IBN HALDUN UNIVERSITY
SCHOOL OF GRADUATE STUDIES
DEPARTMENT OF FINANCIAL ECONOMICS

MASTER THESIS

THE EFFECTS OF GLOBAL OIL PRICES ON LOCAL STOCK MARKET INDEXES OF EMERGING MARKETS: A CROSS-COUNTRY ANALYSIS

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THESIS SUPERVISOR
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ISTANBUL, 2021

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by

BABA OSMAN BUKARI

A thesis submitted to the School of Graduate Studies in partial fulfillment of the requirements for the degree of Master of Science in Financial Economics

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APPROVAL PAGE

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Science in Financial Economics.

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ACADEMIC HONESTY ATTESTATION

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

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ÖZ

KÜRESEL PETROL FİYATLARININ GELİŞEN PİYASALARIN YEREL HİSSE SENETLERİNE ETKİLERİ: ÜLKELER ARASI BİR ANALİZ

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Bu çalışmada, küresel petrol fiyatlarının, hem petrol ihraç eden hem de petrol ithal eden gelişen ülke piyasalarının yerel borsa endeksleri üzerindeki etkisi incelenmiştir. Bu amaçla 15 gelişen ülke piyasasına ilişkin Ocak 2010 ile Mart 2021 tarihlerini kapsayan veriler kullanılmıştır. Çalışmanın iki ana hedefi bulunmaktadır. Öncelikle küresel petrol fiyatlarının yerel borsalar üzerindeki etkisi değerlendirilmiş ikinci olarak ise hisse senedi piyasaları ile makroekonomik değişkenler arasındaki ilişki incelenmiştir. Veriler panel regresyon modeli kullanılarak analiz edilmiştir. Analiz sonucunda petrol ithal eden gelişen piyasa ekonomilerinde, küresel petrol fiyatları ile borsa endeksleri arasında negatif bir ilişki bulunmuştur. Petrol ihraç eden ülkeler için ise küresel petrol fiyatları ile borsa endeksleri arasındaki ilişki pozitiftir. Çalışmanın bulguları aynı zamanda faiz oranlarının, tüketici fiyat endekslerinin, döviz kurlarının ve sanayi üretim endekslerinin, hem petrol ihraç eden hem de ithal eden gelişen ülke ekonomilerinde hisse senedi piyasalarını etkilediğini ortaya koymaktadır. Gerek petrol ihraç eden gerekse petrol ithal eden gelişmekte olan ekonomilerde borsa fiyat endeksleri faiz oranları ve döviz kurları ile ters yönde hareket etmektedir. Borsa fiyat endeksi ile sanayi üretim endeksi ve tüketici fiyat endeksi ile aynı yönde hareket ettiği sonucuna ulaşılmıştır. Çalışmanın sonuçları önemli politika çıkarımları içermektedir. Çalışmanın sonuçların gösterdiği gibi, gelişmekte olan ekonomilerdeki hisse senedi piyasaları sadece petrol fiyatlarındaki değişikliklere değil, aynı zamanda faiz oranı, enflasyon oranı, döviz kuru ve ekonomik büyüme gibi ekonomik temellerdeki değişikliklere de tepki vermektedir. Hisse senedi piyasa endeksleri genellikle önde gelen ekonomik göstergeler olarak görülür. Küresel petrol fiyatlarında meydana gelen ani şoklar ekonomik büyümeye ilişkin beklentileri etkileyecektir. Bu sebeple merkez banklarının bu şokların olası etkilerini absorbe edecek para politikası araçlarını kullanmaları gerekmektedir.

Anahtar Kelimeler: Borsa, Döviz Kuru, Gelisen Piyasalar, Panel Verisi, Petrol Fiyati, PVAR

