (.SETIC, ICT)
- 15) Industrial Materials and Machinery (.SETIM, IMM)
- 16) Insurance (.SETIN, INSUR)
- 17) Media and Publishing (.SETMP, MEDIA)
- 18) Mining (.SETMN, MINE)
- 19) Packaging (.SETPK, PKG)
- 20) Paper and Printing Materials (.SETPA, PAPER)
- 21) Personal Product and Pharmaceuticals (.SETPS, PERSON)
- 22) Petrochemicals and Chemicals (.SETPT, PETRO)
- 23) Property Fund (.SETP, PF&REITs)
- 24) Professional Services (.SETPF, PROF)
- 25) Property Development (.SETPR, PROP)
- 26) Steel (.SETST, STEEL)
- 27) Tour and Leisure (.SETTO, TOURISM)
- 28) Transportation and Logistics (.SETTP, TRANS)

The data are exported from Thomson Reuters Eikon Datastream in monthly frequency within the study period of 2 January 2002 to 29 December 2019, providing 215 observations after adjustments for time-series analysis. There are 4 sectors with incomplete data, which are Construction Services (data available from February 2014), Industrial Materials & Machinery (data available from August 2006), Property Fund (data available from April 2009), and Steel (data available from February 2014).

For sectors with incomplete data, the analysis has been made separately with its available data period.

The stock return is calculated by

$$r_{S_{i,t}} = [(r_{S_{i,t}} - r_{S_{i,t-1}}) / r_{S_{i,t-1}}] * 100$$

Where  $r_{S_{i,t}}$  represents Stock Return of sector  $i$  in period  $t$

$r_{S_{i,t-1}}$  represents Stock Return of sector  $i$  in one preceding period before period  $t$

The correlations between sectoral returns and market return are represented by correlation coefficients as shown in Table 3.1.

**Table 3.1** Correlation Coefficients Between Market Return and Sector Returns (Ranking from Highest to Lowest Correlation)

Sector	Correlation with Rm	Sector	Correlation with Rm	Sector	Correlation with Rm
<b>BANK</b>	0.861634	<b>MEDIA</b>	0.730261	<b>INSUR</b>	0.534781
<b>PROP</b>	0.852691	<b>COMM</b>	0.699163	<b>MINE</b>	0.491017
<b>CONMAT</b>	0.837892	<b>CONST</b>	0.663890	<b>HEALTH</b>	0.485257
<b>ENERG</b>	0.832259	<b>ICT</b>	0.660296	<b>FASH</b>	0.482222
<b>FINN</b>	0.792259	<b>AUTO</b>	0.649899	<b>PFUND</b>	0.448525
<b>TRANSP</b>	0.791138	<b>ELECT</b>	0.612118	<b>PROF</b>	0.447174
<b>PETRO</b>	0.789407	<b>PKG</b>	0.581072	<b>PERSON</b>	0.265642
<b>IMM</b>	0.761553	<b>AGRO</b>	0.577511	<b>PRINT</b>	0.256811
<b>STEEL</b>	0.737489	<b>TOUR</b>	0.564585		
<b>FOOD</b>	0.731737	<b>HOME</b>	0.544899		

**Source:** Author's calculation based on monthly SET market and sector returns data from Thomson Reuters Datastream

Correlations between each stock sector are provided in Table 3.2

**Table 3.2** Correlations between Stock Sectors

	AGRI	AUTO	BANK	COMM	CONMA	CONSTR	ELECT	ENERG	FASH	FINN	FOOD	HEALTH	HOME	ICT	IMM	INSUR	MEDIA	MINE	PACK	PERSON	PETRO	PFUND	PRINT	PROP	PSERV	STEEL	TOUR	TRANS
AGRI	1																											
AUTO	0.448	1																										
BANK	0.482	0.496	1																									
COMM	0.474	0.530	0.566	1																								
CONMA	0.515	0.608	0.702	0.527	1																							
CONSTR	0.555	0.494	0.501	0.382	0.560	1																						
ELECT	0.477	0.457	0.516	0.404	0.568	0.386	1																					
ENERG	0.395	0.410	0.652	0.468	0.620	0.462	0.459	1																				
FASH	0.500	0.472	0.381	0.431	0.340	0.300	0.314	0.318	1																			
FINN	0.449	0.653	0.655	0.582	0.667	0.438	0.495	0.551	0.398	1																		
FOOD	0.573	0.555	0.556	0.681	0.612	0.510	0.527	0.547	0.489	0.551	1																	
HEALTH	0.231	0.383	0.344	0.377	0.430	0.578	0.299	0.364	0.275	0.364	0.418	1																
HOME	0.520	0.549	0.447	0.400	0.559	0.603	0.343	0.283	0.424	0.549	0.507	0.306	1															
ICT	0.318	0.427	0.541	0.478	0.481	0.328	0.341	0.506	0.247	0.512	0.433	0.213	0.331	1														
IMM	0.467	0.423	0.389	0.348	0.491	0.437	0.306	0.441	0.260	0.427	0.466	0.307	0.537	0.324	1													
INSUR	0.425	0.521	0.421	0.491	0.464	0.533	0.491	0.336	0.383	0.519	0.583	0.401	0.472	0.304	0.538	1												
MEDIA	0.426	0.499	0.656	0.578	0.589	0.465	0.411	0.524	0.363	0.612	0.565	0.403	0.471	0.542	0.462	0.456	1											
MINE	0.410	0.318	0.368	0.425	0.370	0.229	0.372	0.401	0.242	0.437	0.404	0.366	0.327	0.221	0.286	0.267	0.420	1										
PACK	0.510	0.552	0.417	0.403	0.573	0.396	0.390	0.383	0.391	0.500	0.480	0.331	0.496	0.320	0.548	0.357	0.433	0.388	1									
PERSON	0.276	0.151	0.201	0.243	0.193	0.209	0.165	0.245	0.236	0.188	0.287	0.077	0.183	0.261	0.318	0.278	0.245	0.246	0.189	1								
PETRO	0.447	0.501	0.630	0.441	0.733	0.451	0.547	0.741	0.285	0.539	0.533	0.407	0.341	0.408	0.427	0.399	0.480	0.346	0.540	0.141	1							
PFUND	0.155	0.101	0.077	0.273	0.229	0.170	-0.046	0.390	0.033	0.161	0.121	0.086	0.017	0.212	0.071	-0.006	0.252	0.128	0.124	0.232	0.101	1						
PRINT	0.244	0.374	0.199	0.217	0.258	0.353	0.154	0.134	0.271	0.285	0.245	0.104	0.332	0.147	0.409	0.305	0.207	0.129	0.304	0.090	0.186	0.119	1					
PROP	0.490	0.701	0.736	0.651	0.752	0.670	0.528	0.555	0.502	0.786	0.653	0.465	0.600	0.506	0.549	0.557	0.685	0.393	0.575	0.220	0.590	0.211	0.293	1				
PSERV	0.356	0.381	0.363	0.313	0.430	0.404	0.386	0.283	0.317	0.415	0.397	0.324	0.446	0.360	0.348	0.344	0.360	0.308	0.379	0.176	0.309	0.035	0.273	0.438	1			
STEEL	0.748	0.529	0.518	0.390	0.530	0.603	0.433	0.605	0.392	0.348	0.524	0.266	0.619	0.415	0.561	0.493	0.465	0.387	0.661	0.333	0.519	0.089	0.428	0.663	0.335	1		
TOUR	0.350	0.573	0.455	0.522	0.496	0.423	0.387	0.349	0.366	0.538	0.507	0.395	0.466	0.317	0.297	0.510	0.446	0.367	0.386	0.225	0.384	0.188	0.274	0.623	0.305	0.405	1	
TRANS	0.467	0.567	0.637	0.595	0.705	0.488	0.524	0.508	0.458	0.704	0.595	0.415	0.513	0.491	0.310	0.516	0.572	0.421	0.519	0.216	0.593	0.351	0.227	0.785	0.426	0.364	0.546	1

**Source:** Author's calculation based on monthly sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream

Stock Sectors with Strong Positive Correlation ( $r \geq 0.70$ ) between each other can be depicted as:

**Table 3.3** Stock Sectors with Strong Positive Correlation

	BANK	PETRO	CONMAT	FINN	ENERG	PROP	TRANS
BANK						0.763855	
PETRO			0.770339		0.763222		
CONMAT		0.770339				0.779496	
FINN							0.752173
ENERG		0.763222					
PROP	0.763855		0.779496				0.80708
TRANS				0.752173		0.80708	

**Source:** Author's calculation based on monthly sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream

High correlations between sectors are noted for Banking and Property, Petrochemicals and Construction Materials, Petrochemicals and Energy & Utility, Construction Materials and Property Services, Finance and Transportation & Logistics, Banking and Property Services, and Property and Transportation & Logistics.

Macroeconomic data used in this study are:

- 1) Real Gross Domestic Product (GDP) growth rate of Thailand from CEIC database where the data source gathered from the National Economic and Social Development Board. The data has been automatically distributed monthly from the system before download as this study performs analysis on a monthly basis for all data.
- 2) Thailand Manufacturing Production Index (PMI), Seasonally Adjusted from the Bank of Thailand (BOT) statistics website
- 3) Thailand Consumer Price Index (CPI), Seasonally Adjusted from the Bank of Thailand (BOT) statistics website
- 4) Thailand interest rate using policy rate from the Bank of Thailand (BOT) statistics website

- 5) Real Effective Exchange Rate (REER) from Bank of Thailand (BOT) statistics website
- 6) Money Supply using Broad Money (M3) data from Bank of Thailand (BOT) statistics website
- 7) Coincident Economic Index (CEI) developed by The Bank of Thailand (BOT), data available from BOT website
- 8) Business Sentiment Index (BSI and expected BSI), data available from BOT website

Coincident Economic Index (CEI) can be used to predict the future economic activity and its turning points. Theoretically, CEI moves in accordance with overall economic activity, and monthly CEI is applicable to forecast quarterly GDP. CEI was constructed based on growth cycle approach (measuring fluctuations of growth rates of economic activity and compares the growth rate of economy with its long-term growth rate trend) also with expansion and contraction swing according to economic activity changes.

#### CEI calculation procedures

- 1) Remove seasonal factor and price effects from component series  
 $X_{i,t}$  = Seasonally adjusted series component  $i$  in month  $t$  in real term
- 2) Calculate symmetric percentage change of  $X_{i,t}$   
 By using formula  $X_{i,t} = [(X_{i,t} - X_{i,t-1}) / [(X_{i,t} + X_{i,t-1}) / 2]] * 100$
- 3) Calculate  
 $|A| = \sum (X_{i,t} / N - 1)$  where  $t=2$  to  $N$
- 4) Standardize  $X_{i,t}$  by formula  $S_{i,t} = X_{i,t} / |A|$
- 5) Use formula  
 $R_t = \sum W_i S_{i,t} / \sum W_i$  where  $i = 1$  to  $10$  to calculate percentage change of index ( $R_t$ )
- 6) Standardize  $R_t$  ( $rt$ ) by using  $R_t$  divided with  $F$  to adjust consistency to trend-cycle component of the coincident index
- 7) Calculate cumulative index  $I_t = I_{t-1} * [(200 + rt) / (200 - rt)]$  where the  $I_{t-1}$  or first month is set to 100

Note:  $rt = R_t / F$  where  $F = \sum |R_t| / \sum |P_t|$  where  $t = 2$  to  $N$ ,  $P$  = Composite Index of  $R_t$

Coincident Economic Index (CEI) (Seasonally Adjusted) is constructed from six elements consist of Import Volume index (exclude gold), Manufacturing Production Index, Gross Value Added Tax at 2000 prices (Million Baht), Domestic Automobile Sales (Unit) and Debit to Demand Deposit at 2000 prices (Billion Baht).

The growth rate of variable X (gX) at time t is calculated by rate of change formula:

$$gX_t = (X_t - X_{t-1}) / X_{t-1}$$

$X_t$  = value of X at time t

$X_{t-1}$  = value of X in one preceding period before t

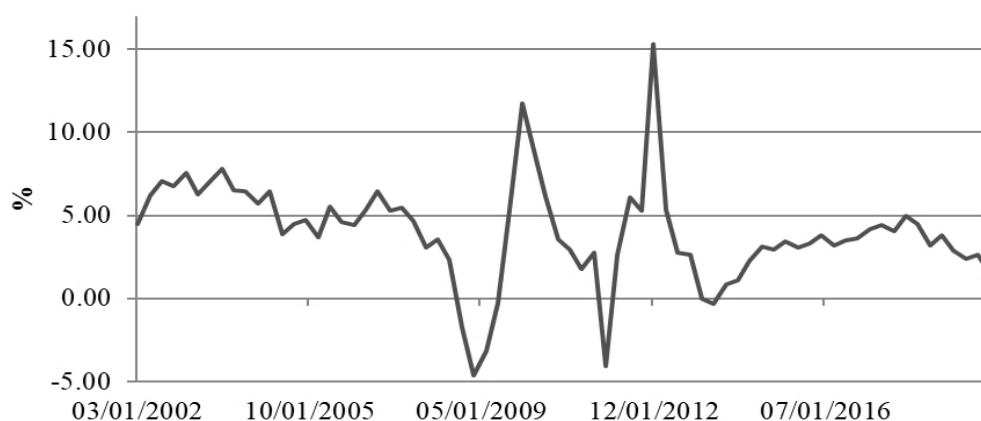
## **3.2 Methodology in Defining Stages of Business Cycle**

### **3.2.1 Defining the Business Cycle**

Essential attributes of business cycle proxy are representing aggregated economic activities, movement in an expansion-contraction cyclical pattern with turning points around peak and trough and repeatable in chronological dimension. Most of the literature uses Gross Domestic Product (GDP) or Manufacturing production Index (MPI) as a proxy of aggregated economic activities measurement.

In addition, composite economic index like Coincident Economic Index (CEI) can measure fluctuations and turning points of economic activity growth rates. CEI also has expansion and contraction swings according to changes in economic activity. Ideally, it is possible that the Coincident Economic Index (CEI) can also be used for business cycle assessment.

I compare graphical illustrations to demonstrate cyclical movement patterns of 3 different proxies of aggregated national economic activity, which are real GDP growth, changes in Manufacturing Production Index (MPI), and composite Coincident Economic Index (CEI) for Thailand during the study period (January 2002 to December 2019).

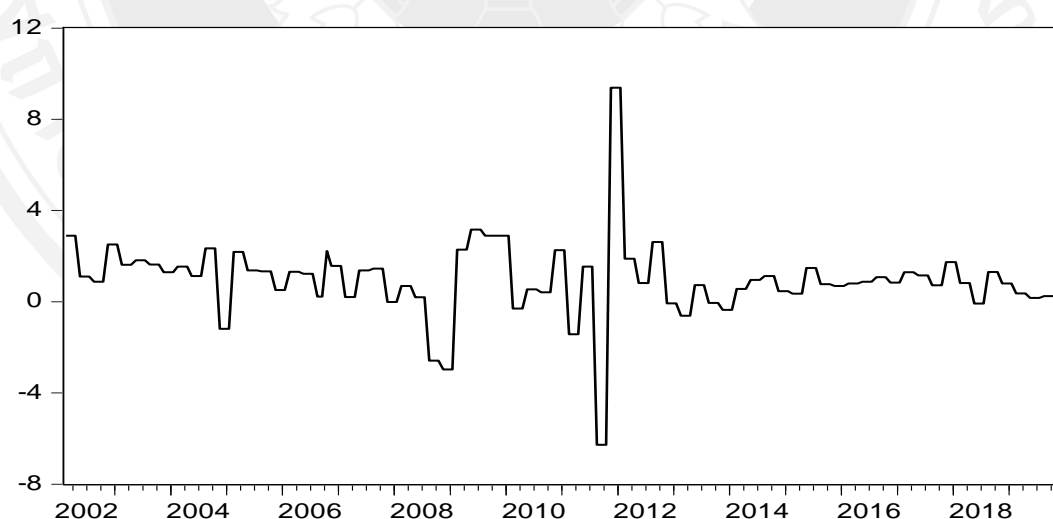


**Figure 3.1** Cyclical movement pattern of Real GDP growth (YoY: Quarterly: Seasonally Adjusted) of Thailand during 2002 – 2019 C.E.

**Source:** CEIC Database

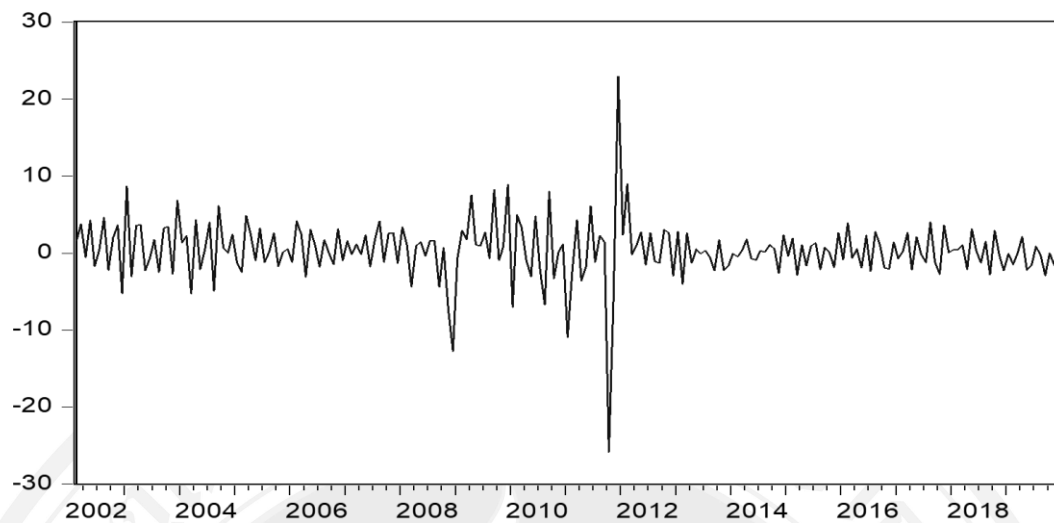
Real GDP growth chart shows clear cyclical expansion/contraction movement pattern with obvious peak and trough, therefore being a good proxy for business cycle identification.

However, this cyclical pattern is less clear on Quarter on Quarter (QoQ) data.



**Figure 3.2** Real GDP Growth (QoQ), Thailand during 2002 – 2019 C.E.

**Source:** Author's calculation based on quarterly data of Thailand real GDP growth from Bank of Thailand statistical database

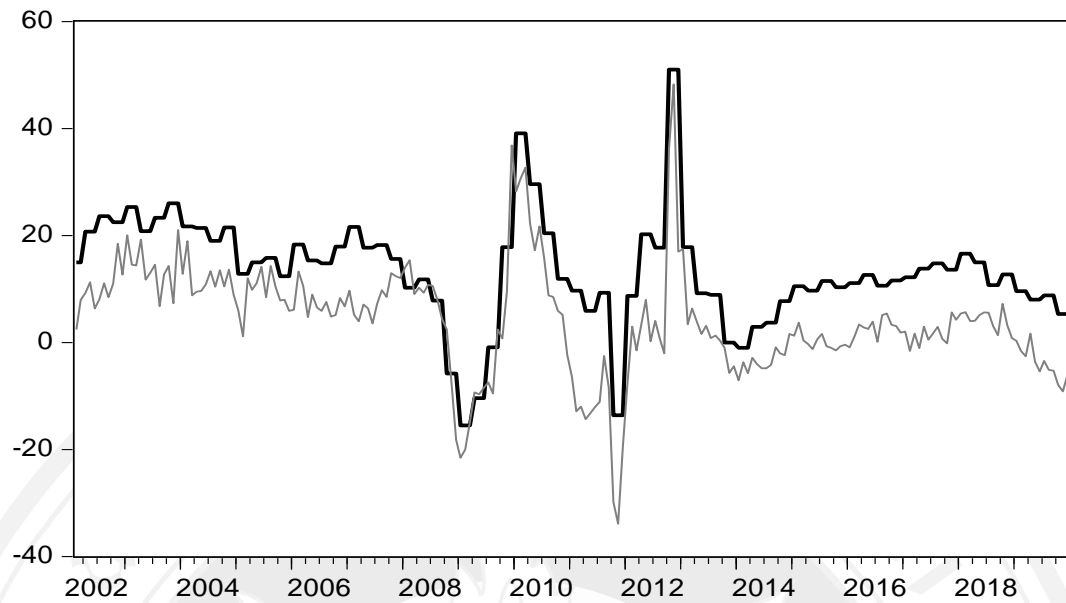


**Figure 3.3** Changes in Manufacturing Production Index (MPI), MoM, Thailand

**Source:** Author's calculation based on monthly data of Thailand Manufacturing Production Index from Bank of Thailand statistical database

Graphical illustration from changes in Manufacturing Production Index (MPI), Month on Month (MoM) has unclear cyclical stages pattern especially during periods 2002-2007 C.E. and 2013-2019 C.E., where MPI changes are quite stable with small fluctuation around zero line and expansion / contraction movement is ill-defined.

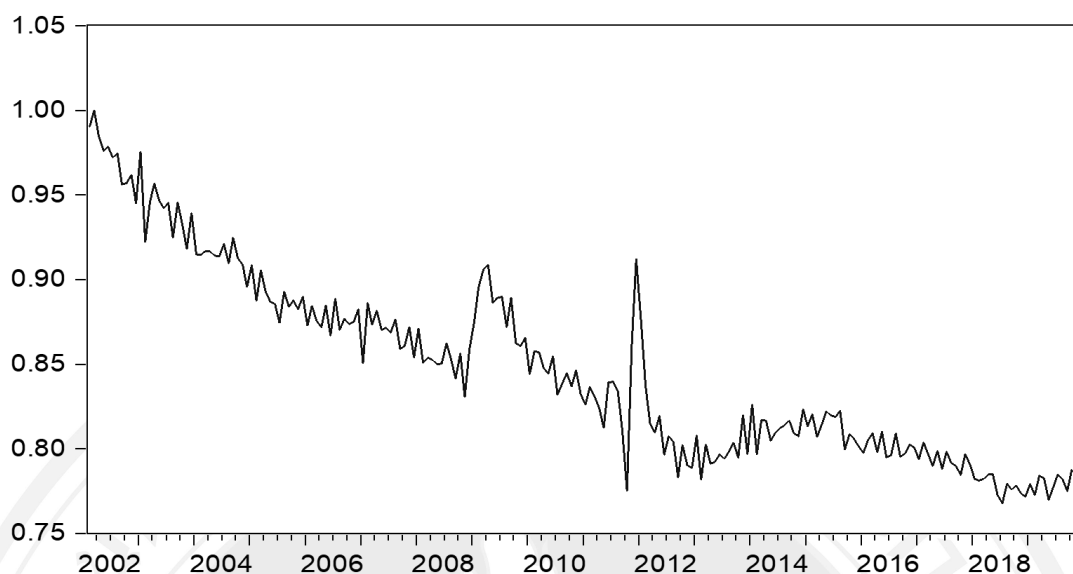
However, similar to finding in real GDP growth, I aware of the difference between Month on Month (MoM) and YoY (Year on Year) growth pattern therefore, I reconstruct Manufacturing Production Index (MPI) on YoY (Year on Year) basis to make a more proper comparison with real GDP growth which the original data had presented on YoY (Year on Year) basis and found that the results are very close in the pattern of cyclical movement and peak and trough as shown in real GDP growth (YoY).



**Figure 3.4** Manufacturing Production Index (MPI) growth, YoY, Thailand (Thin line) compared with Real GDP growth, YoY, Thailand (Thick line)

**Source:** Author's calculation based on Thailand MPI and real GDP data from the Bank of Thailand statistical database

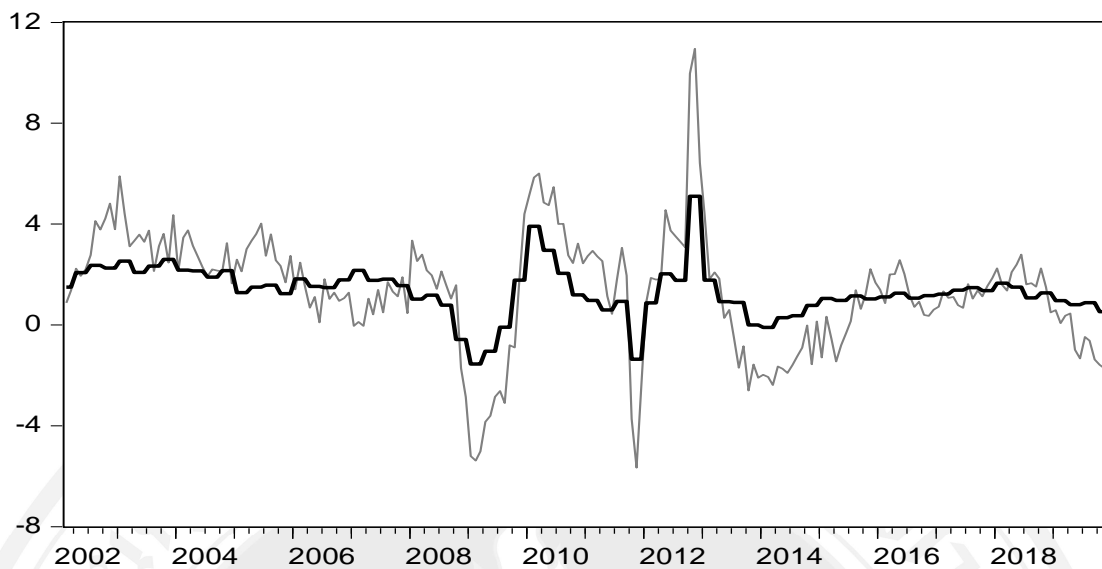
I made a similar approach with the Composite Economic Index (Coincident Economic Index: CEI), plotted chart from changes in the coincident economic index (MoM) shows a downward slope pattern in long-run trend. Expansion and contraction pattern is not clear during the period 2002-2008 C.E.



**Figure 3.5** Changes in Coincident Economic Index (CEI)

**Source:** Author's calculation based on Thailand Coincident Economic Index from Bank of Thailand statistical database

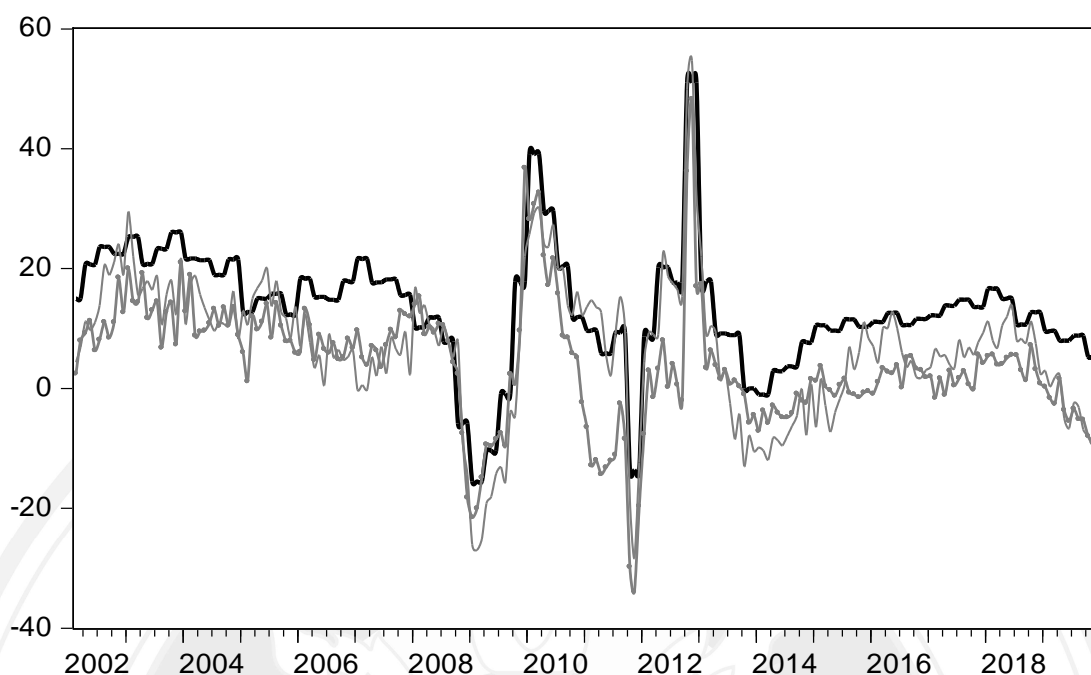
However, similar to the previous approach, reconstruction of Coincident Economic Index (CEI) on YoY (Year on Year) basis to make a more proper comparison with real GDP growth which the original data had presented on YoY (Year on Year) basis and found that the results are very close in the pattern of cyclical movement and peak and trough as shown in real GDP growth (YoY).



**Figure 3.6** Coincident Economic Index (CEI) growth, YoY, Thailand (Thin line) compared with Real GDP growth, YoY, Thailand (Thick line)

**Source:** Author's calculation based on Thailand Coincident Economic Index and real GDP from Bank of Thailand statistical database

Comparison of all 3 output growth proxies are demonstrated in the following figure:



**Figure 3.7** Comparison between 3 Proxies of Output Growth for Business Cycle Identification which are Real GDP growth, YoY, Thailand (Thick line), Growth of Manufacturing Production Index or MPI, YoY, Thailand (Medium line) and Growth of Coincident Economic Index or CEI, YoY, Thailand (Thin line)

**Source:** Author's calculation based on Thailand real GDP, Manufacturing Production Index and Coincident Economic Index from Bank of Thailand statistical database and CEIC database)

This finding implies that whether using real GDP growth, Manufacturing Production Index (MPI) growth or Composite index like Coincident Economic Index (CEI) as a proxy of real output growth for business cycle determination does not matter because they offer similar peak and trough and cyclical movement and the cycles are very close with each other but should be remarkable on using Year on Year growth data rather than Month on Month growth data to figure out cyclical movement pattern. The correlation coefficient also confirms high correlations between these 3 business cycle proxies where real GDP growth has 84 % correlation with MPI growth and 86% correlation with CEI growth while MPI growth and CEI growth have 81 % correlation.

**Table 3.4** Comparison of the Three Business Cycle Proxies (real GDP growth, MPI growth, and CEI growth) for their Peaks and Through and Correlations with Stock Market Return

	real GDP growth	MPI growth	CEI growth	Stock Market Return ( $r_m$ )
Correlation with $r_m$	0.05	0.02	-0.004	N/A
Peak 1	Dec 2003	Dec 2003	Jan 2003	Dec 2003
(number of months deviated from peak of $r_m$ )	(0)	(0)	(11)	
	real GDP growth	MPI growth	CEI growth	Stock Market Return ( $r_m$ )
Trough 1	Feb 2009	Feb 2009	Feb 2009	Oct 2008
(number of months deviated from trough of $r_m$ )	(4)	(4)	(4)	
Peak 2	Jan 2010	Dec 2009	Feb 2010	Apr 2009
(number of months deviated from peak of $r_m$ )	(9)	(8)	(10)	
Trough 2	Nov 2011	Nov 2011	Nov 2011	Sep 2011
(number of months deviated from trough of $r_m$ )	(2)	(2)	(2)	
Peak 3	Nov 2012	Nov 2012	Nov 2012	Feb 2012
(number of months deviated from peak of $r_m$ )	(4)	(4)	(4)	
Trough 3	Jan 2014	Jan 2014	Oct 2013	Aug 2013
(number of months deviated from trough of $r_m$ )	(5)	(5)	(2)	
Peak 4	Mar 2018	Oct 2018	Jun 2018	Jul 2018
(number of months deviated from peak of $r_m$ )	(4)	(7)	(1)	
Average months deviated from peak and trough of $r_m$	4	4.29	4.86	N/A

**Source:** Author's calculation based on market returns data from The Stock Exchange of Thailand from Thomson Reuters Datastream, real GDP growth data from CEIC database, MPI and CEI data from Bank of Thailand statistical database

Comparison between the three business cycle proxies (real GDP growth, MPI growth and CEI growth) in Table 1 shows that real GDP growth has the least deviations of peak and trough from stock market return and has the highest correlation with stock market return; therefore, real GDP growth is the most suitable proxy of business cycle determination for the analysis of stock market returns in different stages of the business cycle compared with MPI growth and CEI growth.

According to the plots, the real GDP growth of Thailand during study period (January 2002 to December 2019) has clearest cyclical fluctuation of expansion and contraction movement and clearest turning point of movement compared with MPI and CEI. In this study, I select real GDP growth rather than MPI growth or CEI growth due to smoothness of graph, its broader representation of the country's aggregate economic activities and in order to make similarity in business cycle proxy with other studies to reduce complexity in future comparison.

