Oil Price and Stock Market Index Co-integration Analysis in East Asia and Pacific Countries

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ABSTRACT

The aim of this study is to analyze the effects of oil prices on selected East Asian Pacific countries stock market indices: Australia, Japan, Hong Kong, Singapore and New Zealand for the period of 1997-2011. These countries have been selected mainly because little research has been done about these countries and these are the fastest and most prosperous countries for future investing. A linear and logarithmic regression analysis is used to carry out the empirical investigation based on the co-integration of the Brent oil prices and the stock market indices. ARDL approach is used to check the unit root test, the bound test, Conditional Error Correction model, the long term growth model. In addition, this study also examines Impulse Response and Variance Decomposition of the oil price and market indices. Results revealed that Hong Kong, Singapore and Japan ex pacific are integrating to oil price changes.

Key Words: Oil price, Stock market indices, ARDL approach

ÖZ

Bu çalışmanın amacı 1997-2011 yılları arasında seçilmiş Doğu Asya Pasifik ülkelerinin petrol fiyatlarının borsa endeksleri üzerine etkisini araştırmaktır. Bu ülkeler sırasıyla Avustralya, Japonya, Hong Kong, Singapur ve Yeni Zelanda'dır. Bu ülkelerle ilgili araştırmaların az olması ve gelecek yatırımlar için bu ülkelerin en zengin ve hızlı gelişen ülkeler olması bu ülkelerin esas alınmasına en önemli etkendir. Lineer ve logaritmik regresyon analizi Brent petrol fiyatlarının ve borsa endekslerinin eşbütünleşmeye dayalı ampirik analizin yapılmasında kullanılmıştır. Birim kök testi için ARDL yöntemi, bound testi, koşullu hata düzeltme modeli ve uzun vadeli büyüme modeli kullanılmıştır. Buna ek olarak bu çalışmada petrol fiyatları ve borsa endekslerinin etki tepki ve varyans ayrışımı da incelenmektedir.

Anahtar Kelimeler: Petrol fiyatı, borsa endeksleri, ARDL yaklaşımı

Dedication

Dedicated to my family

and friends

ACKNOWLEDGMENTS

First of all, I would like to thank Dear God for His splendid support to accomplish this thesis. I would also like to appreciate the effort of my supervisor Prof. Dr Cahit Adaoglu for his outstanding contribution and guidance of this thesis. Dr. Adaoglu provided me with all his time whenever I needed, not only to finish up the thesis work but also achieve with a strong background in the field chosen, without his I would not have reached that far. My appreciation goes to Prof. Dr Salih Katircioglu head of the department of Banking and Finance for assisting me in the data methodology section of my thesis.

Second, I express my gratitude to my family and close friends for their sincere support throughout my research and preparation.

Besides that, I extend my heartfelt to my dad and my mom for believing in me, and supported me financially and morally. I would like to dedicate this study to them as an indication of their significance in this study as well as in my life.

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LIST OF ABBREVIATIONS

GDP	Gross Domestic Product
E-Vıews	Econometric-Views
VAR Model	Vector Autoregressive Model
ARDL	Auto Regressive Distributed Lag Model
OPVI	Oil Price Vulnerability İndex
WTI	World Texas Index
IEA	İnternational Energy Agency
CİA	Central Intelligence Agency
ADF	Phylips Peron

Chapter 1

INTRODUCTION

Crude oil, known as black gold, is one of the most important sources of energy that has been used as the main unit of production beginning with industrial revolution. Economists believe that crude oil is highly essential for the development and economic growth of countries, especially developing countries. Countries like China and India with rapid economic growths and their huge number of populations are dependent on oil and are the major consumers of oil, and they play a crucial role in determining the price of oil. According to the demand rule, an increase in oil demand without an offsetting increase in supply would lead to higher oil prices. In addition, oil price is sensitive to political, geopolitical, as Sadorsky stated (2004) oil price can be sensitive to geopolitical events, institutional arrangements policies such as OPEC and the dynamics of futures market. Given all these factors, significant changes in any of these factors would create risks in the oil prices.

Oil price fluctuations can greatly affect the world economy. The occurrence of oil shocks during 1974-1975 after the global recession, the oil shocks of eighties after the Iranian revolution, and finally, the oils shocks of nighties after the Iraq invasion of Kuwait are the main evidence of the oil price shocks which had resulted in economic recessions all around the world. Furthermore, oil price

volatility may have significant effects on the stock markets through different channels. Accordingly, this thesis's objective is to study the effects of oils price changes on the emerging Pacific and East Asian integrated financial markets, especially focusing on their stock markets. We selected this region because of several reasons. Firstly, Basher and Sadorsky (2006) stated that while the region of the Asia's pacific had the highest increase in oils consumption (37.2%), but Europe and Eurasia had the smallest increase of (1.3%). Particularly, in countries like Japan, Singapore, Australia, Indonesia and Hong Kong, demand for oil has increased significantly due to the rapid economic and financial activities in these regions. Moreover, this region has attracted significant amount of foreign direct and indirect investment. Finally, historical evidence has shown that oil price shocks had substantial impacts on stock markets. East Asian market consists of fast growing economies like Hong Kong, Japan, Singapore, New Zealand and Australia. The purpose of this research is to investigate whether there is a co-integration between the stock market indices of these countries and oil price, since their oil consumption increased dramatically and therefore their economies are dependent on oil. Oil price shocks can influence an economy positively or negatively depending on the position of the country as being net exporter or net importer of oil. The results of this thesis will try to show whether there is a relationship between stock prices and oil prices, especially for this region of the world.

Furtheremore, Balanchandra and Mongia (2004) made a research for The United Nations Development Program (2010) and developed an index for measuring the

countries vulnerabilities to oil price changes. They developed an oil price vulnerability index (OPVI) in order to draw various factors that determine a country's exposure to oil price. This measurement shows that countries' level of vulnerabilities to oil price changes is different from each other. It is clear that oil importing countries are more vulnerable to oil price changes. The OPVI measures the magnitude of countries vulnerabilities to oil price changes according to 15 variables, namely as real GDP, growth rate, GDP per capita, balance of payments, current account, budget balance, import cover, share of net oil fuel subsidy and energy factors like oil intensity of GDP, oil import dependence, share of oil in primary energy consumption and oil reserve to production ratio. The rankings are between 1 which is the most vulnerable and 26 the least one. This index indicates that countries like Australia, New Zealand and Japan rank 26, 15, and 18, respectively.

During the last decade, we have observed the intense rise of global financial activities, particularly among East Asian countries. As a result, the globalization of financial markets has contributed to real GDP growth rates. At the same time, the up and down movements of crude oil prices have affected the stock market returns significantly. As Basher (2006) states: the higher oil price volatility results in increasing risk and uncertainty which might inversely affects stock prices and therefore, reduce wealth and investments. For this reason, researchers have become interested in studying the oil price movements and the resulting effects on stock market.

Our thesis examines to determine whether there is a linear and logarithmic relationship between Brent oil price and countries like Australia, Hong Kong, Singapore, Japan, New Zealand and Japan ex-Pacific market index using time series econometric techniques and then, does oil price have positive or negative effects on market indices. We preferred Brent oil price to World Texas Index because it is the mostly used benchmark. To achieve this goal, monthly data has been used from 1997 to 2011 for Australia, Hong Kong, Japan, New Zealand and Singapore.

Previous researchers have used ARDL approach under Pessaran Methology, therefore we used the same approach for our studies. Since six series of time series variables known as oil price, Australia, Singapore, New Zealand, Hong Kong, Asia Pacific Ex japan are all logarithmic in the same order of one therefore we can rely on variables and use them in economic model for future forecasting.

In conclusion, this thesis can be highly beneficial for portfolio managers to build and design an accurate asset pricing model and forecast of future stock returns by incorporating the effect of oil price changes. Furthermore, it can help them to determine the appropriate hedge ratios and optimal weights of financial assets. In addition, risk managers use oils stock as a benchmark in their portfolios to minimize risks without reducing expected returns. Furthermore, this thesis can be used by Government officials to oversee the financial market and implement the appropriate fiscal and Monetary policies.

This thesis mainly consists of six chapters. In the next chapter, history and development of East Asian Financial markets, their global and regional integration and industrial factors affecting stock markets will be discussed. Then we will concentrate on oil price as the major element in market shock. In the third chapter, the East Asian countries' macroeconomics and their level of oil dependency will be examined. Subsequently, the applied econometric methodology and data will be described, and eventually, empirical data and results will be investigated.

Chapter 2

EAST ASIAN FINANCIAL MARKETS, THEIR INTEGRATION AND OIL PRICE EFFECTS

It is highly essential for financial analysts and investors to have a deep knowledge of the East Asian financial markets, focusing on their level of integration, stock market returns and identifying the primary risk factors which affect the value of their portfolio investments. For this purpose, we try to have a clear understanding of development of their financial markets, their market shares in the globalized world. We try to identify the Global, regional and macroeconomic factors which impact the portfolio holdings. For instance, according to the International Energy Agency forecast (2004), the total East Asians oil demand increase by 3,2 %, after growing by 5.3% . This growth is said to be higher than the overall world growth for oil demand. The global factors like oils prices and US shocks, regional and industry factors which impact the value of this portfolios holdings of both domestic and foreign investors.

2.1 Asian Financial Crisis (1997-1998), East Asia Financial Integration and Markets

During the period from 1993 to 1996, foreign debt to GDP ratios rose from 100% to 167% in four large South East Asian economies like Thailand, Indonesia, South Korea and Hong Kong. In July 1997, these countries' large current account

deficits have resulted in being highly exposed to exchange currency risks. As a result, the central bank, floated exchange rate policy exposed these countries financial markets, especially their stock markets to currency risks. At the same time, the US contra dictionary monetary policy increased the US interest rates which had triggered the foreign investors to switch their financial sources from Asia to US market. Since, East Asian economies are highly dependent on foreign capital investment, they suffered a lot. Finally, Thailand's Thai Bhat currency was devalued and currency devaluation had triggered the crisis in other Asian markets. As a result, the crude oil price had decreased to $12 a barrel to its lowest price since 1972. However, at the end of 1998, after a short time, it had bounced back to its initial price.

Many research papers have tried to discover the long run and short run effects of 1997-1998 financial crises on the movement and integration of Asian stock markets. Scholars have divided the Asian stock market integration into three periods; before, during and after the Asian crisis. They have categorized East Asia as Japan, Korea, Taiwan, Hong Kong, Singapore, Malaysia, Indonesia, Thailand, Philippines and Mainland China (Kiyotaka, Zhaoyong, and Mc Aleer, 2010 , p. 1354). Their statistical analysis shows, that these countries have grown rapidly over three decades from 1965 to 1990, their economy slowed down during the currency crisis of 1997 and after a short time then improved significantly. The financial integration among these countries has accelerated after the financial crisis and has raised the issue of establishing regional monetary arrangements or a monetary union (Kiyotaka et al., 2010 , p. 1354).

In addition to this study, scholars studied the effects of external shocks or global factors, such as oil price shocks and US shocks, on East Asian financial integration, and also studied the internal shocks or local macroeconomic variables on the financial integration. These researchers studied, they used a dynamic approach and the results indicate that from 1978 to 1987 US shocks had the highest impacts on real GDP growth rate in Japan, Taiwan and Malaysia. However, Japanese stocks were the major player in Growth rate of Hong Kong and Singapore. Starting from 1999 to 2007, US has increased its financial integration with Hong Kong, Singapore and Taiwan.

