

**WEATHER, MACROECONOMIC VARIABLES AND STOCK PRICE IN  
JAPAN**

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## Statement of Originality

The work described in this Final Year Project, entitled  
**“Weather, Macroeconomic Variables and Stock Price in Japan”**  
is to the best of the author’s knowledge that of the author except  
where due to reference is made

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## **ABSTRACT**

### **WEATHER, MACROECONOMIC VARIABLES AND STOCK PRICE IN JAPAN**

By

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The objective of this study is to investigate the relationship in between impact of weather, exchange rate, fiscal policy, gross domestic product, and interest rate and the stock price in Japan's primary industry, secondary industry and tertiary industry. The study is conducts for the periods from 2004 until 2013 and the quarterly sample data for the variables are collected. This study employed the Augmented Dickey-Fuller (ADF) Unit-Root Test, Phillip-Perron (PP) Unit Root Test, Johansen and Juselius Cointegration Test, and Granger Causality Test to investigate the relationship among variables. There is a long run relationship in between variables for the Japan's primary industry, secondary industry and tertiary. Lastly, Vector Error Correction Model (VECM) Granger causality test show the causality relationships occurs in between the variables and LERI, LSPI2 and LSPI3 are solely bears the brunt of short run adjustment to bring the long run equilibrium in Japan's primary industry, secondary industry and tertiary industry accordingly. From this study, investors need pay more attention on the weather and macroeconomic variables that influence the stock price index in Japan's stock market.

## **ABSTRAK**

### **KEADAAN CUACA, PEMBOLEHUBAH MAKROECONOMI DAN HARGA SAHAM DI JEPUN**

Oleh

**Chai Kheng Ying**

Objektif kajian ini adalah untuk mengkaji hubungan antara kesan keadaan cuaca, kadar pertukaran, dasar fiskal, keluaran dalam negara kasar, kadar faedah dan harga saham dengan industri utama, industri sekunder dan industri tertiar di Jepun. Kajian ini dijalankan dengan menggunakan data bagi tempoh dari 2004 hingga 2013 dan data sampel dengan suku tahunan bagi pembolehubah dikumpulkan. Kajian ini menggunakan keaedeh ujian kepegunan imbuhan Augmented Dickey-Fuller (ADF), ujian kepegunan imbuhan Phillip-Perron (PP), ujian kopengamiran Johansen dan Juselius, dan ujian penyebab Granger untuk mengkaji hubungan-hubungan antara pembolehubah. Dapatan kajian ini menunjukkan terdapat hubungan-hubungan jangka panjang di antara pembolehubah dengan industri utama, industri sekunder dan industri tertiar di Jepun. Akhir sekali, ujian penyebab Vektor Pembetulan Ralat Model (VECM) Granger menunjukkan hubungan sebab akibat berlaku di antara pembolehubah dan LERI, LSPI2 dan LSPI3 adalah semata-mata menanggung beban pelarasan jangka pendek untuk membawa keseimbangan jangka panjang dalam industri utama, industri sekunder dan industri tertiar di Jepun. Daripada kajian ini, pelabur perlu menumpukan perhatian kepada keadaan cuaca dan pembolehubah makroekonomi yang mempengaruhi indeks harga saham di pasaran saham Jepun.

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## **CHAPTER ONE**

### **INTRODUCTION**

#### **1.0 Introduction**

Macroeconomics is the field of economics that studies the behavior of the aggregate economy as a whole but not the behavior of individual, firms or market (Mankiw, 2009). The aggregate economy for each country is determined by the several factors that known as macroeconomics variables. Macroeconomics variables includes unemployment rate, economics growth rate, gross domestic product (GDP), consumer price index (CPI), inflation rate, foreign exchange rate, interest rate, and fiscal policies.

Stock price also known as market price of stock are the current pricing when the demand and supply are meet at the equilibrium point. Stock price also measures the risk and the percentage changes in the price of securities in one period of time are one of the macroeconomics phenomena. According to the Kurihara (2006), daily stock price are identifying through several factors. Those factors including enterprise performance, dividends, gross domestic product (GDP), foreign exchange rate, interest rate, money supply, employment etc. have shown significant relationship on daily stock price.