Although manufacturing production or industrial production has been introduced as one of the potential proxies of the economy's output growth in business cycle determination, some argument also mentioned that manufacturing production or industrial production may not be a good predictor for predominantly service economy. Young (2006, as cited in Lazarus, 2017) that

... the relationship between stock returns and industrial production will cease in 1989-2004 period due to U.S. economy transitioning from manufacturing to a service-oriented economy in the concluding years of 20th century ... Additionally, the results for the sub-period 1988-2000 indicate that industrial production can no longer predict stock returns, which confirms the U.S. economy's transition from a manufacturing to a service-oriented economy ...

GDP is a better representative for more comprehensive measurement of the aggregated national economic activities in this aspect. Furthermore, GDP represents long-term aggregated economic activities, while MPI represents only short-term production.

There is a common finding among gGDP, cMPI, and cCEI charts that show that shock impacts the economy rapidly during the 2008 – 2013 period, and shock impacts

the economy rapidly and recovery also occurred rapidly in the V-shape figure. This finding may be different from the historical chart in the past before 2000 C.E. Two complete cycles have been identified during these 5 years period, which is an atypical finding and difference from other time spans in history. This possibly explained by the overlapping U.S. subprime mortgage crisis (December 2007 – June 2009) and European sovereign debt crisis (October 2008 – September 2012) creating 2 depression within 5 years period and according to series of Quantitative Easing (Q.E.) imposed by U.S. Federal Reserve causing reflux of money supply to multiple assets, therefore, recovery occurred withing few months then rapidly inclined to the peaks.

### **3.2.2 Defining Stages of Business Cycle**

In literature, stages of the business cycle usually define by the expansion and contraction movement of aggregated economic activities using local maximum and local minimum turning points. This study also elaborates more by dividing expansion into two phases: recovery and expansion and dividing contraction into two phases: contraction and depression. There are two methods used to divide recovery-expansion and contraction-depression stages by using steady zero-growth line or using long-run average trend line together with the identification of peak and trough. Zarnowitz (2007) and Alqaralleh (2019) used long-run average trend line together with peak and trough to divide business cycle stages. However, this may not be practical for the investors who are not intentionally conducting research work to construct long-run average trendline and calculate percentage of deviations from long-run average trendline at each timepoint to assess the stages of business cycle. In addition, the long-run average trendline is a representative only for a particular period of time defined in each research work, but it changes over time when there is additional chronological data along with the expansion of time series period, which makes a comparison between the different time period of the same economic proxy becomes problematic as the reference long-run average trendlines between different chronological time series data set are not the same. This study intends to prove a more simplified practical methodology of using a steady zero-growth line instead of a long-run average trendline. Using a steady a zero-growth line to divide the cyclical fluctuation of the business cycle proxy possibly a more practical method that provides consistent staging of business cycle along the chronological time

series of the same economic proxy which compares the studies using different time period becomes possible. This method, although never being proved in the academic literature but has been mentioned in the investment communities i.e., Investopedia. This paper contributes to proof whether this method is empirically valid and applicable as a standard methodology in defining stages of the business cycle.

### 3.2.2.1 Defining Stages of Business Cycle Using Steady Zero-Growth Line and Identification of Peak and Trough

I divided business cycle into 4 stages according to positive vs negative change of real GDP along a steady zero-growth line and local maxima (peak) and local minima (trough) over the study period.

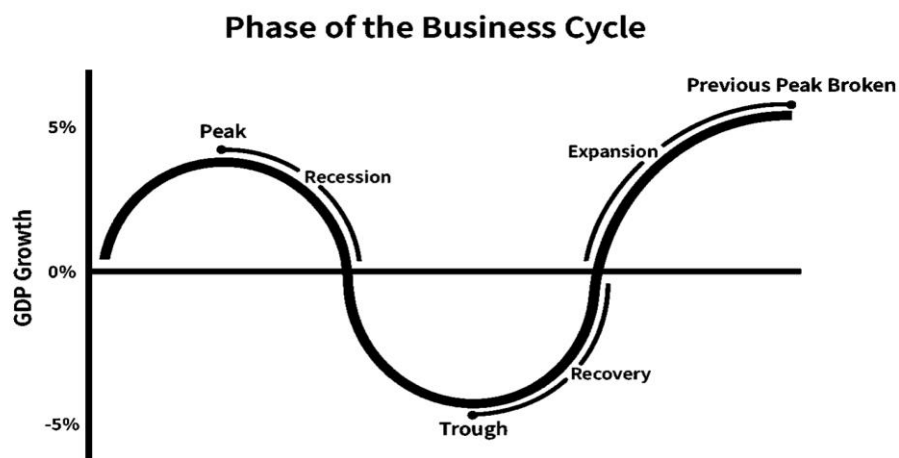
Stage 1 Expansion stage ( $D_1$  or  $D_{\text{expand}}$ ) is defined as positive real GDP growth increasing apart from a steady zero-growth line towards local maxima.

Stage 2 Recession stage ( $D_2$  or  $D_{\text{recess}}$ ) is defined as positive but declining real GDP growth declines from local maxima down towards a steady zero-growth line.

Stage 3 Depression stage ( $D_3$  or  $D_{\text{depress}}$ ) is defined as declining negative real GDP growth path apart from a steady zero-growth line towards local minima.

Stage 4 Recovery stage ( $D_4$  or  $D_{\text{recov}}$ ) is defined as negative real GDP growth but increasing apart from local minima up towards a steady zero-growth line.

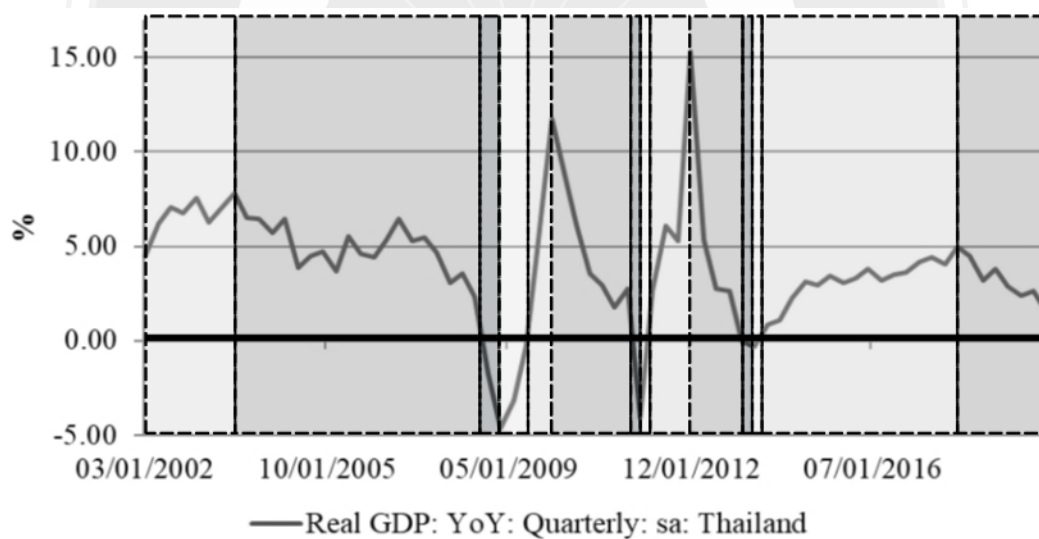
Local maxima in this study is defined as the highest point between the period in which the output growth path in plot chart crossing steady zero-growth line and local minima in this study is the lowest point between the period which output growth path in plot chart crossing steady zero-growth line.



 Investopedia

**Figure 3.8** Phase of the Business Cycle using Steady Zero-Growth Line

Source: Bang, 2019.



**Figure 3.9** Stages of Business Cycle around Steady Zero-Growth Line in Thailand During Period 2002-2019 Using Real GDP Growth

Source: Image modification from a graphical illustration from CEIC database

The specified month period of each stage of the business cycle are defined as Table 3.5.

**Table 3.5** Specified Month Period for Each Stage of Business Cycle using Steady Zero-Growth Line

Expansion	Recession	Depression	Recovery
Jan 2002 – Mar 2003	Apr 2003 – Sep 2008	Oct 2008 – Mar 2009	Apr 2009 – Sep 2009
Oct 2009 – Mar 2010	Apr 2010 – Sep 2011	Oct 2011 – Nov 2011	Dec 2011 – Jan 2012
Feb 2012 – Dec 2012	Jan 2013 – Dec 2013	Jan 2014 – Mar 2014	
Apr 2014 – Mar 2018	Apr 2018 – Dec 2019		

Similar to previously mentioned during the 2008 – 2013 peak and trough occurred rapidly creating two complete short cycle spans within 5 years.

The important global and local events that create positive and negative shocks to Thailand's economy are summarized in Table 3.6

**Table 3.6** Important Global and Local Events which Create Positive and Negative Shocks to the Economy of Thailand

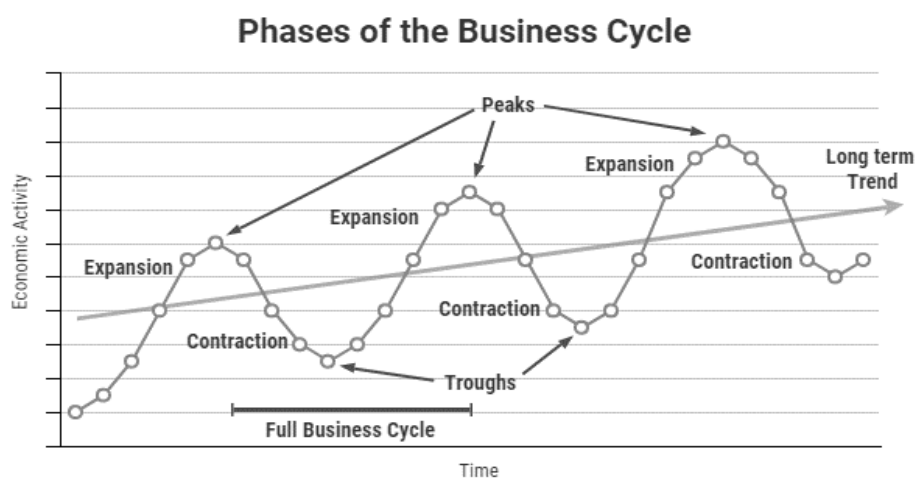
	Shock to Economy	Defined Period
<b>Negative Shocks</b>	U.S. Subprime Mortgage Crisis	Dec 2007 – June 2009
	European Sovereign Debt Crisis	Oct 2008 – Sep 2012
	Bangkok Flood (Natural Disaster)	Aug 2011 – Dec 2011
<b>Positive Shocks</b>	U.S. Quantitative Easing (QE 1)	Nov 2008 – June 2010
	U.S. Quantitative Easing (QE 2)	Nov 2010 – June 2011
	U.S. Quantitative Easing (QE 3)	Sep 2012 – Oct 2014
	EU IMF Bailout Package	May 2010 – Dec 2010
	EU Stability Mechanism (ESM)	Dec 2010 – Dec 2017
	European Quantitative Easing	Jan 2013 – Dec 2019

During this period (2008 – 2013 C.E.), many negative shocks consecutively occurred at both international and local levels, including the U.S. subprime mortgage crisis, European sovereign debt crisis, and Thailand flood (natural disaster) while many

innovative remedies are also serially launched, including U.S. Quantitative Easing, EU IMF Bailout Package, and EU Stability Mechanism (ESM).

### 3.2.2.2 Defining Stages of Business Cycle Using Long-Run Average Trendline and Identification of Peak and Trough

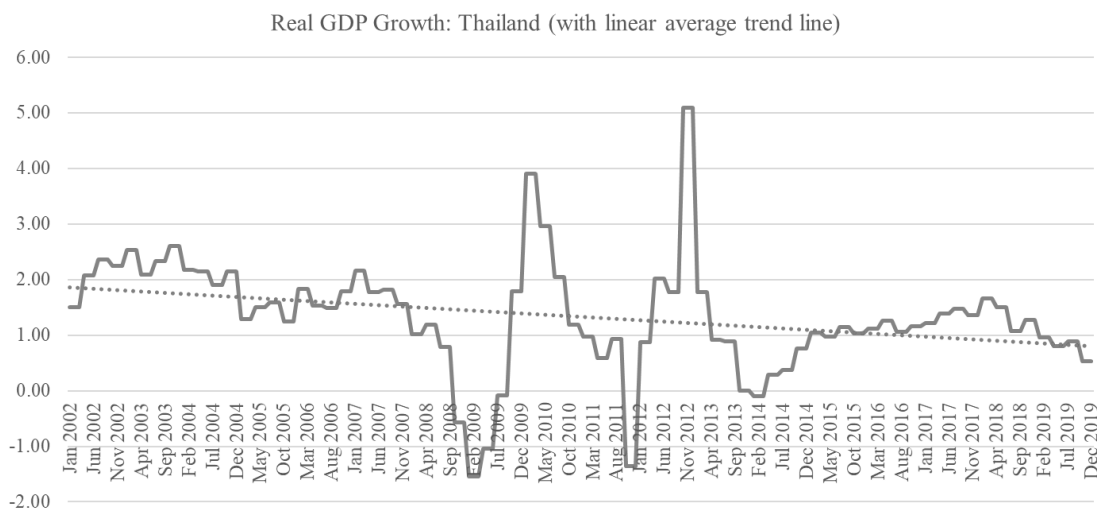
Another method uses long-run average trendline to identify stages in the business cycle instead of steady zero-growth line.



**Figure 3.10** Phases of the Business Cycle

**Source:** The Canadian Encyclopedia, n.d.

I generated a long-run average trend line from real GDP growth data using the Microsoft Excel program and plot together with a chart. The long-run average trend line of Thailand's real GDP growth during the year 2002-2019 shows declining slope.



**Figure 3.11** Stages of Business Cycle around Long-Run Average Trend Line in Thailand During Period 2002-2019 Using Real GDP Growth

**Source:** Author's calculation based on Thailand real GDP data from CEIC database

**Note:** Linear average trendline for Thailand real GDP growth during the study period is defined as a dot-line in the figure.

I divided the business cycle into 4 stages according to the percentage change of real GDP along the long-run average trendline over the study period.

Stage 1 Expansion stage ( $D_1$  or  $D_{\text{expand}}$ ) is defined as positive real GDP growth rising above long-run average trendline until it reaches local maxima.

Stage 2 Recession stage ( $D_2$  or  $D_{\text{recess}}$ ) is defined as positive real GDP growth but declining from local maxima towards a long-run average trendline.

Stage 3 Depression stage ( $D_3$  or  $D_{\text{depress}}$ ) is defined as declining of negative real GDP below long-run average trendline until it reaches local minima.

Stage 4 Recovery stage ( $D_4$  or  $D_{\text{recov}}$ ) is defined as negative real GDP growth but increasing from local minima toward a long-run average trendline.

In this study, local maxima is defined as the highest point between the period which output growth path in plot chart crossing long-run average trend line and local minima in this study is defined as the lowest point between the period which output growth path in plot chart crossing long-run average trend line.

Each stage of the business cycle are defined as Table 3.7.

**Table 3.7** Specified Month Period for Each Stage of Business Cycle using Long-Run Average Trend Line

Expansion (tl)	Recession (tl)	Depression (tl)	Recovery (tl)
Apr 2002 – Dec 2003	Jan 2004 – Dec 2004	Jan 2005 – Dec 2005	Jan 2002 – Mar 2002
Oct 2006 – Mar 2007	Apr 2007– Dec 2007	Jan 2008 – Mar 2009	Jan 2006 – Sep 2006
Oct 2009 – Mar 2010	Apr 2010 – Sep 2010	Oct 2010 – Dec 2011	Apr 2009 – Sep 2009
Apr 2012 – Dec 2012	Jan 2013 – Mar 2013	Apr 2013 – Mar 2014	Jan 2012 – Mar 2012
Apr 2016 – Mar 2018	Apr 2018 – Sep 2019	Oct 2019 – Dec 2019	Apr 2014– Mar 2016

### 3.2.2.3 Testing Two Different Methods of Business Cycle Stages Determination (Steady Zero-growth Line Versus Long-Run Average Trend Line) Using Regression on Dummy Variables for Different Stages of Business Cycle

Song and Qian (2017) used a regression model with dummy variables of four stages of the business cycle (recovery, prosperity, recession, and depression) as follow:

$$SR_{i,t} = c_{i1}D_1 + c_{i2}D_2 + c_{i3}D_3 + c_{i4}D_4 + \varepsilon_{i,t}$$

Where  $SR_{it}$  is the stock return of sector  $i$  at time  $t$ ,  $D_1$   $D_2$   $D_3$   $D_4$  are dummy variables for each stage of the business cycle, and  $c_i$  are parameters of each stage accordingly.

I apply a similar regression model with dummy variables for previously defined four stages with their related  $C_d$  parameters as follow:

Equation 1 (Regression on Business Cycle Stage variables and Sectoral Stock Return)

$$R_{i,t} = C_{i1}*D_{expand} + C_{i2}*D_{recess} + C_{i3}*D_{depress} + C_{i4}*D_{recov}$$

Where  $R_{i,t}$  is the stock return of sector  $i$  at time  $t$ ,  $D_{expand}$  represents dummy variable for expansion stage,  $D_{recess}$  represents dummy variable for recession stage,  $D_{depress}$  represents dummy variable for depression stage and  $D_{recov}$  represents dummy

variable for recovery stage of the business cycle and  $C_{i1}$ ,  $C_{i2}$ ,  $C_{i3}$ ,  $C_{i4}$  are their respective coefficients.

To check for the multicollinearity problem of using 4 stage dummies, I initially calculate correlations between each dummy variable, the results are as follow:

**Table 3.8** Correlations between Dummy Variables of Each Stage of Business Cycle

	<b>Dexpand</b>	<b>Drecess</b>	<b>Ddepress</b>	<b>Drecov</b>
<b>Dexpand</b>	1	<b>-0.83277</b>	-0.16833	-0.15931
<b>Drecess</b>	<b>-0.83277</b>	1	-0.24133	-0.22839
<b>Ddepress</b>	-0.16833	-0.24133	1	-0.04617
<b>Drecov</b>	-0.15931	-0.22839	-0.04617	1

Then further using Variance Inflation Factor (VIF) between high correlation dummies which are  $D_{\text{expand}}$  and  $D_{\text{recess}}$  by using regression model  $D_{\text{expand}} = \alpha + \beta * D_{\text{recess}} + \epsilon_i$  which found  $R^2 = 0.692063$  and use it for VIF calculation.

$$\text{VIF} = 1/(1-R_k^2) = 1/[1-(0.692063)^2] = 1.92$$

VIF between  $D_{\text{expand}}$  and  $D_{\text{recess}} = 1.92$  (VIF is less than 10 so less likely to have multicollinearity)

Therefore, the regression model  $R_{i,t} = C_{i1} * D_{\text{expand}} + C_{i2} * D_{\text{recess}} + C_{i3} * D_{\text{depress}} + C_{i4} * D_{\text{recov}}$  has a low potential for multicollinearity problem.

The regression analysis results of sectoral stock returns and dummy variables representing stages of business cycle (using steady zero-growth line for business cycle stages determination) are demonstrated in Table 3.9.

**Table 3.9** Regression Analysis Results of Sectoral Stock Return and Dummy Variables Representing Stages of Business Cycle (Using Steady Zero-Growth Line for Business Cycle Stages Determination)

Sector	C <sub>i1</sub> (Dexpand)	C <sub>i2</sub> (Drecess)	C <sub>i3</sub> (Ddepress)	C <sub>i4</sub> (Drecov)
SETI (Rm)	0.917852 (0.1330)	0.553004 (0.2700)	-1.524298 (0.3738)	<b>7.334658</b> (0.0001)
10-Year Gov Bond (Rf)	<b>3.235419</b> (0.0000)	<b>4.028909</b> (0.0000)	<b>3.609000</b> (0.0000)	<b>3.701111</b> (0.0000)
AGRI	0.332884 (0.6570)	0.149977 (0.8076)	0.168663 (0.9362)	<b>9.830372</b> (0.0000)
AUTO	<b>1.537570</b> (0.0366)	0.072011 (0.9047)	<b>-4.827152</b> (0.0197)	<b>6.482676</b> (0.0031)
BANK	0.767398 (0.2900)	0.212834 (0.7206)	-2.285223 (0.2623)	<b>8.851666</b> (0.0001)
COMM	<b>1.458953</b> (0.0198)	<b>1.366057</b> (0.0081)	0.813401 (0.6419)	<b>5.629527</b> (0.0025)
CONMAT	<b>1.608812</b> (0.0299)	-0.184711 (0.7604)	0.011460 (0.9956)	<b>9.988376</b> (0.0000)
CONS	-0.141316 (0.8878)	-1.380980 (0.3631)	12.33028 (0.0789)	0.653590 (0.9249)
ETRON	0.356657 (0.6562)	0.102548 (0.8762)	-3.683816 (0.1028)	<b>9.978277</b> (0.0000)
ENERG	0.833172 (0.3307)	1.311091 (0.0633)	-1.484383 (0.5372)	<b>7.379707</b> (0.0039)
FASHION	0.503047 (0.2201)	0.083490 (0.8030)	-0.617669 (0.5897)	2.041424 (0.0918)
FIN	<b>1.629724</b> (0.0526)	0.288095 (0.6754)	-2.272406 (0.3346)	<b>6.961590</b> (0.0054)
FOOD	0.845639 (0.1412)	0.844647 (0.0741)	-0.929692 (0.5641)	<b>6.414579</b> (0.0002)
HEALTH	<b>2.409876</b> (0.0011)	<b>2.125712</b> (0.0005)	-1.531561 (0.4559)	<b>4.825496</b> (0.0266)
HOME	<b>1.948082</b> (0.0111)	-0.486184 (0.4373)	-1.873813 (0.3815)	<b>4.950073</b> (0.0291)

Table 3.9 (Continued)

Sector	C <sub>i1</sub> (Dexpand)	C <sub>i2</sub> (Drecess)	C <sub>i3</sub> (Ddepress)	C <sub>i4</sub> (DrecoV)
ICT	0.080699 (0.9179)	1.052567 (0.1030)	0.713849 (0.7457)	4.214692 (0.0704)
IMM	0.420322 (0.6795)	-1.047174 (0.2634)	-3.921986 (0.1318)	<b>8.988124</b> (0.0012)
INSUR	0.998550 (0.0611)	<b>0.973327</b> (0.0266)	-2.181779 (0.1448)	<b>3.946154</b> (0.0128)
MEDIA	0.570976 (0.4333)	-0.013763 (0.9816)	-2.634147 (0.1990)	<b>4.592586</b> (0.0342)
MINE	0.914789 (0.5024)	-0.445731 (0.6908)	-1.662123 (0.6645)	7.025929 (0.0830)
PKG	1.289028 (0.1497)	0.345023 (0.6381)	-1.591740 (0.5260)	<b>5.955631</b> (0.0252)
PERSON	0.587398 (0.5046)	0.674777 (0.3511)	-0.254705 (0.9180)	3.024834 (0.2466)
PETRO	1.837263 (0.0835)	0.836738 (0.3363)	-3.038421 (0.3074)	<b>10.01049</b> (0.0016)
PF&REITs	<b>0.874670</b> (0.0016)	0.412130 (0.1806)	-0.272722 (0.8034)	1.328899 (0.0706)
PAPER	<b>2.625637</b> (0.0073)	0.850661 (0.2869)	-3.345293 (0.2210)	4.616649 (0.1095)
PROF	1.100352 (0.3616)	-0.325312 (0.7425)	-3.806823 (0.2617)	<b>7.379962</b> (0.0397)
PROP	1.427940 (0.1033)	0.232170 (0.7464)	-3.073775 (0.2115)	<b>11.20130</b> (0.0000)
STEEL	-0.358426 (0.6571)	<b>-2.478778</b> (0.0117)	-0.820535 (0.7912)	2.592657 (0.4693)
TOURISM	<b>1.288699</b> (0.0422)	0.369331 (0.4767)	-1.415189 (0.4254)	2.495367 (0.1830)
TRANS	<b>1.712369</b> (0.0453)	0.530790 (0.4483)	-1.499957 (0.5309)	<b>10.44542</b> (0.0000)

**Source:** Author's calculation based on monthly market and sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and 10-year government bond return from Bank of Thailand statistical database

Analysis of sectoral stock returns along the business cycle has been retested using the same regression model with a different set of dummy variables representing different stages of business cycle by using a different method of defining the business cycle stages (using long-run average trendline for real GDP growth instead of steady zero-growth line).

$$R_{i,t} = C_{i1} * D_{\text{expand-tl}} + C_{i2} * D_{\text{recess-tl}} + C_{i3} * D_{\text{depress-tl}} + C_{i4} * D_{\text{recov-tl}}$$

$R_{i,t}$  is the stock return of sector  $i$  at time  $t$ ,  $D_{\text{expand-tl}}$  represents dummy variable for expansion stage,  $D_{\text{recess-tl}}$  represents dummy variable for recession stage,  $D_{\text{depress-tl}}$  represents dummy variable for depression stage and  $D_{\text{recov-tl}}$  represents dummy variable for recovery stage of the business cycle using a new method to define stages with long-run average trend line and  $C_{i1}$ ,  $C_{i2}$ ,  $C_{i3}$ ,  $C_{i4}$  are their respective coefficients.

I calculated correlations between each dummy as shown in Table 3.10.

**Table 3.10** Correlations between Dummy Variables of Each Stage of Business Cycle (Use Long-Run Average Trend Line in Identifying Business Cycle Stages)

	<b>Dexpand-tl</b>	<b>Drecess-tl</b>	<b>Ddepress-tl</b>	<b>Drecov-tl</b>
<b>Dexpand-tl</b>	1	-0.356813	-0.399749	-0.337604
<b>Drecess-tl</b>	-0.356813	1	-0.322011	-0.271951
<b>Ddepress-tl</b>	-0.399749	-0.322011	1	-0.304675
<b>Drecov-tl</b>	-0.337604	-0.271951	-0.304675	1

Correlations analysis between dummy variables show overall no correlation higher than 0.50

The regression analysis results of sectoral stock return and dummy variables representing stages of the business cycle (using long-run average trend line for business cycle determination) are demonstrated in Table 3.11.

**Table 3.11** Regression Analysis Results of Sectoral Stock Return and Dummy Variables Representing Stages of Business Cycle (Using Long-Run Average Trend Line in Business Cycle Stages Determination)

Sector	C <sub>i1</sub> (Dexpand-tl)	C <sub>i2</sub> (Drecess-tl)	C <sub>i3</sub> (Ddepress-tl)	C <sub>i4</sub> (Drecess-tl)
<b>SETI (Rm)</b>	<b>1.928967</b> (0.0046)	0.828758 (0.2946)	-1.028568 (0.1568)	<b>1.807203</b> (0.0293)
<b>10-Year Gov Bond (Rf)</b>	<b>3.456939</b> (0.0000)	<b>3.628061</b> (0.0000)	<b>4.048943</b> (0.0000)	<b>3.711040</b> (0.0000)
<b>AGRI</b>	0.782919 (0.3579)	0.462858 (0.6428)	-0.180187 (0.8440)	1.599682 (0.1258)
<b>AUTO</b>	<b>2.742856</b> (0.0007)	0.034969 (0.9700)	<b>-2.262348</b> (0.0086)	<b>1.959381</b> (0.0448)
<b>BANK</b>	<b>1.614057</b> (0.0473)	0.306482 (0.7469)	-1.141789 (0.1910)	<b>1.958680</b> (0.0493)
<b>COMM</b>	<b>2.264893</b> (0.0011)	1.428748 (0.0760)	0.548231 (0.4567)	<b>1.922131</b> (0.0226)
<b>CONMAT</b>	<b>2.139096</b> (0.0091)	0.337579 (0.7236)	<b>-1.784269</b> (0.0426)	<b>3.177595</b> (0.0016)
<b>CONS</b>	-1.105068 (0.4455)	-0.530225 (0.7508)	-1.294532 (0.6829)	0.822436 (0.5698)
<b>ETRON</b>	-0.059965 (0.9470)	0.182314 (0.8630)	-0.747099 (0.4414)	<b>2.975720</b> (0.0075)
<b>ENERG</b>	<b>2.873055</b> (0.0024)	1.172909 (0.2868)	-0.654708 (0.5167)	1.143383 (0.2193)
<b>FASHION</b>	<b>1.165601</b> (0.0087)	0.073277 (0.8873)	-0.633263 (0.1829)	0.389567 (0.4710)
<b>FIN</b>	<b>1.983169</b> (0.0305)	1.233656 (0.2492)	-1.795913 (0.0682)	<b>2.605636</b> (0.0204)
<b>FOOD</b>	<b>1.319744</b> (0.0393)	1.002658 (0.1804)	-0.188401 (0.7834)	<b>2.035718</b> (0.0096)
<b>HEALTH</b>	<b>2.897103</b> (0.0004)	1.816647 (0.0536)	0.806478 (0.3489)	<b>3.246028</b> (0.0011)
<b>HOME</b>	0.979437 (0.2361)	-0.457538 (0.6364)	-1.380894 (0.1210)	<b>3.610395</b> (0.0004)

Table 3.11 (Continued)

Sector	C <sub>i1</sub> (Dexpand-tl)	C <sub>i2</sub> (Drecess-tl)	C <sub>i3</sub> (Ddepress-tl)	C <sub>i4</sub> (Drecess-tl)
ICT	1.087229 (0.2072)	1.607155 (0.1122)	0.144661 (0.8758)	0.396593 (0.7067)
IMM	0.166098 (0.8944)	-0.049262 (0.9719)	-2.334335 (0.0636)	2.505884 (0.0789)
INSUR	<b>1.575127</b> (0.0077)	1.030084 (0.1349)	-0.101417 (0.8722)	1.337289 (0.0635)
MEDIA	1.399213 (0.0814)	0.239709 (0.7983)	-1.132344 (0.1892)	0.435868 (0.6565)
MINE	2.383954 (0.1067)	-1.992031 (0.2496)	-2.344632 (0.1402)	1.748503 (0.0818)
PKG	<b>2.167902</b> (0.0271)	0.704589 (0.5380)	-1.168877 (0.2661)	1.582009 (0.1863)
PERSON	1.782531 (0.0646)	0.215040 (0.8486)	0.268002 (0.7954)	0.154199 (0.8957)
PETRO	<b>3.755616</b> (0.0013)	0.538036 (0.6911)	-1.631501 (0.1900)	<b>2.773898</b> (0.0508)
PF&REITs	<b>0.972183</b> (0.0038)	<b>1.532103</b> (0.0002)	-0.688919 (0.0692)	<b>0.912940</b> (0.0121)
PAPER	<b>3.669442</b> (0.0006)	0.105250 (0.9324)	-0.313274 (0.7831)	1.947068 (0.1338)
PROF	0.726858 (0.5819)	-0.142863 (0.9264)	-1.859783 (0.1912)	3.229778 (0.0467)
PROP	<b>2.881432</b> (0.0032)	0.61115 (0.5901)	<b>-2.098525</b> (0.0447)	<b>2.503478</b> (0.0355)
STEEL	0.275646 (0.7988)	-1.455112 (0.2844)	<b>-2.721732</b> (0.0273)	-0.865505 (0.4203)
TOURISM	<b>1.427730</b> (0.0374)	0.223674 (0.7798)	-0.818888 (0.2654)	<b>2.159897</b> (0.0103)
TRANS	<b>2.492767</b> (0.0078)	1.619944 (0.1382)	<b>-2.085454</b> (0.0380)	<b>3.476814</b> (0.0025)

**Source:** Author's calculation based on monthly market and sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and 10-year government bond return from Bank of Thailand statistical database

Then I compare model specifications between two regressions (the one that used steady zero-growth line to define stages of business cycle and the other used long-run average trend line to define stages of business cycle) with Adjusted R-squared, F-statistic and Sum-Squared Residuals. Results are demonstrated in Table 3.12.