ABSTRACT

THE EFFECTS OF GLOBAL OIL PRICES ON LOCAL STOCK MARKET INDEX OF EMERGING MARKETS: A CROSS COUNTRY ANALYSIS

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The study investigated the effect of global oil prices on local stock market indexes of emerging markets for both oil exporting and oil importing countries. Data covering the period from January 2010 to March 2021 for 15 emerging countries was used. Two objectives guided the study. First, the impact of global oil prices on local stock markets was assessed. Secondly, the relationship between stock price and changes in macroeconomic variables was investigated. A panel regression model was carried out to analyze the data. The findings show that global oil price is negatively related to stock market index in oil importing countries. On the other hand, the findings revealed that global oil price is positively related to stock market index in oil exporting countries. The findings also reveal that interest rate, consumer price index, exchange rate and industrial production index impact stock markets in emerging economies for both oil exporting and importing countries. Stock market price index moves in opposite direction to interest rate and exchange rate in both oil exporting and oil importing emerging economies. Stock market price index moves in the same direction as industrial production index and consumer price index. The results have policy implications. As the results in this paper have shown, stock markets in emerging economies not only respond to changes in oil price but also to changes in economic fundamentals like interest rate, inflation rate, exchange rate and economic growth. Stock market indexes are often seen as leading economic indicators. Unforeseen shocks in global oil prices may disturb expectations related to economic growth in emerging economies. Therefore, central banks should use required monetary policy tools to offset the consequences of oil price shocks.

Keywords: Exchange Rate, Emerging Markets, Oil Price, Panel Data, PVAR, Stock Market

DEDICATION

To my mom, Madam Salamatu Ndede for her infinite love and support, to my dad Mr. Osman Bukari, Anti Amina, Brother Abdellah, Hajia Adiza and Adamu Bubacar.

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Baba Osman Bukari

ISTANBUL, 2021

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LIST OF SYMBOLS AND ABBREVIATIONS

BRIC	Brazil, Russia, India and China
BVSP	Bovespa
CPI	Consumer Production Index
DJIA	Dow Jones Industrial Average
EPS	Earnings Per Share
EXC	Nominal Exchange Rate
FE	Fixed Effects
G7	Group of Seven
GDP	Gross Domestic Product
GMM	Generalized Methods of Moments
IEA	Institute of Economic
INTR	Interest Rates
IPI	Industrial Production Index
IRFs	Impulse Response Functions
MBIC	Modified Bayesian Information Criterion
OECD	Organisation for Economic Co-operation and Development
OIL	WTI Global Oil Prices
PVAR	Panel Vector Auto-Regressive
RE	Random Effects
S&P	Standard and Poor 500 Index
SMI	Local Stock Index
SVAR	Structural Vector Autoregressive
USD	United States Dollar
VAR	Vector Autoregressive
VIF	Variance Inflation Factor
VEC	Vector Error Correction
WTI	West Texas Intermediate Crude Oil Price
ΔCPI	Monthly Percentage Changes in the Consumer Production Index
ΔEXC	Monthly Percentage Changes in The Nominal Exchange Rate
ΔINTR	Monthly Percentage Changes in Interest Rate

∆IPI	Monthly Percentage Change Industrial Production Index
∆OIL	Monthly Percentage Change in Global Oil Prices
∆SMI	Monthly Percentage Changes in Stock Market Price

CHAPTER I

INTRODUCTION

Oil is an essential commodity as far as the global economy is concerned and plays a crucial role in nearly all economies worldwide. Oil is a significant resource and is considered the lifeblood of industrialized nations. It is a significant energy source for powering industry, heating homes, fueling vehicles, and airplanes to carry goods worldwide. Thus, it is a significant resource for industrial production. Countries that do not have it or have but in limited amounts buy from other countries that have it in abundance—to supplement theirs. Countries endowed with much of it sell the surplus to the outside world in exchange for cash or other benefits, thereby serving as a significant income source for net oil-exporting countries.

The critical nature of oil to economies requires that countries have measures that ensure the efficiency and sustainability of supplies. Ensuring efficiency and sustainability should help protect against oil price shock and macroeconomic challenges. For example, a positive supply shock in emerging markets may boost the economy by importing cheap oil to boost demand, raising gross domestic product if used effectively. However, such an occurrence would affect net-oil export countries. On the other hand, a negative supply shock would be suitable for net-oil exporters.

In contrast, net-oil importers could face price spikes in all the economic sectors. Aidoo (2016) writes that developing countries' inefficiency exposes them to oil shocks than the advanced economies. The Organisation for Economic Co-operation and Development (OECD) countries use half of the inputs of the less developed countries to produce the same output unit (IEA 2011).

The magnitude of variations in the price of oil impacts capital flows to emerging markets and currency rates in turn due to their influence on investment decisions in oil-producing countries as well as changes in the recycling process for petrodollars.