Finally, the world oil price shocks have become extremely important for the output growth rate of countries like China, Hong Kong, Singapore and Thailand (Kiyotaka et al., 2010 , p. 1363). Furthermore, the intense interrelation among countries has yielded that each countries' real GDP and inflation rate are influenced by other countries' real GDP and inflation rate. For instance, the results of correlation analysis indicate a high correlation between real output, inflation rate of these countries and oil price at 5% level of statistical significance (Kiyotaka et al., 2010 , p. 1354).

In conclusion, the standard economic theory suggests that as a group of countries becomes more financially interrelated, dispersion in asset returns for each country becomes smaller, and capital inflows and outflows increase.

2.2 The sources of major shocks in integrated East Asian economies

Kiyotaka et al., (2010) investigated the variances or disturbances of real GDP growth rates, inflation rate, and figured out that variance mainly results from the US shocks, Japan shocks and oil price. Their statistical results showed that US and Japan shocks were the major disturbances in the East Asian economies before the crisis. The US shocks are mostly visible in the economies of Taiwan, Tailand and Philippines, but the Japanese shocks are more prominent in Hong Kong, Indonesia, Korea and Singapore. The reason can be explained by these two countries, huge investments and substantial amount of international trade in this region. After the crisis, although the US dominant influence has remained consistent, but Japan's role has decreased. instead, China has become the dominant force in the region.

Furthermore, the world oil price shocks played an essential role in the economy of countries like China, Hong Kong, Singapore and Thailand. The rise of their dependency on oil is the main underlying reason. As Arouri said (2010) oil price shocks might have various degree of linkage to recession, inflation, economic growth and other macroeconomic elements in most developed and emerging countries.

2.3 The stock market returns and macroeconomic risk factors

The countries' real output growth and financial development are highly dependent on oil prices. Therefore, economists and financial analysts have developed deep interests in studying the effects of oil price fluctuations on financial markets. In order to achieve this goal, many studies have been designed to recognize and study the macroeconomic risk factors which impact the stock prices. Additionally, studies on the relationship between oil price changes and stock markets have attracted significant attentions by policy makers, risk managers, and investors. Initially, researchers focused on national and regional financial markets. For example, Chen, Roll and Ross (1986) performed a test of a multifactor asset pricing model and discovered that interest rates, inflation rates, bond yield spreads and industrial productions are crucial risk factors which affect stock prices.

Furthermore, Jones and Kaul (1996) carried out a comprehensive study on effects of oil shocks on the international stock markets of Canada, US, Japan and United Kingdom. Their study was based on quarterly data and their results were different for each country. They found out that while there is a significant relationship between oil price shocks and real cash flows in the Canadian and US stock markets, but there is no empirical evidence for Japan and United Kingdom.

Sadorsky (1999) examined the integration of the US stock market returns and oil prices from 1947 to April 1996 by using a VAR model. In this model, he used monthly data and the results indicated that the changes of crude oil prices have a crucial role in the stock market returns. Moreover, Faff and Brailsford (1999) had

the same results for Australia. Papetrou (2001) implemented the same research on Greek stock market and found out the same result. Based on statistical analysis on the US and thirteen European countries, Park and Rotti (2008) demonstrated that, oil price shocks have negative effects on oil importer countries while having a positive effect on oil exporters countries.

Huyghebaer et al. (2009) used multivariate VAR approach and co-integration tests to investigate the integration of seven key stock exchanges in China such as Shanghai, Shenzhen, Hong Kong, Taiwan, Singapore and Japan before, during and after the 1997 financial crisis. The results show that before crisis, stock markets responded positively or negatively to shocks except for Shanghai and Shenzen. Then, the crisis has accelerated the integration of stocks markets, but it lasted only for a short time. Singapore and Hong Kong were the major players in spreading the crisis in the markets of the region. In recent decade, the influence of stock exchanges has changed.

2.4 The major effects of oil price fluctuations on companies

Although global leaders and non-governmental organizations are trying to push major companies to use clean renewable sources of energy instead of non-renewable sources, the crude oil is still used as the main input. Recently, the price of black gold has increased dramatically by 30% in 2010, by another 40% in 2011 and decreased in 2012 by 30%. Oil price variations can have a significant effect on the equity's returns over both short-term and long-term. Moreover, it should be added that the magnitude and signs of effects vary from one market to another

market depending on the extent of oil dependency (Papapetrou, 2001; Basher and Sadosrsky, 2006; Narayan, 2010).

According to Gissor and Goodwin (1996), the relationship between oil price and stock prices is highly essential because as oil price rises, the production costs increase, higher production costs will negatively affect cash flows and finally, affect the stock prices adversely. Sadorsky (1999) mentioned that oil price variations alter the company's corporate cash flows and their discount rates, countries price index, interest rates, industrial production costs and industrial consumption costs.

In conclusion, the rise of oil prices increases the production costs and affects the cash flows negatively resulting in stock price decreases. In the long term and short term, oil price increases result in a higher level of inflation rate in the economy. In this case, the central bank might decide to control the situation by increasing the level of interest rate, which means that investors will prefer bonds to stocks or prefer to invest their money in saving accounts. Thus, the demand for stocks decreases and causes the stocks prices to decrease. It also affects the interest rates in an upward direction increasing the cost of capital, eventually leads to lower market values.

Chapter 3

OIL DEPENDENCY OF EAST ASIA AND PACIFIC COUNTRIES

In this chapter, we try to provide more detailed information about the five selected countries; Australia, Hong Kong, Singapore, Japan and New Zealand. These countries are among the fastest growing economies and after the financial crisis of 1997, their GDP growth rates and inflation rates are influenced by oil price volatility. Their brief historical developments, macroeconomics indicators, the level of oil production, consumption, imports and exports have been taken from CIA world fact resources. The main goal is to analyze the selected East Asia and Pacific countries characteristics, the position of the country as net importer or exporter of oil. In following chapters, effects of oil price on stock market index will be discussed.

3.1 Australia

In late 18th and 19th centuries, six colonies were created and then, federalized in the name of commonwealth of Australia. The country with its huge natural resources rapidly developed its agricultural and manufacturing sectors. In addition, it has a substantial sources of coal, iron, copper, gold, natural gas, uranium and renewable sources. Its huge geographical sources and diverse population contributed to the emergence of transportation and freight sectors which have

increased the oil demand. It means that transportation and freight sector are highly dependent on the oil price. As Faff & Brailsford (1999) said, industries like transportation, with a relatively high proportion of their input cost devoted to oil, are expected to have a negative sensivity.

According to the data obtained from CIA World Fact (2013), Australia's GDP reaches 960.7 billion dollar in 2012. Moreover, the country's main sector consists of industries, services and agriculture which contribute to 25.6%, 70.4% and 4% of GDP respectively.

Table 1: Australia's macroeconomic indicators (CIA source 2013)

Gross Domestic product	$960.7 billion (2012 est.)billion
Real Economic Growth	3.3%
GDP composition	Agriculture:4%Industry:25.6%,Service:70.6%
Unemployment rate	5.2%
Inflation Rate	2.1%

Focusing on oil dependency, Australia oil consumption from 1997 to 2011 has been shown below in Figure 1. As it is shown in the figure, although Australia oil production decreases starting from 2000, but its oil consumption increased dramatically from 2005 to 2012.

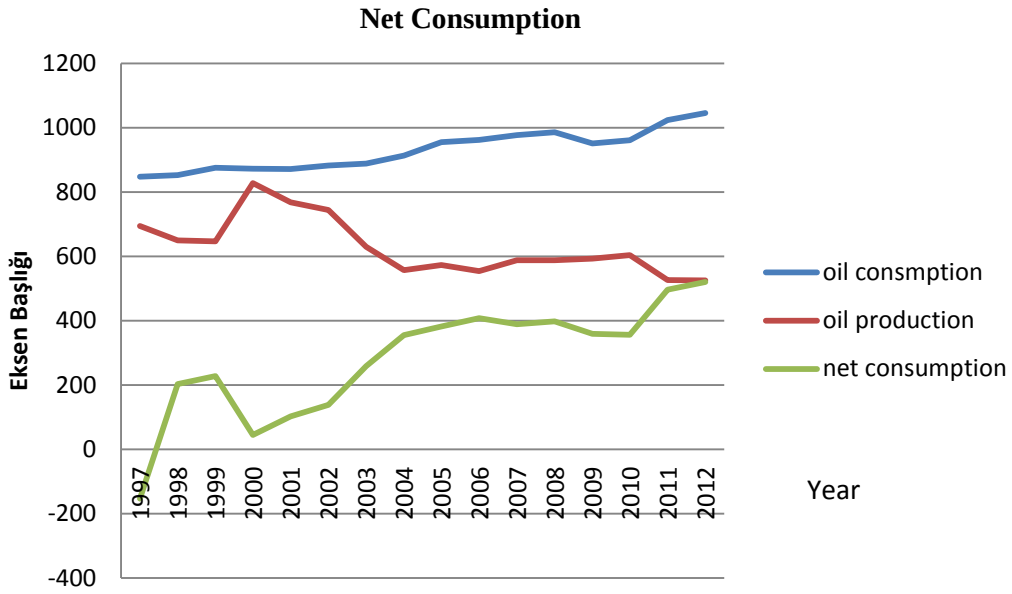

Figure 1: The Australian Oils Consumption, Production and Net

In addition, Figure 2 shows Australia's export, import, net of oil position.

In this figure, we gathered the crude oil imports and exports in thousand barrels. The data has been taken from Energy Information Association in 2013. As we have expected the Australia's oil import has increased sharply from 2005 to 2009 and then decreased by small amount. As it is illustrated in the figure below, Countries oil import has increased significantly from 2002 to 2010 by 200 thousand barrels per day. However, Australia's oil export remained consistent by 100 thousand barrels per day. It can be conclude that Australia is a net importer.

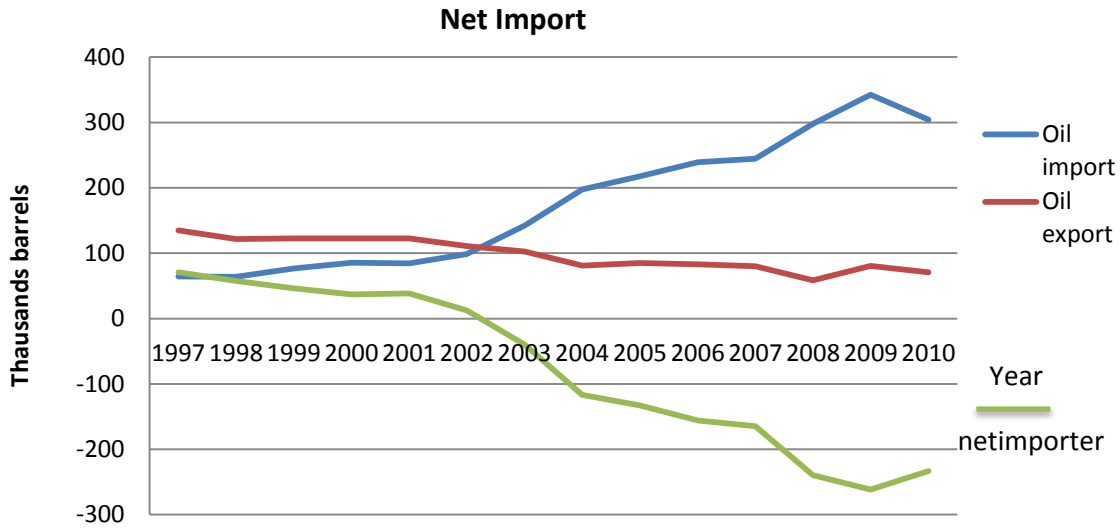

Figure 2: The crude oil import, Export and Net

3.2 Hong Kong

Hong Kong's GDP reaching 375 $ billion. (CİA source 2013) Its economy is highly dependent on international trade and finance. In addition, it does have limited food and materials for manufacturing, resulting in being dependent on import. An earlier study estimates that a US$10/barrel permanent increase in oil prices will knock down Hong Kong's GDP growth by 0.6 of a percentage point in the first year of incidence, taking on board both the direct impact on household disposable income, as well as the indirect impact working through the trade front. Hong Kong's macroeconomic indicators are shown below in Table 2.