**Table 3.12** Model Comparison between Two Business Cycle Stages Identification Methods (Steady Zero-Growth Line vs. Long-Run Average Trend Line)

Sector (Ri)	Model using steady zero-growth line to define dummies Ds			Model using long-run average trend line to define dummies Ds-tl		
	Adj R <sup>2</sup>	F-Stat	SSR	Adj R <sup>2</sup>	F-Stat	SSR
AGRI	<b>0.359071</b>	<b>29.41230</b>	<b>6497.283</b>	0.338265	28.34804	6582.811
AUTO	0.415763	39.07241	5509.607	<b>0.417343</b>	<b>39.32072</b>	<b>5494.707</b>
BANK	<b>0.748991</b>	<b>160.6397</b>	<b>2324.506</b>	0.742012	154.8739	2389.136
COMM	0.484278	51.23799	3339.159	<b>0.491456</b>	<b>52.70232</b>	<b>3292.681</b>
CONMAT	<b>0.704754</b>	<b>128.7051</b>	<b>2885.783</b>	0.701825	126.9251	2914.412
CONS	<b>0.439668</b>	<b>14.73151</b>	<b>1788.930</b>	0.427673	14.07690	1827.288
ETRON	<b>0.394773</b>	<b>35.89654</b>	<b>6930.397</b>	0.390036	35.21014	6984.633
ENERG	<b>0.694005</b>	<b>122.3397</b>	<b>3783.297</b>	0.692709	121.6021	3799.326
FASHION	<b>0.237364</b>	<b>17.65144</b>	<b>2098.102</b>	0.226430	16.65983	2128.185
FIN	<b>0.621451</b>	<b>88.82904</b>	<b>4520.065</b>	0.620899	88.62352	4526.648
FOOD	0.536492	62.92417	2625.261	<b>0.560056</b>	<b>69.10629</b>	<b>2491.800</b>
HEALTH	<b>0.253790</b>	<b>19.19562</b>	<b>6644.299</b>	0.245595	18.41681	6717.267
HOME	0.320682	26.25545	6763.928	<b>0.330880</b>	<b>27.36989</b>	<b>6669.552</b>
ICT	<b>0.444259</b>	<b>43.76778</b>	<b>5645.589</b>	0.439052	42.87430	5698.477
IMM	<b>0.604511</b>	<b>62.14054</b>	<b>4433.602</b>	0.585837	57.58037	4642.940
INSUR	0.278324	21.63302	3447.068	<b>0.291116</b>	<b>22.97079</b>	<b>3385.967</b>
MEDIA	<b>0.542011</b>	<b>64.31503</b>	<b>4084.062</b>	0.533270	62.12732	4162.008
MINE	<b>0.232435</b>	<b>17.20094</b>	<b>23687.73</b>	0.230492	17.02491	23747.70
PKG	<b>0.329823</b>	<b>27.32966</b>	<b>8936.101</b>	0.328896	27.21934	8948.467
PERSON	0.053487	4.023232	1210.21	<b>0.054136</b>	<b>4.062047</b>	<b>12001.96</b>
PETRO	<b>0.618612</b>	<b>87.77692</b>	<b>7308.225</b>	0.616904	87.15163	7340.948
PF&REITs	<b>0.222967</b>	<b>10.18231</b>	<b>459.7904</b>	0.192269	8.617167	477.9552
PAPER	<b>0.070709</b>	<b>5.070762</b>	<b>14719.66</b>	0.059422	4.379890	14898.44
PROF	0.199311	14.31745	19529.46	<b>0.218448</b>	<b>15.95355</b>	<b>19062.69</b>
PROP	<b>0.727625</b>	<b>143.9206</b>	<b>3709.959</b>	0.724022	141.3563	3759.034

**Table 3.12** (Continued)

Sector (Ri)	Model using steady zero-growth line to define dummies Ds			Model using long-run average trend line to define dummies Ds-tl		
	Adj R <sup>2</sup>	F-Stat	SSR	Adj R <sup>2</sup>	F-Stat	SSR
STEEL	<b>0.542162</b>	<b>32.38076</b>	<b>1801.710</b>	0.529468	30.85514	1850.485
TOURISM	0.324359	26.68401	4468.395	<b>0.343689</b>	<b>29.01622</b>	<b>4340.553</b>
TRANSP	<b>0.626047</b>	<b>90.56619</b>	<b>4757.166</b>	0.625038	90.18125	4770.000

**Source:** Author's calculation based on monthly sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream

Better model specifications rate has been calculated compared to both methods considering the above three model specifications (Adjusted R<sup>2</sup>, F-Stat and Sum Squared Residual). Better model specifications rate is calculated by number of sectors that provide better model specifications divided by total stock sectors being tested. Using a steady zero-growth line provides better model specifications in 20 of total 28 sectors (Better model specifications rate = 20/28 or 71.43% while using a long-run average trendline provides better model specifications in only 8 of total 28 sectors (Better model specifications rate = 8/28 or 28.57%).

**Table 3.13** Better Model Specification Rate Comparison between the Two Methods (Using Steady Zero-Growth Line vs. Long-Run Average Trend Line)

	Using Steady Zero-Growth Line	Using Long-Run Average Trend Line
Better Model Specifications Rate	71.43% (better in 20 of 28 sectors)	28.57% (better in 8 of 28 sectors)

**Source:** Author's calculation based on monthly sector return data in The Stock Exchange of Thailand from Thomson Reuters Datastream

The regression results are close to each other whether using a steady zero-growth line or long-run average trendline to identify the business cycle stages. However, the regression model using a steady zero-growth line provides a slightly better regression model specification overall, therefore, I use the dummies of each stage of the business cycle from a steady zero-growth line method in business cycle stages identification in further analysis.

### **3.3 Analysis of Sectoral Stock Return along the Different Stages of Business Cycle**

Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT) have been two major models to demonstrate capital asset return in association with risk for many decades with the ground principle that capital assets with the same level of systematic risk should have the same level of expected return. The value of a security assets is determined at the level in which the expected return corresponds to systematic risk. The difference between CAPM and APT is CAPM considered a market risk as the only systematic risk measured by the beta coefficient in the model, while APT considered more systematic risk factors expressed by the sensitivity of return to the numbers of risk factors.

Leković and Stanišić (2018) described that securities' return is a function of market risk, but in the APT model return of security asset is a function of multiple unknown risk factors. The APT model has the assumption that in market equilibrium, there is no possibility of obtaining risk-free arbitrage profit. Theoretically, the APT model should explain the unclear part that was unexplained by the CAPM model. The APT model also provides analytical framework for the study of the relationship between macroeconomic variables and stock prices with sensitivity to changes in each factor being represented by beta-specific factors (Assagaf et al., 2019). Herwany, Omar, Meera, and Febrian (2014) study results showed that CAPM is not valid but APT showed significant explanation of macroeconomic and market risk premium to changes in portfolio returns. However, controversies still occur in the literature and neither of these two models is perfect nor superior over another (Leković & Stanišić, 2018). Although APT is good at explaining assets pricing with multiple factors it requires

investor to perceive the risk sources and, therefore, can reasonably estimate these factors' sensitivities.

According to that, there is no consensus on which model is the most appropriate to analyze sectoral stock returns in different stages of the business cycle; therefore, in this study, I make the analysis of sectoral stock return along the different stages of the business cycle using Modified CAPM Model incorporating dummy variables of different stages of business cycle as the interaction term with market risk premium (Equation 2) under the assumption that market risk premium varies across different stages of the business cycle because this is the most appropriate modification method to incorporating the business cycle stage dummies into the market model.

Analysis of Sectoral Stock Returns in Response to Different Market Risk Premium in each Stage of Business Cycle Using Modified CAPM Model. The CAPM model can be modified to take into account the business cycle effect on sectoral stock returns in this study by introducing an interaction term between market risk premium and dummy variables representing market risk premium in each stage of the business cycle under the assumption that market risk premium varies along the different stages of business cycle, therefore, interaction term  $(R_m - R_f) * D_s$  represents market risk premium in different stages of business cycle (sth stage) and  $\beta_i$  coefficient represents a systematic risk of stock in sector  $i$  in sth stage of the business cycle. Therefore, we modify the CAPM model in this study by introducing dummy variables representing each business cycle stage.

From the CAPM Model

$$(R_i - R_f) = \beta_i (R_m - R_f)$$

$$\text{or } R_i = R_f + \beta_i (R_m - R_f)$$

In the CAPM model, the only systematic risk is market risk. In the modified CAPM model, I use interaction term between market risk premium and dummy variables representing market risk premium in each stage of the business cycle under the assumption that market risk premium varies along the different stages of business cycle, therefore, interaction term  $(R_m - R_f) * D_s$  represents market risk premium in different stages of the

business cycle ( $s^{\text{th}}$  stage) and  $\beta_i$  coefficient represents a systematic risk of stock in sector  $i$  in  $s^{\text{th}}$  stage of the business cycle.

The regression equation is defined as:

$$R_{i,t} - R_{f_t} = \beta_{i,k}(R_m - R_{f_t}) * D_s$$

with 4 different stages of the business cycle the regression model is:

Equation 2 (Modified CAPM Model with Business Cycle Stage Dummies variable interacting to Market Risk Premium)

$$R_{i,t} - R_{f_t} = \alpha_{i,t} + \beta_{i1} * (R_m - R_{f_t}) * D_{\text{expand}} + \beta_{i2} * (R_m - R_{f_t}) * D_{\text{recess}} + \beta_{i3} * (R_m - R_{f_t}) * D_{\text{depress}} + \beta_{i4} * (R_m - R_{f_t}) * D_{\text{recov}}$$

Where  $R_{i,t}$  is the return of stock in sector  $i$  at time  $t$ ,  $R_{f_t}$  is the risk-free rate at time  $t$ ,  $(R_m - R_{f_t})$  is market risk premium or excess market return over the risk free rate at time  $t$ ,  $D_s$  is dummy variable representing  $s^{\text{th}}$  stage of the business cycle which are  $D_{\text{expand}}$  for expansion stage,  $D_{\text{recess}}$  for recession stage,  $D_{\text{depress}}$  for depression stage,  $D_{\text{recov}}$  for recovery stage and coefficient  $\beta_{i,k}$  represents the systematic risk (market risk) of stock in sector  $i$  in  $s^{\text{th}}$  stage of the business cycle. Table 3.14 shows the descriptive statistics.

**Table 3.14** Descriptive Statistics of Sectoral Stock Returns

Sector	Mean Return	Median Return	Max Min	S.D.	Skewness	Kurtosis	Jarque-Bera (Prob.)	Sum Sq. Dev
<b>Rm</b>	0.87433	1.11997	19.52231 -30.17568	5.56116	-0.70462	7.27784	181.7277 (0.0000)	6618.275
<b>AGRI</b>	0.62328	0.29537	22.34548 -24.19583	6.88262	0.12932	4.08229	11.09262 (0.0039)	10137.28
<b>AUTO</b>	0.65100	0.19746	35.66389 -24.21564	6.70125	0.84042	7.69620	222.8795 (0.0000)	9610.057
<b>BANK</b>	0.66204	0.89242	31.82638 -28.6476	6.64066	0.03409	5.99683	80.49657 (0.0000)	9437.039

Table 3.14 (Continued)

Sector	Mean Return	Median Return	Max Min	S.D.	Skewness	Kurtosis	Jarque- Bera (Prob.)	Sum Sq. Dev
<b>COMM</b>	1.55296	1.62567	20.69477 -24.46749	5.55266	-0.15415	5.20461	44.39159 (0.0000)	6598.051
<b>CONMAT</b>	0.90928	0.52400	20.55461 -26.90616	6.82230	0.02960	4.49434	20.03618 (0.0000)	9960.354
<b>CONS</b>	-0.32113	-0.95497	19.93917 -17.64706	6.95508	0.09602	3.41947	0.629642 (0.72992)	3386.120
<b>ETRON</b>	0.43321	0.77780	29.81880 -32.9031	7.38431	-0.15777	5.70132	66.26189 (0.0000)	11669.01
<b>ENERG</b>	1.25950	1.80724	53.28470 -32.83434	7.67306	1.073063	13.5786	1043.836 (0.0000)	12599.44
<b>FASHION</b>	0.28601	-0.01076	15.99750 -10.71775	3.61947	0.90465	5.88485	103.8804 (0.0000)	2803.522
<b>FIN</b>	0.94133	1.01354	27.84329 -34.94846	7.54052	-0.32130	5.59177	63.87499 (0.0000)	12167.93
<b>FOOD</b>	0.99564	1.15805	15.53482 -24.98639	5.19336	-0.53166	5.54147	67.99128 (0.0000)	5771.782
<b>HELTH</b>	2.17303	1.84033	34.22415 -27.82078	6.51155	0.37050	7.09308	155.0006 (0.0000)	9073.660
<b>HOME</b>	0.57129	0.32237	42.18750 -25.93699	6.88578	0.88501	10.21505	494.4100 (0.0000)	10146.59
<b>ICT</b>	0.81208	0.87658	28.60119 -22.73476	6.95518	0.02751	4.65990	24.70974 (0.0000)	10352.16
<b>IMM</b>	-0.07229	-0.21727	25.07227 -49.69453	8.47713	-0.99280	10.03694	358.6351 (0.0000)	11497.87
<b>INSUR</b>	0.96029	0.82440	16.87874 -20.55608	4.76919	-0.15938	5.34484	50.16557 (0.0000)	4867.459
<b>MEDIA</b>	0.27204	0.16807	26.31579 -37.28240	6.51642	-0.58501	8.42951	276.3510 (0.0000)	9087.235
<b>MINE</b>	0.31037	0.00000	59.25373 -50.87311	12.12256	0.55278	7.16859	166.6195 (0.0000)	31448.70
<b>PKG</b>	0.83667	-0.04941	41.75017 -26.69015	7.96838	0.82285	7.30422	190.2275 (0.0000)	12930.58

**Table 3.14** (Continued)

Sector	Mean Return	Median Return	Max Min	S.D.	Skewness	Kurtosis	Jarque-Bera (Prob.)	Sum Sq. Dev
<b>PERSON</b>	0.69781	0.59685	60.66151 -23.99967	7.77324	2.28643	20.63890	2974.537 (0.0000)	12930.58
<b>PETRO</b>	1.40815	1.29159	36.0465 -40.64502	9.55240	0.08981	6.13159	88.13687 (0.0000)	19527.15
<b>PF&amp;REITs</b>	0.68791	0.66970	8.259590 -5.567440	2.18449	0.05332	4.18515	7.60723 (0.02225)	610.8139
<b>PAPER</b>	1.46535	0.62887	53.94718 -18.69953	8.68487	1.61610	9.54857	477.7562 (0.0000)	16141.37
<b>PROF</b>	0.35915	-0.07216	58.98125 -41.13022	10.77714	0.90625	8.35678	286.4895 (0.0000)	24855.41
<b>PROP</b>	0.97695	1.25241	33.23853 -34.46774	8.05363	0.18194	5.24599	46.37625 (0.0000)	13880.24
<b>STEEL</b>	-1.10543	-0.76923	16.47675 -19.05992	6.21136	-0.19610	3.28031	1.03608 (0.59569)	4089.583
<b>TOURISM</b>	0.71314	0.68658	23.44946 -22.45856	5.61188	0.22795	6.20022	93.60783 (0.0000)	6739.533
<b>TRANSP</b>	1.28553	1.58053	27.74019 -41.29515	7.78316	-0.63883	7.83258	223.8346 (0.0000)	12963.61

**Source:** Author's calculation based on monthly market and sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream

From descriptive statistics, steel and construction sectors have overall negative mean and median returns. The healthcare services sector has the highest overall average return. Mining has the highest overall return volatility. The commerce sector has second-highest mean return, which energy sector has second-highest median return comparing to its peers. Among others, the mining sector has the highest overall return volatility, followed by the petrochemical sector. However, analysis of different stages of the business cycle will further be made.

**Table 3.15** Regression Analysis Results of Sectoral Stock Return and Dummy Variables Representing Stages of Business Cycle (Using Modified CAPM Model with Business Cycle Stage Dummies interacting with Market Risk Premium)

Sector	$\beta_{i1}$ (Dexpand)	$\beta_{i2}$ (Drecess)	$\beta_{i3}$ (Ddepress)	$\beta_{i4}$ (Drecov)
AGRI	<b>0.929830</b> (0.0000)	<b>0.589122</b> (0.0000)	<b>0.679457</b> (0.0000)	<b>1.220952</b> (0.0000)
AUTO	<b>0.730746</b> (0.0000)	<b>0.825514</b> (0.0000)	<b>0.641430</b> (0.0000)	<b>0.908230</b> (0.0000)
BANK	<b>1.227742</b> (0.0000)	<b>1.001473</b> (0.0000)	<b>0.838838</b> (0.0000)	<b>1.204348</b> (0.0000)
COMM	<b>0.746148</b> (0.0000)	<b>0.687546</b> (0.0000)	<b>0.783364</b> (0.0000)	<b>0.495876</b> (0.0034)
CONMAT	<b>1.090629</b> (0.0000)	<b>0.958831</b> (0.0000)	<b>1.048272</b> (0.0000)	<b>1.327154</b> (0.0000)
CONS	<b>1.245362</b> (0.0000)	<b>1.693046</b> (0.0000)	<b>3.439159</b> (0.0184)	0.289680 (0.8463)
ETRON	<b>0.724188</b> (0.0000)	<b>0.676801</b> (0.0000)	<b>1.054830</b> (0.0000)	<b>1.432041</b> (0.0000)
ENERG	<b>0.918443</b> (0.0000)	<b>1.211584</b> (0.0000)	<b>1.194666</b> (0.0000)	<b>1.068494</b> (0.0000)
FASHION	<b>0.447879</b> (0.0000)	<b>0.274335</b> (0.0000)	<b>0.401261</b> (0.0000)	0.139107 (0.2952)
FIN	<b>1.138984</b> (0.0000)	<b>1.068698</b> (0.0000)	<b>1.025517</b> (0.0000)	<b>1.117653</b> (0.0000)
FOOD	<b>0.518908</b> (0.0000)	<b>0.687051</b> (0.0000)	<b>0.830129</b> (0.0000)	<b>0.683969</b> (0.0000)
HEALTH	<b>0.274182</b> (0.1015)	<b>0.541066</b> (0.0000)	<b>0.983884</b> (0.0000)	<b>0.458713</b> (0.0528)
HOME	<b>1.147236</b> (0.0000)	<b>0.551853</b> (0.0000)	<b>0.688093</b> (0.0001)	<b>0.514614</b> (0.0322)
ICT	<b>0.944466</b> (0.0000)	<b>0.919170</b> (0.0000)	<b>0.597710</b> (0.0001)	<b>0.431493</b> (0.0484)
IMM	<b>0.936282</b> (0.0000)	<b>0.990590</b> (0.0000)	<b>1.647784</b> (0.0000)	<b>1.371941</b> (0.0000)

**Table 3.15** (Continued)

Sector	$\beta_{i1}$ (Dexpand)	$\beta_{i2}$ (Drecess)	$\beta_{i3}$ (Ddepress)	$\beta_{i4}$ (DrecoV)
INSUR	<b>0.360693</b> (0.0030)	<b>0.441228</b> (0.0000)	<b>0.587286</b> (0.0000)	<b>0.492940</b> (0.0040)
MEDIA	<b>0.872715</b> (0.0000)	<b>0.793865</b> (0.0000)	<b>1.160838</b> (0.0000)	<b>0.601854</b> (0.0013)
MINE	<b>1.158217</b> (0.0003)	<b>0.988810</b> (0.0000)	<b>1.367571</b> (0.0000)	0.793269 (0.0764)
PKG	<b>0.959754</b> (0.0000)	<b>0.860126</b> (0.0000)	<b>0.667421</b> (0.0006)	<b>0.729661</b> (0.0083)
PERSON	0.378058 (0.0936)	<b>0.394535</b> (0.0015)	0.303964 (0.1737)	0.345828 (0.2768)
PETRO	<b>1.225313</b> (0.0000)	<b>1.347338</b> (0.0000)	<b>1.382985</b> (0.0000)	<b>1.603795</b> (0.0000)
PF&REITs	<b>0.162979</b> (0.0223)	<b>0.312391</b> (0.0000)	-0.219539 (0.3860)	0.114745 (0.1637)
PAPER	<b>0.862869</b> (0.0006)	<b>0.368734</b> (0.0071)	0.148715 (0.5474)	0.236817 (0.5012)
PROF	<b>0.972075</b> (0.0008)	<b>0.701803</b> (0.0000)	<b>1.316983</b> (0.0000)	<b>0.863360</b> (0.0340)
PROP	<b>1.212426</b> (0.0000)	<b>1.214212</b> (0.0000)	<b>1.156911</b> (0.0000)	<b>1.581914</b> (0.0000)
STEEL	<b>1.234027</b> (0.0000)	<b>1.644760</b> (0.0000)	-0.154849 (0.7790)	0.96279 (0.1142)
TOURISM	<b>0.422471</b> (0.0023)	<b>0.629231</b> (0.0000)	<b>0.686993</b> (0.0000)	0.202376 (0.2961)
TRANS	<b>1.145788</b> (0.0000)	<b>1.020288</b> (0.0000)	<b>1.247145</b> (0.0000)	<b>1.350313</b> (0.0000)

**Source:** Author's calculation based on monthly sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream.

The analysis of the modified CAPM model indicates that sectoral stock returns have different sensitive responses to market risk premium in different business cycle stages. Assessment of beta can be summarized as below table:

**Table 3.16** Summary of Results from Analysis of Sectoral Stock Returns with Modified CAPM Model (ranking from highest to lowest beta coefficient)

	Expansion	Recession	Depression	Recovery
$\beta > 1$	CONS	CONS	CONS	PETRO
	STEEL	STEEL	IMM	PROP
	BANK	PETRO	PETRO	ETRON
	PETRO	PROP	MINE	IMM
	PROP	ENERG	PROP	TRANS
	MINE	FIN	TRANSP	CONMAT
	HOME	TRANSP	ENERG	AGRI
	TRANS	BANK	MEDIA	BANK
	FIN		PROP	FIN
			ETRON	ENERG
			FIN	
			CONMAT	
	$\beta < 1$	PROF	IMM	HELTH
PKG		MINE	BANK	PROF
ICT		CONMAT	FOOD	PKG
IMM		ICT	COMM	FOOD
AGRI		PKG	HOME	MEDIA
MEDIA		AUTO	TOURISM	HOME
PAPER		MEDIA	AGRI	COMM
COMM		PROF	PKG	INSUR
AUTO		COMM	AUTO	ICT
ETRON		FOOD	ICT	IMM
FOOD		TOURISM	INSUR	
FASHION		ETRON	FASHION	
TOURISM		AGRI		
INSUR		HOME		
PF&REITs		HELTH		
		INSUR		
		PERSON		
	PAPER			

**Table 3.16** (Continued)

	<b>Expansion</b>	<b>Recession</b>	<b>Depression</b>	<b>Recovery</b>
		PF&REITs		
		FASHION		
<b>B not significant</b>	HEALTH PERSON	N/A	PERSON PF&REITs PAPER STEEL	CONST FASHION HEALTH MINE PERSON PF&REITs PAPER STEEL TOURISM

The beta value indicates sectoral returns' sensitivity in responses to positive/negative changes in equity market risk premium. The beta higher than one implies that when equity market risk premium increases or declines one unit, the particular stock sector moves more than one unit in the same direction. Positive beta value but lower than one implies that when equity market risk premium increases or declines one unit, the particular stock sector moves less than one unit in the same direction. In the stages of business cycle where the market risk premium is expected to be positive, i.e. recovery stage or expansion stage, investment in equity sectors which beta higher than one probably yields positive leverage to gain more than market risk premium. In contrast, in the business cycle stages where the market risk premium is expected to be negative i.e. depression stage, investment in equity sectors with beta value lower than one probably provides volatility risk protection relative to overall market.

Before conclusion of investment recommendations, I examine stock sector return performance compared with market performance using average return in each stage of business cycle also with volatility risk (volatility of return) into consideration. The below table reports sectoral stock returns in each stage of the business cycle, in percentage terms, compared with market performance. The performances of the sectorial return are then ranked by descending order.

**Table 3.17** Sectoral Stock Returns in Each Stage of Business Cycle (%) Compared with Market Performance (Ranking by Order)

	Expansion	Recession	Depression	Recovery
<b>Positive return</b>	PAPER (2.62)	HELTH (2.13)	COMM (0.81)	PROP (11.20)
<b>(+) and above Rm</b>	HELTH (2.41)	COMM (1.37)	ICT (0.71)	TRANS (10.45)
	HOME (1.95)	ENERG (1.31)	AGRI (0.17)	PETRO (10.01)
	PETRO (1.84)	ICT (1.05)	CONMAT (0.01)	CONMAT (9.99)
	TRANS (1.71)	INSUR (0.97)		ETRON (9.98)
	FIN (1.63)	PAPER (0.85)		AGRI (9.83)
	CONMAT (1.61)	FOOD (0.84)		IMM (8.99)
	AUTO (1.54)	PETRO (0.84)		BANK (8.85)
	COMM (1.46)	PERSON (0.67)		ENERG (7.38)
	PROP (1.43)			PROF (7.37)
	PKG (1.29)			MINE (7.03)
	TOURISM (1.29)			FIN (6.96)
	PROF (1.10)			AUTO (6.78)
	INSUR (1.00)			FOOD (6.41)
				PKG (5.96)
				COMM (5.63)
				HOME (4.95)
				HELTH (4.83)
				PAPER (4.62)
				MEDIA (4.59)
				ICT (4.21)
				INSUR (3.95)
<b>Rm</b>	<b>0.92</b>	<b>0.55</b>	<b>-1.52</b>	<b>7.33</b>
<b>Positive return</b>	MINE (0.91)	TRANS (0.53)	No stock sector	PERSON (3.02)
<b>(+) but less Rm</b>	PF&REITs (0.87)	PF&REITs (0.41)	with positive	STEEL (2.59)
	FOOD (0.85)	TOURISM (0.37)	return but less	TOURISM (2.50)
	ENERG (0.83)	PKG (0.35)	than Rm	FASHION (2.04)
	BANK (0.77)	FIN (0.29)		PF&REITs (1.33)
	PERSON (0.59)	PROP (0.23)		CONS (0.65)
	MEDIA (0.57)	BANK (0.21)		

**Table 3.17** (Continued)

	<b>Expansion</b>	<b>Recession</b>	<b>Depression</b>	<b>Recovery</b>
	FASHION (0.50)	AGR (0.15)		
	IMM (0.42)	ETRON (0.10)		
	ETRON (0.36)	FASHION (0.08)		
	AGRI (0.33)	AUTO (0.07)		
	ICT (0.08)			
<b>Negative return (-)</b>	CONS (-0.14)	MEDIA (-0.01)	PERSON (-0.25)	No stock sector
	STEEL (-0.36)	CONMAT (-0.18)	PF&REIT (-0.27)	with negative return
		PROF (-0.33)	FASHION (-0.62)	
		MINE (-0.45)	STEEL (-0.82)	
		HOME (-0.49)	FOOD (-0.92)	
		IMM (-1.05)	TOUR (-1.42)	
		CONS (-1.38)	ENERG (-1.48)	
		STEEL (-2.48)	TRANS (-1.50)	
			HEALTH (-1.53)	
			PKG (-1.59)	
			MINE (-1.66)	
			HOME (-1.87)	
			INSUR (-2.18)	
			FIN (-2.27)	
			BANK (-2.29)	
			MEDIA (-2.63)	
			PETRO (-3.04)	
			PROP (-3.07)	
			PAPER (-3.34)	
			ETRON (-3.68)	
			PROF (-3.80)	
			IMM (-3.92)	
			AUTO (-4.83)	

Considering both risks and return aspects for appropriate investment decision, I use Treynor Ratio as a proxy of risk-adjusted return to develop investment recommendations in each stage of the business cycle by selecting stock sectors with the highest ranking of Treynor Ratio and significant beta coefficient from modified CAPM model in equation 2.

Treynor Ratio was developed by Jack Treynor using a beta value from the CAPM model as a volatility measurement. Treynor Ratio is a fraction of return and risk where return (numerator) is defined as incremental average return from investment in stock  $i$  over risk-free asset and risk (denominator) is defined as a beta of stock  $i$ , which represents the sensitivity of return from stock  $i$  relative to market risk benchmark. Treynor Ratio can be written as:

$$T_i = \frac{r_i - r_f}{\beta_i}$$

where  $T_i$  is Treynor Ratio of stock  $i$ ,  $r_i$  is annualized return of stock  $i$ , and  $r_f$  is annualized risk-free return

We can analyze Treynor ratio of stocks in different business cycle stages by using beta value calculated from modified CAPM model in equation 2 which can be used for comparison of risk-adjusted return between different stocks.

I calculate the business cycle Treynor ratio of each stock sector using the beta value from table 3.12 and the results are as table 3.15.

**Table 3.18** Treynor Ratio of Stock Sectors in Different Stages of Business Cycle

Sector / Stage	Expansion	Recession	Depression	Recovery
AGRI	0.024607	-0.25465	-0.193301	<b>7.805688</b>
AUTO	<b>1.679886</b>	-0.276179	-7.993312	6.807395
BANK	0.372554	-0.087042	-3.081906	<b>7.100664</b>
COMM	<b>1.539842</b>	<b>1.550529</b>	<b>0.655379</b>	<b>10.74771</b>
CONMAT	<b>1.190882</b>	-0.505522	-0.275253	<b>7.300117</b>
CONS	0.2006	-0.992873	-0.488492	$\beta_i$ Not Sig
ETRON	0.064431	-0.29174	-3.776732	6.758382
ENERG	0.569627	<b>0.834519</b>	-1.493622	6.625868
FASHION	0.425003	-0.789218	-2.286965	$\beta_i$ Not Sig
FIN	<b>1.158682</b>	-0.011144	-2.508403	5.960338
FOOD	<b>1.032245</b>	<b>0.792736</b>	-1.481324	<b>8.93985</b>

**Table 3.18** (Continued)

Sector / Stage	Expansion	Recession	Depression	Recovery
HEALTH	$\beta_i$ Not Sig	<b>3.373914</b>	-1.861561	$\beta_i$ Not Sig
HOME	<b>1.427849</b>	-1.424619	-3.159181	<b>9.036035</b>
ICT	-0.242783	<b>0.81875</b>	<b>0.692393</b>	<b>9.07243</b>
IMM	0.009645	-0.5027	-2.561015	6.334092
INSUR	<b>1.908964</b>	<b>1.526036</b>	-4.225846	<b>7.396742</b>
MEDIA	0.299044	-0.395231	-2.527614	<b>7.132261</b>
MINE	0.522173	-0.754169	-1.434748	$\beta_i$ Not Sig
PKG	<b>1.020084</b>	0.052341	-2.834403	<b>7.751038</b>
PERSON	$\beta_i$ Not Sig	<b>0.949928</b>	$\beta_i$ Not Sig	$\beta_i$ Not Sig
PETRO	<b>1.246424</b>	<b>0.398371</b>	-2.413924	6.054695
PF&REITs	-1.943441	-0.670026	$\beta_i$ Not Sig	$\beta_i$ Not Sig
PAPER	-0.367078	<b>1.49338</b>	$\beta_i$ Not Sig	$\beta_i$ Not Sig
PROF	<b>1.150055</b>	-0.891005	-3.118355	<b>8.200473</b>
PROP	<b>0.923562</b>	-0.055863	-2.916197	6.891209
STEEL	-0.542938	-0.987822	$\beta_i$ Not Sig	$\beta_i$ Not Sig
TOURISM	<b>2.316609</b>	0.110182	-2.496663	$\beta_i$ Not Sig
TRANS	<b>1.223935</b>	0.226201	-1.443264	<b>7.513384</b>

**Note:** Highlighted sectors with Treynor ratio higher than the market. Market Treynor ratio is calculated by  $(R_m - R_f)/1$  (market beta = 1), which equal to 0.60785 for expansion, 0.253 for recession, -1.8243 for depression and 7.03466 for recovery

### Summary and Implications for investment

1) In the recovery stage, majority of the stock sectors have positive average return above the market (almost half of them also have a Treynor ratio higher than the market when considering risk-adjusted return perspective), and the recovery stage is the only business cycle stage where there is no stock sector with negative average return. Therefore with these considerations, recovery stage is the best timing for investing in the stock market. The expansion stage is second-best timing for stock market investment.

2) In the depression stage, most of the stock sectors have a negative average return where only commerce and ICT sectors have a positive average return above the market with a higher Treynor ratio. It implies that in the depression stage, commerce and ICT are the only two sectors which can be invest.

3) Commerce is the only stock sector that can be invested in all stages of the business cycle. It is the only stock sector with a positive average return across all business cycle stages and the only stock sector with a positive Treynor ratio higher than the market in all business cycle stages.

4) The Tourism sector performs best in the aspect of risk-adjusted return in the expansion stage (incremental positive real GDP growth) of the business cycle.

5) The healthcare services sector is the best stock sector to invest in the recession stage (positive real GDP growth but declining towards steady zero-growth line) of business cycle considering a risk-adjusted return.

6) Steel is the only stock sector with a negative average return in all stages of business cycles except the recovery stage. It also has a negative Treynor ratio in expansion and recovery stages with an insignificant beta value in depression and recovery stages.