The government agencies may help pay down existing debt by taking on more debt while setting away monies for future generations. In addition, the government might choose to raise expenditures. Assume that the price surge (and consequently greater money) is here to stay for the sake of the argument. If such is the case, the most outstanding choice is to boost government expenditures to help finance domestic expenditure and investment.

There are two reasons for this: economic cycles and high oil prices. One option to boost the savings ratio would be to expect high oil prices to hold for a short time. These funds are intended to be utilized as a buffer against future economic shocks, such as those induced by oil price changes. Using petrodollars to purchase foreign financial instruments protects a country's budget from the oil industry's boom-and-bust cycle while also enabling it to earn returns beyond the necessary rate of return or diversify its possibilities. When oil-exporting countries' financial inflow and outflow needs become more pressing, emerging economies need to investigate if a petrodollar recycling system is already in place and whether their economic diversification priorities are aligned with it.

The importance of oil in an economy has led to a significant effort to understand the relationship between oil prices and stock market (Badeeb and Lean, 2018). Theoretically, in equity valuation, stock price is dependent on macroeconomic such as inflation, investor confidence, interest rates and aggregate demand. Oil is such a powerful tool to cause turbulence in economic activities. Economic turmoil caused by oil affects both oil importers and oil exporters. Hamilton (1983) documents evidence that, between 1948 to 1972, 87.5% of economic recessions in the United States were preceded by an increment in crude oil price, showing how vital oil is to an economy. Farzanegan and Markwardt (2009) established the vulnerability of the Iranian economy to oil price shock. They found that negative and positive oil price shocks increase inflation significantly. Turhan, Hacihasanoglu, and Soytas (2013) also found that the non - symmetric consequences of negative and positive oil price shock significantly cause inflation to increase. To sum up, as income shifts to net oil-exporters, a rise in the price of oil typically translates into rises in the price levels of products and services in an economy, impacting the prosperity of net oil-importing countries.

A rise in oil prices will cause input prices to increase. Increasing the growing cost, storing becomes more expensive, and transportation fares rise as oil prices at the pump rise. A higher price of oil affects the price of insulin, thereby increasing heating costs. All these increases affect different sectors of the economy. These oil price changes affect macroeconomic indicators such as inflation, current account balances, money supply, terms of trade, exchange rates, and Gross Domestic Product (GDP) growth. According to Eltony & Al-Awadi (2001), these oil price shocks impact the demand for money in Kuwait, an oil-exporting nation. The findings show that oil prices are related to oil income, government spending, and other factors. The researchers concluded that oil price shocks influence macroeconomic variables via government development and current expenditures in Kuwait's case.

1.1. The Stock Market

We may often see a news report announcing that the stock market has gone down or that the stock market has closed or is up for the day. Thus, most frequently indicating that stock market indices have shifted up or down, implying stocks have either gained or lost value within the index. Through this movement in stock prices, investors who buy and sell shares expect to turn a profit.

The financial system is based on stock exchanges. Typically, stock markets are used to convert savings into real-world financing. Stock markets can theoretically contribute to economic growth by increasing domestic savings and increasing the quality and quantity of investments. Increased mobilization of funds has the potential to boost saving rates. When stock markets redistribute money to higher-yielding investment opportunities, funds become more appealing.

Empirical data have shown that stock markets contribute to economic growth. In recent times, studies have concentrated on the factors that drive the development of stock markets. Understanding the stock market's movements and forces is instrumental in explaining finance and economic progress. It has critical consequences since it outlines areas where the government could improve the economic and institutional environment of the stock market. Theoretical study on what determines stock market development is still in its infancy. Stock market behavior can be completed and perplexing. However, future studies will require a framework for evaluating those processes and formulating a financial theory of stock market evolution.

Stock prices and economic growth rates are inextricably linked. Nonetheless, stock prices are primarily determined by a corporations' performance and growth prospects. When a company's performance and rate of return improve, stock prices climb in response. On the other hand, stock prices should represent the discounted present value of predicted future dividends or growth. Stock prices, viewed in this light, act as a leading predictor of future changes in total economic activity.