Table 2: Hong Kong's macroeconomic indicators

Gross Domestic product	$350 billion
Real Economic Growth	5%
GDP composition	Agriculture:0%Industry:7%,Service:22.6%
Unemployment rate	3.4%
Inflation Rate	5.3%
Stock market value of DFI	1.141 trillion dollar (2011)

(CIA source 2013)

Hong Kongs oils consumption from 1997 to 2011 has been shown in Figure 3. The oil consumption has increased significantly from 200 to 1000 thousand barrels from 2009 to 2010. It should be stated that Hong Kong is not a producing oil country.

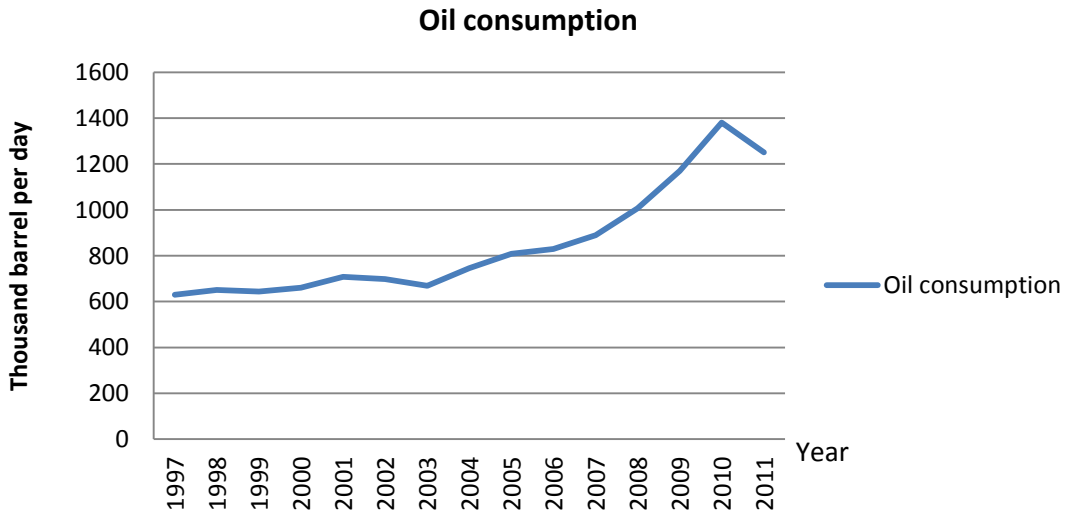

Figure 3: Hong Kongs oils consumptions

Hong Kong's oil import, export and net position are shown in Figure 4. As it is shown, both import and export are following the same trend. Between 1997 to

1999, Honk Kong's oil import is decreasing sharply from 200 thousand barrels per day to 50 thousands, However, oil export is rising slowly from 325 thousand barrels per day to 350 and then falls to 275 thousand barrels again and then start rising to reach its pick at 375 thousand barrels in 2005. In contrast, oil import is decreasing as become close to 0 units. It shows Hong Kong's policy to become independent to oil import.

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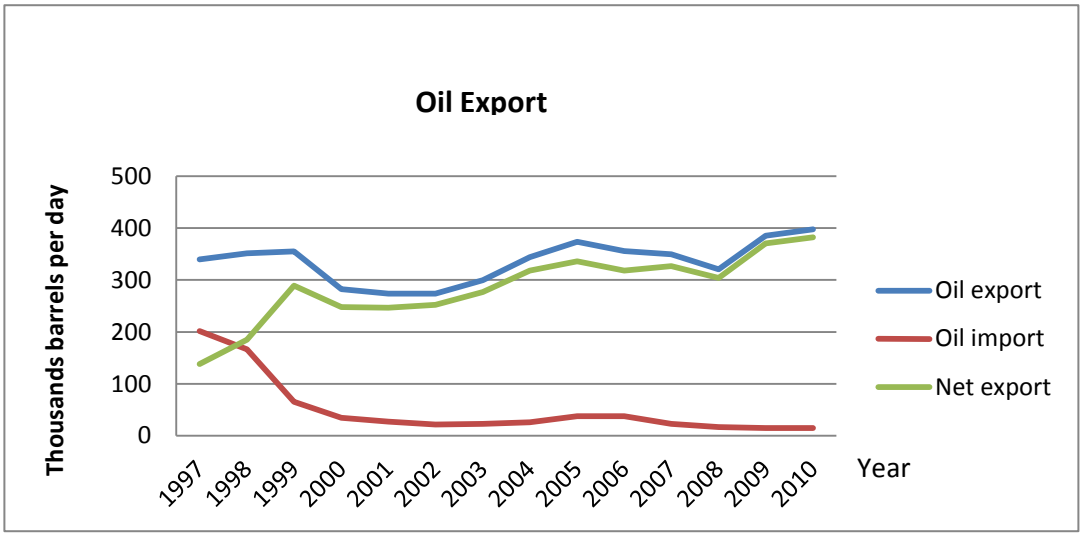


Figure 4: Hong Kong's Oils Import and Export

3.3 Japan

In 1603, a military-led Dynastic government was established. After two centuries, it signed the treaty of Kanagowa with US in 1854, and in the following years, it invaded Korea, Taiwan and Sothern Sakhalin and finally, invaded China in 1937 resulting in an invasion by the US military force during the Second World War after World War II, country started recovering its economy quickly. It has a small agriculture sector which is subsidized by government therefore, its economy is

dependent on raw materials and fuels import for manufacturing and transportation. Overall, the country enjoyed real economic growth of average 10%,

5% and 4% in 1960s, 1970s and 1980s, respectively. In following decade, the economy slowed down because of insufficient investment. Average economic growth has been generated in 2000 and then country experienced three economic recessions since 2008. Japan's huge 9.0 earthquakes and tsunami have caused many damages to its economy. However, it ranked as fourth-largest economy after China and India in second and third place. In Table 3, we will look at the Japan's macroeconomics indicators.

Table 3: Japan's Macroeconomic Indicators

GDP	$4,389 trillion (2011)
Real Growth Rate	-0.5% (2011)
Unemployment rate	4.4%
Inflation rate	0.4%
Oil depandancy	26

(CIA source2013)

As it is illustrated in figure 5, Japan's consumption increased dramatically and oil production fallowed a stable trend. As it is evident Japan is highly dependent on oil import.

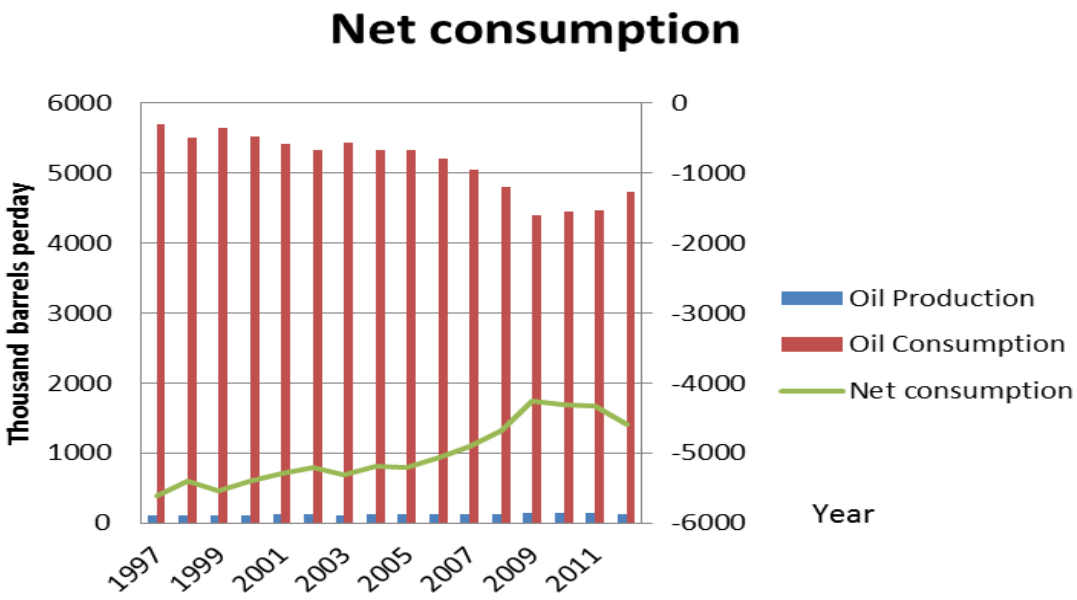


Figure 5: Japans oil Production, Consumption and Net

In Figure 6 Japans oil import and export is illustrated. As it is shown Japan's net import increased and oil import and export fluctuate slowly.

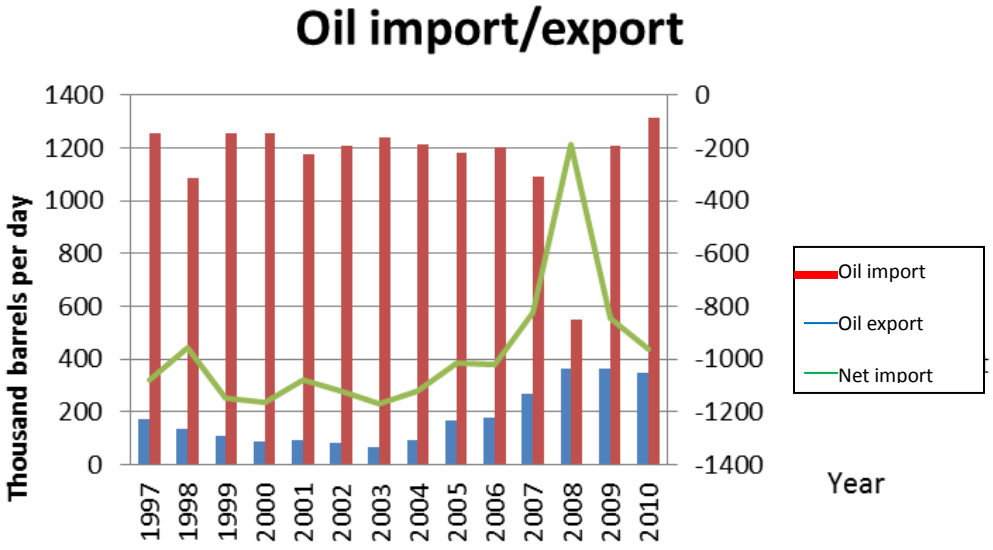


Figure 6: Japan's Oil Import, Export and Net

3.4 Singapore

Singapore's economy is also ranked second in the World Economic Forum's (2012) global competitiveness report behind Switzerland. According to Watch Economies Report Singapore was the third fastest growing economy in the world behind Qatar and Paraguay.

In 1819, British Empire colonized Singapore and later on, the nation quickly became the center of the international trade. In addition, according to Energy Information Association (2011), import crude oil makes 90% of total Singapore's energy consumption. Given this fact, Singapore does not have oil reserves or production.

Singapore has the fourth largest foreign exchange market in the world after London, New York and Tokyo. Singapore Exchange (SGX) was also the first securities and derivatives exchange in Asia-Pacific. Table 4 indicates Singapore's macroeconomic factors.