The relationship between the macroeconomics variables and the stock price had been study all over the world. Many studies conducted to investigate the relationship between the macroeconomics variables and the stock price based on the data from the developed countries. There are some model can be used to investigate the relationship between the stock market return and macroeconomics variables. Zakaria and Shamsuddin (2012) examined the stock price using the Generalized Auto-Regressive Conditional Heteroskedasticity (GARCH) models, and the relationship between the macroeconomics variables and the stock price volatility has been found using bi-variate and multivariate Vector Autoregressive (VAR) Granger causality tests. They found that there is positive relationship in between volatility in consumer price index (CPI) and base lending rate (BLR) and the stock price. Besides, the money supply volatility shown positive related to the stock market volatility. Additionally, Wang (2011) also using the Exponential Generalized Auto-Regressive Conditional Heteroskedasticity (E-GARCH) and lag-augmented Vector Autoregressive (VAR) models to investigates the relationship between the macroeconomics variables and the stock price in his study. He found that there is a bi-directional related between stock price and inflation volatility. However, there is no significant relationship in between stock price and gross domestic products (GDP) had been founded.

Recently, behavioral finance researchers have begun to investigate whether investors' emotions influence their decision-making and also the economic outcome when the decision-making are affected by the behavioral. According to the Akhtari (2011), one of the factors that influence a person behavioral is weather. Based on the

study done by Akhtari (2011), there is a relationship between local New York City weather and the day return of the stock price index in New York. Besides that, based on the research conducted by Pardo and Valor (2003), the relationship between weather and stock price volatility had been discovered. The weather condition is positive related to the stock price volatility. The stock market returns is higher when the sunny days. Although there are some literatures suggest that there is a relationship in between weather and the stock price volatility, but there is still no specific methodology can be used to achieve it. However, the arguments still can continuous provided useful information for understanding how the weather affects the stock price volatility.

## **1.1 Background of the Study**

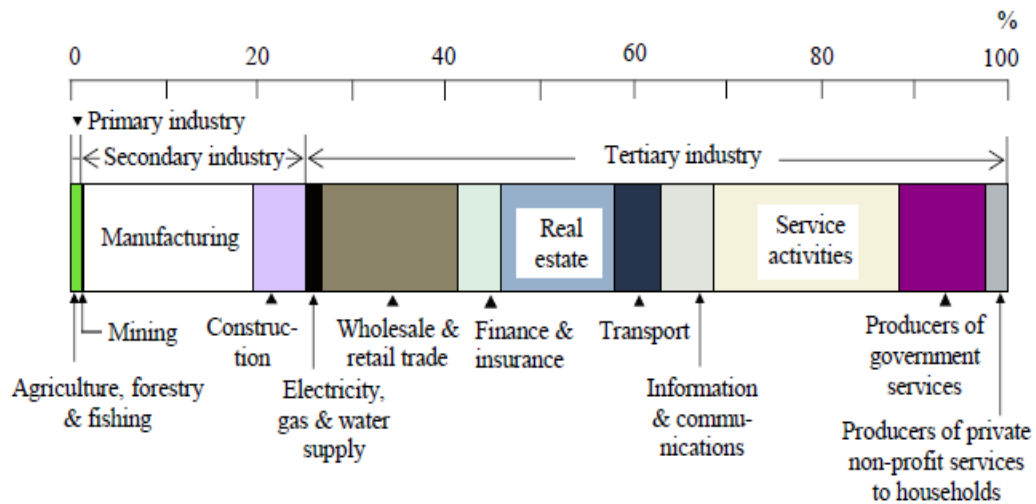
Japan is small island country in East Asia which located in the Pacific Ocean. Therefore, it has a temperate marine climate. The Japan archipelago is a four distinct season's country with an annual average temperature in range between 10 to 20 degrees centigrade. Generally, Japan experiences hot and humid weather during the summer season. However, during the winter's season, Japan's weather is cold and dry.

The government system in Japan is a parliamentary government with a constitutional monarchy. Japan faced a long restoration period after World War II to becoming the second largest gross domestic product (GDP) economy country in the world. Japan enjoyed the economy condition with stable wholesale prices and a high

employment rate only at the end of the 1980s. However, at the beginning of 1990, the bubble economy existing and the major economic recession in Japan and it's once again faced the economy downturn. In the early of the 1990s, Japan able to make a moderate recovery on its economy. Since the 2001, the Bank of Japan (BOJ) enforces the quantitative easing policy to recovery its economy condition. But, the economies of Japan are still fluctuated and unstable from 2001 until 2012. In 2013, the government of Japan enforces the three-arrow strategy to overcome the deflation and break free of economy stagnation situation in Japan.