There are three primary mechanisms through which stock prices might influence real economic activity: the wealth effect, the cost of capital effect and the confidence/expectation effect. The wealth effect establishes that, more outstanding stock prices and more wealth in stocks encourage investors to spend m over the entire lifecycle income. This increased demand will be more pronounced in nations with a strong stock ownership base. The cost of capital explains that when stock prices rise, the cost of new capital compared to current capital drops, thereby encouraging more companies to go public and raise money through public offerings. *Ceteris paribus*, a strong stock market performance may attract foreign capital allowing interest rates to fall. The confidence/expectation effect explains that a strong stock market may boost overall expectations, resulting in economic growth via increased investment.
Additionally, stock prices indicate more significant company growth. As a result, a projected increase in future real individual income may also increase consumption (Morck et al, 1990). While these variables/channels are difficult to quantify, it is critical to appropriately analyze the strength of the connection between stock markets and real business activity.

1.2. Transmission Channels between Oil and Stock Market Returns

This section describes some of the theoretical transmission mechanisms (channels) through which changes in oil prices may affect stock market behavior. The presentation has been carried out in five categories (Degiannakis et al. 2018).

1.2.1. The Stock Valuation Channel

Stock valuation is the most obvious route via which the price of oil affects stock markets. This can be made precise using two mathematical equations as shown below: firstly, stock returns is expressed as the log-difference of stock prices. Mathematically, this is given as:

$$R_{i,t} = log(\frac{P_{i,t}}{P_{i,t-1}}) \text{ .... } (0.1)$$

where $P_{i,t}$ indicates the firm *i*'s stock price at time *t*. Secondly, according to economic theory, present stock prices reflect stock's discounted future cash flows (Huang et al., 1996). This can be explained by the equation below.

$$P_{i,t} = \sum_{n=t+1}^{N} \left(\frac{E(CF_n)}{\left(1+E(r)\right)^n}\right) \ldots \text{ (0.2)}$$

where CF_n is the current cash flow and r is the discount rate? As shown in equations 1.1 and 1.2, oil prices affect stock returns because they may change anticipated cash flows or the discount rate. Mohanty and Nandha (2010) assert that changes in oil prices have different effects on economies. Thus, it may have a favorable or unfavorable impact on future cash flows depending on its position (whether a country is an oil-user (oil-consumer) or an oil-producer).

Generally, it is anticipated that net oil importers will behave bearish during periods of rising oil prices. Assuming there are no perfect substitutes for factors of production, an increase in the price of oil will lead to a rising cost of production (Basher and Sadorsky, 2006). This increased cost of production will lower profits and therefore cash flows to be received in the future for an oil-consuming country (Mork, Olsen, Brown and Yucel 1999; Filis et al., 2011). However, oil-producing countries turn to be bullish during periods of rising oil prices. This is because the increase in oil prices results in higher profit levels and, therefore higher cash flows(Degiannakis et al. 2018).

1.2.2. The Monetary Channel

Future cash flow discount rates are also affected by changes in oil prices (as depicted in equation 1.2 above). Mohanty and Nandha (2011) explains that actual interest rates and anticipated inflation partly constitute the discount rate. As a result, interest rates and inflations are the second-way oil price fluctuations affect the stock market. Rising oil prices, as stated above, results in higher costs of production. These expenses, however, will be transferred to consumers in the form of an increase in retail prices (Hamilton 1996: Abel & Bernanke 2001, and others). Therefore, it is expected that monetary policymakers will have to increase short-term interest rates in times of rising prices to cater to the inflationary pressures (Basher & Sadorsky, 2006). Increasing the short-term interest rates have two immediate impacts on stock markets. Firstly, rising short-term interest rates lead to a higher discount rate (borrowing rates in the market). This will increase a company's future investments, thus increasing the cost of borrowing for companies. Additionally, the higher cost of borrowing results in a smaller number of projects due to lower cash flows. This reduced cash flow leads to a fall in the value of stock prices.

It is worth noting that the degree of the impact is contingent on the Central Bank's ability to control inflation. Thus, in a country where the Central Bank has high credibility, expectations about inflation will stay constant, notwithstanding a rise in oil prices. On the other hand, if the central bank's credibility is low, inflation expectations are bound to be volatile, leading to a more remarkable shift in inflation expectations after a rise in oil prices, resulting in an even harsher effect on stock prices.

1.2.3. The Output Channel

The output channel is the third transmission channel between oil returns and the stock market. According to the literature, changes in oil prices have an impact on aggregate production (Hamilton, 1983; Hamilton, 2003; Hamilton, 2009a; Kilian, 2008a, 2008b). According to this channel, positive changes in oil prices are expected to affect both production costs and revenues, resulting in changes in aggregate production.