Table 4: Singapore's Macroeconomic Indicators (2013)

GDP	$276.5 billion
Real GDP Growth Rate	1.3%
GDP compositions	Services (72.8%), Industry (27.2%)
Inflation rate	4.4% (2012)
Unemployment rate	2% (2012)

(CIA source 2013)

Singapore oil consumption is illustrated in Figure 7. As it is indicated from 1997 to 2003, after financial crisis, the oil consumption remained constant but, then started increasing dramatically from 700 to 1400 thousand barrels per day from 2003 to 2011.

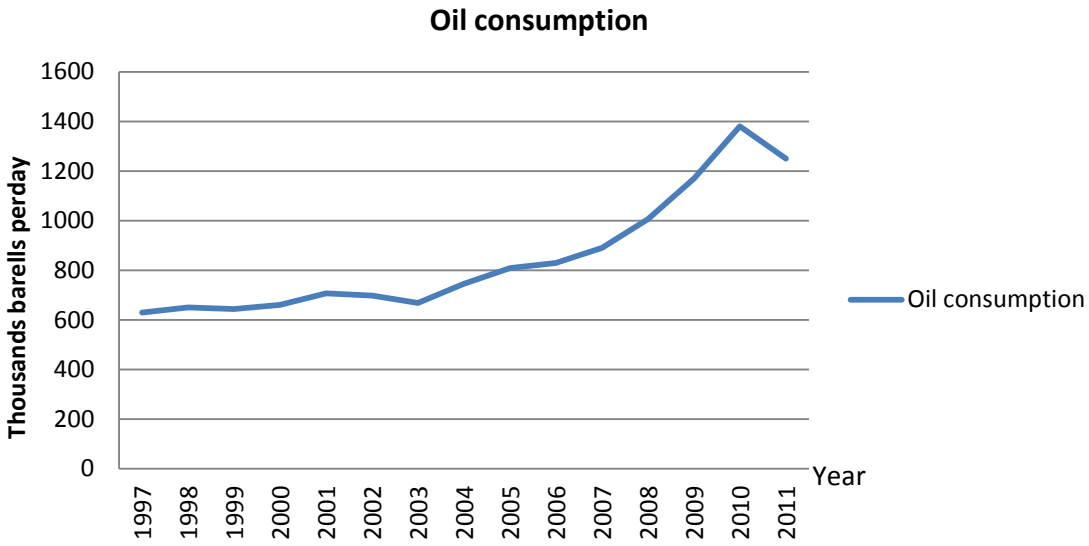


Figure 7: Singapore Oil Consumption

Furthermore, according to Economy watch (2012) report Singapore places 18th largest oil exporter and it has the third largest oil refinery in the world behind Rotterdom and Houston until 2009 and then it became oil importer. Moreover, Singapore's net export is illustrated in Figure8. Singapore'import and export increased from 900 to 1600 thousand barrels per day.

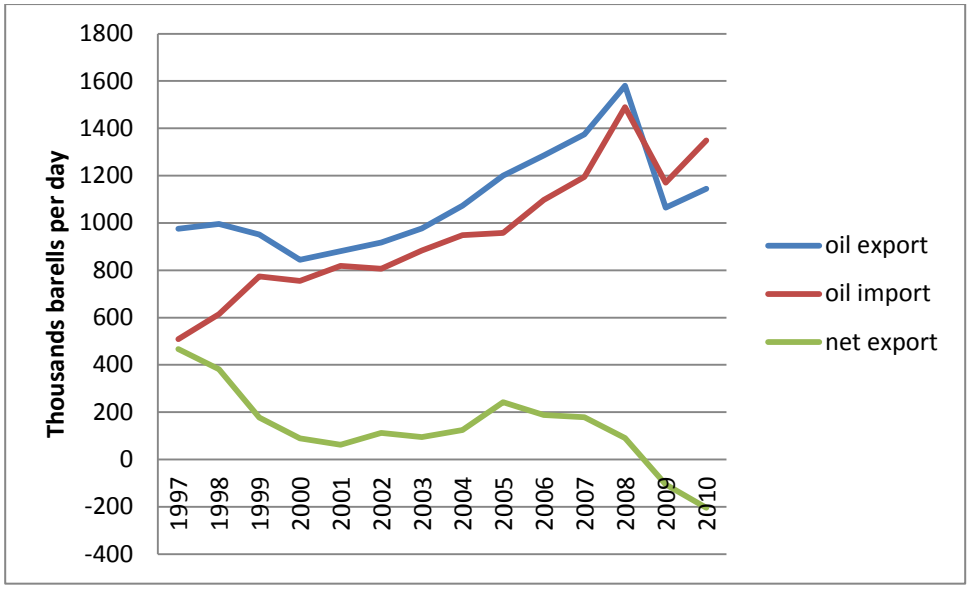


Figure 8: Singapore Oils Import, Export and Net

3.5 New Zealand

New Zealand started as a tribal society. Initially, it as a commodity exchange market, with huge resources like land, attracted many British and Europeans to resettle in the island. In 1840, the Maori tribes and Britain signed the treaty of Waitongi which allow British to come, settle and buy and sell land. Until nineteenth century, citizens suffered from disease, alcohol and drug released from foreigners, causing the death of several citizens and therefore shrinkage of the population. In the mid-nineteenth, the gold and refinery oil was discovered which strengthen their economy significantly. In addition, during World War I, they make a huge profit from exporting food, as European market was not that sufficient. Between 1929 to 1930, global economic downturn weakened their economy. In 1934, their currency was devalued by 14 percent against sterling.

In years 1973 and 1984, economy suffered from oil crisis, high inflation rate and high unemployment rate. Later on country concentrate on financial sector development.

According to New Zealand's Tag oil (2013), it has oil reserves of 528 million barrels and proved gas reserves of 6.9 trillion cubic feet (http://www.tagoil.com/new-zealand-operations.asp). Moreover, according to New Zealand Energy Data File (2011), during 1997 to 2011 although, non-renewable sector rises significantly but renewable sectors like Hydro, and Geothermal increase from 28% to 39%. New Zealand's major oil consumer sectors are transportation by 38%, industrial 35%, residual 11% and commercial 9%.

New Zealand's macroeconomic indicators are shown in the table 5. As it is indicated, New Zealand's GDP mainly consists of services.

Table 5: New Zealand's macroeconomic indicators

GDP	123.8 billion (2012)
GDP real growth rate	2.2% (2012)
GDP Composition	Agriculture(4.8%),industry(24.5%),services(70.7%)
Unemployment rate	6.5% (2012)
Inflation rate	1.2% (2012)

(CIA source2013)

As it is illustrated, New Zealand's oil production has been increased from 2005 to 2011 and oil consumption increased. It is evident that New Zealand meets its oil demand mostly from its oil import.

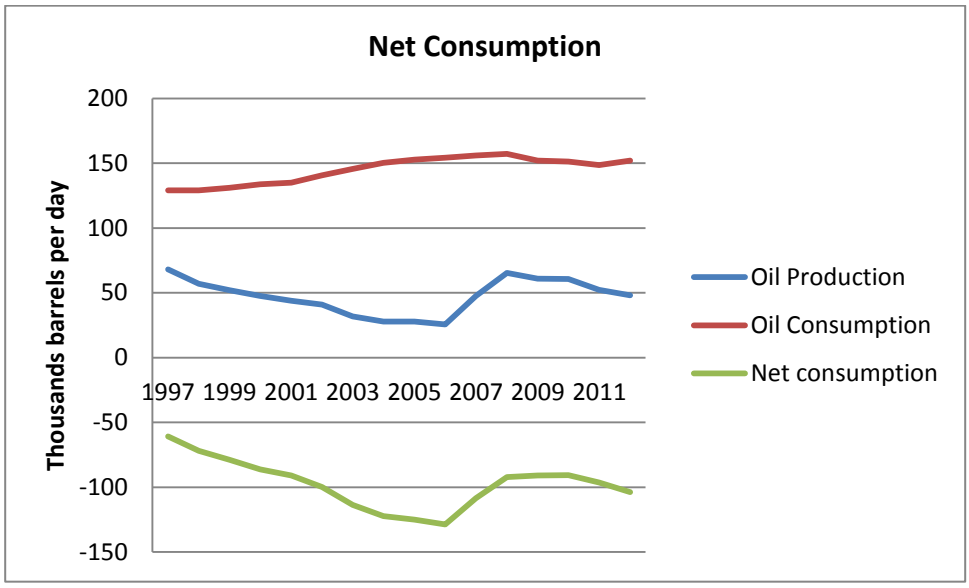


Figure 11: New Zealand oil Production, Consumption and Net.

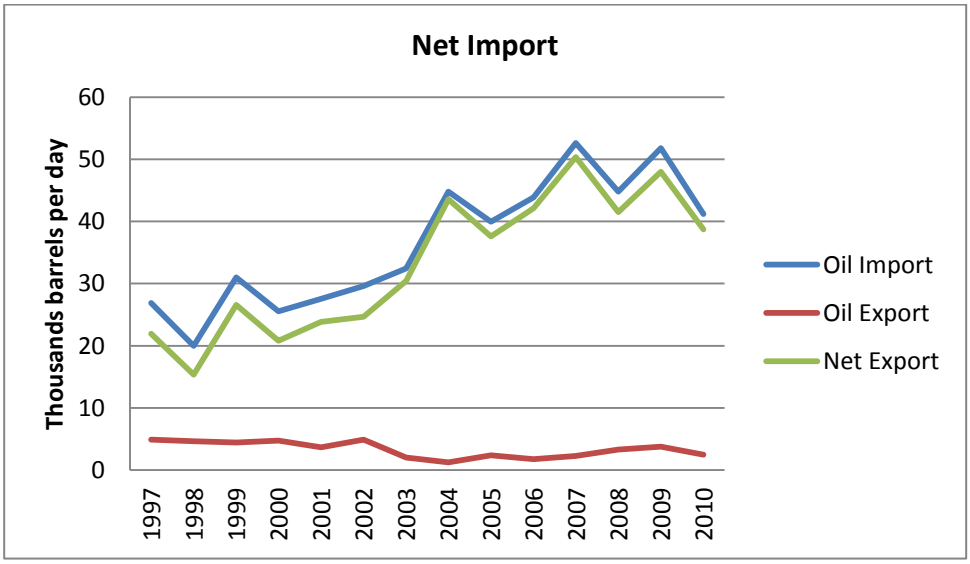


Figure 12: New Zealand's Oils Import, Export and Net

3.6 Summary of oil dependency

Eventually, Australia's transportation and fright sectors made the economy to be highly dependent on oil. Therefore, economy watched the rise of oil consumption slowly since 2004. However, the country oil production decreased sharply during this period of time because of reasons which were not the goal of this thesis to be investigated. As a result, the country becomes an oil importer. In the case of Hong Kong, given the fact that Hong Kong is not an oil producing country but it has a oil refinery, converting it to an oil export country. Moreover, Japan, fourth largest growing economy, while having almost zero oil production, but high oil consumption which has tried to decrease its dependency to oil especially after 2003. However, its oil import is rising and oil export has increased dramatically since 2008, converting it to an oil export country. In case of Singapore, oil consumption has increased significantly and it is the third largest oil refinery.

In the end, New Zealand economy and its great demand for oil drive its economy to be oil importer.

Table 6: Countries net oil Position

Country	**Oil position**
Australia	Oil importer
Hong Kong	Oil importer
Japan	Oil importer
Singapore	Oil importer
New Zealand	Oil importer

Chapter 4

EMPIRICAL METHODOLOGY AND DATA

The main objective of this chapter is to explain econometric methods which have been used in the analysis in order to describe the relationship among the economic variables known as stock market index and brent oil prices. This chapter consists of seven sections. In the first section type and sources of data are presented, then, econometric tests like Unit root test for stationary, Bound test for co-integration, level Coefficient in the Long Run Growth model, Conditional Error Correction model, Impulse Response and finally Variance Decomposition will be explained.