7) Recommendations on strategic portfolio allocation along the different stages of the business cycle can be summarized in Table 3.16

**Table 3.19** Summary of Recommendations on Sectoral Allocation Investment Strategy Along Different Stages of Business Cycle (Ranked by highest Treynor ratio to lowest Treynor ratio from top to bottom)

<b>Expansion</b>	<b>Recession</b>	<b>Depression</b>	<b>Recovery</b>
Tourism & Leisure	Healthcare	ICT	<b>Commerce</b>
Insurance	<b>Commerce</b>	<b>Commerce</b>	ICT
Automotive	Insurance		Home & Office
<b>Commerce</b>	Paper & Print Mat		Food & Beverage
Home & Office	Personal Products		Prof. Services
Construction Mat	Energy & Utilities		Agribusiness
Petrochemical	ICT		Packaging

**Table 3.19** (Continued)

<b>Expansion</b>	<b>Recession</b>	<b>Depression</b>	<b>Recovery</b>
Transportation	Food & Beverage		Transportation
Finance & Sec	Petrochemical		Construction Mat
Prof. Services			Insurance
Food & Beverage			Media
Packaging			Banking
Property Dev			

**Note:** Highlighted the best sector with the highest risk-adjusted return in each stage of the business cycle. Commerce is the only sector that can be invested in all stages of the business cycle.

### **3.4 Portfolio Simulation Using Recommendations on Sectoral Allocation Investment Strategy Along Different Stages of Business Cycle**

I perform portfolio simulation using sectoral allocation strategy compared with all investments in the market portfolio and all investments in the risk-free assets. I perform portfolio analysis using 2 strategies, the first strategy is to invest in only one best sector (with highest business cycle stage Treynor ratio) in each stage of the business cycle (no inter-sectoral diversification) and the second strategy is to invest in each stage of the business cycle with inter-sectoral diversification strategy with inter-sectoral investment allocation ratio determined by Markowitz portfolio optimization approach.

Portfolio Strategy 1: Invest only one best sector (No Inter-Sectoral Allocation) in each stage of the business cycle

The formula calculates value of portfolio in each month in equation 3.

Equation 3 (Value of Portfolio without Weighted Investment)

$$V_{pt} = V_{pt-1} * (1 + (r_{pt}/100))$$

$V_{p_t}$  = Value of portfolio at month t

$V_{p_{t-1}}$  = Value of portfolio in previous month (period t-1)

$r_{p_t}/100$  = Portfolio rate of return in month t

Assumptions:

- 1) Realize profit/loss and reinvest every end of the month to maximize the benefit of compound return
- 2) For strategic portfolio, in the month under expansion stage of business cycle put all investment in tour & leisure sector, in the month under recess stage of business cycle put all investment in the healthcare services sector, in the month under depression stage of business cycle put all investment in the ICT sector and the month under the recovery stage of business cycle put all investment in the commerce sector
- 3) For market portfolio, reinvest with the rate of market return ( $R_m$ ) in every month regardless of stages in the business cycle
- 4) For the risk-free portfolio, reinvest in the risk-free asset (10-years government bond) every month regardless of stages in the business cycle

**Table 3.20** Portfolio Simulation Using Sectoral Allocation Along with The Business Cycle Recommendation Strategy (with No Inter-Sectoral Allocation Within Each Stage of Business Cycle)

	Initial funding (currency unit)	Value of portfolio at the end (currency unit)	Portfolio growth (%)	Average monthly return (%)	Portfolio Variance	Sharpe Ratio
<b>Strategic Portfolio</b>	1,000,000	39,749,850	3,874.99	1.90	35.53	0.04
<b>Market Portfolio</b>	1,000,000	4,198,930	319.89	0.83	30.49	0.09
<b>Risk-Free Portfolio</b>	1,000,000	1,394,062	93.41	0.31	0.008	N/A

**Source:** Author's calculation based on monthly market and sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and 10-year government bond return from Bank of Thailand statistical database

The results from portfolio simulation using sectoral allocation along with the business cycle recommendation strategy without inter-sectoral allocation within each stage of business cycle reveal that Strategic Portfolio allocation per business cycle has an average monthly return 2.23 times higher than market portfolio and 6.13 times above risk-free asset despite the risk (portfolio return variance) increased only 1.17 times above market portfolio (Risk-free portfolio has extremely low variance as theoretically expected). Investment all in one sector with best Treynor Ratio during each stage of the business cycle gives 3,874.99 % portfolio growth along the study period if power of compound return has been utilized by reinvesting at every end of the month.

Portfolio Strategy 2: Apply inter-sectoral diversification within each stage of the business cycle using Markowitz Mean-Variance Portfolio Optimization Strategy to define optimal inter-sectoral allocation ratio in addition to sectoral allocation recommendation strategy in each stage of the business cycle

I apply Markowitz Mean-Variance Portfolio Optimization Strategy to find out the appropriate intersectoral diversification proportion in each stage of the business cycle to maximize portfolio return considering involved risk. Before calculation of the optimal weight of investment, I screen out stock sectors with high intersectoral correlation; hence for each pair of stock sectors with an intersectoral correlation higher than 0.50 just only the sector with a higher Treynor ratio is included, and the lower is excluded.

Calculation of optimal weight of investment to each stock sectors in each stage of the business cycle has been analyzed with Solver Add-ins in Microsoft Excel program under the setting condition of maximizing Portfolio Sharpe ratio subject to a constraint of allocation weight summation equal to one with a given average rate of stock sector return and covariance matrix of each stage of the business cycle.

Inter-sectoral portfolio diversification proportion according to Markowitz Mean-Variance Portfolio Optimization Strategy is in table 3.18.

**Table 3.21** Optimum Inter-sectoral Portfolio Diversification Ratio to Maximize Overall Portfolio Sharpe Ratio According to Markowitz Mean-Variance Portfolio Optimization Theory

Expansion		Recession		Depression		Recovery	
Sector	Weight	Sector	Weight	Sector	Weight	Sector	Weight
Tourism	0.46	Healthcare	0.62	Commerce	1.00	Commerce	0.78
HomeOff	0.15	Commerce	0.25			HomeOff	0.22
Insurance	0.12	Insurance	0.08				
Petrochem	0.27	Paper	0.05				

**Source:** Author's calculation based on monthly market and sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and 10-year government bond return from Bank of Thailand statistical database

The formula calculates value of portfolio in each month in equation 4  
Equation 4 (Value of Portfolio Using Weighted Investment)

$$V_{p_t} = \sum V_{i_t}$$

where  $V_{i_t} = V_{i_{t-1}} * [(1 + (r_{i_t} / 100))]$  and  $V_{i_{t-1}} = V_{p_{t-1}} * W_{i_{t-1}} * [(1 + (r_{i_{t-1}} / 100))]$   
or can be simplified as  $V_{p_t} = \sum [V_{i_{t-1}} * [(1 + (r_{i_t} / 100))]]_{i,t}$

$V_{p_t}$  = Value of total portfolio at month t

$V_{p_{t-1}}$  = Value of total portfolio in previous month (period t-1)

$V_{i_t}$  = Value of investment in the stock sector i at month t

$V_{i_{t-1}}$  = Value of investment in the stock sector i in previous month (period t-1)

$r_{i_t}$  = rate of return of the stock sector i in month t

$r_{i_{t-1}}$  = rate of return of the stock sector i in previous month (period t-1)

$W_{i_t}$  = weight of portfolio investment allocated to the stock sector i in month t

$W_{i_{t-1}}$  = weight of portfolio investment allocated to the stock sector i in the previous month (period t-1)

Assumptions:

- 1) Realize profit/loss and reinvest every end of the month to maximize the benefit of compound return
- 2) For a strategic portfolio, in each stage of the business cycle, intersectoral allocation to different stock sectors has been made according to suggestions from Markowitz's Mean-Variance Portfolio Optimization results, as stated in table 3.18.
- 3) For market portfolio, reinvest all portfolio with the rate of market return ( $R_m$ ) in every month regardless of stages in the business cycle
- 4) For risk-free portfolio, reinvest all portfolio in the risk-free asset (10-years government bond) in every month regardless of stages in the business cycle

**Table 3.22** Portfolio Simulation Using a Combination of Markowitz Mean-Variance Portfolio Optimization Strategy in addition to Sectoral Allocation Recommendation Strategy along each Stage of Business Cycle

	Initial funding (currency unit)	Value of portfolio at the end (currency unit)	Portfolio growth (%)	Average monthly return (%)	Variance	Sharpe Ratio
Strategic Portfolio	1,000,000	37,921,804	3,690.18	1.82	24.76	0.06
Market Portfolio	1,000,000	4,198,930	319.89	0.83	30.49	0.09
Risk-Free Portfolio	1,000,000	1,394,062	93.41	0.31	0.008	N/A

**Source:** Author's calculation based on monthly market and sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and 10-year government bond return from Bank of Thailand statistical database

The results from portfolio simulation using a combination of Markowitz Mean-Variance Portfolio Optimization Strategy in addition to sectoral allocation recommendations along the different stages of business cycle reveal that strategic portfolio allocation per business cycle has average monthly return 2.19 times higher than market portfolio and 5.87 times above risk-free asset. At the same time, risk (portfolio return variance) also decrease 18.79 % from the market portfolio (Risk-free portfolio has extremely

low variance as theoretically expected). Investment using a combination of Markowitz Mean-Variance Portfolio Optimization Strategy together with Sectoral Allocation Along The Business Cycle Recommendations gives 3,690.18 % portfolio growth along the study period if the power of compound return has been utilized by reinvest every end of month.



**Table 3.23** Comparison Between Portfolio Strategy Without and With Intersectoral Diversification in each Business Cycle Stage

	Initial funding (currency unit)	Value of portfolio at the end (currency unit)	Portfolio growth (%)	E(Rp) Monthly (%)	$\sigma^2$	Sharpe Ratio
Strategic Portfolio without intersectoral diversification	1,000,000	39,749,850	3,874.99	1.90	35.53	0.04
Strategic Portfolio (with inter-sectoral diversification using Markowitz Portfolio Optimization)	1,000,000	37,921,804	3,690.18	1.82	24.76	0.06
Market Portfolio	1,000,000	4,198,930	319.89	0.83	30.49	0.09
Risk-Free Portfolio	1,000,000	1,394,062	93.41	0.31	0.008	N/A

**Source:** Author's calculation based on monthly market and sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and 10-year government bond return from Bank of Thailand statistical database.

Incorporating an intersectoral diversification strategy using Markowitz's mean-variance portfolio optimization strategy helps to maximize the overall portfolio Sharpe ratio. Despite lower monthly expected return and overall portfolio growth compared with investment in only one best sector in each stage of the business cycle, it reduces risk exposure below market risk level while raising expected return 2.19 times above market return level.

**Table 3.24** Comparison of Different Portfolio Strategies by each Stage of Business Cycle

	<b>Strategic Portfolio without intersectoral diversification</b>	<b>Strategic Portfolio (using Markowitz Portfolio Optimization)</b>	<b>Market Portfolio</b>	<b>Risk-Free Portfolio</b>
<b>Expansion Stage</b>				
E(Rp) Monthly (%)	1.29	1.50	0.81	0.06
Portfolio variance	17.28	13.58	12.95	0.09
Portfolio Sharpe Ratio	0.30	0.39	0.21	N/A
<b>Recession Stage</b>				
E(Rp) Monthly (%)	2.12	1.78	0.27	0.02
Portfolio variance	45.83	27.32	40.39	0.28
Portfolio Sharpe Ratio	0.31	0.34	0.04	N/A
<b>Depression Stage</b>				
E(Rp) Monthly (%)	0.71	0.81	3.12	0.26
Portfolio variance	64.85	95.13	30.67	0.21
Portfolio Sharpe Ratio	0.06	0.06	0.52	N/A
<b>Recovery Stage</b>				
E(Rp) Monthly (%)	5.62	5.48	5.63	0.47
Portfolio variance	9.87	7.26	22.40	0.15
Portfolio Sharpe Ratio	1.64	1.86	1.09	N/A

**Source:** Author's calculation based on monthly market and sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and 10-year government bond return from Bank of Thailand statistical database

From the comparison, strategic portfolio management with sectoral allocation per recommendations along the different stages of business cycle and Markowitz portfolio optimization provides better portfolio Sharpe ratio than market portfolio except in depression stage where some stock sectors have faster rebound from bottom. The benefit of this strategy is most obvious in the expansion stage.



## **CHAPTER 4**

### **INFLUENCE OF MACROECONOMIC ENVIRONMENT AND EXPECTED BUSINESS SENTIMENT INDEX IN THE DIFFERENT STAGES OF BUSINESS CYCLE ON STOCK MARKET AND SECTORAL RETURNS**

The macroeconomic environment clearly influences systematic risk and stock returns. In literature, many macroeconomic factors have been studied about their impact on market return. In this chapter, I analyze the impact of key macroeconomic factors on stock returns at the sector level, providing additional insights. Besides, the expected business sentiment index also impacts investment decisions, and it changes from time to time across different stages of the business cycle. This chapter also explores the difference of expected business sentiment index in the different stages of business cycle and its relationship with stock market and sectoral returns.

#### **4.1 Influence of Key Macroeconomic Factors and Business Sentiment Index on the Stock Market and Sectoral Stock Return**

Key macroeconomic factors influencing the market and sectoral stock returns commonly mentioned in the literature are Gross Domestic Product (GDP), Inflation rate and Consumer Price Index (CPI), interest rate, exchange rate, money supply, and oil price.

Business Sentiment Index has been mentioned in some literature but not common and has never been analyzed together with the context of the business cycle. In principle, business sentiment index and expectation (forecast) on business sentiment index should be vary across different stages of business cycle.

I use the Business Sentiment Index (BSI) developed by The Bank of Thailand (BOT), which was constructed from Business Performance, Total Order Books, Investment, Employment, and Production Costs (Invert). Business Sentiment survey

questionnaires are distributed during the first week of the survey month and complied with the first working day of the following month. Each question contains 3 measurement scales (improved, unchanged, worsened). Respondents are requested to compare the current business situation with last month and the tendency in the next 3 months. Samples (representative firms) are mainly from Stock Exchange of Thailand (SET) listed company and Department of Business Development consist of large (capital over than 200 million baht), medium (capital 50 to less than 200 million baht), and small (capital less than 50 million baht) firms. The samples are from production, trade and service business sectors, including both metropolitan and provincial areas (ratio around 80:20), with the response rate on the average of around 60%. Each component is applied with equal weight to calculate the monthly composite index. Each component index is constructed from the formula:

$$\text{Index} = 100 \times [(1.0 \times \text{percentage of respondents indicating improvement}) + (0.5 \times \text{percentage of respondents indicating stable}) + (0 \times \text{percentage of respondents indicating deterioration})]$$

Expected BSI also available from the BOT statistics website.

**Table 4.1** Mean and Variance of Changes in Business Sentiment Index and Expected Business Sentiment Index in each Stage of Business Cycle

		<b>Expansion Stage</b>	<b>Recession Stage</b>	<b>Depression Stage</b>	<b>Recovery Stage</b>
cBSI	Mean	0.42481	-0.46706	-1.58956	6.34043
	Variance	20.95883	18.05398	87.26398	67.1613
cBSI <sup>e</sup>	Mean	-0.02415	-0.12295	0.12910	3.08248
	Variance	6.329006	11.06828	134.3926	4.654435

**Source:** Author's calculation based on monthly data of Thailand Business Sentiment Index and Expected Business Sentiment Index from Bank of Thailand statistical database

The data shows that the depression stage has the highest volatility in changes of both BSI and BSIE. BSI and BSIE are highest in the recovery stage but BSIE has a more progressive outlook towards economic recovery.

**Table 4.2** Correlation Coefficient between Business Sentiment Index (BSI), Expected Business Sentiment Index (BSIE), Key Macroeconomic Indicators and Market Index (SETI)

	BSI	BSI <sup>e</sup>	CEI	LEI	GDP	CPI	INT	REER	MS	SETI
<b>BSI</b>	1									
<b>BSI<sup>e</sup></b>	<b>0.82144</b>	1								
<b>CEI</b>	0.27449	0.19784	1							
<b>LEI</b>	0.39150	0.33653	0.91665	1						
<b>GDP</b>	0.27088	0.21019	0.96620	0.96828	1					
<b>CPI</b>	0.20316	0.13311	0.96222	0.92008	0.95898	1				
<b>INT</b>	-0.48685	-0.41788	-0.14017	-0.38207	-0.27296	-0.18427	1			
<b>REER</b>	0.13052	0.08641	0.90256	0.83454	0.90736	0.92644	-0.08136	1		
<b>MS</b>	0.31733	0.25696	0.92773	0.99165	0.98112	0.94618	-0.34366	0.86918	1	
<b>SETI</b>	0.38023	0.34463	0.93167	0.96768	0.94763	0.91400	-0.26891	0.84567	0.95763	1

**Source:** Author's calculation based on monthly market return data in The Stock Exchange of Thailand from Thomson Reuters Datastream and BSI, BSIE, CEI, LEI, GDP, CPI, interest rate, Real Effective Exchange Rate, Money Supply (M2) from Bank of Thailand statistical database

At level, Business Sentiment Index (BSI) has a strong positive correlation with Expected Business Sentiment Index (BSIE) ( $r \geq 0.70$ ), but both have a weak correlation ( $r < 0.30$ ) with other macroeconomic factors also have a slightly weak correlation with market Index (SETI).

**Table 4.3** Correlation Coefficient between Changes in Business Sentiment Index (BSI), Expected Business Sentiment Index (BSI<sup>e</sup>), Key Macroeconomic Indicators and Market Return (R<sub>m</sub>)

	cBSI	cBSI <sup>e</sup>	gGDP	cCPI	cINT	cREER	cMS	R <sub>m</sub>
cBSI	1							
cBSI <sup>e</sup>	0.11876	1						
gGDP	-0.04222	-0.09439	1					
cCPI	-0.00187	0.00002	-0.33946	1				
cINT	-0.09031	-0.16425	0.19709	0.10540	1			
cREER	-0.11838	0.00043	0.11858	0.15348	0.04131	1		
cMS	-0.01552	0.00632	-0.03208	-0.09715	0.01206	0.04689	1	
R <sub>m</sub>	0.11961	0.29139	0.05785	0.06825	-0.11838	0.16787	0.10480	1

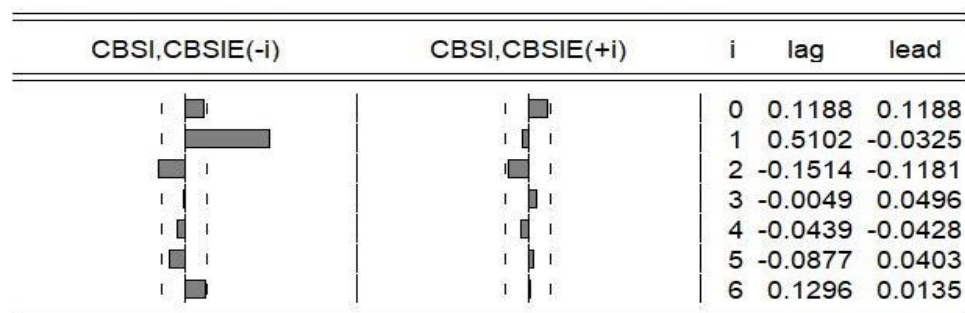
**Source:** Author's calculation based on monthly market return data in The Stock Exchange of Thailand from Thomson Reuters Datastream and BSI, BSI<sup>e</sup>, GDP, CPI, interest rate, Real Effective Exchange Rate, Money Supply (M2) from Bank of Thailand statistical database

Both changes of Business Sentiment Index (cBSI) and changes of Expected Business Sentiment Index (cBSI<sup>e</sup>) have a low correlation with changes in composite economic indexes, changes of key macroeconomic factors and market return.

According to that Business Sentiment Index (BSI) and Expected BSI are expected to be leading indicators where their changes can provide insights to changes in key macroeconomic indicators in following periods; therefore I further explore the association between the lags of changes in BSI and BSI<sup>e</sup> with market return (as a proxy of the overall stock market) using cross correlogram.

$$R(\tau) = \int_{-\infty}^{+\infty} x(t)y(t+\tau)dt$$

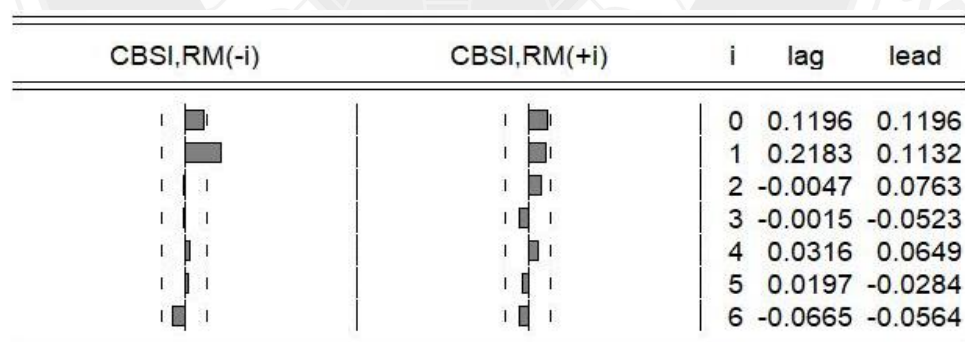
$R(\tau)$  is cross-correlation as a function of time delay  $\tau$ ,  $x(t)$  and  $y(t)$  is a function of time lags,  $\tau$  is a time delay or lag order.



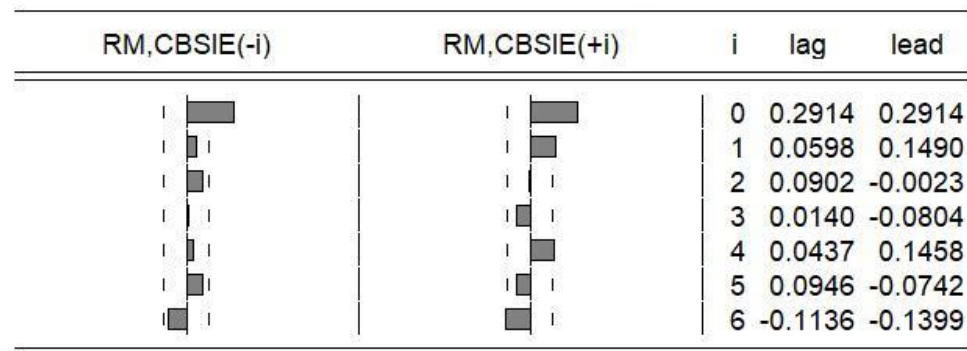
**Figure 4.1** Cross Correlogram between Changes in Business Sentiment Index (CBSI) and Changes in Expected Business Sentiment Index (CBSIE)

**Source:** Author's calculation based on the Thailand Business Sentiment Index and Expected Business Sentiment Index from Bank of Thailand statistical database

Cross correlogram analysis between changes in Business Sentiment Index (BSI) and Expected Business Sentiment Index (BSIe) suggests that first month lag of changes in Expected Business Sentiment Index has the highest and significant correlation with changes in Business Sentiment Index. This implies that the Expected Business Sentiment Index might able to predict Business Sentiment Index one month ahead.



**Figure 4.2** Cross Correlogram between Changes in Business Sentiment Index, Changes in Expected Business Sentiment Index and Market Returns



**Figure 4.2** (Continued)

**Source:** Author's calculation based on monthly market return data in The Stock Exchange of Thailand from Thomson Reuters Datastream and Business Sentiment Index and Expected Business Sentiment Index from Bank of Thailand statistical database

Cross Correlogram analysis between changes in Business Sentiment Index, Changes in Expected Business Sentiment Index and market return suggest that changes in Business Sentiment Index has the highest correlation with first lag of the market return but Expected Business Sentiment Index has highest and significant correlation with market return at zero lag level. This implies that the Expected Business Sentiment Index is appropriate to be further included in the multi-factor model.

#### **4.2 Impact of Macroeconomic Factors and Expected Business Sentiment Index on Sectoral Stock Returns Using Multifactor APT Model**

Finally, I analyze the impact of key macroeconomic factors, including the Expected Business Sentiment index on the market and sectoral stock returns using the Multi-factor APT Model. Under the assumption that expected business sentiment index may vary across the different stages of business cycle, in Multifactor APT Model, I incorporate business cycle stage dummies interacting with expected business sentiment index to represent different expected business sentiment index in the different stages of business cycle.

Equation 2 (Multifactor APT Model Including Key Macroeconomic Factors and Expected Business Sentiment Index Interacting with Business Cycle Stage Dummies)

$$\begin{aligned}
 (R_i - R_f)_t = & \alpha_{i,t} + \beta_1(R_m - R_f)_t + \beta_2gGDP_t + \beta_3cCPI_t + \beta_4cINT_t + \beta_5cEXR_t \\
 & + \beta_6cMS_t + \beta_7cBSI_t^e * D_{\text{expand}} + \beta_8cBSI_t^e * D_{\text{recess}} + \beta_9cBSI_t^e * D_{\text{depress}} \\
 & + \beta_{10}cBSI_t^e * D_{\text{recov}} + \varepsilon_{i,t}
 \end{aligned}$$

Where  $(R_i - R_f)_t$  is the excess return of stock in sector  $i$  over return of the risk-free asset (10-Year Government Bond) in month  $t$ ,  $(R_m - R_f)_t$  is market risk premium in month  $t$ ,  $gGDP_t$  is real GDP growth in period  $t$ ,  $cCPI_t$  is changes of consumer price Index in month  $t$ ,  $cINT_t$  is changes of interest rate in month  $t$ ,  $cEXR_t$  is changes of interest rate in month  $t$  and  $cMS_t$  is changes of money supply (broad money) in month  $t$ ,  $cBSI_t^e$  is changes of expected Business Sentiment Index in month  $t$ , and  $\beta_{k,t}$  is their respective coefficients representing the sensitivity of stock return of  $i$  to changes in key macroeconomic indicators at month  $t$

**Table 4.4** Multiple Regression of Multifactor APT Model for Sectoral Stock Return and Key Macroeconomic Factors Incorporating Expected Business Sentiment Index (Result from Equation 2)

	$\beta_1$	$\beta_2$	$\beta_3$	$\beta_4$	$\beta_5$	$\beta_6$	$\beta_7$	$\beta_8$	$\beta_9$	$\beta_{10}$
	$(R_m - R_f)$	GDP	CPI	INT	EXR	MS	BSI <sup>ex</sup> *D <sub>expand</sub>	BSI <sup>ex</sup> *D <sub>recess</sub>	BSI <sup>ex</sup> *D <sub>depress</sub>	BSI <sup>ex</sup> *D <sub>recov</sub>
<b>AGRI</b>	<b>0.70493</b> (0.0000)	-0.37677 (0.3585)	0.87166 (0.2886)	0.04436 (0.4783)	-0.22580 (0.4729)	-0.70139 (0.4024)	0.47759 (0.0616)	0.25598 (0.1203)	-0.01378 (0.9308)	0.031524 (0.9309)
<b>AUTO</b>	<b>0.69253</b> (0.0000)	<b>0.72196</b> (0.0448)	0.28389 (0.6919)	-0.05537 (0.3112)	<b>0.63469</b> (0.0216)	-1.21224 (0.0983)	-0.12021 (0.5886)	0.26406 (0.0668)	<b>0.34117</b> (0.0145)	0.47505 (0.1357)
<b>BANK</b>	<b>1.04036</b> (0.0000)	-0.28017 (0.2515)	-0.19394 (0.6912)	<b>0.09558</b> (0.0108)	0.12851 (0.4924)	-0.04334 (0.9307)	0.20770 (0.1711)	-0.03611 (0.7120)	-0.08706 (0.3570)	0.109514 (0.6129)
<b>COMM</b>	<b>0.69516</b> (0.0000)	-0.23811 (0.4012)	0.25008 (0.6593)	0.05174 (0.2322)	<b>0.57387</b> (0.0088)	0.62362 (0.2819)	-0.00977 (0.9557)	-0.02428 (0.8307)	0.16871 (0.1251)	<b>-0.57497</b> (0.0230)
<b>CONMAT</b>	<b>1.02346</b> (0.0000)	0.24277 (0.3700)	-0.78203 (0.1496)	-0.07231 (0.0809)	-0.18183 (0.3813)	-0.12761 (0.8173)	-0.14666 (0.3829)	-0.03888 (0.7200)	-0.08903 (0.3956)	0.35892 (0.1358)
<b>CONS</b>	<b>1.46711</b> (0.0000)	-3.52319 (0.0682)	4.04562 (0.0809)	0.24366 (0.1357)	-1.36819 (0.0637)	-0.33047 (0.9285)	-0.44713 (0.1838)	-0.12191 (0.7463)	1.41264 (0.5611)	1.26515 (0.3022)
<b>ETRON</b>	<b>0.71009</b> (0.0000)	0.10791 (0.7938)	-0.06718 (0.9352)	-0.05716 (0.3643)	0.012214 (0.9692)	-0.49759 (0.5551)	-0.06396 (0.8028)	0.23031 (0.1649)	<b>0.37563</b> (0.0195)	<b>1.31292</b> (0.0004)
<b>ENERG</b>	<b>1.18240</b> (0.0000)	0.35466 (0.2456)	0.08642 (0.8874)	-0.04498 (0.3341)	<b>-0.70336</b> (0.0029)	-0.98030 (0.1165)	-0.09836 (0.6034)	-0.02470 (0.8399)	-0.20083 (0.0900)	0.16816 (0.5344)
<b>FASHION</b>	<b>0.32636</b> (0.0000)	0.15828 (0.4884)	-0.48568 (0.2884)	0.02357 (0.4987)	-0.16870 (0.3359)	0.09064 (0.8458)	<b>0.30593</b> (0.0318)	0.11504 (0.2096)	-0.01784 (0.8400)	-0.35330 (0.0822)

Table 4.4 (Continued)

	$\beta_1$	$\beta_2$	$\beta_3$	$\beta_4$	$\beta_5$	$\beta_6$	$\beta_7$	$\beta_8$	$\beta_9$	$\beta_{10}$
	( $R_m - R_f$ )	GDP	CPI	INT	EXR	MS	BSI**D <sub>expand</sub>	BSI**D <sub>recess</sub>	BSI**D <sub>depress</sub>	BSI**D <sub>recov</sub>
<b>FIN</b>	<b>1.00443</b> (0.0000)	-0.21400 (0.5169)	-0.30615 (0.6430)	-0.01797 (0.7211)	<b>0.61472</b> (0.0159)	0.24022 (0.7215)	0.31737 (0.1223)	0.23137 (0.0814)	0.23950 (0.0619)	0.18415 (0.5295)
<b>FOOD</b>	<b>0.65794</b> (0.0000)	-0.40289 (0.1129)	<b>1.04711</b> (0.0060)	0.04665 (0.2282)	0.28807 (0.1393)	0.00922 (0.9858)	-0.10592 (0.5008)	0.11143 (0.2732)	0.12162 (0.2158)	0.06062 (0.7874)
<b>HEALTH</b>	<b>0.51731</b> (0.0000)	0.44238 (0.2817)	0.86101 (0.2950)	0.03386 (0.5886)	0.23340 (0.4586)	0.29012 (0.7292)	-0.35390 (0.1656)	0.01252 (0.9393)	<b>0.43573</b> (0.0066)	0.24738 (0.4970)
<b>HOME</b>	<b>0.65145</b> (0.0000)	-0.42212 (0.3154)	-0.42536 (0.6128)	0.11254 (0.0800)	0.41621 (0.1971)	0.54253 (0.5271)	0.28601 (0.2731)	0.12863 (0.4450)	0.26329 (0.1063)	-0.22501 (0.5459)
<b>ICT</b>	<b>0.90589</b> (0.0000)	-0.53326 (0.1548)	-0.09549 (0.8984)	0.00094 (0.9868)	0.11511 (0.6881)	-1.15283 (0.1321)	-0.27750 (0.2325)	-0.15239 (0.3098)	-0.00708 (0.9610)	<b>-1.13436</b> (0.0007)
<b>IMM</b>	<b>1.15857</b> (0.0000)	-0.02763 (0.9499)	<b>1.93393</b> (0.0329)	0.03048 (0.6843)	-0.39622 (0.2496)	-0.58667 (0.6341)	0.10312 (0.7227)	-0.14649 (0.4628)	0.29706 (0.0592)	0.05212 (0.8840)
<b>INSUR</b>	<b>0.37582</b> (0.0000)	<b>0.86450</b> (0.0017)	<b>1.31775</b> (0.0162)	-0.04303 (0.30000)	0.14102 (0.4990)	-0.51473 (0.3552)	0.07549 (0.6547)	0.16137 (0.1397)	<b>0.46779</b> (0.0000)	0.30858 (0.2016)
<b>MEDIA</b>	<b>0.84764</b> (0.0000)	-0.26058 (0.4164)	0.22005 (0.7315)	0.06582 (0.1790)	<b>0.49361</b> (0.0456)	0.05772 (0.9297)	-0.21917 (0.2711)	0.09442 (0.4624)	<b>0.25749</b> (0.0389)	-0.47099 (0.0986)
<b>MINE</b>	<b>1.05610</b> (0.0000)	-0.69029 (0.3711)	0.97442 (0.5279)	0.06576 (0.5762)	0.73170 (0.2168)	0.35984 (0.8192)	0.51238 (0.2850)	0.31549 (0.3079)	0.15829 (0.5960)	-1.23814 (0.0714)
<b>PKG</b>	<b>0.81780</b> (0.0000)	0.31849 (0.5034)	-0.71866 (0.4506)	0.01351 (0.8523)	0.15610 (0.6688)	0.96079 (0.3231)	0.24054 (0.4156)	0.22738 (0.2338)	-0.10215 (0.5792)	-0.29186 (0.4894)