As earlier explained, if there is no perfect substitute for factors of production, then an increase in oil price will lead to an increase in the cost of production. On the other hand, Bernanke (2006) and Edelstein and Kilian (2009) found that increasing oil prices, in particular, tend to reduce family discretionary income. This is the case owing to increases in retail pricing because of higher production costs. In other words, rising oil prices will impair an oil-importing economy's terms of trade, resulting in reduced income and a negative wealth impact on spending. This eventually will lead to lower overall demand in the economy (Svensson, 2006).

Such events usually have a detrimental impact on stock markets leading to reaction as indicated in equations 1.1 and 1.2 above. For example, a decrease in aggregate demand results in lower anticipated cash flows for businesses, resulting in lower stock values. On the other hand, they are dependent upon whether the economy imports or exports oil. For an oil-importing economy, the above sequence of events remains true. An oil-exporting country, on the contrary, will stand to gain from a favorable impact on income owing to increasing oil revenues, leading to greater aggregate demand and higher output. Assuming the income impact is large enough to offset the negative cost of production, there will be a positive shift in aggregate demand. Stock markets will react positively to increased production in this scenario since it will enhance the anticipated cash flows of the country's businesses.

1.2.4. The Fiscal Channel

This transmission channel is mainly concerned with oil producing economies that use their oil earnings to fund physical and social infrastructure (Farzanegan 2011; Emami & Adibpour 2012). As oil prices increases, money tend to shift from net oil-importer to net oil-exporter, allowing for more government expenditure (Dohner, 1981). If consumption and state purchases are seen as complementary, the latter will result in increased household consumption. Private businesses are anticipated to improve their cash flows and, as a result, their profitability under this situation. As a result of these events, stock prices will rise, and the stock market will enter a bullish phase. However, when consumption and government expenditure are seen as substitutes, the reverse effect is shown owing to crowding out effects. Such changes will have a destructive impact on stock markets, since the substitution effect will push away the economy's most productive private capital.

1.2.5. Uncertainty Channel

Brown and Yücel (2002) propose the uncertainty channel as the ultimate transmission channel. Rising oil prices, in particular, increase uncertainty in the general economy due to their impact on production, consumption, inflation, and other factors. As a result, rising oil costs will decrease market demands for irreversible investments, lowering anticipated cash flows. In addition, uncertainty is spread to families, causing them to decrease the purchase of durable items (Bernanke 1983; Pindyck 2003). Edelstein and Kilian (2009) households are more likely to conserve than spend if future oil prices become unclear. As uncertainty grows due to higher oil prices, the value of deferring both consumption and investment choices rises, resulting in a drop in the incentive to invest or spend, dampening economic development expectations (Chuku et al., 2010) and hence stock market gains.

1.3. Significance of the Study

The global influences of emerging markets are expected to rise because these nations' economies are growing in strength and even more so during financial crises. The financial crisis of 2008 attests to this claim that the BRIC countries displayed during the 2008 global credit crunch and the resulting financial crises. Examples of this have been the increasing influence of developing economies such as India and China. Emerging economies makeup 85% of the world's population and are critical to economies globally. They accounted for 80% of global economic growth since the 2008 financial crisis, contributing tremendously to saving jobs in advanced countries (Lagarde, 2016).

According to the sigma research, the seven most significant developing economies will account for up to 42% of global growth, with China alone accounting for 27%. Economic development will assist the insurance business. The percentage of worldwide premiums held by emerging markets is expected to increase by almost 50% during the next ten years (Insurance Journal, 2019)

Emerging economies are capturing a more significant percentage of international capital flows, which further drives the analysis. Suttle et al. (2012) established that in 2010, portfolio investment capital inflows into developing nations totaled $990 billion. This is an increase of $350 billion over 2009 levels, and the momentum is anticipated to continue. Emerging markets are more likely to be impacted by foreign investors' cross-border restructuring operations, as their monetary institutions are less developed than wealthier economies. As a result, their economies may become less resilient in the future. While the crisis may not persist indefinitely, the more ambiguous its duration and scope become, the more crucial it is to evaluate the impact of monetary policy on emerging economies.