4.1 Data

In order to investigate the linear relationship between market index and oil price, the monthly stock market indices have been taken from MSCI. MSCI is a leading source of information for indices, portfolios risks and performance analysis. It has branches in 22 places all around the world. It categorizes indices according to country, regional and sectors. The subcategories indices include developed, developing, emerging, and frontier markets.

As the target of this study is East Asia and Pacific countries, the data are obtained for developed markets like Australia, Hong Kong, Japan, Singapore, New Zealand and Asia Pacific indices. MSCI Asia pacific index is a free float adjusted market capitalization index that is prepared to examine the equity market performance of

developed market in pacific region. It consists of Australia, Hong Kong, Japan, New Zealand and Singapore.

Generated monthly stock market index are in US dollar and range from 1997 to 2011.(http://www.msci.com/products/) Furthermore, the average oil price are taken from Energy Information Association. Brent Crude oil prices are quoted in US dollar. (http://www.eia.gov)

In conclusion, this study covers six time series variables, like Australia, Singapore, Hong Kong, New Zealand, Pacific ex Japan index and oil price in order to investigate the relationship between market index and oil price. E-views software will be adopted using ARDL approach.

4.2 Empirical methodology of time series data

There are several steps which should be examined before confirming estimated economic model and relying on it for forecasting and policy implications. Economic analysts assume that economic time series variables should be stationary in order to be applicable in econometric model. The second step is to check whether non-stationary variables (if any) are co-integrating or not in long term using various approaches like bounds tests. The third step will be to estimate the level coefficients and finally, the conditional error correction model for short term coefficients and error correction term for the speed of adjustment.

4.2.1 Time series unit root tests

Economic theories assume that time series variables should be stationary in order to be qualified to be used in estimated economic equation. The term stationary means that the mean, variance, covariance of series data to be fixed over time. To

examine stationarity, econometricians have developed unit root tests. Two types of unit root tests, Phillips and Perron (PP) and Augmented Dickey-Duller (ADF), have been used in this study. The null hypothesis of unit root test is as follows:

H0= unit root (non-stationary)

Hl=No unit root (stationary)

4.2.2 Bound tests of time series analysis

The goal of this stage is to check whether economic time series variables are co-integrating in the long-term or not. It means that in the long term there is possibility that non-stationary series might be in long term relationship. Several studies have been developed to investigate the long term co-integration of variables. The most famous one is Pesaran et al. (2001). Each of these theories have specific conditions where the Pesaran et al. (2001) methology is the most suitable for our series variables since it uses different options with/without and restricted/unrestricted deterministic trends in addition to distributed lag levels that might be different for each explanatory variable.

4.2.3 Level coefficients and conditional error correction model of time series analysis

In this stage, the long term coefficients of proposed econometric equations will be estimated to see whether regressors have statistically significant impact on dependent variables or not in long term. In the later steps, conditional error correction model under the autoregressive distributed lag systems will be estimated to obtain short term coefficients and error correction terms (ECT). The ECT shows us how speed the discrepancy between short term and long term values

of dependent variable is eliminated each period through the channels of its regressors.

4.2.4 Variance decomposition and Impulse response function

The purpose of this section is to discover how much of stock market index variations from the mean can be explained by oil price variations. In addition, the magnitude and direction of oil price impact on stock market index will be examined. Furthermore, Econometricians apply Impulse Response function in order to determine how macroeconomic factors respond over time to shocks. IRF shows the reaction of the endogenous macroeconomic variables like GDP or Stock market indices to exogenous shock, in our thesis oil price at specific time.

Chapter 5

EMPIRICAL RESULTS AND ANALYSIS

The goal of this chapter is to present the empirical results and analysis describing the relationship between the time series economic variables known as stock market index and Brent oil price. As a result, the estimated equation will be tested to see whether it meets economic theories or not. Fortunately, results are satisfactory and meet the econometric assumptions. Furthermore, financial analysis and investors can use this economic model to forecast future stock prices and hedging against oil price risk. This chapter consists of seven sections; results of unit root tests, bound tests for co-integration, level Coefficient in the Long Run Growth model, Conditional Error Correction model, impulse Response and finally Variance Decomposition. Finally, summary and interpretation of results are discussed.

5.1 Unit root tests results

As it is shown in table 7, ADF and PP Unit Root test results show that the null hypothesis of a unit root cannot be rejected for stock prices in Singapore, Hong Kong, Australia, New Zealand and Japan ex Pacific and for oil prices at their level forms; but this null hypothesis can be rejected at their first differences. Therefore, it is concluded that all of the series under consideration at non-stationary at their levels but become stationary at first differences. Series are integrated of order one, I (1). Optimum lag structures have been selected based on Akaike Information Criteria (AIC).

Unit root test results have shown that all the series are integrated of the same order. Since they are non-stationary variables, there is possibility that they might be in co-movement together in the long run. There might still be cointegrating vectors between stock prices and oil prices. Therefore, bounds test procedures will be followed in the next section with this respect.

Table 7: ADF and PP Tests for Unit Root

Statistics (Level)	AUS stock price	Lag	AveOil price	Lag	SING Stock price	lag	Hong Stock price	lag	JAP Stock price	lag
τ_T (ADF)	-1.99	(0)	-2.86	(1)	-2.42	(3)	-3.00	(1)	-2.42	(3)
τ_μ (ADF)	-1.01	(0)	-1.54	(1)	-2.42	(3)	-2.15	(1)	-2.42	(3)
τ (ADF)	0.80	(0)	0.14	(1)	-0.23	(0)	-0.01	(1)	-0.23	(0)
τ_T (PP)	-2.44	(6)	-2.94	(5)	-2.14	(6)	-2.75	(1)	-2.14	(6)
τ_μ (PP)	-1.23	(6)	-1.63	(5)	-2.15	(6)	-1.93	(1)	-2.15	(6)
τ (PP)	0.65	(5)	0.13	(5)	-0.21	(5)	0.03	(1)	-0.21	(5)
Statistics (First Difference)	ΔAUS Stock price	Lag	ΔOil Price	lag	ΔSING Stock price	lag	Δ Hong Stock price	lag	ΔJap Stock price	lag
τ_T (ADF)	-11.17*	(0)	-11.61*	(0)	-10.90*	(0)	-10.94*	(0)	-10.90*	(0)
τ_μ (ADF)	-11.21*	(0)	-11.61*	(0)	-10.93*	(0)	-10.97*	(0)	-10.93*	(0)
τ (ADF)	-11.21*	(0)	-11.64*	(0)	-10.96*	(0)	-11.00	(0)	-10.96*	(0)
τ_T (PP)	-11.33*	(5)	-11.70*	(4)	-10.92*	(3)	-10.88*	(4)	-10.92*	(3)
τ_μ (PP)	-11.37*	(5)	-11.71*	(4)	-10.95*	(3)	-10.91*	(4)	-10.95*	(3)
τ (PP)	-11.37*	(5)	-11.74*	(4)	-10.98*	(3)	-10.94*	(4)	-10.98*	(3)
Statistics (Level)	New zealand	Lag	ΔJapan exPacific	lag						
τ_T (ADF)	-1.93	(0)	-3.27	(0)						
τ_μ (ADF)	-1.67	(0)	-1.30	(0)						
τ (ADF)	-0.35	(0)	-0.19	(2)						
τ_T (PP)	-2.17	(7)	-3.14	(2)						
τ_μ (PP)	-1.95	(7)	-0.96	(3)						
τ (PP)	-0.33	(7)	0.61	(7)						
Statistics (First Difference)	ΔNew Zealand	Lag	ΔJapan exPacific	lag						
τ_T (ADF)	-12.79*	(0)	-12.29*	(1)						
τ_μ (ADF)	-12.80*	(0)	-12.24*	(1)						
τ (ADF)	-12.84*	(0)	-12.21*	(1)						
τ_T (PP)	-12.98*	(7)	-13.94*	(8)						
τ_μ (PP)	-13.00*	(7)	-13.84*	(7)						
τ (PP)	-13.03*	(7)	-13.82*	(6)						

Note: y represents stock market index; AUS is Australia stock market index, SING is Singapore market index, HONG is hong kong stock market index, JAP is Japan market index, New is New Zealand market index and Pacific ex japan is Pacific ex japan index. All of the series are at their natural logarithms. τ_T represents the most general model with a drift and trend; τ_μ is the model with a drift and without trend; τ is the most restricted model without a drift and trend. Numbers in brackets are lag lengths used in ADF test (as determined by AIC set to maximum 3) to remove serial correlation in the residuals. When using PP test, numbers in brackets represent Newey-West Bandwith (as determined by Bartlett-Kernel). Both in ADF and PP tests, unit root tests were performed from the most general to the least specific model by eliminating trend and intercept across the models (See Enders, 1995: 254-255). *, ** and *** denote rejection of the null hypothesis at the 1%, 5% and 10% levels respectively. Tests for unit roots have been carried out in E-VIEWS 6.0 (These explanations have been obtained and revised from Katircioglu, 2010).

5.2 Bound tests for level relationship

Bound tests will be employed to measure the long-run equilibrium relationship between oil price and stock indices in Singapore, Hong Kong, Australia, Japan, New Zealand and Japan ex Pacific. The ARDL approach has been introduced to examine whether the time series variables are integrating in the long term or not. Pesaran (2001) suggested a new approach to examining for the existence of a level relationship among time series variables with various orders levels of I(0) or I(1). Critical values for F-statistics for small samples are presented in Table 8 as taken from Narayan (2005). In order to be able to use Pesaran et al. (2001) methodology, the dependent variable should be in order (1) and the independent variable can be mixed. As it is revealed in table 7 the dependent and independent variables are all in same order at first difference.

The F-statistics results will be investigated according to five scenarios developed by Pesaran et al. (2001, pp. 295-296) which we will use only three of them as F(iii), F(iv) and F(v). F(iii) is without deterministic restrictive trend, F(iv) is with restrictive determinants trends and F(v) is unrestrictive determinants trend. Table 5.3 shows the Bound Test for level relationship. According to those five scenarios, there are three conclusions as a, b and c, which are also noted in bounds tests from Table 9.

a) If F-statistic value is below critical value of order (0) then the null hypothesis will be accepted and there is no co-integration.

b) If F-statistics value is within critical value of I (0) and I(1) boundaries, test is inconclusive.

c) If F-statistic value is greater than I(1), the alternative hypothesis will be accepted and there is co-integration between dependent and independent variables.

Table8:Critical Values for the ARDL Modelling Approach

K=1	0,10		0,05		0,01	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Fıv	3,77	4,54	4,54	5,54	6,43	7,51
FV	4,58	5,60	5,55	6,75	7,98	9,41
Fİİİ	3,44	4,47	4,27	5,47	6,18	7,87

k is the number of regressors for the dependent variable in ARDL models, FIV represents the F-statistic of the model with unrestricted intercept and restricted trend, FV represents the F-statistic of the model with unrestricted intercept and trend, and FIII represents the F-statistic of the model with unrestricted intercept and no trend.