Table 4.4 (Continued)

	$\beta_1$	$\beta_2$	$\beta_3$	$\beta_4$	$\beta_5$	$\beta_6$	$\beta_7$	$\beta_8$	$\beta_9$	$\beta_{10}$
	$(R_m - R_f)$	GDP	CPI	INT	EXR	MS	BSI**D <sub>expand</sub>	BSI**D <sub>recess</sub>	BSI**D <sub>depress</sub>	BSI**D <sub>recov</sub>
PERSON	<b>0.38646</b> (0.0002)	0.03145 (0.9548)	0.81213 (0.4643)	0.03033 (0.7198)	-0.08262 (0.8459)	0.11874 (0.9164)	0.23429 (0.4960)	-0.19876 (0.3714)	0.13604 (0.5262)	-0.26988 (0.5832)
PETRO	<b>1.35628</b> (0.0000)	<b>1.10457</b> (0.0076)	-0.23380 (0.7759)	<b>-0.13398</b> (0.0333)	-0.50661 (0.1086)	-1.468404 (0.0808)	-0.29636 (0.2454)	-0.13781 (0.4026)	<b>-0.36940</b> (0.0209)	<b>0.98354</b> (0.0074)
PF&REITs	<b>0.20403</b> (0.0000)	<b>0.38317</b> (0.0276)	0.16725 (0.7765)	-0.01872 (0.5789)	0.16868 (0.2082)	-0.38132 (0.4608)	0.02876 (0.7774)	0.14563 (0.1220)	<b>0.13792</b> (0.0297)	0.03458 (0.7897)
PAPER	<b>0.34804</b> (0.0025)	0.30286 (0.6233)	1.73681 (0.1601)	0.04727 (0.6153)	-0.18141 (0.7012)	0.70861 (0.5736)	0.33174 (0.3863)	0.39616 (0.1100)	0.16793 (0.4818)	0.00806 (0.9882)
PROF	<b>0.84419</b> (0.0000)	-0.79599 (0.2525)	-0.37683 (0.7863)	-0.010018 (0.9247)	0.53798 (0.3131)	-1.21127 (0.3934)	0.27319 (0.5264)	0.34068 (0.2219)	<b>0.62521</b> (0.0209)	-1.14111 (0.0651)
PROP	<b>1.14729</b> (0.0000)	0.33995 (0.2523)	-0.36860 (0.5346)	0.03167 (0.4840)	0.48242 (0.0348)	0.60150 (0.3210)	0.08595 (0.6405)	0.08021 (0.4999)	<b>0.39383</b> (0.0007)	<b>0.73756</b> (0.0055)
STEEL	<b>1.12224</b> (0.0000)	0.31119 (0.5039)	0.96958 (0.5105)	0.00165 (0.9867)	-0.05696 (0.8549)	1.10547 (0.5209)	<b>0.56139</b> (0.0301)	-0.15899 (0.4670)	0.20191 (0.1585)	0.64530 (0.3383)
TOURISM	<b>0.55333</b> (0.0000)	0.43562 (0.1935)	0.54298 (0.4174)	0.04676 (0.3596)	0.32195 (0.2101)	0.33551 (0.6232)	-0.04759 (0.8186)	-0.05686 (0.6714)	<b>0.26134</b> (0.0445)	-0.28534 (0.3365)
TRANSP	<b>1.04811</b> (0.0000)	0.45707 (0.1733)	-1.20635 (0.0730)	-0.08577 (0.0942)	0.10151 (0.6927)	<b>1.38981</b> (0.0431)	0.38009 (0.0686)	-0.21620 (0.1083)	<b>0.28033</b> (0.0315)	0.56249 (0.0594)

**Source:** Author's calculation based on monthly market and sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and 10-year government bond return from Bank of Thailand statistical database

The results from multiple regression analysis using Multifactor APT Model with an excess return of stock sectors over the risk-free asset as a dependent variable and market risk premium, key macroeconomic factors together with expected business sentiment index as independent variables can be summarized as follows.

Real GDP growth positively associates with stock returns in the automotive, insurance, petrochemicals, and property fund sectors.

Changes in Consumer Price Index (CPI) positively associates with stock returns in food & beverage, insurance, and industrial materials & machinery sectors.

The increasing interest rate has a positive relationship with a return in the banking sector but has an inverse relationship with petrochemicals sector.

Domestic currency appreciation positively associates with stock returns in automotive, commerce, finance and securities, and media sectors but inversely associates with stock return in the energy sector.

Increasing broad money supply positively associates with stock return only in the transportation & logistics sector.

In the expansion stage of the business cycle, positive expectations on business sentiment have a positive relationship with stock returns in fashion and steel sectors.

There is no significant association between expected business sentiment and stock returns in all sectors in the recession stage of business cycle.

Expected business sentiment index has the most significant relationship with sectoral stock returns in depression stage where confluence relationship is found with automotive, electrical components, healthcare services, insurance, media, property fund, professional services, property development, tourism & leisure, and transportation & logistic sectors. In contrast, an inverse relationship is noted with petrochemicals sector.

In the recovery stage of the business cycle, the expected business sentiment index has a confluence relationship with stock returns in electrical components, petrochemicals, and property development sectors, while an inverse relationship is noted with commerce and ICT sectors.

**Table 4.5** Summary of Macroeconomic Factors Effect on Sensitivity of Sectoral Stock Return

Macroeconomic Factors	Positive Relationship (+)	Negative Relationship (-)
Real GDP growth	Automotive, Insurance, Petrochemicals, Property Fund	Not Sig
Changes in Consumer Price Index (CPI)	Food & Beverage Industrial Materials & Machinery Insurance	Not Sig
Changes in Interest Rate (INT)	Banking	Petrochemicals
Changes in Real Effective Exchange Rate (REER)	Automotive, Commerce, Finance & Securities, Media	Energy
Changes in Money Supply (Broad Money)	Transportation & Logistics	Not Sig

**Source:** Author's calculation based on monthly sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and 10-year government bond return, real GDP, CPI, interest rate, Real Effective Exchange Rate and Money Supply (M2) from Bank of Thailand statistical database

**Table 4.6** Influence of Expected Business Sentiment Index on Sectoral Stock Return in each Stage of Business Cycle

	Expansion Stage	Recession Stage	Depression Stage	Recovery Stage
<b>Positive (+) Relationship</b>	Fashion Steel	Not Sig	Automotive, Electrical components, Healthcare, Insurance, Media, Property Fund, Professional Services, Property development, Tourism & Leisure, Transportation & Logistics	Electrical components, Petrochemicals, Property development
<b>Negative (-) Relationship</b>	Not Sig	Not Sig	Petrochemicals	Commerce ICT

**Source:** Author's calculation based on monthly sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and real GDP from CEIC database

The study results can be summarized that real GDP growth has a positive significant association with stock returns in the automotive, insurance, petrochemicals, and property fund sectors. Changes in Consumer Price Index (CPI) has a significant relationship with the sensitivity of stock return in food & beverage, industrial materials & machinery and insurance sector. Increasing the interest rate has a positive significant impact on stock return in the banking sector while negatively impacting the petrochemical sector. Changes in real effective exchange rates have a significant positive association with automotive, commerce, finance & securities and media sectors while it has a significant negative association with the energy sector. Changes in money supply (broad money) are associated with only return sensitivity in the transportation & logistics sector. Expected business sentiment index has a most significant association with return of stock sectors in the depression stage of business cycle where it has confluence relationship with automotive, electrical components, healthcare services, insurance, media, property fund, professional services, property development, tourism & leisure, and transportation & logistic sectors. In contrast, it has an inverse relationship with the stock return in the petrochemical sector in this stage. The expected business sentiment index has no significant relationship with the stock return in the recession stage. In the expansion stage, it has a significant positive relationship with stock returns in the fashion and steel sectors. In the recovery period, the expected business sentiment index has a confluence relationship with stock returns in electrical components, petrochemical, and property development sector but has an inverse relationship with stock returns in commerce and ICT sectors.

## **CHAPTER 5**

### **EFFECT OF FUND FLOW BY INVESTOR TYPES ON MARKET AND SECTORAL STOCK RETURNS AND IMPACT OF KEY MACROECONOMIC FACTORS ON CHANGES OF STOCK MARKET INVESTMENT FROM DIFFERENT TYPES OF INVESTORS**

The investors drive stock market and there are many players in the market buying and selling stocks every day. In The Stock Exchange of Thailand (SET), there are 4 major types of the investor which are foreign investors, local institution investors, proprietary traders, and retail investors. Understanding the investment behavior of different market players and their impact on the stock market helps with situational assessment in observing net changes of their investment in each period of time. This study will explore whether net investment from different investor types has any association with stock returns in each industrial sector (and vice versa).

In the literature, there are 3 possible explanations about the relationship between equity fund flows and stock market returns which are the feedback-trader hypothesis (market returns attract fund flows), the price-pressure hypothesis (increasing fund flows to equity market affect market returns by pushing the price higher) or the information-response hypothesis (both equity fund flows and market returns react to new information without any direct causal linkage between them). The empirical study in this chapter will also explore whether the feedback-trader hypothesis, price-pressure hypothesis, or information-response hypothesis is most applicable for the Stock Exchange of Thailand and this study also contributes to explaining more in details at the sectors level, with the different types of investors and in the different stages of the business cycle.

## 5.1 Evaluation of Fund Flow by Different Investor Types and Their Impact on Market and Sectoral Stock Returns

I begin with an analysis of the correlation between net investment from different types of investors and stock market returns.

**Table 5.1** Correlations Between Net Investment to Stock Market from Different Types of Investors and Market Return

	Foreign	Institution	Proprietary Trader	Retail Investor	Rm
Foreign	1	-0.685504	0.278758	-0.882318	<b>0.557586</b>
Institution	-0.685504	1	-0.133539	0.289301	-0.204328
Proprietary Trader	0.278758	-0.133539	1	-0.455899	0.311597
Retail Investor	-0.882318	0.289301	-0.455899	1	-0.624109
Rm	<b>0.557586</b>	-0.204328	0.311597	-0.624109	1

**Source:** Author's calculation based on monthly market return data in The Stock Exchange of Thailand from Thomson Reuters Datastream and monthly data of net investment from a different type of investors from The Stock Exchange of Thailand database

Correlation analysis reveals that net foreign investment has the highest correlation with market return (significant correlation coefficient = 0.557586, Chi-Square 85.98, Prob 0.0000) compared with net investment from other types of investors. Among different types of investors, net foreign investment has a positive correlation with proprietary trader investment and has a negative correlation with net investment from institution and retail investors.

However, most fluctuation has been found in net investment to the stock market from foreign investors, followed by retail investors, which are demonstrated in the following table and graph.

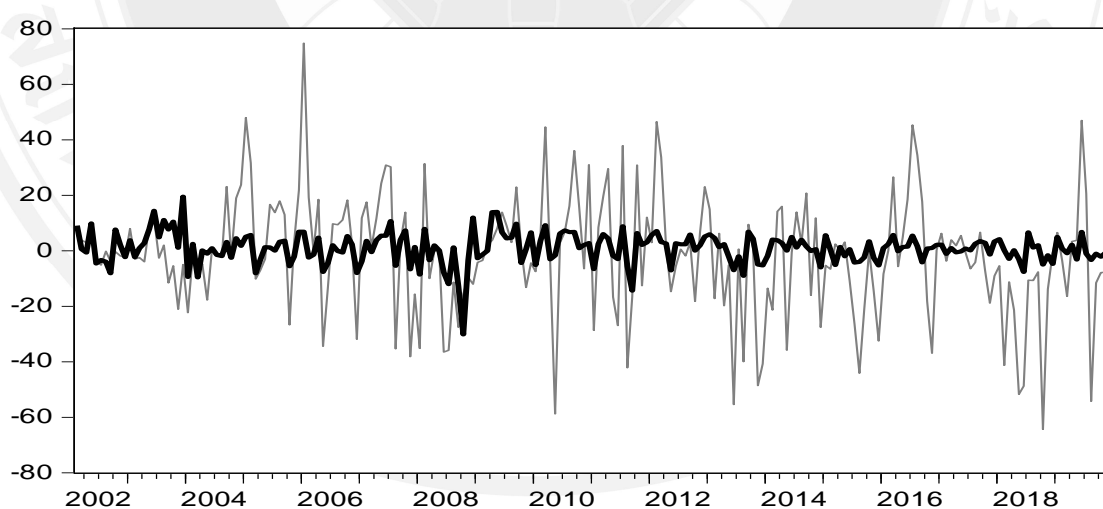
**Table 5.2** Variance and Sum-Squared Deviation of Net Investment to Stock Market from Different Types of Investors

	Foreign	Institution	Proprietary Trader	Retail Investor
Variance	450.86	99.52	11.09	301.62
Sum squared deviation	96,484	21,298	2,374	64,546

**Source:** Author's calculation based on monthly data of net investment from a different type of investors from The Stock Exchange of Thailand database

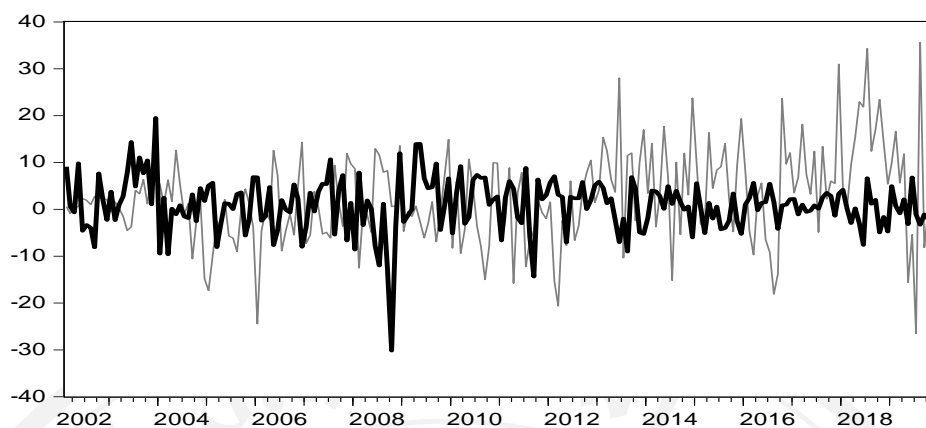
Net investment from a foreign investor has the highest variance and sum-squared deviation compared with other types of investors.

The graphical illustration also shows that net foreign investment has the highest volatility (followed by net investment from retail investors) compared with net investment from other types of investors.



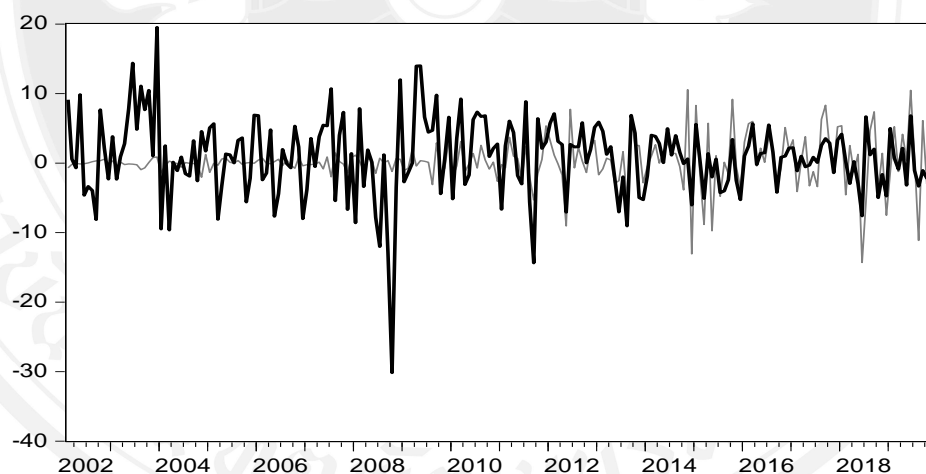
**Figure 5.1** Net Foreign Investment to Thailand Stock Exchange (Thin line) and Market Return (Thick Line) during 2002 – 2019 C.E.

**Source:** Data analysis with program Eviews 9



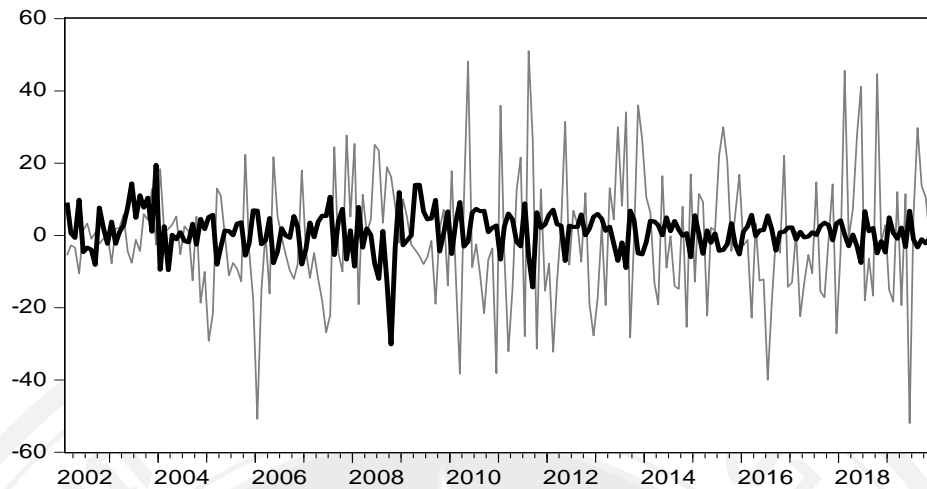
**Figure 5.2** Net Local Institution Investment to Thailand Stock Exchange (Thin Line) and Market Return (Thick Line) during 2002 – 2019 C.E.

**Source:** Author's calculation based on monthly market return data in The Stock Exchange of Thailand from Thomson Reuters Datastream and monthly data of net investment from a different type of investors from The Stock Exchange of Thailand database



**Figure 5.3** Net Proprietary Trader Investment to Thailand Stock Exchange (Thin Line) and Market Return (Thick Line) during 2002 – 2019 C.E.

**Source:** Author's calculation based on monthly market return data in The Stock Exchange of Thailand from Thomson Reuters Datastream and monthly data of net investment from a different type of investors from The Stock Exchange of Thailand database



**Figure 5.4** Net Retail Investment to Thailand Stock Exchange (Thin Line) and Market Return (Thick Line) during 2002 – 2019 C.E.

**Source:** Author's calculation based on monthly market return data in The Stock Exchange of Thailand from Thomson Reuters Datastream and monthly data of net investment from a different type of investors from The Stock Exchange of Thailand database

## 5.2 Evaluation of Impact from Net Investment to Stock Market from Different Types of Investors on Market and Sectoral Stock Returns

Vector autoregressive model helps to study the relationship between variables and their lag terms. Vector autoregressive model enables us to estimate how many lags significantly influence the dependent variable in the model and relationships with lag effects.

The general form of the VAR(p) model, including deterministic terms and exogenous variables, is given by

$$Y_t = \Pi_1 Y_{t-1} + \Pi_2 Y_{t-2} + \dots + \Pi_p Y_{t-p} + \Phi D_t + G X_t + \varepsilon_t$$

Where  $X_t$  represents a matrix of exogenous variables,  $D_t$  represents a matrix of deterministic components,  $\Phi$  and  $G$  are parameter matrices.

The impulse response function enables us to study the time onset of shock impact on other variables and shock decomposition patterns. Impulse responses identify the dependent variable's responsiveness when a shock is put to the error term in VAR. The impulse response function is suitable for analyzing the pattern of response to shock such as does the volatility shock in error term cause immediately impact the endogenous variable, positive or negative impact, size of impact and pattern of decomposition in shock.

From Augmented Dickey-Fuller test, net investment from different investors' data and sectoral stock returns data is stationary.

Most of Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hannan-Quinn Criterion (HC) suggest the appropriate lag structure of 1-3 for all data therefore, I use lag structure up to third lag in VAR estimation, which represent a net investment of different types of an investor during last quarter period.

**Table 5.3** Results of VAR Estimation for First Quarter Lags of Net Investment to Stock Market from Different Types of Investors and Sectoral Stock Return (critical t-value  $\pm 2.18$ ,  $p=0.05$ , t-statistics in [ ] and S.E. in ( ))

Sector	For (-1)	For (-2)	For (-3)	Ins (-1)	Ins (-2)	Ins (-3)	Prop (-1)	Prop (-2)	Prop (-3)	Ret (-1)	Ret (-2)	Ret (-3)
<b>Rm</b>	-0.00516 (0.0311) [-0.1662]	-0.02919 (0.0316) [-0.9246]	-0.03490 (0.0312) [-1.1198]	-0.01290 (0.0577) [-0.2242]	-0.06080 (0.0571) [-1.0643]	-0.0627 (0.0563) [-1.1140]	-0.1933 (0.1306) [-1.4797]	-0.01330 (0.1351) [-0.0984]	-0.05330 (0.1326) [-0.4016]	-0.0045 (0.0304) [-0.1481]	0.0225 (0.0307) [ 0.7347]	0.0245 (0.0302) [ 0.8116]
<b>AGRI</b>	-0.00587 (0.0332) [-0.1769]	-0.04335 (0.0335) [-1.2933]	-0.00941 (0.0333) [-0.2830]	-0.01155 (0.0695) [-0.1662]	-0.09922 (0.0685) [-1.4488]	-0.04488 (0.0671) [-0.6693]	-0.21497 (0.1595) [-1.3475]	-0.05863 (0.1654) [-0.3545]	-0.13539 (0.1621) [-0.8351]	-0.00639 (0.0322) [-0.1987]	0.03008 (0.0324) [ 0.9291]	-0.00808 (0.0320) [-0.2523]
<b>AUTO</b>	0.01742 (0.0291) [ 0.5988]	-0.01910 (0.0297) [-0.6426]	-0.03666 (0.0297) [-1.2356]	0.02653 (0.0615) [0.43169]	-0.070120 (0.06115) [-1.1467]	-0.058410 (0.0603) [-0.9683]	-0.11765 (0.1460) [-0.8056]	0.05019 (0.1512) [ 0.3319]	-0.04896 (0.1488) [-0.3290]	-0.02613 (0.0291) [-0.8980]	0.01574 (0.0293) [ 0.5367]	0.02145 (0.0291) [ 0.7371]
<b>BANK</b>	-0.01967 (0.0351) [-0.5600]	-0.03383 (0.0357) [-0.9492]	-0.03093 (0.0357) [-0.8661]	-0.01107 (0.0672) [-0.1647]	-0.07721 (0.0667) [-1.1576]	-0.03008 (0.0666) [-0.4517]	-0.18134 (0.1560) [-1.1628]	0.04607 (0.1616) [ 0.2850]	-0.08403 (0.1590) [-0.5284]	0.01010 (0.0346) [ 0.2914]	0.03395 (0.0348) [ 0.9760]	0.02088 (0.0346) [ 0.6039]
<b>COMM</b>	0.01440 (0.0270) [ 0.5331]	0.00115 (0.0273) [ 0.0420]	-0.03684 (0.0272) [-1.3549]	-0.02861 (0.0555) [-0.5158]	-0.03528 (0.0551) [-0.6399]	-0.06385 (0.0536) [-1.1914]	-0.12548 (0.1318) [-0.9523]	0.04111 (0.1360) [ 0.3022]	-0.00433 (0.1333) [-0.0325]	-0.02853 (0.0268) [-1.0637]	-0.00829 (0.0270) [-0.3072]	0.02961 (0.0267) [ 1.1076]
<b>CONMAT</b>	-0.03173 (0.0357) [-0.8884]	-0.06944 (0.0362) [-1.9206]	-0.02076 (0.0362) [-0.5730]	-0.02512 (0.0693) [-0.3627]	<b>-0.16659</b> (0.0683) [-2.4392]	-0.01155 (0.0685) [-0.1686]	-0.22253 (0.1557) [-1.4296]	0.07310 (0.1613) [ 0.4532]	0.06704 (0.1587) [ 0.4225]	0.01189 (0.0350) [ 0.3397]	0.05485 (0.0353) [ 1.5531]	0.01363 (0.0352) [ 0.3868]

Table 5.3 (Continued)

Sector	For (-1)	For (-2)	For (-3)	Ins (-1)	Ins (-2)	Ins (-3)	Prop (-1)	Prop (-2)	Prop (-3)	Ret (-1)	Ret (-2)	Ret (-3)
<b>CONS</b>	0.08937 (0.0615) [ 1.4534]	0.06139 (0.0636) [ 0.9652]	-0.10941 (0.0609) [ -1.7954]	<b>0.23229</b> ( <b>0.1015</b> ) [ <b>2.2882</b> ]	0.01965 (0.1059) [ 0.1856]	0.01665 (0.1033) [ -0.7759]	<b>-0.62751</b> ( <b>0.2046</b> ) [ <b>-3.0666</b> ]	-0.09899 (0.2206) [ -0.4487]	-0.21399 (0.2216) [ -0.9659]	-0.10956 (0.0568) [ -1.9278]	-0.01661 (0.0576) [ -0.2886]	0.06449 (0.0565) [ 1.1423]
<b>ETRON</b>	-0.03375 (0.0360) [ -0.9376]	-0.02899 (0.0366) [ -0.7916]	-0.06878 (0.0367) [ -1.8741]	-0.03543 (0.0756) [ -0.4687]	-0.11471 (0.0747) [ -1.5366]	-0.09586 (0.0739) [ -1.2974]	-0.299975 (0.1722) [ -1.7416]	-0.02772 (0.1787) [ -0.1551]	-0.15638 (0.1757) [ -0.8901]	0.01157 (0.0352) [ 0.3291]	0.01442 (0.0355) [ 0.4061]	0.04340 (0.0354) [ 1.2277]
<b>ENERG</b>	0.02807 (0.0391) [ 0.7184]	-0.05352 (0.0399) [ -1.3403]	0.00932 (0.0398) [ 0.2337]	-0.00313 (0.0780) [ -0.0401]	-0.05386 (0.0775) [ -0.6951]	-0.05495 (0.0766) [ -0.7175]	-0.20820 (0.1834) [ -1.1350]	-0.02146 (0.1898) [ -0.1130]	-0.14671 (0.1865) [ -0.7869]	-0.04092 (0.0386) [ -1.0591]	0.04497 (0.0391) [ 1.1509]	-0.02255 (0.0387) [ -0.5822]
<b>FASHION</b>	0.01151 (0.0163) [ 0.7083]	<b>-0.03626</b> ( <b>0.0165</b> ) [ <b>-2.1934</b> ]	-0.00483 (0.0168) [ -0.2870]	-0.02701 (0.0358) [ -0.7545]	-0.04218 (0.0354) [ -1.1910]	0.00352 (0.0347) [ 0.1017]	-0.11810 (0.0831) [ -1.4208]	-0.00703 (0.0861) [ -0.0817]	0.04670 (0.0845) [ 0.5525]	-0.02239 (0.0161) [ -1.3905]	0.02853 (0.0162) [ 1.7572]	0.00887 (0.0163) [ 0.5446]
<b>FIN</b>	0.02974 (0.0361) [ 0.8253]	0.00182 (0.0370) [ 0.0492]	-0.03012 (0.0369) [ -0.8161]	0.08268 (0.0741) [ 1.1155]	-0.01561 (0.0743) [ -0.2102]	-0.05462 (0.0734) [ -0.7441]	-0.14635 (0.1758) [ -0.8325]	-0.09419 (0.1823) [ -0.5167]	0.03286 (0.1789) [ 0.1837]	-0.02707 (0.0355) [ -0.7625]	-0.00127 (0.0357) [ -0.0357]	0.02509 (0.0355) [ 0.7060]
<b>FOOD</b>	-0.00562 (0.0248) [ -0.2264]	-0.01495 (0.0253) [ -0.5915]	-0.01859 (0.0252) [ -0.7369]	-0.06103 (0.0507) [ -1.2028]	-0.09052 (0.0504) [ -1.7951]	-0.04774 (0.0497) [ -0.9610]	-0.15862 (0.1199) [ -1.3235]	0.03475 (0.1242) [ 0.2798]	-0.08765 (0.1220) [ -0.7185]	-0.01199 (0.0250) [ -0.4794]	0.00076 (0.0252) [ 0.0303]	0.00584 (0.0250) [ 0.2337]

Table 5.3 (Continued)

Sector	For (-1)	For (-2)	For (-3)	Ins (-1)	Ins (-2)	Ins (-3)	Prop (-1)	Prop (-2)	Prop (-3)	Ret (-1)	Ret (-2)	Ret (-3)
<b>HEALTH</b>	-0.01395 (0.0296) [-0.4716]	0.04343 (0.0302) [ 1.4386]	-0.02215 (0.0302) [-0.7335]	-0.03900 (0.0633) [-0.6158]	0.01494 (0.0630) [ 0.2371]	-0.08054 (0.0622) [-1.2956]	-0.30650 (0.1504) [-2.0383]	-0.10922 (0.1561) [-0.6999]	-0.09299 (0.1535) [-0.6059]	-0.00761 (0.0293) [-0.2603]	-0.05482 (0.0294) [-1.8673]	0.00805 (0.0293) [ 0.2747]
<b>HOME</b>	0.03531 (0.0303) [ 1.1654]	-0.01857 (0.0308) [-0.6035]	-0.00394 (0.0299) [-0.1318]	0.09201 (0.0623) [ 1.4777]	-0.12192 (0.0620) [-1.9670]	-0.02055 (0.0609) [-0.3373]	<b>-0.35566</b> <b>(0.1456)</b> <b>[-2.4432]</b>	-0.00119 (0.1509) [-0.0079]	0.16978 (0.1481) [ 1.1465]	-0.04860 (0.0294) [-1.6535]	0.00749 (0.0298) [ 0.2512]	-0.00250 (0.0291) [-0.0859]
<b>ICT</b>	-0.03489 (0.0347) [-1.0064]	-0.06000 (0.0351) [-1.7095]	0.01864 (0.0354) [ 0.5263]	-0.05919 (0.0710) [-0.8342]	-0.03570 (0.0703) [-0.5081]	-0.03172 (0.0694) [-0.4573]	-0.27685 (0.1670) [-1.6582]	-0.03317 (0.1707) [-0.1944]	0.02801 (0.1676) [ 0.1671]	0.01701 (0.0341) [ 0.4983]	0.05550 (0.0344) [ 1.6124]	-0.02129 (0.0344) [-0.6185]
<b>IMM</b>	0.07880 (0.0439) [ 1.7937]	-0.02202 (0.0453) [-0.4857]	0.00569 (0.0455) [ 0.1250]	0.06102 (0.0871) [ 0.7006]	-0.16581 (0.0861) [-1.9255]	0.01516 (0.0862) [ 0.1760]	-0.34030 (0.2039) [-1.6691]	0.17120 (0.2108) [ 0.8120]	0.117289 (0.20774) [ 0.5646]	<b>-0.10489</b> <b>(0.0446)</b> <b>[-2.3514]</b>	0.01150 (0.0455) [ 0.2525]	-0.01348 (0.0455) [-0.2965]
<b>INSUR</b>	<b>0.04973</b> <b>(0.0215)</b> <b>[ 2.3139]</b>	-0.00622 (0.0223) [-0.2796]	-0.01358 (0.0222) [-0.6124]	0.04907 (0.0461) [ 1.0656]	-0.05439 (0.0458) [-1.1870]	-0.02055 (0.0451) [-0.4559]	<b>-0.25852</b> <b>(0.1083)</b> <b>[-2.3865]</b>	0.02124 (0.1124) [ 0.1889]	-0.09963 (0.1107) [-0.9002]	<b>-0.06269</b> <b>(0.0212)</b> <b>[-2.9608]</b>	0.00404 (0.0217) [ 0.1860]	0.00076 (0.0215) [ 0.0354]
<b>MEDIA</b>	0.04984 (0.0324) [ 1.5375]	-0.01274 (0.0331) [-0.3849]	-0.00674 (0.0333) [-0.2026]	0.04928 (0.0661) [ 0.7453]	-0.01584 (0.0659) [-0.2403]	-0.01567 (0.0653) [-0.2397]	-0.01050 (0.1572) [-0.0668]	-0.10651 (0.1637) [-0.6506]	0.02084 (0.1608) [ 0.1296]	-0.04551 (0.0322) [-1.4136]	0.00585 (0.0325) [ 0.1801]	0.00603 (0.0323) [ 0.1866]