The disposal of petrodollars is a crucial element that determines the flow of cash to developing economies. Mastering the regeneration mechanism is becoming increasingly relevant to worldwide businesspeople as the price of oil rises. In theory, a rise in the cost of oil is anticipated to undermine an oil-importing economy by increasing the host country's balance of payments. A decline in the local currency is projected in line with these factors. In the 1970s, however, this was not the case since a jump in export receipts from the OPEC corresponded with an increase in financial outflows to currency assets. This cash flow might be regarded as an OPEC member's preferred investment. However, it is critical to remember that the international banking system's direct recycling of petrodollars provides industrialized countries with significant advantages in gaining access to these resources. The developed countries can fund their balance-of-payments gaps affected by increasing fuel prices by investment in risk-free assets. The reliance on the global banking system to move oil money appears to have evolved in the previous decade. Oil-exporting economies' financial institutions in charge of maintaining reserve funds started to buy developing market economy assets directly. Capital flows to developing nations now interact with fuel prices more strongly, resulting in a movement in the price for both fuel and currencies.

Furthermore, recycling incomes from petrol (petrodollars) is essential in determining capital flow to emerging markets. The financial institutions' developments in emerging countries have made them rely less on the world banking system to manage the oil revenue reserves, reducing reliance on developed countries' international banking systems. This is related to oil prices, revenue (cash flows) to developing markets, and currency rates. (Turhan et al., 2013).

As these economies expand, industries will be needed to produce goods and offer services and energy (mainly oil) to operate such industries.

This research looks at the link between global oil prices and local stock market indices in a few developing countries. A Panel Regression technique was used to accomplish the study's goal. Then to confirm the results, The Panel Vector Auto-Regressive (PVAR) was also used. PVAR technique yields a more accurate conclusion from a small number of nations by pooling many data.

1.4. Research Objectives

The objectives of the study are, therefore, to:

a. investigates the influence of changes in global oil prices on local stock market indices of emerging markets.

b. assesses the relationship between stock price changes and macroeconomic variables such as economic growth rate, exchange rate, interest rate, and inflation rate for some emerging economies.

1.5. Research Questions

The study seeks to address the questions.

a. Do changes in global oil prices influence local stock indexes of emerging markets?

b. Do changes in macroeconomic variables affect stock market performance in emerging countries?

1.6. Research Hypothesis

This study aims to test the hypothesis that changes in global oil prices do not influence local stock indexes of emerging markets. The alternative hypothesis is that changes in global oil prices influence local stock indexes of emerging markets.

1.7. Thesis Outline

The first chapter provides an overview of the study, explains its significance, and details the research objectives, research questions, and thesis hypothesis. The second chapter reviews the existing literature on the impact of oil prices vis-à-vis the stock market and macroeconomic variables. Models, data selection, variable descriptions, and study methodologies are discussed in Chapter 3. The fourth chapter presents the data analysis and examines the findings of the study. Chapter 5 concludes the research by summarizing the main findings and states their contributions and recommendation.

CHAPTER II

LITERATURE REVIEW

Numerous oil market variables may theoretically have a wide range of implications on stock prices. The discounted future cash flow finance theory explains that a company's stock price matches the present value of its predicted cash flows. By influencing future cash flows, oil prices, including exchange rates, may directly affect the stock values of oil companies.

Bénassy-Quéré et al. (2007) examine the relationship between oil prices and rapid economic expansion in developing countries such as China. Other scholars have researched paradigms around the interdependence of stock markets and oil price fluctuations (Jones & Kaul 1996; Huang et al. 1996) and have identified the most significant variables, including economic growth, inflation (Fama & Schwert, 1977; Chen et al., 1986 and Caporale & Jung, 1997), and exchange rates and interest rates (Maghayereh, 2003).

2.1. Empirical Studies

Given the importance of this topic, there is much research on this topic. The relationship between oil prices and macroeconomic indicators such as economic growth and stock prices has been studied through several methods, variables and samples. Some research examines the impact of oil price shocks on macroeconomic variables such as GDP and interest rates on oil prices and the relationship between these variables.

The results of several of these research vary depending on the variables. While some have similar or the same outcomes, others have comparable or identical results. Nonetheless, several publications conflict with one another. The combination of variables affects the outcome of the results. So do the study's structure regarding sample size and scope (thus considering developing emerging economies or developed economies or oil importers or oil exporters).