Table9: The Bounds Test for Level Relationships

Variables		With Deterministic Trends F_{IV}	F_V	t_V	Without Deterministic Trend F_{III}	t_{III}	Conclusion
F_y (lnJapan / lnOil)							
	P= 4	3.5982a	5.3455	-2.94784a	3.3723a	-2.456062	H_0
	P= 5	2.87264a	4.2726	-2.69180a	3.2285a	-2.433656	
	P= 6	2.41414a	3.62110	-2.52116a	3.7885a	-2.687821	Rejected
	P= 7	2.84725a	4.2695	-2.79818a	3.0714a	-2.435064	
F_T (lnAUS / lnOil)							
	P= 2	2.30482a	3.4425a	-2.570256	0.6865a	-1.156481	
	P= 3	2.52527a	3.7877a	-2.676910	0.7970a	-1.205505	
	P= 4	3.50412a	5.2468a	-3.107433	1.0976a	-1.328837	
	P= 5	3.56906a	5.3522a	-3.203632	1.04554a	-1.401182	Rejected
F_y (lnhong / lnOil)							
	P= 2	3.81031a	5.6037b	-2.900539	2.0840a	-1.938296	
	P= 3	3.40301a	5.0285b	-2.783596	1.9365a	-1.871875	
	P= 4	3.91976a	5.8314b	-2.934260	2.1326a	-1.904203	
	P= 5	5.06503c	7.4923c	-3.275997	2.3168a	-1.974534	
F_{HE} (lnSing / lnOil)							Rejected
	p= 1	4.33302b	6.2175b	-2.709220	0.9238a	-1.094318	
	P= 2	4.18585b	6.0117b	-2.900477	1.0912a	-1.362135	
	P= 3	3.85985a	5.6223b	-2.941485	1.2877a	-1.522778	
	P= 4	4.22775b	6.2859c	-3.052949	1.5334a	-1.555381	
F_{HE}(lnpacificexjapan/lnoill)							Rejected
	p= 2	4.42727b	6.2445b	-3.124262	1.0387a	-1.409541	
	P= 3	4.39370b	6.3891c	-3.198990	1.2581a	-1.519713	
	P= 4	4.86614c	7.1805c	-3.387292	1.4610a	-1.591226	
	P= 5	5.68623c	8.3468c	-3.676158	1.4829a	-1.623573	Rejected
(4)FHE(lnNew Zealand/ lnOil)							
	p= 1	1.262643a	1.7112a	-1.848836	1.6061a	-1.717440	
	p= 2	1.350151a	1.8326a	-1.834403	1.9435a	-1.788995	
	p= 3	1.316677a	1.8041a	-1.818340	1.8962a	-1.775020	Accepted
	p= 4	1.711717a	2.4718a	-2.190417	2.4052a	-2.114930	

Note: Akaike Information Criterion (AIC) and Schwartz Criteria (SC) were used to select the number of lags required in the bounds test. p shows lag levels and * denotes optimum lag selection in each model as suggested by both AIC and SC while ** denotes optimum lag selection in F_{HE} (lnHE / lny, lnRER) model for F_{IV} and F_V scenarios. F_{IV} represents the F statistic of the model with unrestricted intercept and restricted trend, F_V represents the F statistic of the model with unrestricted intercept and trend, and F_{III} represents the F statistic of the model with unrestricted intercept and no trend. t_V and t_{III} are the t ratios for testing $\sigma_{1Y} = 0$ in Equation (7) and $\varpi_{1Y} = 0$ in Equation (8) respectively with and without deterministic linear trend. [a] indicates that the statistic lies below the lower bound, [b] that it falls within the lower and upper bounds, and [c] that it lies above the upper bound (These explanations have been obtained and revised from Katircioglu, 2010).

Bounds testing procedures as presented in Table 9 suggest that the null hypothesis of no cointegration can be rejected in all of the countries except New Zealand. Therefore, in these countries other than New Zealand it is seen that oil prices are in long term relationship or co-movement with stock markets. Long term association has not been confirmed between oil prices and stock market in New Zealand according to the results of this study.

It is important to mentioned that economic estimations are done mainly for the long term periods. Therefore, further analysis in the case of New Zealand will not be proceeded in this study since no cointegration has been found between oil prices and stock market of this country. Further analyses starting from the next section will be proceeded for the other countries under consideration.

5.3 Level Coefficients in the Long Run Growth Models

The Bound Test results in section 5.2 indicated that dependent variables known as stock index of the countries other than New Zealand are cointegrating with average oil prices in the long term. Therefore, further investigation of level or long term coefficients by the ARDL approach are needed. The equation coefficients should be tested to see whether there are statistically significance or not. To achieve this goal, we propose the following model with the ARDL approach.

lnstock market index = B0 + B1 (lnoi1 price)+Et

Ln stock market index is a natural logarithmic form of market index and Ln oil price is a natural logarithmic form of average oil price. B0 is intercept and B1 is the coefficient of oil price.

Results in Table 10 show that oil prices have negative impacts on stock market movements in Singapore, Japan, Australia, Japan ex Pacific, and Hong Kong. But this negative coefficient is not statistically significant in the case of Australia. This means that oil prices do not significantly affect Australian stock market in the long term. To explain, for example, when oil prices in Singapore change by 1 percent, Singaporean stock index will change significantly by 0.827 in the reverse direction. It is seen from Table 10 that intercept coefficients in all of the countries' cases are positive, significant, and reasonable. Since coefficients of oil prices are negative, this means that in the absence of oil price movements stock market indices will move upwards significantly. This contains important signals for policy makers.

Table 10: Level Coefficients in the Long Run Growth Models through the ARDL Approach.

Panel (a)

Dependent Variable	Regressors		
	Countries	lnOil	Intercept
ln Singapore	ln Singapore	-0.827208 (0.0968)	9.413492 (0.0000)
ln Japan	ln Japan	-0.522520 (0.0688)	9.173547 (0.0000)
ln Australia	lnAustralia	-0.588639 (0.1246)	7.170841 (0.0000)
ln Japan ex pacific	ln Japan ex pacific	-0.745427 (0.0000)	7.006185 (0.0108)
ln Hong Kong	ln Hongkong	-0.548790 (0.0225)	9.733581 (0.0000)

5.4 Conditional Error Correction Models

Conditional error correction models are estimated and provided in this section of the study. Short term coefficients and ECTs for each country are presented in Tables 11 and 12 with this respect.

ECT estimations in Tables 11 and 12 show that stock markets react to their long term equilibrium path significantly but at very low levels through the channel of oil price changes. This means that oil prices do not contribute so much to long

term convergence of stock markets. For example, in the case of Hong Kong, it is seen that stock index in Hong Kong reacts to its long term path significantly by 11.963 percent speed of adjustment through the channel of oil price movements. However, it is important to mention that all of the ECTs are negative and statistically significiant in each country as theoretically expected (Katircioglu, 2010).

As short term coefficients are considered in Table 10, it is seen that oil prices do not exert significant impacts on stock indices again. The coefficients in the cases of all countries are negative but insignificant. Thus, results of long term coefficients, ECTs, and short term coefficients so far are consistent in the present study.

Table 11: Conditional Error Correction Models through the ARDL Approach

Hong Kong

Dependent Variable: lnHong KONG (2, 0)*			
Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0.119635	0.028544	0.0000
ΔlnHong kong	0.269155	0.077804	0.0007
ΔlnOil	-0.092435	0.056341	0.1029
Intercept	0.000961	0.005508	0.8618

Adj. $R^2$0.100996=, S.E. of Regr. =0.070597,
AIC =,-2.388569 SBC = ,
F-stat. =2.544710,F-prob. =0.004318
D-W stat. = 1.963019

Japan

Dependent Variable: lnJapan (2, 0)*			
Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0.071585	0.020439	0.0006
$\Delta\ln Japan_{t-1}$	0.202877	0.077293	0.8341
ΔlnOil	-0.005738	0.039974	0.8861
Intercept	-9.93E-06	0.004002	0.9980

Adj. R^2=0.113913, S.E. of Regr. 0.051535,
AIC =0.051535, SBC = ,
F-stat. =2.940045, F-prob. =0.001471
D-W stat. = 1.986221

*Note: * denotes p lag structures in the model.*

New Zealand

Dependent Variable: lnNewzealand (2, 0)*			
Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0.046903	0.018103	0.0104
$\Delta\ln NewZ_{t-1}$	0.015956	0.076049	0.8341
ΔlnOil	0.045650	0.050276	0.3652
Intercept	-0.000187	0.005144	0.9711

Adj. R^2= 0.071989, S.E. of Regr. = 0.067005,
AIC =-2.528239, SBC = ,
F-stat. =3.210853, F-prob. =0.005224
D-W stat. = 1.990192

Table 12: Conditional Error Correction Models through the ARDL Approach

Singapore

Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0.071254	0.019239	0.0003
ΔlnSingapore	0.114980	0.074388	0.1240
ΔlnOil	-0.007776	0.059990	0.8970
Intercept	0.000472	0.006111	0.9385

Adj. R^2=0.070310, S.E. of Regr. =0.080658,
AIC =-2.174599, SBC = ,
F-stat. =5.386361F-prob. =0.001446
D-W stat. = 2.003662

Australia

Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0.061460	0.021926	0.0056
$\Delta\ln Australia_1$	0.165971	0.076203	0.0308
ΔlnOil	-0.039985	0.047650	0.4026
Intercept	0.000669	0.004968	0.8930

Adj. $R^2$0.046282=, S.E. of Regr. =0.064015,
AIC =-2.636796, SBC = ,
F-stat. =,3.814633 F-prob. =0.011149
D-W stat. = 1.991659

*Note: * denotes p lag structures in the model.*

Japan ex pacific

Dependent Variable: lnJapan ex Pacific (2, 0)*

Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0.092180	0.023024	0.0001
ΔlnPacific	0.243912	0.074953	0.0014
ΔlnOil	-0.071829	0.050682	0.1584
Intercept	0.000951	0.005111	0.8527

Adj. R^2=0.121807, S.E. of Regr. =0.065350,
AIC =,-2.548987 SBC = ,
F-stat. =3.093133,F-prob. =0.000874
D-W stat. = 1.950017

*Note: * denotes p lag structures in the model.*

5.5 Conditional Granger Causality tests

In this section, conditional Granger causality tests are provided which are run under the ARDL approach. The aim is to investigate the direction of long term causality between stock indices and oil prices. This can be characterized as followings:

$Y = F(x)$

$X = F(Y)$

In order to infer for any causality, t-statistics of ECT in the error correction model need to be negative and statistically significant (Katircioglu, 2010).

Results in Table 13 show that there are significant and negative t-statistics. But, interestingly the direction of causality is from stock markets to oil prices. In the cases of Singapore, Hong Kong, Japan-Pacific, and Japan, there are unidirectional causality that runs from stock markets to oil price changes since t-ratios are significant only in the models when oil prices are dependent variable. On the other hand, in the case of Australia, t-ratio in each model are statistically significant, therefore, it is inferred that there exists bidirectional long term causality between stock market and oil prices. In Australia, stock market and oil prices are in long term feedback relationship.