Table 5.3 (Continued)

Sector	For (-1)	For (-2)	For (-3)	Ins (-1)	Ins (-2)	Ins (-3)	Prop (-1)	Prop (-2)	Prop (-3)	Ret (-1)	Ret (-2)	Ret (-3)
<b>MINE</b>	0.07309 (0.0571) [ 1.2793]	0.05711 (0.0585) [ 0.9763]	0.01147 (0.0590) [ 0.1945]	0.03034 (0.1217) [ 0.2492]	0.07516 (0.1204) [ 0.6244]	-0.06934 (0.1193) [-0.5815]	-0.21093 (0.2897) [-0.7282]	-0.09918 (0.3001) [-0.3304]	-0.36774 (0.2943) [-1.2497]	-0.08582 (0.0568) [-1.5114]	-0.05927 (0.0574) [-1.0324]	-0.03550 (0.0575) [-0.6178]
<b>PKG</b>	0.00594 (0.0364) [ 0.1632]	-0.07629 (0.0367) [-2.0646]	-0.02841 (0.0371) [-0.7656]	-0.01124 (0.0763) [-0.1472]	<b>-0.18665</b> <b>(0.0754)</b> <b>[-2.4759]</b>	-0.05095 (0.0751) [-0.6782]	-0.28233 (0.1790) [-1.5779]	0.24308 (0.1851) [ 1.3134]	0.11033 (0.1832) [ 0.6021]	-0.03274 (0.0361) [-0.9082]	0.06510 (0.0362) [ 1.8008]	0.01246 (0.0360) [ 0.3466]
<b>PERSON</b>	0.03130 (0.0359) [ 0.8724]	-0.01260 (0.0366) [-0.3445]	-0.00694 (0.0367) [-0.1893]	-0.00992 (0.0792) [-0.1253]	-0.07546 (0.0787) [-0.9589]	-0.04275 (0.0766) [-0.5582]	-0.23887 (0.1890) [-1.2640]	-0.13582 (0.1961) [-0.6927]	-0.11170 (0.1923) [-0.5809]	-0.05074 (0.0357) [-1.4233]	-0.00696 (0.0360) [-0.1932]	-0.00685 (0.0359) [-0.1908]
<b>PETRO</b>	-0.01628 (0.0477) [-0.3415]	-0.06177 (0.0486) [-1.2698]	-0.01575 (0.0490) [-0.3222]	0.00193 (0.0968) [ 0.0199]	-0.20429 (0.0956) [-2.1381]	-0.00886 (0.0961) [-0.0922]	-0.22039 (0.2243) [-0.9825]	-0.01740 (0.2323) [-0.0749]	-0.11045 (0.2282) [-0.4840]	-0.00071 (0.0470) [-0.0150]	0.04207 (0.0474) [ 0.8872]	-0.00857 (0.0471) [-0.1818]
<b>PF&amp;REITs</b>	0.01675 (0.0115) [ 1.4616]	0.00783 (0.0118) [ 0.6635]	-0.01822 (0.0118) [-1.5431]	0.03673 (0.0230) [ 1.5988]	-0.00107 (0.0231) [-0.0460]	-0.03317 (0.0226) [-1.4670]	-0.0862 (0.0549) [-1.5703]	-0.09088 (0.0574) [-1.5835]	0.00090 (0.0560) [ 0.0161]	-0.01986 (0.0118) [-1.6845]	-0.01085 (0.0119) [-0.9085]	0.01618 (0.0119) [ 1.3647]
<b>PAPER</b>	0.02395 (0.0397) [ 0.6035]	0.03412 (0.0407) [ 0.8377]	-0.01842 (0.0411) [-0.4484]	0.11884 (0.0868) [ 1.3693]	-0.02774 (0.0868) [-0.3195]	-0.00198 (0.0859) [-0.0230]	-0.09921 (0.2133) [-0.4652]	0.02296 (0.2212) [ 0.1038]	0.30282 (0.2165) [ 1.3986]	-0.01901 (0.0395) [-0.4818]	-0.02989 (0.0398) [-0.7517]	0.02402 (0.0396) [ 0.6061]

Table 5.3 (Continued)

Sector	For (-1)	For (-2)	For (-3)	Ins (-1)	Ins (-2)	Ins (-3)	Prop (-1)	Prop (-2)	Prop (-3)	Ret (-1)	Ret (-2)	Ret (-3)
<b>PROF</b>	0.01006 (0.0513) [ 0.1962]	0.02704 (0.0520) [ 0.5203]	-0.08464 (0.0521) [-1.6258]	0.17497 (0.1102) [ 1.5878]	-0.09309 (0.1103) [-0.8442]	-0.14477 (0.1080) [-1.3401]	<b>-0.69965</b> <b>(0.2563)</b> <b>[-2.7299]</b>	0.01142 (0.2670) [ 0.0428]	0.23275 (0.2623) [ 0.8851]	-0.02644 (0.0496) [-0.5327]	-0.02360 (0.0500) [-0.4716]	0.06940 (0.0492) [ 1.3930]
<b>PROP</b>	-0.04902 (0.0394) [-1.2437]	-0.01273 (0.0401) [-0.3176]	-0.06267 (0.0397) [-1.5771]	-0.06703 (0.0788) [-0.8505]	-0.07604 (0.0782) [-0.9731]	-0.08140 (0.0767) [-1.0613]	-0.22747 (0.1817) [-1.2517]	-0.00417 (0.1883) [-0.0222]	0.02102 (0.1850) [ 0.1136]	0.02925 (0.0388) [ 0.7534]	0.00101 (0.0392) [ 0.0259]	0.05165 (0.0387) [ 1.3351]
<b>STEEL</b>	0.06051 (0.0438) [ 1.3815]	-0.00449 (0.0429) [-0.1046]	-0.04468 (0.0424) [-1.0542]	0.11312 (0.0789) [ 1.4331]	-0.03292 (0.0749) [-0.4395]	-0.07840 (0.0740) [-1.0590]	-0.26266 (0.1719) [-1.5283]	0.08677 (0.1759) [ 0.4932]	-0.00537 (0.1735) [-0.0310]	-0.06866 (0.0442) [-1.5525]	0.01687 (0.0431) [ 0.3911]	0.03015 (0.0424) [ 0.7109]
<b>TOURISM</b>	0.03587 (0.0271) [ 1.3228]	-0.00968 (0.0279) [-0.3472]	-0.02895 (0.0280) [-1.0351]	0.05039 (0.0569) [ 0.8858]	-0.09784 (0.0567) [-1.7265]	-0.03083 (0.0559) [-0.5514]	<b>-0.34524</b> <b>(0.1313)</b> <b>[-2.6287]</b>	-0.03641 (0.1367) [-0.2664]	-0.12883 (0.1333) [-0.9662]	-0.05369 (0.0264) [-2.0350]	0.00259 (0.0268) [ 0.0968]	0.00968 (0.0267) [ 0.3622]
<b>TRANS</b>	-0.01880 (0.0380) [-0.495]	-0.01390 (0.0389) [-0.3576]	-0.04782 (0.0389) [-1.2279]	-0.01133 (0.0782) [-0.1448]	-0.07251 (0.0777) [-0.9333]	-0.07555 (0.0771) [-0.9799]	-0.22398 (0.1808) [-1.2387]	-0.02157 (0.1843) [-0.1170]	0.00071 (0.03734) [ 0.0190]	0.01283 (0.0373) [ 0.3440]	<b>0.23746</b> <b>(0.0775)</b> <b>[ 3.0639]</b>	-0.02081 (0.0773) [-0.2693]

**Source:** Author's calculation based on monthly market and sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and monthly data of net investment from a different type of investors from The Stock Exchange of Thailand database

From VAR estimation results, the first lag of net stock market investment from foreign investors has a significant association with stock return in the insurance sector. The second lag of net stock market investment from foreign investors has a significant association with stock return in the fashion sector.

However, VAR Granger Causality / Block Exogeneity Wald Test does not confirm the causality between these relationships. In addition, VAR Granger Causality/ Block Exogeneity Wald Test also reveals no significant causal relationship between net foreign investment to the stock market and stock returns in any sector.

**Table 5.4** VAR Granger Causality / Block Exogeneity Wald Test Using Sectoral Stock Returns as Dependent Variable and Net Foreign Investment as Exogenous Variable

Dependent Variable	Exogenous Variable	$\chi^2$	Prob.	Dependent Variable	Exogenous Variable	$\chi^2$	Prob.
AGRI	Foreign	1.270324	0.7362	IMM	Foreign	4.876024	0.1811
AUTO	Foreign	1.534439	0.6743	INSUR	Foreign	1.083711	0.7810
BANK	Foreign	1.226982	0.7465	MEDIA	Foreign	0.475800	0.9242
COMM	Foreign	3.357110	0.3398	MINE	Foreign	5.263754	0.1535
CONMAT	Foreign	1.253332	0.7402	PKG	Foreign	0.975978	0.8071
CONST	Foreign	3.594811	0.3087	PERSON	Foreign	1.059484	0.7869
ETRON	Foreign	1.810674	0.6126	PETRO	Foreign	0.388499	0.9426
ENERG	Foreign	1.374958	0.7114	PF&REIT	Foreign	1.944551	0.5840
FASHION	Foreign	3.937462	0.2683	PAPER	Foreign	2.474770	0.4799
FIN	Foreign	1.912069	0.5909	PROP	Foreign	2.724594	0.4361
FOOD	Foreign	3.035535	0.3862	STEEL	Foreign	0.858850	0.8353
HEALTH	Foreign	3.058044	0.3828	PROF	Foreign	4.371480	0.2240
HOME	Foreign	4.282472	0.2325	TOUR	Foreign	7.064439	0.0699
ICT	Foreign	2.393812	0.4948	TRANSP	Foreign	1.063388	0.7859

**Source:** Author's calculation based on monthly sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and monthly data of net investment from a different type of investors from The Stock Exchange of Thailand database

From VAR estimation results, the first lag of net stock market investment from domestic institution investors has a significant association with stock return in the construction sector. The second lag of net investment from domestic institutions has a significant association with stock returns in the construction materials and packaging sectors.

However, VAR Granger Causality / Block Exogeneity Wald Test does not confirm the causality between these relationships. VAR Granger Causality / Block Exogeneity Wald Test reveals only a significant causal relationship between net domestic institution investment to the stock market and stock returns in the food and beverage sector.

**Table 5.5** VAR Granger Causality / Block Exogeneity Wald Test Using Sectoral Stock Returns as Dependent Variable and Net Institution Investment as Exogenous Variable

Dependent Variable	Exogenous Variable	$\chi^2$	Prob.	Dependent Variable	Exogenous Variable	$\chi^2$	Prob.
AGRI	Institution	0.954448	0.8123	IMM	Institution	5.830814	0.1201
AUTO	Institution	0.047956	0.9972	INSUR	Institution	1.466267	0.6901
BANK	Institution	0.677671	0.8784	MEDIA	Institution	0.483195	0.9226
COMM	Institution	4.027537	0.2585	MINE	Institution	4.265425	0.2342
CONMAT	Institution	1.150835	0.7648	PKG	Institution	0.519846	0.9145
CONS	Institution	2.155429	0.5408	PERSON	Institution	1.098197	0.7775
ETRON	Institution	2.005040	0.5714	PETRO	Institution	1.176377	0.7587
ENERG	Institution	2.370567	0.4991	PF&REIT	Institution	0.892288	0.8273
FASHION	Institution	5.633392	0.1309	PAPER	Institution	1.009696	0.7989
FIN	Institution	0.119668	0.9894	PROP	Institution	1.167733	0.7608
FOOD	Institution	<b>8.481486</b>	<b>0.0370</b>	STEEL	Institution	0.528283	0.9126
HEALTH	Institution	2.729740	0.4352	PROF	Institution	1.386643	0.7087
HOME	Institution	3.249622	0.3547	TOUR	Institution	5.627278	0.1312
ICT	Institution	2.345106	0.5039	TRANSP	Institution	1.115139	0.7734

**Source:** Author's calculation based on monthly sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and monthly data of net investment from a different type of investors from The Stock Exchange of Thailand database

From VAR estimation results, the first lag of net stock market investment from proprietary traders has a significant association on stock returns in construction, home & office products, insurance, professional services, and tour & leisure sectors.

However, VAR Granger Causality / Block Exogeneity Wald Test confirms only the causality relationship between net investment from proprietary traders to return in construction, insurance, and tour & leisure sectors.

**Table 5.6** VAR Granger Causality / Block Exogeneity Wald Test Using Sectoral Stock Returns as Dependent Variable and Net Proprietary Trader Investment as Exogenous Variable

Dependent Variable	Exogenous Variable	$\chi^2$	Prob.	Dependent Variable	Exogenous Variable	$\chi^2$	Prob.
AGRI	Prop. Trade	1.191263	0.7551	IMM	Prop. Trade	1.709659	0.6348
AUTO	Prop. Trade	1.304277	0.7281	INSUR	Prop. Trade	<b>13.48311</b>	<b>0.0037</b>
BANK	Prop. Trade	4.478863	0.2142	MEDIA	Prop. Trade	1.246756	0.7418
COMM	Prop. Trade	3.427064	0.3303	MINE	Prop. Trade	4.925424	0.1773
CONMAT	Prop. Trade	4.568537	0.2063	PKG	Prop. Trade	2.818461	0.4205
CONS	Prop. Trade	<b>10.18713</b>	<b>0.0170</b>	PERSON	Prop. Trade	1.992440	0.5740
ETRON	Prop. Trade	<b>9.149186</b>	<b>0.0274</b>	PETRO	Prop. Trade	3.439128	0.3287
ENERG	Prop. Trade	3.803269	0.2835	PF&REIT	Prop. Trade	2.092220	0.5535
FASHION	Prop. Trade	1.045121	0.7903	PAPER	Prop. Trade	1.063139	0.7860
FIN	Prop. Trade	0.301052	0.9598	PROP	Prop. Trade	4.935322	0.1766
FOOD	Prop. Trade	4.818483	0.1856	STEEL	Prop. Trade	1.649564	0.6482
HEALTH	Prop. Trade	6.496265	0.0898	PROF	Prop. Trade	3.088243	0.3782
HOME	Prop. Trade	3.102646	0.3761	TOUR	Prop. Trade	<b>7.954268</b>	<b>0.0470</b>
ICT	Prop. Trade	3.733611	0.2917	TRANSP	Prop. Trade	2.118703	0.5481

**Source:** Author's calculation based on monthly sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and monthly data of net investment from a different type of investors from The Stock Exchange of Thailand database

From VAR estimation results, the first lag of net stock market investment from retail investors has a significant association with stock returns in industrial materials & machinery and insurance sectors. The second lag of net stock market investment

from retail investors has a significant association with stock return in transportation & logistics sector.

However, VAR Granger Causality / Block Exogeneity Wald Test does not confirm the causality between these relationships. In addition, VAR Granger Causality / Block Exogeneity Wald Test also reveals no significant causal relationship between net investment to the stock market from retail investors and stock returns in any sector.

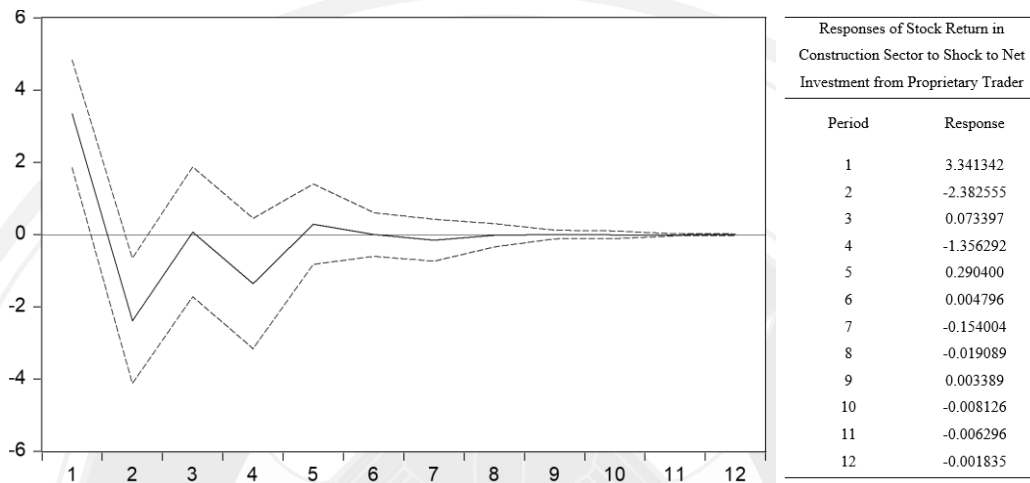
**Table 5.7** VAR Granger Causality / Block Exogeneity Wald Test Using Sectoral Stock Returns as Dependent Variable and Net Retail Investment as Exogenous Variable

Dependent Variable	Exogenous Variable	$\chi^2$	Prob.	Dependent Variable	Exogenous Variable	$\chi^2$	Prob.
AGRI	Retail	1.382550	0.7096	IMM	Retail	3.334228	0.3429
AUTO	Retail	3.817962	0.2818	INSUR	Retail	1.921059	0.5890
BANK	Retail	2.131370	0.5456	MEDIA	Retail	1.507882	0.6805
COMM	Retail	3.919637	0.2703	MINE	Retail	5.178873	0.1592
CONMAT	Retail	3.111325	0.3748	PKG	Retail	1.835400	0.6073
CONS	Retail	4.092178	0.2517	PERSON	Retail	1.063377	0.7859
ETRON	Retail	6.048558	0.1093	PETRO	Retail	1.693024	0.6385
ENERG	Retail	0.107687	0.9909	PF&REIT	Retail	3.501402	0.3206
FASHION	Retail	0.979755	0.8062	PAPER	Retail	1.925575	0.5880
FIN	Retail	3.062323	0.3821	PROP	Retail	5.876370	0.1178
FOOD	Retail	0.770291	0.8566	STEEL	Retail	1.873948	0.5990
HEALTH	Retail	7.029769	0.0710	PROF	Retail	6.295765	0.0981
HOME	Retail	3.079159	0.3796	TOUR	Retail	5.164684	0.1601
ICT	Retail	1.466339	0.6901	TRANSP	Retail	2.998877	0.3918

**Source:** Author's calculation based on monthly sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and monthly data of net investment from a different type of investors from The Stock Exchange of Thailand database

The overall analysis of this part indicates that the first month lag of net investment to The Stock Exchange of Thailand from proprietary traders has a significant impact on stock returns in construction, insurance, and tourism & leisure sectors.

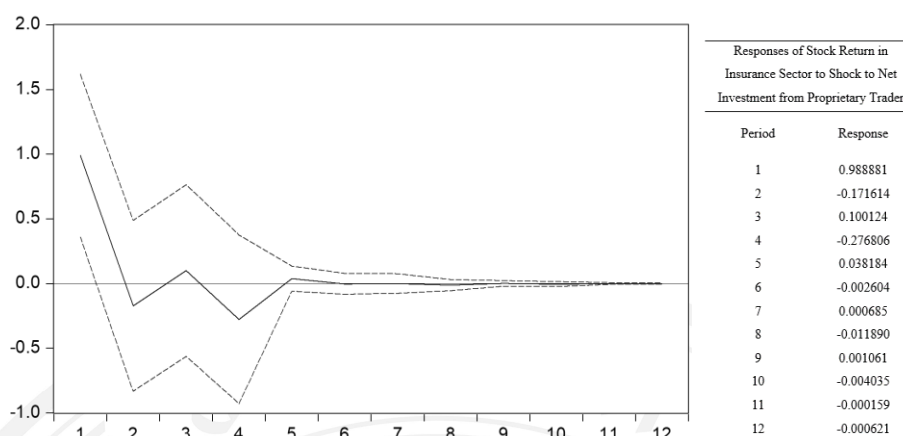
Impulse response analysis shows that in response to S.D. shock to residuals of net investment from proprietary trader, stock return in the construction sector starts to decline at first month to second month after shock impose then fluctuates until return to stable at sixth month.



**Figure 5.5** Impulse Response Function of Return of Stock in the Construction Sector to Cholesky One S.D. Shock to Net Investment from Proprietary Trader

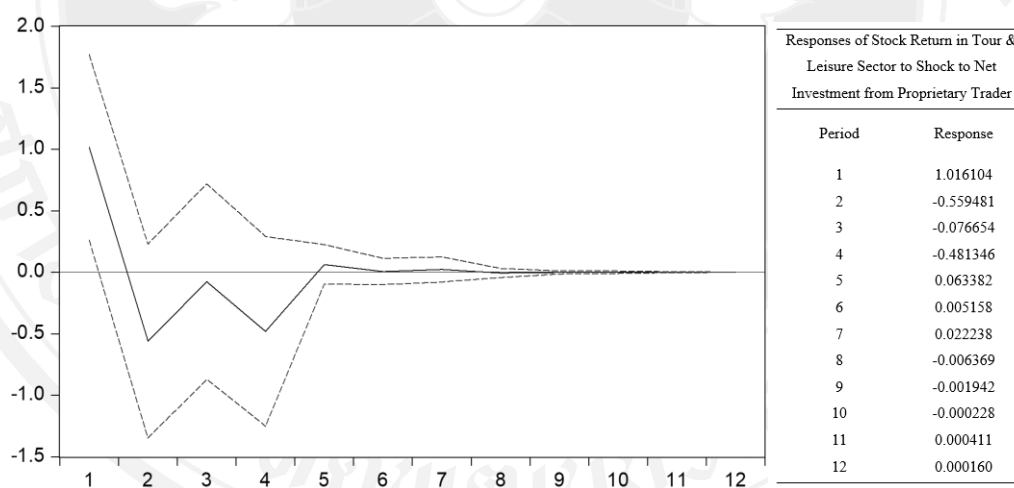
**Source:** Author's calculation based on monthly sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and monthly data of net investment from a different type of investors from The Stock Exchange of Thailand database

Impulse response analysis shows that in response to S.D. shock to residuals of net investment from proprietary trader, stock return in the insurance sector starts to decline at first month to second month after shock impose then fluctuates until return to stable at fifth month.



**Figure 5.6** Impulse Response Function of Return of Stock in Insurance Sector to Cholesky One S.D. Shock to Net Investment from Proprietary Trader

**Source:** Author's calculation based on monthly sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and monthly data of net investment from a different type of investors from The Stock Exchange of Thailand database



**Figure 5.7** Impulse Response Function of Return of Stock in Tour & Leisure Sector to Cholesky One S.D. Shock to Net Investment from Proprietary Trader

**Source:** Author's calculation based on monthly sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and monthly data of net investment from a different type of investors from The Stock Exchange of Thailand database

### 5.3 Evaluation of Sectoral Stock Returns and Their Impact to Fund Flow by Different Investor Types

Some literature discussed bidirectional relationship between the fund flow of investors and sectoral stock returns. Increasing stock sector returns will attract investors' money flow and increasing demand from investors will push stock price higher followed by higher sectoral stock returns. Therefore, I investigated the impact of sectoral stock returns on net investment from different investor types by changing Cholesky ordering in the analysis.

Most of the Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hannan-Quinn Criterion (HC) suggest the appropriate lag structure of lag 1 therefore, I use lag structure up to third lag in VAR estimation which represent a net investment of different types of an investor during last quarter period.

**Table 5.8** Results of VAR Estimation for First Quarter Lags of Sectoral Stock Returns and Net Investment to Stock Market from Different Types of Investors (critical t-value 2.35,  $p = 0.05$ )

Sector	Foreign	Institution	Proprietary Trader	Retails
<b>Rm (-1)</b>	-0.227634 (0.31816) [-0.71547]	<b>-0.321919</b> (0.12153) [-2.64885]	0.037915 (0.04343) [ 0.87294]	0.189293 (0.28754) [ 0.65832]
<b>Rm (-2)</b>	-0.069810 (0.32281) [-0.21626]	0.121579 (0.12417) [ 0.97914]	-0.047250 (0.04408) [-1.07194]	0.040839 (0.29259) [ 0.13958]
<b>Rm (-3)</b>	0.065380 (0.31585) [ 0.20700]	0.133732 (0.12325) [ 1.08507]	0.001798 (0.04340) [ 0.04142]	-0.196415 (0.28526) [-0.68855]

Table 5.8 (Continued)

Sector	Foreign	Institution	Proprietary Trader	Retails
<b>AGRI (-1)</b>	-0.029347 (0.23081) [-0.12715]	<b>-0.287116</b> (0.09870) [-2.90896]	0.022587 (0.03592) [ 0.62878]	0.160892 (0.20564) [ 0.78239]
<b>AGRI (-2)</b>	-0.150206 (0.23553) [-0.63775]	0.197534 (0.10229) [ 1.93109]	-0.021651 (0.03687) [-0.58722]	-0.017263 (0.21099) [-0.08182]
<b>AGRI (-3)</b>	0.143923 (0.22879) [ 0.62906]	-0.003140 (0.10035) [-0.03129]	-0.017243 (0.03556) [-0.48492]	-0.090986 (0.20240) [-0.44954]
<b>AUTO (-1)</b>	0.022886 (0.24836) [ 0.09215]	-0.177924 (0.10973) [-1.62154]	0.011917 (0.03757) [ 0.31723]	-0.007730 (0.03697) [-0.20907]
<b>AUTO (-2)</b>	0.004533 (0.25791) [ 0.01758]	0.120371 (0.11469) [ 1.04955]	-0.023063 (0.03923) [-0.58790]	-0.068023 (0.22059) [-0.30837]
<b>AUTO (-3)</b>	-0.177709 (0.24402) [-0.72825]	0.069794 (0.10912) [ 0.63963]	-0.007730 (0.03697) [-0.20907]	0.147995 (0.20702) [ 0.71490]
<b>BANK (-1)</b>	0.043222 (0.26162) [ 0.16521]	<b>-0.259848</b> (0.10284) [-2.52669]	0.033007 (0.03620) [ 0.91169]	-0.098039 (0.22824) [-0.42954]
<b>BANK (-2)</b>	0.076555 (0.25979) [ 0.29467]	-0.009047 (0.10389) [-0.08708]	-0.025931 (0.03609) [-0.71859]	-0.033505 (0.22628) [-0.14807]
<b>BANK (-2)</b>	0.076555 (0.25979) [ 0.29467]	-0.009047 (0.10389) [-0.08708]	-0.025931 (0.03609) [-0.71859]	-0.033505 (0.22628) [-0.14807]

Table 5.8 (Continued)

Sector	Foreign	Institution	Proprietary Trader	Retails
<b>BANK (-3)</b>	0.053610 (0.25384) [ 0.21120]	0.132227 (0.10278) [ 1.28657]	0.008699 (0.03563) [ 0.24411]	-0.207161 (0.22297) [-0.92909]
<b>COMM (-1)</b>	0.032919 (0.29143) [ 0.11296]	<b>-0.370898</b> (0.12300) [-3.01542]	0.062256 (0.04311) [ 1.44405]	0.081239 (0.25224) [ 0.32207]
<b>COMM (-2)</b>	-0.214411 (0.29379) [-0.72980]	0.100497 (0.12640) [ 0.79507]	-0.068631 (0.04399) [-1.56005]	0.249746 (0.25585) [ 0.97614]
<b>COMM (-3)</b>	0.330603 (0.29134) [ 1.13477]	0.007948 (0.12564) [ 0.06326]	-0.016618 (0.04357) [-0.38142]	-0.261064 (0.25132) [-1.03875]
<b>CONMAT (-1)</b>	-0.013895 (0.25369) [-0.05477]	<b>-0.267666</b> (0.10082) [-2.65480]	0.000629 (0.03556) [ 0.01769]	0.038645 (0.22802) [ 0.16948]
<b>CONMAT (-2)</b>	-0.001807 (0.25538) [-0.00707]	0.041481 (0.10231) [ 0.40544]	-0.026710 (0.03586) [-0.74487]	-0.004901 (0.22894) [-0.02141]
<b>CONMAT (-3)</b>	0.073425 (0.24788) [ 0.29621]	0.165687 (0.10048) [ 1.64893]	-0.005719 (0.03495) [-0.16364]	-0.241133 (0.22299) [-1.08137]
<b>CONS (-1)</b>	-0.351228 (0.38658) [-0.90856]	-0.416469 (0.22320) [-1.86592]	-0.069615 (0.11445) [-0.60824]	0.633934 (0.39047) [ 1.62353]
<b>CONS (-2)</b>	0.545790 (0.39437) [ 1.38395]	-0.053748 (0.23167) [-0.23200]	-0.070785 (0.11719) [-0.60404]	-0.369129 (0.40341) [-0.91503]

Table 5.8 (Continued)

Sector	Foreign	Institution	Proprietary Trader	Retails
<b>CONS (-3)</b>	-0.062765 (0.38804) [-0.16175]	0.035243 (0.22651) [ 0.15559]	0.029667 (0.11165) [ 0.26571]	-0.135707 (0.39528) [-0.34332]
<b>ETRON (-1)</b>	0.101218 (0.20954) [ 0.48306]	-0.204974 (0.09042) [-2.26686]	0.007091 (0.03183) [ 0.22278]	-0.057923 (0.18326) [-0.31607]
<b>ETRON (-2)</b>	-0.038766 (0.21242) [-0.18250]	0.155128 (0.09283) [ 1.67105]	-0.018604 (0.03220) [-0.57769]	-0.154773 (0.18613) [-0.83152]
<b>ETRON (-3)</b>	-0.043950 (0.21145) [-0.20785]	0.054233 (0.09342) [ 0.58056]	0.009881 (0.03195) [ 0.30926]	-0.009348 (0.18536) [-0.05043]
<b>ENERG (-1)</b>	-0.318917 (0.20857) [-1.52904]	-0.135533 (0.08760) [-1.54716]	0.007997 (0.03066) [ 0.26086]	0.272817 (0.18213) [ 1.49796]
<b>ENERG (-2)</b>	-0.007349 (0.20947) [-0.03508]	0.105521 (0.08804) [ 1.19857]	-0.020413 (0.03071) [-0.66478]	-0.051899 (0.18294) [-0.28369]
<b>ENERG (-3)</b>	0.056791 (0.20933) [ 0.27129]	0.049540 (0.08843) [ 0.56024]	0.008593 (0.03072) [ 0.27971]	-0.093185 (0.18274) [-0.50995]
<b>FASHION (-1)</b>	0.476682 (0.41805) [ 1.14025]	<b>-0.577766</b> (0.18347) [-3.14914]	0.021007 (0.06546) [ 0.32091]	-0.101596 (0.36418) [-0.27897]
<b>FASHION (-2)</b>	-0.477733 (0.41043) [-1.16397]	<b>0.469759</b> (0.18636) [ 2.52071]	-0.056442 (0.06452) [-0.87481]	0.017114 (0.35594) [ 0.04808]

Table 5.8 (Continued)