Nowadays, Japan is one of the successful developed countries that have achieved smooth and quick economy growth. Currently, the Japan's industrialized, free market economy is rank at the third place at the largest economy in the world. One of the successful factors in the Japan's development is its position are relative to the Asian mainland. This had played a significant role in the country's development. The prices of goods and services are identifying in a free price system in Japan economy market. The major economy sectors of Japan includes manufacturing sector, construction sector, real estate sector, wholesale and retail trade sector, transport and communication sector, and business services sector. However, the smaller sector includes agriculture sector, hotels and restaurants sector, and other economic sectors. Japan has high potential develop the robotic field in the future economy growth. The different types of economic activity in Japan show as below according to the gross domestic product (GDP) recorded in year 2012.

**Figure 1.1: Gross Domestic Products by Different Types of Economic Sectors in Japan**



Source: *Statistical Handbook of Japan 2014*.

Based on the Figure 1.1, Japan's economic consists of three major industries which are primary industries, secondary industries and tertiary industries. The primary industries<sup>1</sup> involving extract or engage the natural resources products from the earth. The examples of the primary industries in Japan are agriculture sector, forestry sector and fishing sectors. The secondary industries<sup>2</sup> of the economy are involving in the manufactures finished goods. In other word, the secondary industries transform the raw material in primary industries into goods or products. Mining sector, manufacturing sector, and construction sector are the example of the secondary industry in Japan. The tertiary industries<sup>3</sup> are the segment of economy that provided the supplying of services to consumers and businesses. In Japan, there are several sectors that combined in the tertiary industries. The tertiary industries that

<sup>1</sup> The definition is adopted and modified from BusinessDictionary Website.

<sup>2</sup> The definition is adopted and modified from BusinessDictionary Website.

<sup>3</sup> The definition is adopted and modified from Investopedia Website.



include electricity, gas and water supply sector, whole sale and retail trade sector, finance and insurance sector, transport sector, information and communications sector, real estate sector, services activities sector, producers of government services sector and producers of private non-profit services to household sector are covered about 75 percent of the whole gross domestic product (GDP) of Japan in year 2012. Therefore, the tertiary industries are the main contributed in Japan gross domestic product (GDP) in year 2012. Additionally, the primary industries and secondary industries both contributed about 3 percent and 22 percent respectively.

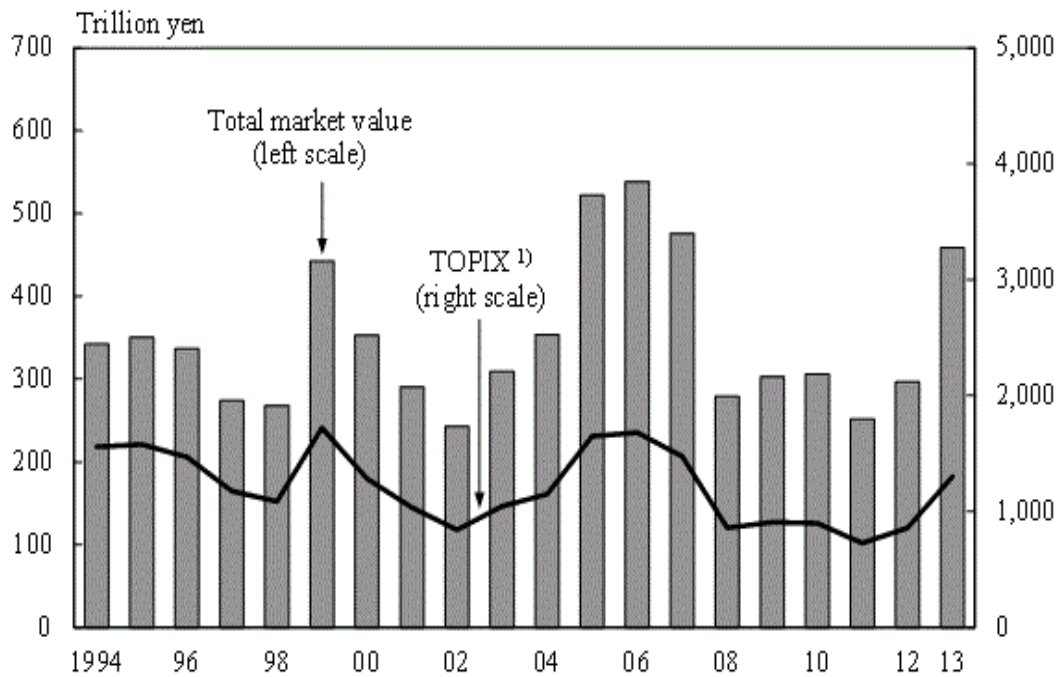
Stock market is the place that exchanging the shares or bond that issued by public companies and traded the shares or bond. The stock market functions as a medium to allocation of funds among alternative resources that are useful to the growth and efficiency of the economy. These stock markets can lead to social-economic growth by issuing of shares, stocks, and other equities for firms that need finance to expand their business. Besides that, stock markets also provided wealth for Japan economy and at the same time create the jobs opportunity for the populations in Japan. Japan stock market is known as Tokyo Stock Exchange (JPX) while NIKKEI is the leading index of Japanese stocks. NIKKEI is a price-weighted index comprised of Japan's top 225 blue-chip companies on the Tokyo Stock Exchange (JPX).