Table 13. Conditional Granger Causality Tests through ARDL Approach Including Exports

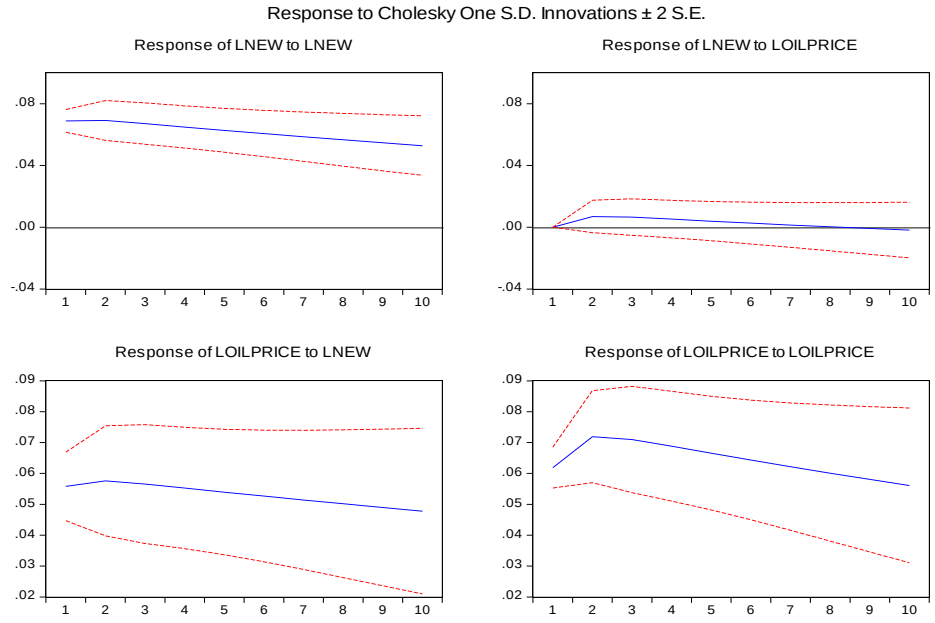
Dependent Variable	F-statistics [probability values]		
	$\Delta lnOil_t$	$\Delta lncountry$	t-stat (prob) for ECT_{t-1}
$\Delta lnOil_t$	-		-1.23296 (0.21928)
$\Delta lnSingapore$		-	**-3.57696 (0.00045)**
$\Delta lnOil_t$	-		-0.64907 (0.51717)
$\Delta lnHongKong$		-	**-3.35944 (0.00096)**
$\Delta lnOil_t$	-		-1.25992 (0.20942)
$\Delta lnJapan Pacific$		-	**3.60417 (0.00041)**
$\Delta lnOil_t$	-		**-1.85938 (0.06469)**
$\Delta lnAustralia$		-	**-2.52942 (0.01233)**
$\Delta lnOil_t$	-		-1.32964 (0.18541)
$\Delta lnJapan$		-	**-2.31321 (0.02190)**

5.6 Variance Decomposition and Impulse Response Function

Results of impulse responses are given in Tables 14 through 16 while variance decompositions are given in Tables 17 and 18. The aim of this section is to determine l%Δ in Stock market index can be explained by how much oil price variations. Moreover, the obtained results from Vector Autoregressive Systems reveal that in two months period of time, 11% of 1% change in Hong Kong can be explained by oil price changes. Ln Japan, 68% of 1% change in stock market index is because of oil price variation.

In addition, the Impulse Response figure describes the response of stock market Index to oil price changes and reverse monthly. It is evident that Hong Kong is responding positively and more than 2% after 4 months to oil Price changes. Japan market index is not affected by oil price. During first 7 months the New Zealand is responding positively to oil prices and then started to become zero and ineffective to oil price changes. Japan ex pacific index is positively responding to oil price changes by large amounts. Initially, Australia is responding negatively and then ineffective to oil price. Singapore was responding negatively and then started to become ineffective.

Table 14: Impulse Response Function



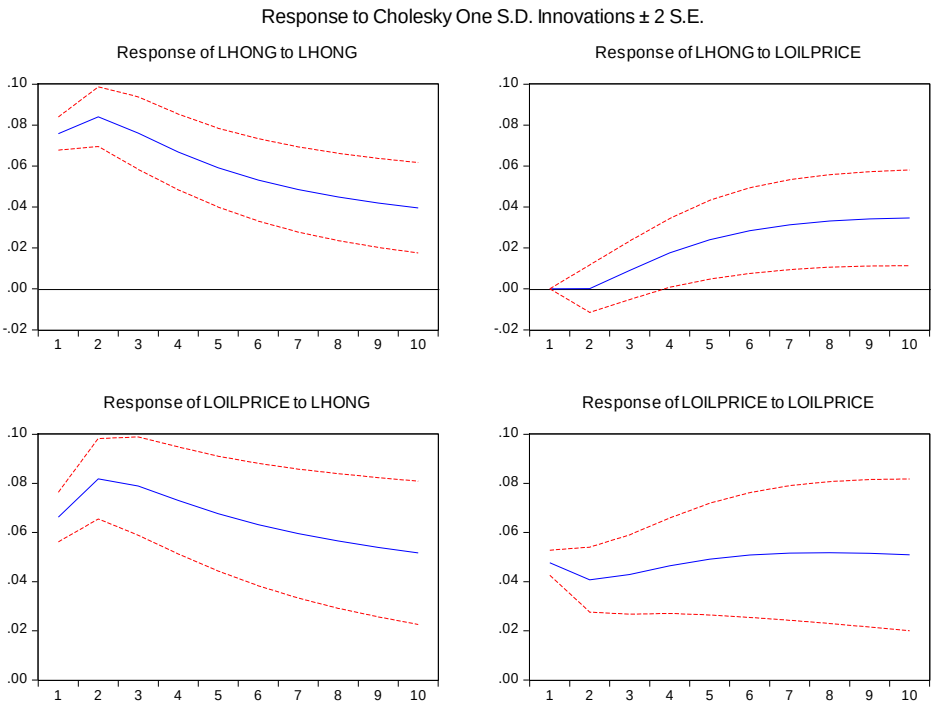
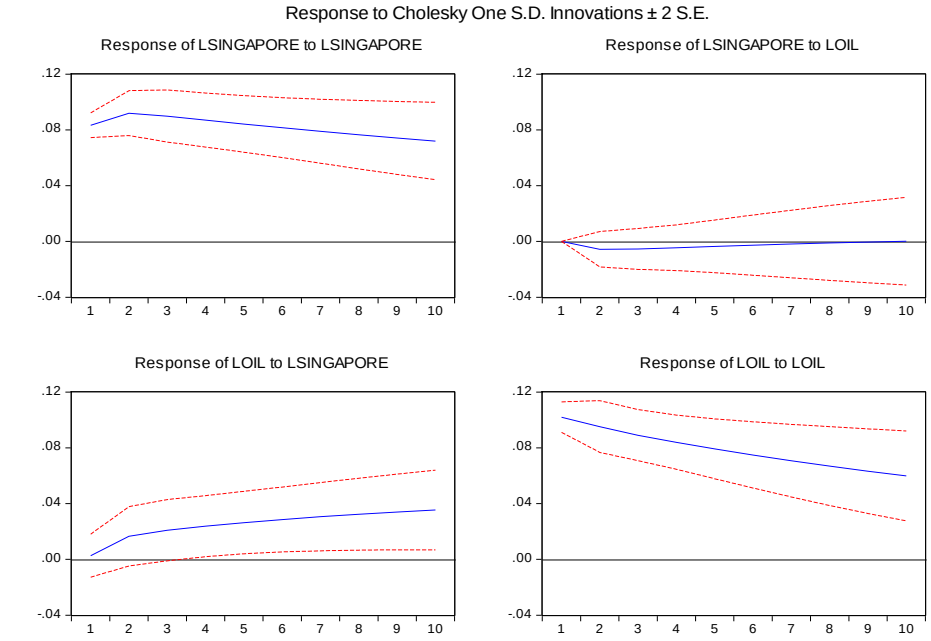


Table 15: Impulse Response Function



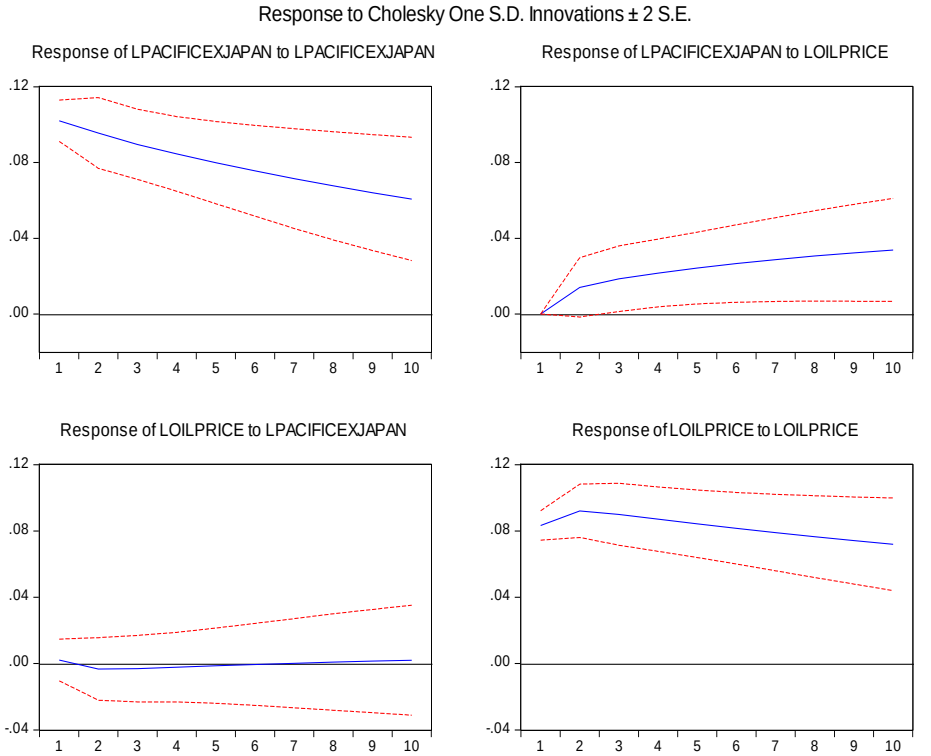
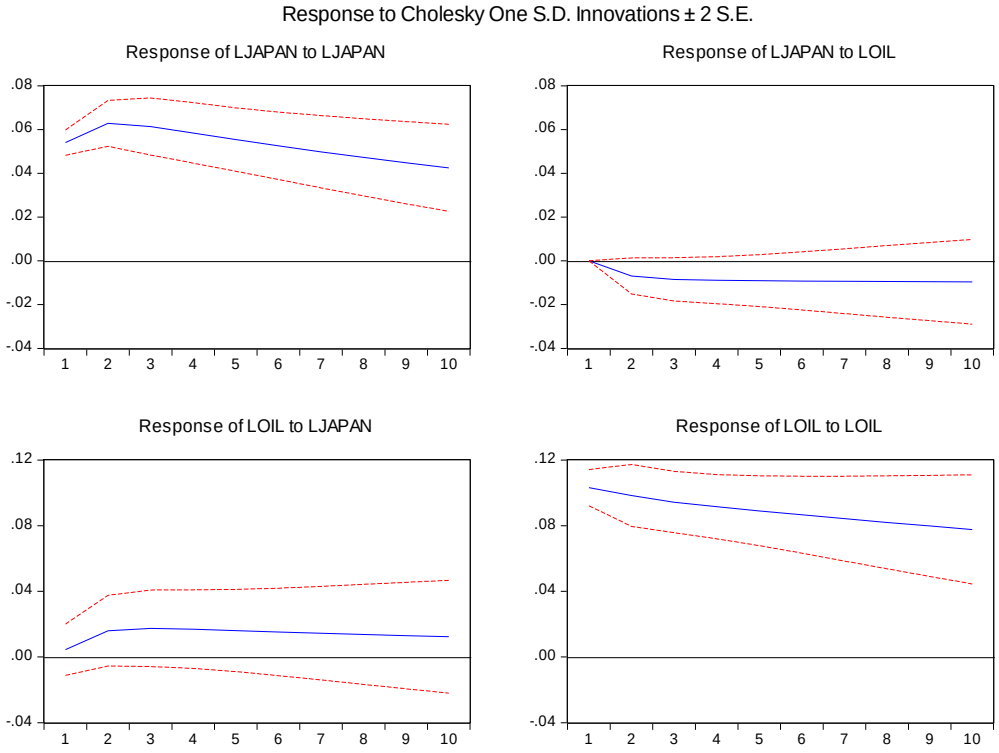