Sector	Foreign	Institution	Proprietary Trader	Retails
<b>FASHION (-3)</b>	-0.008743 (0.41823) [-0.02090]	0.099038 (0.18996) [ 0.52136]	0.070894 (0.06541) [ 1.08388]	-0.094234 (0.36150) [-0.26067]
<b>FIN (-1)</b>	-0.100182 (0.21242) [-0.47163]	-0.103740 (0.09204) [-1.12716]	0.017514 (0.03216) [ 0.54463]	0.001596 (0.18474) [ 0.00864]
<b>FIN (-2)</b>	-0.122185 (0.21862) [-0.55890]	0.086470 (0.09470) [ 0.91309]	0.013065 (0.03307) [ 0.39507]	0.054092 (0.18893) [ 0.28630]
<b>FIN (-3)</b>	0.022887 (0.21069) [ 0.10863]	0.096002 (0.09152) [ 1.04892]	-0.022422 (0.03176) [-0.70603]	-0.076307 (0.18154) [-0.42033]
<b>FOOD (-1)</b>	0.019413 (0.31667) [ 0.06130]	<b>-0.330923</b> (0.13471) [-2.45664]	0.041144 (0.04636) [ 0.88744]	0.045413 (0.27425) [ 0.16559]
<b>FOOD (-2)</b>	0.018448 (0.32019) [ 0.05762]	0.024435 (0.13704) [ 0.17830]	0.003540 (0.04748) [ 0.07454]	0.007578 (0.28065) [ 0.02700]
<b>FOOD (-3)</b>	0.343420 (0.31374) [ 1.09460]	-0.033337 (0.13452) [-0.24782]	-0.003174 (0.04605) [-0.06891]	-0.261165 (0.27135) [-0.96245]
<b>HELTH (-1)</b>	-0.262321 (0.22876) [-1.14670]	-0.102564 (0.10445) [-0.98192]	-0.032717 (0.03602) [-0.90826]	0.313744 (0.19526) [ 1.60682]
<b>HELTH (-2)</b>	0.230050 (0.23099) [ 0.99594]	0.044069 (0.10550) [ 0.41773]	-0.012591 (0.03683) [-0.34188]	-0.217193 (0.19900) [-1.09142]

Table 5.8 (Continued)

Sector	Foreign	Institution	Proprietary Trader	Retails
<b>HEALTH (-3)</b>	0.448194 (0.22929) [ 1.95468]	-0.176702 (0.10436) [-1.69322]	0.028921 (0.03605) [ 0.80224]	-0.319233 (0.19654) [-1.62428]
<b>HOME (-1)</b>	-0.457954 (0.25110) [-1.82380]	-0.198809 (0.11092) [-1.79242]	-0.034722 (0.03882) [-0.89452]	<b>0.530728</b> (0.21771) [ 2.43781]
<b>HOME (-2)</b>	0.067777 (0.25453) [ 0.26629]	0.123088 (0.11099) [ 1.10897]	0.023744 (0.03954) [ 0.60049]	-0.172729 (0.22315) [-0.77405]
<b>HOME (-3)</b>	0.388875 (0.22751) [ 1.70926]	-0.045368 (0.10106) [-0.44890]	-0.037436 (0.03515) [-1.06512]	-0.266188 (0.19724) [-1.34953]
<b>ICT (-1)</b>	0.142652 (0.22935) [ 0.62198]	<b>-0.319496</b> (0.09452) [-3.38015]	0.046494 (0.03275) [ 1.41985]	-0.054190 (0.19756) [-0.27430]
<b>ICT (-2)</b>	-0.106758 (0.22909) [-0.46600]	0.000793 (0.09689) [ 0.00819]	<b>-0.084713</b> (0.03314) [-2.55625]	0.214125 (0.19746) [ 1.08437]
<b>ICT (-3)</b>	-0.096078 (0.22695) [-0.42334]	0.141408 (0.09659) [ 1.46399]	-0.023815 (0.03348) [-0.71130]	0.002989 (0.19747) [ 0.01514]
<b>IMM (-1)</b>	-0.240548 (0.23269) [-1.03377]	-0.103079 (0.10398) [-0.99130]	-0.038201 (0.03775) [-1.01204]	0.240000 (0.20842) [ 1.15149]
<b>IMM (-2)</b>	-0.019464 (0.22999) [-0.08463]	-0.014878 (0.10150) [-0.14657]	0.012920 (0.03753) [ 0.34424]	0.074310 (0.20778) [ 0.35764]

Table 5.8 (Continued)

Sector	Foreign	Institution	Proprietary Trader	Retails
<b>IMM (-3)</b>	0.241953 (0.23373) [ 1.03520]	-0.056848 (0.10403) [-0.54644]	-0.005940 (0.03798) [-0.15640]	-0.174808 (0.20584) [-0.84926]
<b>INSUR (-1)</b>	-0.339389 (0.32501) [-1.04423]	-0.155588 (0.14627) [-1.06373]	0.015781 (0.05011) [ 0.31495]	0.316019 (0.28023) [ 1.12770]
<b>INSUR (-2)</b>	0.500280 (0.33181) [ 1.50775]	-0.090440 (0.14934) [-0.60562]	-0.019798 (0.05153) [-0.38419]	-0.308469 (0.28678) [-1.07565]
<b>INSUR (-3)</b>	-0.447557 (0.32051) [-1.39638]	0.192013 (0.14532) [ 1.32128]	-0.077740 (0.04978) [-1.56173]	0.311314 (0.27396) [ 1.13633]
<b>MEDIA (-1)</b>	-0.142162 (0.24292) [-0.58522]	-0.209321 (0.10425) [-2.00792]	-0.012476 (0.03635) [-0.34323]	0.163257 (0.20871) [ 0.78222]
<b>MEDIA (-2)</b>	0.077690 (0.24342) [ 0.31916]	0.011329 (0.10538) [ 0.10750]	-0.003795 (0.03636) [-0.10438]	-0.079440 (0.20926) [-0.37962]
<b>MEDIA (-3)</b>	0.412815 (0.24270) [ 1.70095]	-0.016628 (0.10501) [-0.15835]	0.027594 (0.03609) [ 0.76453]	-0.397542 (0.20817) [-1.90967]
<b>MINE (-1)</b>	-0.168972 (0.12446) [-1.35767]	-0.020297 (0.05558) [-0.36520]	0.004280 (0.01911) [ 0.22400]	0.110266 (0.10654) [ 1.03493]
<b>MINE (-2)</b>	0.003625 (0.12448) [ 0.02912]	0.099286 (0.05550) [ 1.78901]	0.012206 (0.01909) [ 0.63928]	-0.103828 (0.10622) [-0.97744]

Table 5.8 (Continued)

Sector	Foreign	Institution	Proprietary Trader	Retails
<b>MINE (-3)</b>	0.164099 (0.12461) [ 1.31688]	-0.052085 (0.05617) [-0.92723]	0.017974 (0.01913) [ 0.93968]	-0.114228 (0.10621) [-1.07554]
<b>PKG (-1)</b>	-0.176885 (0.20208) [-0.87533]	-0.155924 (0.08929) [-1.74636]	0.017285 (0.03113) [ 0.55523]	0.204899 (0.17523) [ 1.16930]
<b>PKG (-2)</b>	0.225449 (0.19972) [ 1.12882]	0.075153 (0.08808) [ 0.85326]	-0.009606 (0.03080) [-0.31185]	-0.275843 (0.17377) [-1.58742]
<b>PKG (-3)</b>	-0.009242 (0.19669) [-0.04699]	0.012209 (0.08701) [ 0.14032]	-0.015090 (0.03015) [-0.50050]	0.015396 (0.17061) [ 0.09024]
<b>PERSON (-1)</b>	0.043638 (0.18937) [ 0.23044]	<b>-0.234238</b> (0.08590) [-2.72677]	0.025764 (0.02999) [ 0.85912]	0.115406 (0.16058) [ 0.71869]
<b>PERSON (-2)</b>	-0.069974 (0.18893) [-0.37038]	0.023337 (0.08722) [ 0.26757]	0.003573 (0.03002) [ 0.11901]	0.067833 (0.16030) [ 0.42316]
<b>PERSON (-3)</b>	0.251266 (0.18894) [ 1.32987]	0.021961 (0.08724) [ 0.25174]	-0.002022 (0.03009) [-0.06721]	-0.215204 (0.16041) [-1.34158]
<b>PETRO (-1)</b>	-0.146709 (0.16779) [-0.87434]	-0.088978 (0.07164) [-1.24201]	0.001978 (0.02498) [ 0.07919]	0.086234 (0.14863) [ 0.58020]
<b>PETRO (-2)</b>	0.002205 (0.16770) [ 0.01315]	0.010986 (0.07117) [ 0.15437]	-0.004417 (0.02482) [-0.17793]	0.004552 (0.14780) [ 0.03080]

Table 5.8 (Continued)

Sector	Foreign	Institution	Proprietary Trader	Retails
<b>PETRO (-3)</b>	-0.048528 (0.16647) [-0.29151]	0.078071 (0.07116) [ 1.09714]	-0.024291 (0.02477) [-0.98086]	0.020723 (0.14764) [ 0.14036]
<b>PF&amp;REITs (-1)</b>	-0.664611 (0.98872) [-0.67219]	-0.808602 (0.47901) [-1.68808]	0.296909 (0.18436) [ 1.61051]	0.595526 (0.89536) [ 0.66512]
<b>PF&amp;REITs (-2)</b>	-0.596613 (0.99978) [-0.59674]	0.440013 (0.48889) [ 0.90003]	-0.067097 (0.18835) [-0.35623]	0.549137 (0.90206) [ 0.60876]
<b>PF&amp;REITs (-3)</b>	1.401567 (1.00455) [ 1.39522]	-0.049158 (0.49506) [-0.09930]	-0.003383 (0.19001) [-0.01780]	-1.015606 (0.89956) [-1.12901]
<b>PAPER (-1)</b>	-0.114678 (0.16826) [-0.68155]	-0.056244 (0.07797) [-0.72132]	0.020976 (0.02732) [ 0.76776]	0.110224 (0.14379) [ 0.76657]
<b>PAPER (-2)</b>	0.100741 (0.16731) [ 0.60213]	-0.018666 (0.07757) [-0.24064]	0.011052 (0.02725) [ 0.40557]	-0.084938 (0.14320) [-0.59316]
<b>PAPER (-3)</b>	0.119584 (0.16728) [ 0.71486]	-0.005713 (0.07750) [-0.07371]	-0.029604 (0.02720) [-1.08840]	-0.078338 (0.14329) [-0.54672]
<b>PROF (-1)</b>	0.064415 (0.13920) [ 0.46277]	<b>-0.191142</b> (0.06125) [-3.12075]	0.031492 (0.02205) [ 1.42825]	0.013897 (0.12109) [ 0.11477]
<b>PROF (-2)</b>	-0.122043 (0.13932) [-0.87596]	0.096698 (0.06269) [ 1.54244]	-0.017988 (0.02224) [-0.80900]	0.028674 (0.12146) [ 0.23607]

Table 5.8 (Continued)

Sector	Foreign	Institution	Proprietary Trader	Retails
<b>PROF (-3)</b>	0.109863 (0.13863) [ 0.79251]	0.045501 (0.06253) [ 0.72772]	-0.013025 (0.02205) [-0.59083]	-0.109208 (0.12091) [-0.90320]
<b>PROP (-1)</b>	0.120740 (0.20961) [ 0.57602]	<b>-0.236055</b> (0.08586) [-2.74917]	0.026245 (0.03044) [ 0.86219]	-0.097660 (0.18480) [-0.52846]
<b>PROP (-2)</b>	-0.116555 (0.22003) [-0.52973]	0.128721 (0.09098) [ 1.41481]	-0.020962 (0.03210) [-0.65312]	0.025177 (0.19510) [ 0.12904]
<b>PROP (-3)</b>	0.055609 (0.20973) [ 0.26515]	0.060950 (0.08778) [ 0.69434]	-0.002973 (0.03050) [-0.09750]	-0.107608 (0.18408) [-0.58457]
<b>STEEL (-1)</b>	-0.201121 (0.40123) [-0.50127]	-0.409019 (0.18075) [-2.26293]	0.115508 (0.08191) [ 1.41018]	0.280547 (0.39208) [ 0.71553]
<b>STEEL (-2)</b>	0.243335 (0.40503) [ 0.60079]	0.276326 (0.18876) [ 1.46387]	-0.086451 (0.08376) [-1.03218]	-0.414940 (0.39453) [-1.05172]
<b>STEEL (-3)</b>	0.031173 (0.40404) [ 0.07715]	0.132036 (0.18846) [ 0.70059]	-0.008192 (0.08287) [-0.09885]	-0.313767 (0.38640) [-0.81203]
<b>TOURISM (-1)</b>	-0.081330 (0.27785) [-0.29271]	-0.106201 (0.12277) [-0.86501]	0.083871 (0.04192) [ 2.00056]	-0.125857 (0.24399) [-0.51582]
<b>TOURISM (-2)</b>	-0.228596 (0.28118) [-0.81300]	0.092582 (0.12417) [ 0.74558]	-0.031343 (0.04301) [-0.72878]	0.180615 (0.24655) [ 0.73258]

**Table 5.8** (Continued)

<b>Sector</b>	<b>Foreign</b>	<b>Institution</b>	<b>Proprietary Trader</b>	<b>Retails</b>
<b>TOURISM (-3)</b>	-0.079800 (0.27899) [-0.28603]	0.122835 (0.12307) [ 0.99808]	0.012187 (0.04247) [ 0.28693]	-0.028328 (0.24300) [-0.11657]
<b>TRANS (-1)</b>	-0.097665 (0.20364) [-0.47959]	-0.112408 (0.08785) [-1.27957]	0.025536 (0.03045) [ 0.83856]	0.009691 (0.17883) [ 0.05419]
<b>TRANS (-2)</b>	0.012383 (0.20929) [ 0.05917]	0.046056 (0.09002) [ 0.51165]	-0.032199 (0.03130) [-1.02870]	0.004152 (0.18367) [ 0.02261]
<b>TRANS (-3)</b>	-0.038567 (0.20289) [-0.19009]	0.074749 (0.08783) [ 0.85106]	0.014521 (0.03048) [ 0.47646]	-0.065295 (0.17803) [-0.36677]

**Source:** Author's calculation based on monthly market and sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and monthly data of net investment from a different type of investors from The Stock Exchange of Thailand database

From VAR estimation results, there is no significant association between the return of any stock sector in last quarter period lag with net investment from foreign investor despite VAR Granger Causality / Block Exogeneity Wald Test shows a significant causal relationship between returns of healthcare, home & office products and insurance sectors and net foreign investment.

**Table 5.9** VAR Granger Causality/ Block Exogeneity Wald Test Using Net Foreign Investment as Dependent Variable and Sectoral Stock Returns as Exogenous Variable

Dependent Variable: Net Foreign Investment					
Exogenous Variable	$\chi^2$	Prob.	Exogenous Variable	$\chi^2$	Prob.
AGRI	0.493286	0.9204	IMM	2.654406	0.4480
AUTO	3.895317	0.2730	INSUR	<b>10.59430</b>	<b>0.0141</b>
BANK	6.261432	0.0996	MEDIA	2.925529	0.4033
COMM	2.237141	0.5247	MINE	0.354034	0.9496
CONMAT	3.523693	0.3177	PKG	4.466179	0.2153
CONS	3.280425	0.3504	PERSON	3.236000	0.3567
ETRON	0.928921	0.8184	PETRO	0.378480	0.9447
ENERG	2.540323	0.4680	PF&REITs	2.477944	0.4793
FASHION	2.407837	0.4922	PAPER	2.561167	0.4643
FIN	2.091302	0.5537	PROP	3.676721	0.2986
FOOD	3.477776	0.3237	STEEL	0.574988	0.9021
HEALTH	<b>8.234768</b>	<b>0.0414</b>	PROF	2.473032	0.4802
HOME	<b>8.581998</b>	<b>0.0354</b>	TOURISM	1.662320	0.6453
ICT	1.604629	0.6583	TRANSP	2.389833	0.4955

**Source:** Author's calculation based on monthly sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and monthly data of net investment from a different type of investors from The Stock Exchange of Thailand database

From VAR estimation results, first lag of market return and stock returns from agribusiness, banking, commerce, construction materials, fashion, food & beverage, ICT, personal products, professional services, property sectors and second lag of stock return in fashion sector has a significant association with net investment in the stock market from institutional investor. However, VAR Granger Causality / Block Exogeneity Wald Test does not confirm this relationship and does not confirm any causal relationship between sectoral stock returns and net investment from institution investors.

**Table 5.10** VAR Granger Causality / Block Exogeneity Wald Test Using Net Institution Investment as Dependent Variable and Sectoral Stock Returns as Exogenous Variable

Dependent Variable: Net Institution Investment					
Exogenous Variable	$\chi^2$	Prob.	Exogenous Variable	$\chi^2$	Prob.
AGRI	1.008410	0.7992	IMM	1.164232	0.7616
AUTO	0.670752	0.8801	INSUR	4.443806	0.2174
BANK	1.586559	0.6624	MEDIA	2.214860	0.5290
COMM	2.326280	0.5075	MINE	1.096611	0.7779
CONMAT	4.079637	0.2530	PKG	1.382403	0.7097
CONS	3.488222	0.3223	PERSON	5.110825	0.1639
ETRON	5.900971	0.1165	PETRO	0.501982	0.9185
ENERG	0.237293	0.9714	PF&REITs	3.359656	0.3394
FASHION	5.307912	0.1506	PAPER	2.299014	0.5127
FIN	2.761781	0.4298	PROP	2.474823	0.4799
FOOD	1.374904	0.7114	STEEL	7.515544	0.0572
HEALTH	2.884254	0.4098	PROF	4.106829	0.2502
HOME	2.926090	0.4032	TOURISM	0.397802	0.9407
ICT	0.570032	0.9033	TRANSP	2.235031	0.5251

**Source:** Author's calculation based on monthly sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and monthly data of net investment from a different type of investors from The Stock Exchange of Thailand database

From VAR estimation results, the second lag of stock return in the ICT sector has a significant impact on the stock market's net investment from proprietary trader. However, VAR Granger Causality / Block Exogeneity Wald test results do not confirm this causality and show only a significant causal relationship between return of stock sector in home & office products with net investment from the proprietary trader.

**Table 5.11** VAR Granger Causality/ Block Exogeneity Wald Test Using Net Proprietary Trader Investment as Dependent Variable and Sectoral Stock Returns as Exogenous Variable

Dependent Variable: Net Proprietary Trader Investment					
Exogenous Variable	$\chi^2$	Prob.	Exogenous Variable	$\chi^2$	Prob.
AGRI	1.389577	0.7080	IMM	1.070736	0.7841
AUTO	0.701704	0.8728	INSUR	4.297931	0.2310
BANK	1.855116	0.6030	MEDIA	4.041835	0.2570
COMM	2.750311	0.4317	MINE	1.671588	0.6433
CONMAT	0.552720	0.9072	PKG	0.983111	0.8053
CONS	0.828047	0.8427	PERSON	2.562600	0.4641
ETRON	2.444549	0.4854	PETRO	5.125167	0.1629
ENERG	0.324267	0.9554	PF&REITs	2.661878	0.4467
FASHION	2.367917	0.4996	PAPER	0.717655	0.8690
FIN	2.642232	0.4501	PROP	1.577041	0.6646
FOOD	3.679059	0.2983	STEEL	2.745481	0.4326
HEALTH	1.342532	0.7191	PROF	4.015444	0.2598
HOME	<b>8.150136</b>	<b>0.0430</b>	TOURISM	2.726588	0.4357
ICT	1.950369	0.5828	TRANSP	2.899002	0.4075

**Source:** Author's calculation based on sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and monthly data of net investment from a different type of investors from The Stock Exchange of Thailand database

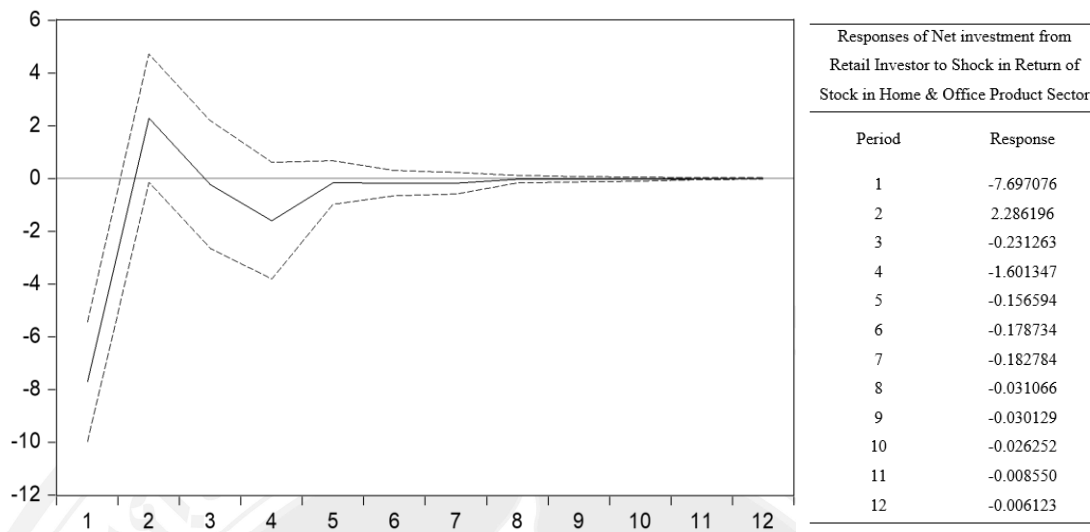
From VAR estimation results, the first lag of stock return in the home & office products sector has a significant association with net investment in the stock market from retail investors. In addition, the VAR Granger Causality / Block Exogeneity Wald Test also confirms this causal relationship. VAR Granger Causality / Block Exogeneity Wald Test also shows a significant causal relationship between stock returns in banking and insurance sectors and net investment from retail investors.

**Table 5.12** VAR Granger Causality / Block Exogeneity Wald Test Using Net Retail Investment as Dependent Variable and Sectoral Stock Returns as Exogenous Variable

Dependent Variable: Net Retail Investment					
Exogenous Variable	$\chi^2$	Prob.	Exogenous Variable	$\chi^2$	Prob.
AGRI	0.617497	0.8920	IMM	2.525669	0.4707
AUTO	3.311154	0.3461	INSUR	<b>9.438832</b>	<b>0.0240</b>
BANK	<b>8.942510</b>	<b>0.0301</b>	MEDIA	2.787026	0.4256
COMM	2.206227	0.5307	MINE	1.313537	0.7259
CONMAT	5.490392	0.1392	PKG	5.816040	0.1209
CONS	3.979150	0.2637	PERSON	3.213503	0.3599
ETRON	0.765935	0.8576	PETRO	0.556485	0.9063
ENERG	3.756138	0.2890	PF&REITs	1.858477	0.6023
FASHION	0.895945	0.8264	PAPER	1.834423	0.6075
FIN	3.563233	0.3127	PROP	1.972793	0.5781
FOOD	4.059016	0.2552	STEEL	2.586047	0.4599
HEALTH	7.272643	0.0637	PROF	1.969861	0.5787
HOME	<b>10.05586</b>	<b>0.0181</b>	TOURISM	2.895699	0.4080
ICT	2.009297	0.5705	TRANSP	2.359103	0.5013

**Source:** Author's calculation based on monthly sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and monthly data of net investment from a different type of investors from The Stock Exchange of Thailand database

Impulse Response Analysis shows sudden negative decline response of net investment from the retail investor in response to S.D. shock impose to residuals of stock return in home & office product sector at first month with rapidly rebounding in the second month and fluctuates until stable at eight months.



**Figure 5.8** Impulse Response Function of Net Investment from Retail Investor to Cholesky One S.D. Shock to Return of Stock in Home & Office Product Sector

**Source:** Author's calculation based on monthly market and sector returns data in The Stock Exchange of Thailand from Thomson Reuters Datastream and monthly data of net investment from a different type of investors from The Stock Exchange of Thailand database.

#### 5.4 Relationship between Business Cycle and Net Investment from Different Types of Investors

To study the impact of business cycle on net investment from different types of investors, the basic assumption is that market returns vary across different business cycle stages, causing variation of net investment from different types of investors. In the recovery stage and early expansion stage, the investors may have positive anticipation towards better market return in the future; therefore, these stages may attract more investment. In the contrary, investors may withdraw investment in the recession and depression stages. I use interaction terms between market return and business cycle stage dummies to represent different market returns in different business cycle stages. Vice versa, investment from different types of investors varies across the different stages of the business cycle and may cause impact market return in the respective

business cycle stage. I also use interaction terms between net investment from different types of investors to represent a different net investment levels from the investors in different stages of the business cycle.

I apply AutoRegressive Distributed Lag (ARDL) model for a short-term relationship, the cointegration test for a long-term relationship, and the pairwise Granger causality test to confirm a causal relationship.

The ARDL model is defined as:

Equation 7 (ARDL Model for the Relationship between Net Investment from Different Types of Investors and Market Returns in Different Stages of the Business Cycle)

$$\Delta \text{INV}_{k,t} = \alpha_{k,s,t} + \sum_{i=1}^n \beta_i \Delta \text{INV}_{t-i} + \sum_{i=1}^n \delta_i \Delta \text{Rm}_{t-i} * \text{D}_{s,t-i} + \varphi_1 \Delta \text{INV}_{t-1} + \varphi_2 \Delta \text{Rm}_{t-1} * \text{D}_{s,t-1} + \mu_t$$

$$\Delta \text{Rm}_t = \alpha_{k,s,t} + \sum_{i=1}^n \beta_i \Delta \text{Rm}_{t-1} + \sum_{i=1}^n \delta_i \Delta \text{INV}_{k,t-1} * \text{D}_{s,t-1} + \varphi_1 \Delta \text{Rm}_{t-1} + \varphi_2 \Delta \text{INV}_{k,t-1} * \text{D}_{s,t-1} + \mu_t$$

$\text{INV}_{k,t}$  is a net investment from investor type  $k$  at month  $t$  and  $\text{Rm}_t$  is market return at month  $t$ .

The data are all stationary from the ADF test and optimal lag determination from Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hannan-Quinn Criterion (HC) suggest the appropriate lag structure of lag 1 therefore, I use ARDL (1,1) for the analysis.

**Table 5.13** ARDL Estimation, Long-Run Cointegration, and Granger Causality Analysis for Market Return in Each Stage of the Business Cycle and Net Investment from a Different Type of Investors

	<b>Foreign</b>	<b>Institute</b>	<b>Proprietary Trader</b>	<b>Retail Investors</b>
Rm*D <sub>expand</sub>	<b>2.417605</b> (0.0000)	-0.338528 (0.2328)	<b>0.609293</b> (0.0000)	<b>-2.728354</b> (0.0000)
Rm*D <sub>expand</sub> (-1)	0.315509 (0.5266)	<b>-0.914749</b> (0.0010)	-0.028769 (0.7623)	0.383187 (0.3645)
Rm*D <sub>expand</sub> (long-run)	<b>4.006766</b> (0.0001)	<b>-1.575883</b> (0.0025)	<b>0.480119</b> (0.0000)	<b>-2.671286</b> (0.0000)
Rm*D <sub>expand</sub> (Causality Test)	Not Sig	<b>Rm*D<sub>expand</sub> granger cause institution</b>	Not Sig	Not Sig
Rm*D <sub>recess</sub>	<b>2.721752</b> (0.0000)	<b>-0.528895</b> (0.0006)	<b>0.117020</b> (0.0160)	<b>-2.333410</b> (0.0000)
Rm*D <sub>recess</sub> (-1)	<b>-1.035419</b> (0.0013)	-0.121186 (0.4405)	0.045184 (0.3622)	<b>0.670952</b> (0.0125)
Rm*D <sub>recess</sub> (long-run)	<b>2.472177</b> (0.0000)	<b>-0.817419</b> (0.0019)	<b>0.134150</b> (0.0142)	<b>-1.893639</b> (0.0000)
Rm*D <sub>recess</sub> (Causality Test)	<b>Rm*D<sub>recess</sub> granger cause foreign</b>	Not Sig	Not Sig	Not Sig
Rm*D <sub>depress</sub>	0.438727 (0.3647)	0.324409 (0.2458)	0.019157 (0.8291)	<b>-0.777551</b> (0.0470)
Rm*D <sub>depress</sub> (-1)	0.083512 (0.8616)	-0.158555 (0.5664)	-0.005795 (0.9473)	-0.000659 (0.9986)
Rm*D <sub>depress</sub> (long-run)	0.765607 (0.4352)	0.208546 (0.6671)	0.011051 (0.9132)	-0.886428 (0.1496)
Rm*D <sub>depress</sub> (Causality Test)	Not Sig	Not Sig	Not Sig	Not Sig
Rm*D <sub>recov</sub>	0.699498 (0.4058)	-0.217418 (0.6540)	0.145917 (0.3443)	-0.578661 (0.3929)
Rm*D <sub>recov</sub> (-1)	0.841665 (0.3207)	-0.509302 (0.2955)	-0.064746 (0.6747)	-0.499376 (0.4634)

**Table 5.13** (Continued)

	<b>Foreign</b>	<b>Institute</b>	<b>Proprietary Trader</b>	<b>Retail Investors</b>
Rm*D <sub>recov</sub> (long-run)	<b>2.259356</b> <b>(0.0356)</b>	-0.913784 (0.0848)	0.067132 (0.5426)	-1.227948 (0.0666)
Rm*D <sub>recov</sub> (Causality Test)	Not Sig	Not Sig	Not Sig	Not Sig

**Source:** Author's calculation based on monthly market return data of The Stock Exchange of Thailand from Thomson Reuters Datastream, real GDP data from CEIC database, and monthly data of net investment from a different type of investors from The Stock Exchange of Thailand database

Results show that the first month lag of market return in the expansion stage has a significant short-term relationship with net investment from domestic institutional investors and the long-term relationship between market return in the expansion stage and net investment from domestic institutional investors also presents with an inverse relationship. Granger causality test also confirms that market return in the expansion stage has a causal relationship with net domestic institution investment.

Market return in the recession stage has a short-term and long-term relationships with net foreign investment. Granger causality test also confirms a causal relationship between market return in the recession stage and net investment from the foreign investors.

**Table 5.14** ARDL estimation, long-run cointegration, and granger causality analysis for net investment from different types of investors in each stage of business cycle and market return

<b>Foreign Investor</b>					
Rm	FOR*D <sub>expand</sub>	FOR*D <sub>expand</sub> (-1)	FOR*D <sub>expand</sub> (long-run)	FOR*D <sub>expand</sub> (Causality Test)	
	<b>0.119452</b> <b>(0.0002)</b>	<b>-0.059837</b> <b>(0.0634)</b>	0.069916 (0.1000)	Not Sig	
	FOR*D <sub>recess</sub>	FOR*D <sub>recess</sub> (-1)	FOR*D <sub>recess</sub> (long-run)	FOR*D <sub>recess</sub> (Causality Test)	
	<b>0.156116</b> <b>(0.0000)</b>	-0.031202 (0.1360)	<b>0.146498</b> <b>(0.0000)</b>	Not Sig	
	FOR*D <sub>depress</sub>	FOR*D <sub>depress</sub> (-1)	FOR*D <sub>depress</sub> (long-run)	FOR*D <sub>depress</sub> (Causality Test)	
	<b>0.238943</b> <b>(0.0139)</b>	0.005350 (0.9584)	0.286505 (0.0651)	Not Sig	
	FOR*D <sub>recov</sub>	FOR*D <sub>recov</sub> (-1)	FOR*D <sub>recov</sub> (long-run)	FOR*D <sub>recov</sub> (Causality Test)	
	<b>0.418209</b> <b>(0.0044)</b>	-0.094596 (0.4993)	0.379532 (0.0527)	Not Sig	
	<b>Institution</b>				
	INS*D <sub>expand</sub>	INS*D <sub>expand</sub> (-1)	INS*D <sub>expand</sub> (long-run)	INS*D <sub>expand</sub> (Causality Test)	
	-0.033911 (0.6024)	0.026106 (0.6839)	-0.008885 (0.9219)	Not Sig	
	INS*D <sub>recess</sub>	INS*D <sub>recess</sub> (-1)	INS*D <sub>recess</sub> (long-run)	INS*D <sub>recess</sub> (Causality Test)	
<b>-0.145055</b> <b>(0.0024)</b>	0.011705 (0.8121)	<b>-0.151815</b> <b>(0.0223)</b>	Not Sig		
INS*D <sub>depress</sub>	INS*D <sub>depress</sub> (-1)	INS*D <sub>depress</sub> (long-run)	INS*D <sub>depress</sub> (Causality Test)		
0.519438 (0.0514)	-0.176302 (0.5139)	0.390650 (0.3686)	Not Sig		
INS*D <sub>recov</sub>	INS*D <sub>recov</sub> (-1)	INS*D <sub>recov</sub> (long-run)	INS*D <sub>recov</sub> (Causality Test)		
<b>-1.028446</b> <b>(0.0426)</b>	0.275558 (0.5757)	-0.857141 (0.2575)	Not Sig		

Table 5.14 (Continued)

<b>Proprietary Trader</b>				
	PROP*D <sub>expand</sub>	PROP*D <sub>expand</sub> (-1)	PROP*D <sub>expand</sub> (long-run)	PROP*D <sub>expand</sub> (Causality Test)
	<b>0.526145</b> <b>(0.0006)</b>	0.045713 (0.7665)	<b>0.662422</b> <b>(0.0203)</b>	Not Sig
	PROP*D <sub>recess</sub>	PROP*D <sub>recess</sub> (-1)	PROP*D <sub>recess</sub> (long-run)	PROP*D <sub>recess</sub> (Causality Test)
	<b>0.468750</b> <b>(0.0051)</b>	-0.270666 (0.1123)	0.229454 (0.4314)	Not Sig
	PROP*D <sub>depress</sub>	PROP*D <sub>depress</sub> (-1)	PROP*D <sub>depress</sub> (long-run)	PROP*D <sub>depress</sub> (Causality Test)
	<b>4.849614</b> <b>(0.0024)</b>	<b>4.015232</b> <b>(0.0137)</b>	<b>10.268763</b> <b>(0.0006)</b>	Not Sig
	PROP*D <sub>recov</sub>	PROP*D <sub>recov</sub> (-1)	PROP*D <sub>recov</sub> (long-run)	PROP*D <sub>recov</sub> (Causality Test)
	0.456734 (0.4889)	-0.039927 (0.9511)	0.482817 (0.6321)	Not Sig
<b>Retail Investor</b>				
	RET*D <sub>expand</sub>	RET*D <sub>expand</sub> (-1)	RET*D <sub>expand</sub> (long-run)	RET*D <sub>expand</sub> (Causality Test)
	<b>-0.149892</b> <b>(0.0000)</b>	0.033616 (0.2954)	<b>-0.141262</b> <b>(0.0064)</b>	Not Sig
	RET*D <sub>recess</sub>	RET*D <sub>recess</sub> (-1)	RET*D <sub>recess</sub> (long-run)	RET*D <sub>recess</sub> (Causality Test)
	<b>-0.209190</b> <b>(0.0000)</b>	0.020949 (0.4028)	<b>-0.228690</b> <b>(0.0000)</b>	Not Sig
	RET*D <sub>depress</sub>	RET*D <sub>depress</sub> (-1)	RET*D <sub>depress</sub> (long-run)	RET*D <sub>depress</sub> (Causality Test)
	<b>-0.447325</b> <b>(0.0000)</b>	-0.037107 (0.7332)	<b>-0.588525</b> <b>(0.0017)</b>	Not Sig
	RET*D <sub>recov</sub>	RET*D <sub>recov</sub> (-1)	RET*D <sub>recov</sub> (long-run)	RET*D <sub>recov</sub> (Causality Test)
	<b>-0.467261</b> <b>(0.0017)</b>	0.072598 (0.6164)	<b>-0.479467</b> <b>(0.0252)</b>	Not Sig

**Source:** Author's calculation based on monthly market return data of The Stock Exchange of Thailand from Thomson Reuters Datastream, real GDP data from CEIC database, and monthly data of net investment from a different type of investors from The Stock Exchange of Thailand database

Results show that net foreign investment in the recession stage has both short-run and long-run relationship with market return however, Granger causality test does not confirm this result. This is similar to net domestic institution investment in the recession stage as well. Net investment from the proprietary traders in both expansion and depression stages have both short-run and long-run relationships with market returns however, Granger causality test does not confirm this result. Net investment from the retail investors in all stages of the business cycle have both short-run and long-run relationships with market return; however, Granger causality test does not confirm this result.