**Table 1.1: Stock Price (Tokyo Stock Exchange, First Section) from 2000 to 2013**

<b>Year</b>	<b>Total Market Value (Million Yen)</b>	<b>Total Trading Value (Million Yen)</b>	<b>Tokyo Stock Price Index (TOPIX) Average</b>	<b>Nikkei Stock Average (225 issues) (Yen)</b>
<b>2000</b>	352,784,685	242,632,346	1,283.67	13,785.69
<b>2001</b>	290,668,537	199,844,292	1,032.14	10,542.62
<b>2002</b>	242,939,136	190,869,955	843.29	8,578.95
<b>2003</b>	309,290,031	237,905,753	1,043.69	10,676.64
<b>2004</b>	353,558,256	323,918,214	1,149.63	11,488.76
<b>2005</b>	522,068,129	459,136,406	1,649.76	16,111.43
<b>2006</b>	522,068,129	644,308,788	1,681.07	17,225.83
<b>2007</b>	475,629,039	735,333,528	1,475.68	15,307.78
<b>2008</b>	278,988,813	568,538,950	859.24	8,859.56
<b>2009</b>	302,712,168	368,679,737	907.59	10,546.44
<b>2010</b>	305,693,030	354,598,763	898.80	10,228.92
<b>2011</b>	251,395,748	341,587,524	728.61	8,455.35
<b>2012</b>	296,442,945	306,702,280	859.80	10,395.18
<b>2013</b>	458,484,253	640,193,836	1,302.29	16,291.31

*Source: Statistical Handbook of Japan 2014.*

**Figure 1.2: Trends in Stock Price Index and Total Market Value from 1994 to 2013**



*Source: Statistical Handbook of Japan 2014.*

Table above show the stock price listed in Tokyo Stock Exchange (JPX) for the first section from 2000 to 2013. While, the figure above show the trends of the stock price index and total market value from 1994 to 2013 in Japan.

In this research, the relationship between weather, macroeconomics determinants and the stock price in Japan by economic industries which are primary industry, secondary industry and tertiary industry are study.

## 1.2 Problem Statement

Stock market is the place that exchanging the shares or bond that issued by public companies and traded the shares or bond. The movements in stock market are important for both industry as well as investors. Besides that, the performance of stock markets also shows us about the economic trend of a country and it is used to analyze the economics position of that country. But, what control the stock market movement in Japan? How the individual and corporate investor to identify the strength of each investments? Therefore, both individual and corporate investor able to invest in the most strategizes investment by knowing well the macroeconomics determinants of the stock market.

There are a number of researches conducted to study the relationship between the different macroeconomics variables such as monetary policy, interest rate, gross domestic product, exchange rate, consumer price index, inflation rate and the stock price volatility based on the data from the developed countries. However, the findings from the previous studies were produced different outcome. Therefore, there are no conclusive results to show that there is are positive or negative related in between exchange rate, fiscal policy, gross domestic product, interest rate and stock price.