Table 16: Impulse Response Function



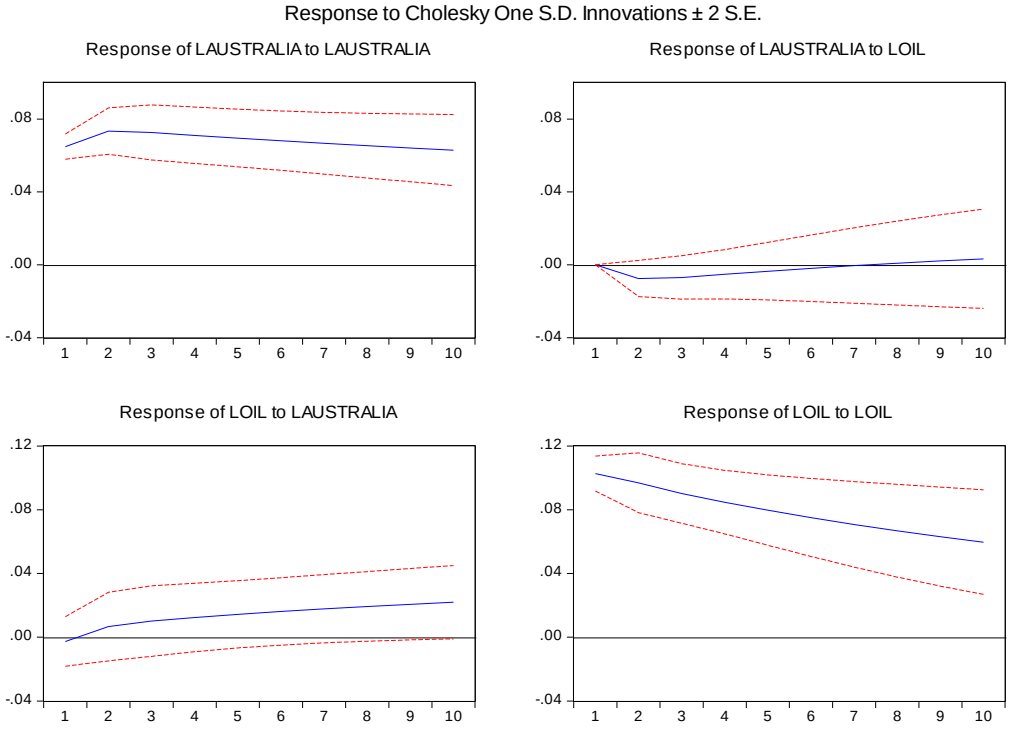


Table17: Variance Decomposition

Variance Decomposition of HongKong

Period	S.E.	LHONGKONG	LOIL
1	0.077559	100.0000	0.000000
2	0.117858	99.88644	0.113561
3	0.145993	99.87037	0.129631
4	0.167131	99.88432	0.115677
5	0.183801	99.90209	0.097905
6	0.197368	99.91486	0.085141
7	0.208650	99.91963	0.080368
8	0.218176	99.91559	0.084407
9	0.226316	99.90282	0.097175
10	0.233338	99.88182	0.118178

Variance Decomposition of Japan

Period	S.E.	LJAPAN	LOIL
1	0.054014	100.0000	0.000000
2	0.083114	99.31023	0.689773
3	0.103640	98.89015	1.109849
4	0.119294	98.61045	1.389550
5	0.131848	98.38990	1.610097
6	0.142233	98.19659	1.803409
7	0.150998	98.01713	1.982869
8	0.158500	97.84528	2.154723
9	0.164986	97.67785	2.322145
10	0.170638	97.51316	2.486838

Variance Decomposition of New Zealand

Period	S.E.	LNEWZEALAND	LOIL
1	0.068585	100.0000	0.000000
2	0.097514	99.22598	0.774015
3	0.118231	99.13911	0.860890
4	0.134814	99.21030	0.789703
5	0.148737	99.31178	0.688223
6	0.160751	99.40522	0.594783
7	0.171311	99.47559	0.524406
8	0.180714	99.51646	0.483542
9	0.189173	99.52518	0.474820
10	0.196842	99.50105	0.498948

Table18: Variance Decomposition

Variance Decomposition of Singapore

Period	S.E.	LSINGAPORE	LOIL
1	0.083286	100.0000	0.000000
2	0.124211	99.79008	0.209919
3	0.153422	99.73646	0.263540
4	0.176438	99.73622	0.263782
5	0.195542	99.75254	0.247463
6	0.211883	99.77341	0.226586
7	0.226136	99.79427	0.205729
8	0.238740	99.81317	0.186831
9	0.250003	99.82928	0.170718
10	0.260147	99.84230	0.157698

Variance Decomposition of Pacific ex Japan

Period	S.E.	LPACIFIC	LOIL
1	0.070049	100.0000	0.000000
2	0.110301	99.27809	0.721907
3	0.139460	99.05435	0.945652
4	0.162203	99.04976	0.950235
5	0.180901	99.11734	0.882658
6	0.196798	99.20332	0.796676
7	0.210620	99.28698	0.713023
8	0.222830	99.35974	0.640258
9	0.233747	99.41812	0.581879
10	0.243598	99.46096	0.539037

Variance Decomposition of Australia

Period	S.E.	LAUSTRALIA	LOIL
1	0.064859	100.0000	0.000000
2	0.098217	99.41079	0.589208
3	0.122343	99.29493	0.705071
4	0.141573	99.33665	0.663349
5	0.157761	99.41610	0.583895
6	0.171831	99.49523	0.504767
7	0.184319	99.56068	0.439317
8	0.195572	99.60775	0.392252
9	0.205826	99.63526	0.364740
10	0.215254	99.64365	0.356355

Chapter 6

CONCLUSION

6.1 Summary of major Findings

This study aimed to determine the cointagration between oil price and stockmarket indices of Singapore, Australia, Japan, New Zealand, Hong Kong and Japan ex-Pacific market index between 1997 to 2011.

To achieve this goal, this thesis applied Times Series Economic techniques, using ARDL methology.Under this mothod, there are several tests which should be measured.

The unit root test results confirm that time series variables are stationarity at the first difference, then the bound test result revealed that Hong Kong, Singapore and Japan ex-Pacific Index are cointegrating and having level relationship in the long-term. It means that we can use these variables in the long-term economic model for future estimating. In addition, level coefficients and Error correction models were statistically significant for these countries.

It means that these market indeces and oil price are integrating in the long term, since they are oil imorter and their economy are highly dependent on oil import. From economic sense, stock market can be negativelty affected. It is obvious that each countries oil import and export can be varied in each year. Therefore, the thesis focous is especcially on last year. Previous reserch papers assumed that

Australia, Japan and New Zealand are not so much affected by oil price changes.Our results confirms these findings. However our obtained result found out that Japan ex Pacific, Singapore and Hong Kong indices are integrated to oil price changes and therefore should be consider for stock pricing and hedging. In contrast, previous studies assumptions were correct in assumming that Australia and New Zealand are not vulnerable to oil price variations .since their cointegration test results were not significant.

Granger Casuality tests show that there is a unidirectional relationship from oil prices to Singapore, Hong Kong, Japan ex Pacific, Australia and New Zealand Indices.

Impluse Response Function indicated that although Hong Kong and Japan ex Pacific respondig positively to oil price changes but Sinagpore responded negatively and then become ineffective to oil price changes.

Finally, Variance Decomposition shows that 0.22% variations in Singapores stock market is becoause of oil price changes.The results for Japan ex Pacific and HongKong are 0.72% and 0.11%.

In Conclusion, Hong kong and Japan ex pacific indices are affecting by oil price changes positively and Singapore ineffective.

REFERENCES

Arouru, E., & Lahiani, A., (2010). Return and Volatility transmission between world oil prices and stock markets of the GCC countries, *Journal of Economic Modeling,* 28, 1815-1825.

Balachandra, P., & Mongia, N., (2010). Oil-Price Vulnerability Index (OPVI) for the Developing Countries of Asia and the Pacific, *United Nation Development Program*

Basher, S. A., & Sadorsky, P. (2006). Oil price risk and emerging stock markets. *Journal of Science Direct*, 17, 224-251.

Chen, N. F., Roll, R., & Ross S. A. (1986). Economic forces and the stock market. *Journal of Business*, 59, 383-403.

Faff, R.W. & Brailsford, T. J. (1999). Oil price risk and the Australian stock market. *Journal of Energy Finance,* 4, 69-87.

Gisser, M., & Goodwin, T., H. (1986). Crude oil and the macro economy: tests of some popular nations. *Journal of Money*, credit and Banking, 18(1), 95-103.

Hammoudeh, S., & Nandha. M., (2006). Systematic Risk, and oil price and exchange rate sensitivities in Asia-Pacific Stock markets. *Journal of Science Direct,*21, 326-341.

Hedi Arouri, M., E., (2011). Does crude oil move stock markets in Europe? A sector investigation. *Journal of Economic Modeling*, 28, 1716-1735.

Huyghebaert, N., & Wang. L. (2009). The co-movement of stock markets in East Asia, Did the 1997-1998 Asian Financial Crisis really strengthen stock market integration, 21, 98-112.

Jones, C. M., & kaul, G. (1996). Oil and the stock markets. *Journal of Finance,* 51, 463-491.

Narayan, P. K., and S. Narayan (2005), Estimating Income and Price Elasticities of Imports for Fiji in a Contegration Framewor. *Economic Modelling,* 22, 423–38.

Papapetrou, E., (2001). Oil price shocks, stock market, economic activity and employment in Greece. *Energy Economics*, 23, 511-532.

Park, J., Ratti, R. A. (2008). Oil price shocks and stock markets in the US and 13 European countries. *Energy Economics,* 30, 2587-2608.

Sadorsky, P. (1999). Oil price shocks and stock market activity. *Energy Economics,* 21, 449-469.

Pesaran, M. H., and Shin, Y. and Smith, R. J., (2001). Bound Testing Approaches to the Analysis of Level Relationships. *Journal of Applied Econometrics,19,289-326.*

Phillips, P., and Perron, P., (1988). Testing for a Unit Root in Time series Regression. Biometrica, 75. 335-346.

Sadorsky, P. (2004). Stock markets and energy prices. *Encylopedia of Energy*, 5, 707-717.

Sato, k ., & Zhang. Z, & McAleer, M. (2010). Identıfyıng shocks in regionally integrated East Asian Economies with structured VAR and block exogeneity. *Jourrnal of Science direct*, 81, 1353-1364.

http://asia-pacific.undp.org/practices/energy_env/rep-por/documents/Oil-Price_Vulnerability_Index%20_OPVI_%20for_the_Devloping_Countries_of_Asia_and_the_Pacific-Summary_Paper.pdf

Energy Information Administration (2012).

http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=5&pid=54&aid=3&cid=AS,&syid=1997&eyid=2010&unit=TBPD.

New Zealand Energy Data File(2011)

http://www.med.govt.nz/sectors-industries/energy/pdf-docs-library/energy-data-and-modelling/publications/energy-data-file/energydatafile-2011.pdf

Watch economy (2012)

http://www.economywatch.com/world_economy/singapore/?page=full

World Economic Forum (2012)

http://www.weforum.org/reports/global-competitiveness-report-2012-2013

World Factbook (2013).

https://www.cia.gov/library/publications/the-world-factbook/geos/as.html

MSCI Indices (2012).

http://www.msci.com/products/indices/country_and_regional/dm/performance.html

http://asia-pacific.undp.org/practices/energy_env/rep-por/documents/Oil-Price_Vulnerability_Index%20_OPVI_%20for_the_Devloping_Countries_of_Asia_and_the_Pacific-Summary_Paper.pdf

http://www.tagoil.com/new-zealand-operations.asp