This chapter's overall results partly support the feedback-trader hypothesis that market return in the expansion stage of the business cycle has a short-term relationship with net equity investment from domestic institutions and the market return in the recession stage has a short-term relationship with foreign investment. At the sector level, only return in the home & office products sector has a significant association with net investment from retail investors.

The results also partly support the price-pressure hypothesis. At the market level, only net investment from domestic institution has a significant relationship with the stock market return. At the sector level, net investment from the domestic institutions also has a significant relationship with a return in the food & beverage sector. Net investment from proprietary trader has a significant relationship with a return in the construction, insurance, and tour & leisure sectors. This study's results do not support price-pressure hypothesis for both foreign investment and investment from retail investors at both market level and sector level.

This study contributes to more insights in this area with the sectoral approach and exploration with a different type of investors and different stages of the business cycle environment.

## CHAPTER 6

### CONCLUSION DISCUSSION AND RECOMMENDATION

#### 6.1 Defining Stages of Business Cycle and Association between Business Cycle and Sectoral Stock Returns

Determination of business cycle requires repeatable cyclical pattern movement of aggregate economic activities with expansion and recession periods and turning points (peak and trough). Real GDP growth is a reasonable proxy of aggregate economic activities and has cyclical movement per definition.

This study also found that whether using real GDP growth, Manufacturing Production Index (MPI) growth or Composite index like Coincident Economic Index (CEI) as a proxy of real output growth for business cycle determination does not matter because they offer similar peak and trough and cyclical movement and the cycles are very close with each other but should be remarkable on using Year on Year growth data rather than Month on Month growth data to figure out cyclical movement pattern. The correlation coefficient also confirms high correlations between these 3 business cycle proxies where real GDP growth has 84 % correlation with MPI growth and 86% correlation with CEI growth while MPI growth and CEI growth have 81 % correlation. Real GDP growth also has the highest correlation and closest peaks and troughs with the stock market return. However, despite manufacturing production or industrial production has been introduced as one of the potential proxies of output growth of the economy in business cycle determination, some arguments also mentioned that manufacturing production or industrial production might not be a good predictor for a predominantly service economy. In Thailand, the service economy comprises 52.7% of GDP while agriculture and manufacturing comprise around 13.3% and 34%, respectively (www.adb.org) therefore, real GDP growth is being used as a proxy of the business cycle in this study.

Most of the literature divided the business cycle into expansion and recession stage with peak and trough, while some authors elaborated more by dividing expansion and recession into early expansion (recovery), late expansion, early recession, and late recession (depression) using either long-run average trend line or steady zero-growth line. For the study period (2002 - 2019 C.E.), Thailand's real GDP growth has declining long-run average trend line. This study has tested two regression models using steady zero-growth line and long-run average trend line in defining stages of the business cycle into 4 stages (expansion, recession, depression, and recovery) with dummy variables of each stage of the business cycle and sectoral stock return including the market return to compare which method gives better regression model specifications. The results show that the model using a steady zero-growth line has better model specifications (Adjusted  $R^2$ , F-statistics and Sum-Squared Residuals) compared with another model using a long-run average trend line in defining business cycle stages. A steady zero-growth line is practical and easier to standardize analysis between different studies that vary in period of time and country of reference. Theoretically, the long-term average trend line of real GDP growth should be expected to have an inclining upward slope reflecting long-run incremental of the nation's aggregate economic activities through technological improvement and better productivity; however, it shows a declining downward slope of the long-term average trend line of real GDP growth in the study period for Thailand data which contradict to the theoretical principle. With the providing rationales, stages of the business cycle in this study are defined by using steady zero-growth line and the stages of the business cycle are specified as expansion, recession, depression, and recovery according to the movement of real GDP growth around the steady zero-growth line and local maxima or local minima between steady zero-growth line crossing points. This provides a practical and standardized method of business cycle stages determination applicable for any different period of time, different country and different GDP growth movement pattern. While commonly used methodology in the literature is most dependent on the U.S. stock market and NBER defined peak and trough dates the methodology used in this study is more universal and applicable for broader study conditions.

**Table 6.1** Comparison of Pro and Con between Different Methodology of Business Cycle Stages Identification in Literatures and This Research Work

Methodology in defining stages of business cycle	Pro	Con
DeStefano (2014) and Song & Qian (2017)	Peak and trough are defined by a central agency (NBER) therefore similar to all studies using this method.	<ul style="list-style-type: none"> <li>• Applicable only for U.S. market study because NBER does not announce peak and trough date for other countries</li> <li>• Challenges in identifying middle points to divide half of expansion and contraction</li> <li>• No separation between stages of positive output (GDP) growth and negative output (GDP) growth</li> </ul>
This Study	<ul style="list-style-type: none"> <li>• Applicable to all markets, not only limited to the U.S.</li> <li>• A simplified and standardized methodology using a steady zero-growth line which clearly separate stages of positive output (GDP) growth and stages of negative output (GDP) growth then peak and trough are being identified by local maxima and local minima</li> <li>• More practical for applicability to investment</li> </ul>	Maybe a challenge when output growth is steady with minimal fluctuation around a steady zero-growth line.

Despite using a similar methodology, the results from DeStefano (2004) and Song and Qian (2017) were contradicting each other. Empirical results from DeStefano (2004) indicate that Late Recession is the best timing for investment in the stock market due to expectation on future earnings, but estimated parameters in the depression

stage of Song and Qian (2017) (which is equivalent to late recession stage of DeStefano (2014)) showed the negative sign for all stock sectors.

Interestingly, the results from this study found that the recovery stage is the best timing in the business cycle to invest in the stock market where the majority of the stock sectors have positive average return above market (almost half of them also have Treynor ratio higher than the market when considering risk-adjusted return perspective). The recovery stage is the only business cycle stage where there is no stock sector with negative average return. The expansion stage is the second-best timing for stock market investment. In contrast, in depression stage almost all stock sectors have negative Treynor ratio except only commerce and ICT sectors and investment in Risk free asset (10-Year Government Bond) may be better option in this period than other stock sectors other than commerce and ICT. This finding suggests the potential effect of expectation towards future earnings where investors expect future earnings increase in the recovery stage where real output growth is still negative. DeStefano (2004, pp. 539-545) also discussed this as:

One somewhat surprising result is the relatively high returns during Stage IV (late recession). Average return for the stage are always positive and by far higher than returns in other stages ... expected earnings, and its impact on stock returns can change from negative to positive as the stage progresses and low and decreasing interest rates have a positive impact throughout the stage.

However, the methodology of DeStefano (2004) in defining stages of the business cycle was different. DeStefano (2004, p. 531) divided the business cycle into 4 stages using NBER defined peak date and trough date then further divide expansion into early and late expansion and divide recession into early and late recession; therefore, stage to stage comparison between this study and study of DeStefano (2004) cannot be made.

Following business cycle stages identification, we can use modified CAPM model to find each stock sector's beta-value by incorporating business cycle stage dummies into the model by interacting with market risk premium which represent different market risk premium in the different stages of the business cycle. We can further use beta-value to calculate the Treynor ratio for stock sectors in each stage of business cycle. Finally, we can make investment recommendation based on sectoral

stock allocation in each stage of the business cycle by comparing the Treynor ratio, which represents the risk-adjusted return of the different assets.

From this study, commerce is the only stock sector that can be invested in all stages of the business cycle. It is the only stock sector with a positive average return across all stages of the business cycle and the only stock sector with a positive Treynor ratio higher than the market in all business cycle stages. Food & Beverage and Insurance are the sectors that perform well in almost all business cycle stages except depression stage. Banking, finance & securities, construction materials, home & office products, and transportation & logistics perform well in recovery to expansion stages (rising output growth). In the expansion stage (incremental positive output growth), the tourism & leisure sector performs best in risk-adjusted return. Energy and healthcare services perform later in the recession stage. Healthcare services is the best stock sector to invest in the recession stage (output growth decline but still positive) of the business cycle considering a risk-adjusted return. Steel is the only stock sector with negative average returns in all stages of the business cycle except the recovery stage. It also has a negative Treynor ratio in expansion and recovery stages with an insignificant beta-value in depression and recovery stages.

Portfolio simulation has been performed to prove the real-life benefit of using sectoral allocation along with the business cycle strategy. This study compares two strategic portfolio investment (with or without intersectoral diversification at each stage of the business cycle). It compares strategic portfolios using sectoral allocation along the business cycle with the investment in market portfolio and risk-free asset. The results show that strategic portfolio investment with inter-sectoral allocation at the different stages of the business cycle using Markowitz Mean-Variance Portfolio Optimization to determine optimized intersectoral allocation ratio provides much less risk-associated investment and much higher yield of investment return compared with investment in market portfolio.

## 6.2 Influences of Macroeconomic factors and Business Sentiment Index along the Business Cycle on Sectoral Stock Return

Among key macroeconomic factors, there are high correlations ( $\rho \geq 0.70$ ) between Gross Domestic Product (GDP), Consumer Price Index (CPI), Real Effective Exchange Rate (REER), and Money Supply (Broad Money). The interest rate has negative correlations with all studied macroeconomic factors and with market (SET) Index. For growth rate or rate of change overall correlation between each pair are less than 0.30.

Stock Market Index (SETI) has high correlations ( $\rho \geq 0.70$ ) with GDP, CPI, REER, and Money Supply. From a sectoral perspective, stock market return ( $r_m$ ) has a high correlation ( $\rho \geq 0.70$ ) with Banking, Property Development, Construction Materials, Energy & Utility, Finance & Securities, Transportation & Logistics, Petrochemicals, Industrial Materials and Machine, Steel, Food & Beverages and Media sectors where lowest correlations ( $\rho < 0.30$ ) have found with Personal Products & Pharmaceuticals and Paper & Printing Materials industry.

With a sectoral approach, this study provides more insights on the controversial points in the literature. There were conflicting results in the literature regarding the association of interest rate and stock market returns, which positive in some studies and negative in some studies. Using the sectoral approach, this study concludes that interest rate has a positive significant association with stock return in the banking sector but has a negative significant association with stock return in the petrochemical sector. Conflicting results among previous studies in the literature might belong to different stock market structures in different countries.

The impact of exchange rate on stock market return is also controversial in the literature. This might depend on components of corporate structures in the stock market, whether export-oriented firms or companies with high foreign debt / heavily importation materials are dominant. In this study, automotive, commerce, finance & securities and media sectors are positively associated with domestic currency appreciation but the energy & utility sector has an inverse relationship with domestic currency appreciation. Regarding that most of the studies in the literature used exchange rate as a variable but in this study, Real Effective Exchange Rate (REER) has been used in the analysis due to consistently available data across study timeframe; therefore, interpretation should be

made with cautious as increase exchange rate means domestic currency depreciation but increase REER means domestic currency appreciation and vice versa for decremental change.

Consumer Price Index is another area of controversy in the literature. This study found that CPI positively associates with food & beverage, industrial materials & machine, and insurance sectors.

The relationship between money supply and stock market return had been inconclusive in the literature. However, significant (positive) association between money supply and the stock return has been found only in the transportation & logistic sector.

Some literature included oil prices in the analysis. However, crude oil prices are not much associate with domestic selling oil prices, which reflects real business costs in Thailand, therefore, not included in this study. In addition, oil price risk is not separately rewarded in the stock market, according to Chen et al. (1986).

Business Sentiment Index (BSI) and Expected Business Sentiment Index (BSI<sup>e</sup>) are not much involved in previous studies in the literature. In addition, the business sentiment index (and expected) had never been studied with business cycle stages. In principle, BSI and BSI<sup>e</sup> should be different in each stage of the business cycle as the business environment and entrepreneurs' expectations should be different across different business cycle stages. BSI and BSI<sup>e</sup> are highly correlated with each other ( $\rho \geq 0.70$ ) at a level. Cross correlogram analysis shows that the first month lag of the expected Business Sentiment index has the highest and significant cross- correlation with Business Sentiment Index indicating that the expected BSI might be able to predict BSI one month ahead. In a multi-factor APT model analysis in this study, Expected Business Sentiment Index has a significant association with stock returns in fashion and steel sectors in the expansion stage. Its association with stock returns in the recession stage is not significant in any sector. Many stock sectors have a similar direction relationship with BSI<sup>e</sup> in the depression stage; this includes automotive, electrical components, healthcare services, insurance, media, property funds, professional services, property, tourism & leisure, transportation & logistics but only stock return in the petrochemical sector has an inverse relationship with BSI<sup>e</sup>. In the recovery stage, electrical components, petrochemical, and property development sectors have a positive association with the expected business sentiment index but commerce and ICT sectors have an inverse relationship with sectoral stock returns.

**Table 6.2** Comparisons of Findings between Different Research Works about Macroeconomic Factors on Stock Market Returns

	<b>Positive Regression Coefficient</b>	<b>Negative Regression Coefficient</b>
GDP	Singh et al. (2011) Amtiran et al. (2017) <b>This Study (Automotive, Insurance, Petrochemical, and Property Fund)</b>	N/A
Industrial Production	Alam and Rashid (2014)	N/A
Exports	Zhu (2012)	N/A
CPI / Inflation	Wei and Wong (1992) Kuwornu et al. (2011) Assagaf et al. (2019) <b>This Study (Food &amp; Beverage, Industrial Materials and Machinery and Insurance)</b>	Benakovic et al. (2010) Singh et al. (2011) Alam and Rashid (2014)
Interest Rate	Benakovic et al. (2010) Amtiran (2017) <b>This Study (Banking)</b>	Alam and Rashid (2014) Assagaf (2019) <b>This Study (Petrochemical)</b>
Exchange Rate	Singh et al. (2011) Zhu (2012) Amtiran (2017)	Kuwornu et al. (2011) Alam and Rashid (2014) Assagaf et al. (2019)
	<b>Positive Regression Coefficient</b>	<b>Negative Regression Coefficient</b>
Real Effective Exchange Rate	<b>This Study (Automotive, Commerce, Finance, Media)</b>	<b>This Study (Energy &amp; Utility)</b>
Treasury Bill Rate	N/A	Kuwornu et al. (2011)
Money Supply	Assagaf et al. (2019) Celebi and Hoang (2019) found positive for M1 <b>This Study (Only Transportation &amp; Logistics Sector)</b>	Singh et al. (2011) Alum and Rashid (2014) Celebi and Hoang (2019) found negative for M2 and M3
Foreign Reserve	Zhu (2012)	N/A

### **6.3 Association between Fund Flows to Stock Market from Different Types of Investors on Market and Sectoral Stock Returns in Each Stage of Business Cycle**

Among four major types of investors in the Thailand Stock Exchange, net foreign investment has the highest (positive) correlation with market return (correlation coefficient 0.56, Chi-Square 85.98, Prob 0.0000) compared with net investment from other types of investors. When analyzing correlation between each other, net foreign investment has a positive correlation with proprietary trader investment and has a negative correlation with net investment from institution and retail investor. This contradicts Boyer and Zheng (2009) which mentioned that mutual funds and foreign investors move together with stock market returns. From the graphical plots and descriptive statistics, net foreign investment has the highest volatility (followed by net investment from retail investors) compared with net investment from other types of investors. In some literature, the retail investor has the highest volatility.

Analysis of Vector AutoRegression Model (VAR) together with VAR Granger Causality / Block Exogeneity Wald Test confirmation suggested that there are selectively significant bilateral relationship between net investment to the stock market from different types of investors and sectoral stock returns which need sectoral approach. The first month lag of net proprietary trader investment to the stock market has a significant impact on the stock returns in construction, insurance, and tour & leisure sectors. The first month lag of stock return in home & office products has a significant impact on net investment to the stock market from retail investors.

Analysis of the association between business cycle and fund flow from different type of investors shows that the first month lag of market return in the expansion stage has a significant short-run relationship with net investment from domestic institutes but with inverse long-run relationships. Granger causality test also confirms that market return in the expansion stage has a causal relationship with net investment from domestic institutes. The market return has short-run and long-run relationships with net foreign investment where the Granger causality test also confirms this causal relationship. There is no significant causal relationship between net investment from different investor types to the return from the stock market. Findings imply that the causal relationship's direction

is likely to be market return attracts fund flow rather than fund flow impact stock market return.

According to that some literature mentioned about bidirectional relationship between fund flows and stock returns where increasing stock returns attract money flow from investors and increasing demand from investors drive stock prices up lead to increase in stock return. This study showed a partially and selective bidirectional relationship between fund flows and sectoral stock returns. The overall results partly support the feedback-trader hypothesis that market return in the expansion stage of the business cycle has a short-term relationship with a net equity investment from the domestic institutions and market return in the recession stage has a short-term relationship with foreign investment. At the sector level, only return in home & office products sector has a significant association with net investment from retail investors. The results also partly support the price-pressure hypothesis. At the market level, only net investment from the domestic institutions has a significant relationship with the stock market return. At the sector level, net investment from domestic institution also has a significant relationship with a return in the food & beverage sector. Net investment from proprietary trader has a significant relationship with return in the construction, insurance, and tour & leisure sectors. This study's results do not support price-pressure hypothesis for both foreign investment and investment from retail investors at both market level and sector level. This study contributes to additional insights from the literature with sectoral approach, exploration with different type of investors, and the different business cycle stages.

#### **6.4 Contributions of this Study, Implications for Investment Allocation and Recommendations for Future Research**

The major contribution of this study is providing recommendations on how to optimize investment by sectoral stock allocation in each stage of business cycle considering risk-adjusted return.

This study provides a step-by-step approach starting from defining the stages of the business cycle using practical methodology. Investors can simply identify the business cycle using real GDP growth (YoY, Seasonally Adjusted) and a steady zero-

growth line. The expansion stage of the business cycle can be identified by positive real GDP growth in a rising trend above the steady zero-growth line. Recession stage of the business cycle can be identified by positive real GDP growth but declining trend down towards a steady zero-growth line. Depression stage of the business cycle is the stage where real GDP growth is in negative number and declining trend apart from a steady zero-growth line. The recovery stage is the stage where real GDP growth is negative but appears in a rising trend up towards a steady zero-growth line. Peaks and troughs of the business cycle are local maxima and local minima between the real GDP growth chart cross over the steady zero growth line. This study has proven the methodology of business cycle stage determination for its applicability to the regression model.

This study provides simplified methodology in business cycle identification which may theoretically be in conceptual discussion but never been tested in empirical study literature. This study's business cycle identification method is simple, logical and practical for application as it clearly represents stages of positive and negative output growth also with expansion and recession path with clear turning points. The method is also applicable to different markets and different economic conditions. This study also proved that the Manufacturing Production Index (MPI) growth and growth in the Composite Economic Index, such as the Coincident Economic Index (CEI) developed by The Bank of Thailand, could also be used as a proxy for business cycle identification. However, the challenge of using MPI growth as a proxy of business cycle may be with the country's economic structures at a particular period of time. Using real GDP growth or Composite Economic Index may the options to avoid this issue for the service-based economy. This study also found that Month on Month (MoM) output growth cannot be used for business cycle identification due to unclear cyclical movement patterns. The cyclical output growth pattern is clearly demonstrated in Year on Year (YoY) data regardless of any proxy used. The future challenges of business cycle study may occur if the output growth has less fluctuation, which may cause difficulty in business cycle stages identification. For further studies, I suggest testing different Composite Economic Index as a proxy of business cycle identification.

Recommendations on sectoral stock allocation are proven in this study using the Modified CAPM Model by incorporating business cycle stage dummies into the model using interaction terms between business cycle stage dummies and market risk

premium, which represent a different market risk in the different stages of the business cycle. We can obtain sectoral stock sectors' beta-value in each business cycle stage from the regression of Modified CAPM Model. Comparing risk-adjusted-performance between stock sectors in each stage of the business cycle can then be made by calculating the Treynor ratio using the business cycle beta-value of each stock sectors from the regression result of the Modified CAPM Model. Investment decision of which stock sectors are worth to invest in each stage of the business cycle can be made based on the ranking of Treynor ratio in the particular business cycle stage where the focus should be only made on the stock sectors with Treynor ratio higher than the overall market. We can utilize Markowitz Portfolio Optimization Strategy to find out the best proportion of intersectoral stock allocation to be invested in each stage of the business cycle to maximize portfolio risk-adjusted return.

From the analysis of stock returns data from 28 stock sectors in The Stock Exchange of Thailand during period 2002 – 2019 C.E. in this study reveals that the recovery stage of business cycle is the best timing to put investment in the stock market because in the recovery stage majority of the stock sectors have positive average return above the market (almost half of them also have Treynor ratio higher than market when considering risk-adjusted return perspective) and the recovery stage is the only business cycle stage where there is no stock sector with negative average return. Therefore with these considerations, recovery stage is the best timing for stock market investment. This finding aligns with the literature (DeStefano, 2004) which mentioned that stock market performs best in the bottom-out period where investors' expectations of future earnings are highly positive. Expansion stage is the second-best timing for investment in the stock market where many stock sectors give higher Treynor ratio above the overall market. In the depression stage, most of the stock sectors have a negative average return where only commerce and ICT sectors have a positive average return (with a higher Treynor ratio) above the market. It implies that in depression stage, commerce and ICT are the only two sectors that can be invest because they provide higher return than risk-free assets and perform better than the overall market with a risk-adjusted ratio.

The results from this study also found that commerce is the only stock sector which can be invested in all stages of the business cycle because it is the only stock

sector which has a positive average return across all business cycle stages and also the only stock sector which has positive Treynor ratio higher than the market in all stages of the business cycle. In the expansion stage, the tourism & leisure sector performs best in risk-adjusted return followed by insurance, automotive, home & office products, and petrochemicals sectors. In the recession stage where real output growth is declining but still in positive number, healthcare is the best sector to invest followed by commerce and insurance sectors. As previously mentioned, commerce and ICT are the only two sectors which have a positive average return and risk-adjusted ratio therefore, other stock sectors are not recommended to invest in this stage because they will give a negative average return and not better than risk-free asset investment. In the recovery stage, commerce performs it best with risk-adjusted return compared with other stock sectors followed by ICT, home & office products and food & beverage. Steel is the only stock sector with a negative average return in all stages of business cycles except the recovery stage. It also has a negative Treynor ratio in expansion and recovery stages with an insignificant beta value in depression and recovery stages. Therefore it might not be a good option with the given rationale.

The results from portfolio simulation using a combination of Markowitz Mean-Variance Portfolio Optimization Strategy in addition to sectoral allocation recommendations along the different stages of business cycle reveal that strategic portfolio allocation per business cycle has average monthly return 2.19 times higher than market portfolio and 5.87 times above risk-free asset. At the same time, risk (portfolio return variance) also decrease 18.79 % from the market portfolio (Risk-free portfolio has extremely low variance as theoretically expected). Investment using a combination of Markowitz Mean-Variance Portfolio Optimization Strategy together with Sectoral Allocation Along the Business Cycle Recommendations gives 3,690.18 % portfolio growth along the study period if the power of compound return has been utilized by reinvestment at the end of every month. Incorporating an intersectoral diversification strategy using Markowitz's mean-variance portfolio optimization strategy helps to maximize the overall portfolio Sharpe ratio. Despite lower monthly expected return and overall portfolio growth compared with investment in only one best sector at each stage of the business cycle, it reduces risk exposure below market risk level while raising expected return

2.19 times above market return. The benefit of this strategy is most obvious in the expansion stage.

In the different stages of the business cycle, the Business Sentiment Index (BSI) and expected BSI are expected to vary across the stages as the business and economic conditions are expected to change with the cyclical fluctuation of the business cycle. This study also provides insights into how stock sector returns are influenced by different expected business sentiment indexes in the different business cycle stages. The analysis has been made using the multi-factor Arbitrage Pricing Theory (APT) model, which includes key macroeconomic factors (changes of Gross Domestic Product or GDP, Consumer Price Index or CPI, interest rate, Real Effective Exchange Rate, broad money supply) and expected BSI interacting with business cycle stage dummies as proxies of expected business sentiment index in the different stages of the business cycle. The results show that expected BSI positively associates with stock returns in the fashion and steel sectors however, there is no significant relationship between expected BSI and sectoral stock returns in the recession stage. In the depression stage of the business cycle, expected BSI associates with stock returns in automotive, electrical components, healthcare services, insurance, media, property fund, property development, professional services, tourism & leisure, and transportation & logistics but inversely associates with stock return in the petrochemical sector. In the recovery stage, expected BSI has a positive relationship with stock returns in electrical components, petrochemicals, and property development. The results imply that expected business sentiment index has most impact on sectoral stock returns in the depression stage of the business cycle where investors' expectations play an important role in the investment decision.

In addition to business sentiment, this study also provides clearer perspectives on the impact of macroeconomic conditions on the market and sectoral stock returns. The analysis from Multi-factor APT Model suggests that real GDP growth is positively related to stock returns in the automotive, insurance, petrochemicals, and property fund sectors. Consumer Price Index (CPI) has a positive relationship with stock returns in food & beverage, industrial materials & machine, and insurance sectors. Increase interest rate positively impact stock return in the banking sector but negatively impact stock return in the petrochemical sector. Domestic currency

appreciation has a positive relationship with stock returns in automotive, commerce, finance, and media sectors but negatively relates to stock return in the energy sector. Increase money supply positively impact only transportation & logistic sector. This study's results are based on sectoral approach which contribute to answer some controversial points within this subject area in the literature where the analysis were made on market-level approach.

The final part of this study provides analytical insights about how fund flow to the stock market impact sectoral stock returns in each stage of the business cycle (and vice versa). The analysis has been made with net investment data of 4 types of investors in the Stock Exchange of Thailand, which are foreign investors, domestic institutional investors, proprietary traders, and retail investors using Vector Auto Regressive (VAR) model together with VAR Granger Causality / Block Exogeneity Wald Test. The data shows that net foreign investment has the highest correlation with the overall market return ( $r = 0.56$ , Chi-Square 85.98 Prob 0.0000) but also has the highest volatility. Unlike previous literature, net foreign investment in the Thailand stock market positively correlates with the net investment of proprietary traders but negatively correlates with net investment from local institutions and local retail investors. The analysis reveals a selectively partial bidirectional relationship between net investment from different types of investors and stock sector returns which implies selective sectoral approach recommendation. The results partly support the feedback-trader hypothesis that market return in the expansion stage of the business cycle has a short-term relationship with a net equity investment from the domestic institutions and market return in the recession stage has a short-term relationship with foreign investment. At the sector level, only return in the home & office products sector has a significant association with net investment from retail investors. The results also partly support the price-pressure hypothesis. At the market level, only net investment from the domestic institutions has a significant relationship with the stock market return. At the sector level, net investment from domestic institution also has a significant relationship with return in the food & beverage sector and net investment from proprietary trader has a significant relationship with return in the construction, insurance and tour & leisure sectors. This study's results do not support price-pressure hypothesis for both foreign investment and investment from

retail investors at both market level and sector level. This study contributes to additional insights from the literature with sectoral approach, exploration with different type of investors, and the different business cycle stages.



**Table 6.3** Summary of Business Cycle, Relevant Business Sentiment, Fund Flows and Implications on Stock Sectors Investment Recommendations

<b>Business Cycle</b>	<b>Expansion Stage</b>	<b>Recession Stage</b>	<b>Depression Stage</b>	<b>Recovery Stage</b>
<b>How to define?</b>	Positive real GDP growth in a rising trend apart from steady-zero growth line	Positive real GDP growth in a downward trend toward steady-zero growth line	Negative real GDP growth in downward trend apart from steady-zero growth line	Negative real GDP growth in a rising trend toward steady-zero growth line
<b>Recommended stock sectors to invest considering risk-adjusted returns (% weight by Markowitz Portfolio Optimization)</b>	Tour & Leisure (46%) Home & Office Product (15%) Insurance (12%) Petrochemicals (27%)	Healthcare (62%) Commerce (25%) Insurance (8%) Paper & printing (5%)	Commerce (100%)	Commerce (78%) Home & Office (22%)
<b>Business Sentiment Index (BSI)</b>	Mean 0.42 Variance 20.96	Mean -0.47 Variance 18.05	Mean -1.59 Variance 87.26	Mean 6.34 Variance 67.16
<b>Expected BSI</b>	Mean -0.02 Variance 6.33	Mean -0.12 Variance 11.07	Mean 0.13 Variance 134.39	Mean 3.08 Variance 4.65
<b>A significant association between expected BSI and stock sectors</b>	Fashion, Steel	Not Sig	Automotive, Electrical components, Healthcare services, Insurance, Media, Professional Services, Property Fund, Property development, Tourism & Leisure, Transportation & Logistics	Petrochemicals, Property development

Table 6.3 (Continued)

Business Cycle	Expansion Stage	Recession Stage	Depression Stage	Recovery Stage
<b>Impact of fund flow on market return</b>	Not Sig	Not Sig	Not Sig	Not Sig
<b>Impact of market return on fund flow</b>	1 <sup>st</sup> month lag of market return has a significant causal relationship with net investment from domestic institutes	The market return has a significant causal relationship with net foreign investment	Not Sig	Not Sig

Table 6.3 provides an overall summary of key findings from this study and implications for investment. This study successfully contributes to investment recommendations of sectoral stocks allocation based on business cycle approach together with additional insights on business sentiment and impact of fund flow.



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## BIOGRAPHY

**Name-Surname**

Korn Talthip

**Academic Background**

2003 M.D., Chulalongkorn University  
2005 Post Graduate Diploma in Clinical Science in  
Medicine, Mahidol University  
2007 B.A. (Economics), Ramkhamhaeng University  
2010 M.A. (Business Economics), Thammasat University

**Experience**

Clinical practices as airport physician and forensic  
physician, experiences in both government and private  
sectors and managerial experiences at country and regional  
levels in pharmaceutical industry