Although there are many studies on the relationship between the different macroeconomics variables and stock price, but there is no research is done by focusing on one economic industry only or according to the industries. Japan's

economic consists of three major industries which are primary industries, secondary industries and tertiary industries. In 2012, the tertiary industry is contributed about 75 percent of the whole gross domestic product (GDP) of Japan. While, the primary industries and secondary industries both contributed about 3 percent and 22 percent respectively to the Japan's gross domestic product (GDP). Therefore, the tertiary industries are the main contributed in Japan gross domestic product (GDP) in year 2012.

The fishery sector, agriculture sector and forestry sector are the primary industry in Japan. The primary industry had dominated the Japanese economy through the 1940s. However, those sectors declined in relative importance when other sectors are growing after 1960s. Although those sectors are relatively lack importance in the Japan's economy growth, but it's still play an importance role to produces source of rice and protein to the citizen in Japan.

In Japan, mining sector, manufacturing sector and construction sector are categories at secondary industry. The manufacturing sector in Japan consists of few industries which are machinery industry, chemical industry, iron and steel industry, fabricated metal products industry etc. This sector not only produces of the domestic uses but also contributed in export to other countries. The major export and most contributed industrial in Japan are motor vehicles industry and electronics industry. Construction sectors play an important role in achieving economy growth in Japan. This is the performance of construction sector is relatively connected with other sectors. Construction sector can lead to socio-economic growth by building the

infrastructures such as roads, office and other infrastructures. These also improve the living standard of the country.

The tertiary industry is the most important industry in the Japan. It contributed about 75 percent of the whole gross domestic product (GDP) of Japan as well as provided around 44.3 million of the carrier opportunities to the Japan's populations in 2012. So, it is important to clarify on the relationship between exchange rate, fiscal policy, gross domestic product, interest rate and the stock price of primary industry, secondary industry and tertiary industry in Japan.

Weather is one of the important factors that affected directly on fishery, agriculture and forestry sectors in every country. The Japan archipelago is a four distinct season's country with an annual average temperature in range between 10 to 20 degrees centigrade. Therefore, the weather is the important indicator that influences the fishery, agriculture and forestry sectors in Japan. However, does the weather in Japan affect directly on secondary industry and tertiary industry in Japan? There are least number of previous researches investigated the relationship in between weather and stock price. Although there are some literatures suggest that there is a relationship in between weather and the stock price volatility, but there is still no conclusive results can be used to achieve it and shows how the weather changes can affect the stock price. Based on the study of Worthington (2006) on whether the climate effects in the Australian stock market for the period from 1958 to 2005, the result shows that there is no statistical significant relationship in between the weather and the stock market return in Australia. However, Akhtari

(2011) indicated that local New York City weather affected the daily return of the stock price index in New York. Therefore, it is important to conduct more study in order to clarify these issues. Moreover, there is no previous research conducted on the effect of the weather change based on economic industries.

Therefore, it is interesting to investigate the relationship between the relationship between the weather, exchange rate, fiscal policy, gross domestic product, interest rate and the stock price in Japan by economy industries. Due to the entire explained problem, there are some researches questions addressed which are how the implication of exchange rate, fiscal policy, gross domestic product and interest rate on the stock price of primary economy industry, secondary economy industry and tertiary economy industry in Japan? It there any significant relationship in between the independent variables and the stock price of primary economy industry, secondary economy industry and tertiary economy industry in Japan? Besides that, how does the weather in Japan affected the stock price of primary economy industry, secondary economy industry and tertiary economy industry in Japan?

### **1.3 Objective of the Study**

The main objective of this study is to examine the relationship between weather, macroeconomics determinants and the stock price in Japan by economic industries.

The specific objective of this study includes:

- i. To investigate the relationship between weather, exchange rate, fiscal policy, gross domestic product, interest rate and the stock price of primary economy industry in Japan.
- ii. To examine the relationship between weather, exchange rate, fiscal policy, gross domestic product, interest rate and the stock price of secondary economy industry in Japan.
- iii. To identify the relationship between weather, exchange rate, fiscal policy, gross domestic product, interest rate and the stock price of tertiary economy industry in Japan.