The study of the correlation between oil prices and other macroeconomic indicators, such as economic growth and stock prices, uses different methods, variables and samples. For example, to study the effect of oil price shocks on macroeconomic variables such as GDP and interest rates, researchers look at various aspects, such as oil prices, exchange rates, and GDP.

Sometimes applying different techniques yields the same result. Al-Rjoub (2005) demonstrated a link between an oil price shock and a stock market crash using a combination of VAR, mixed dynamic, and Granger causality. The findings showed that the two factors interrelate: one impacts the other depending on which variable is thought of as a given factor.

As is generally anticipated, rising crude oil prices and economic growth are likely to be correlated with the development of economies that export oil and those that import it. Nevertheless, in some African economies, their relationship is ambiguous. The Nigerian economy, for example, economic activities reduce dramatically due to lower oil prices (Iwayemi & Fowowe, 2011, p. 610). According to the above researchers, from 1985 to 2007, oil price shock did not affect macroeconomic variables contrary to literature. In other words, the variation in oil prices (shock) did not impact the GDP of Nigeria. To ensure that their findings were correct, they examined the data using various economic techniques, including the Granger causality test, variance decomposition, and the impulse response function. The outcome was the same as previously stated.

Regardless, higher prices should lead to a decrease in demand. Over time, the decrease in demand should translate to a decrease in oil supply and, consequently, lead to a decrease in production—since oil is an input of production.

Interest rate serves as a helpful tool for evaluating the importance of economic factors on stock performance. Using the standard dividend-discount valuation methodology Mukherjee and Naka (1995) postulated that nominal risk-free interest rates would impact the discount rate by modifying short- and long-term government bond prices. While interest rates change with cash flows from stocks. With the observation that cash flows from equities fluctuate with interest rates, Reilly and Brown (2000) introduced additional complexity. While it is unknown whether the changes in cash flows would increase or compensate for the changes in interest rates across the company, it is assumed that cash flows will vary as interest rates do. We hypothesize that interest rates are adversely linked to stock prices

Earlier studies such as (Fama & Schwert, 1977); and Chen, Roll, and Ross (1986) found that inflation and stock prices are adversely linked. Increasing inflation will result in economic activity that reduces the money supply, thereby boosting the nominal risk-free rate and the discount rate utilized in the valuation model. While an increase in cash flows often accompanies inflation—cash flows do not grow at the same rate as inflation—they do not compensate for the negative impacts of a higher discount rate on cash flows. (DeFina, 1991) supports these conclusions, revealing that nominal contracts that restrict quick income and cost adjustments prohibit profiting in a recession. Initially, the cash flows would be reduced if input costs increase quicker than the price of output, which increases inflation.

Tainer (1993) explains that there is a possibility that the index of industrial production is pro-cyclical. In other words, as the economy grows, it rises, and when it declines, it does so much more dramatically. The index of industrial production is often used as a proxy for actual economic activity, implying that an increase in industrial output corresponds to an increase in total economic activity. According to Geske and Roll (1983) and Fama (1990), industrial output will have a comparable beneficial impact on anticipated future cash flows as industrial output volume. The number of assets a company has is proportional to the economy's productive potential, and businesses may generate cash flow consequently. Findings based on an American stock portfolio studied by Chen, Roll, and Ross (1986) concluded that an industry's production ability to increase is a substantial contributing element to stock returns. Therefore, there is an expectation of a positive connection between stock prices and real-world economic growth (as measured by the industrial production index). Fama (1981) had shown a clear link between stock returns and industrial production growth rate.

2.2. Oil Prices and Macroeconomic Variables

Oil prices are essential for the macroeconomic behavior of a country. An oil price increase usually signals a general increase in price levels, affecting the interest rate of the future and, subsequently, all investments. The vector auto-regression method was utilized to demonstrate that both oil prices and price uncertainty are necessary for economic activity stimulation; it was verified that oil prices and price volatility are necessary for economic activity stimulation. While oil prices have a significant effect on economic activity, the converse is not valid. In other words, changes in economic activity do not affect the price of oil. Therefore, oil price changes have a significant impact on stock return swings. Furthermore, violent oil price shocks reduce real stock returns; nevertheless, actual stock return shocks have a favorable effect on interest rates and industrial output (Sadorsky, 1999).

Moreover, during the 1970s, massive volatility in oil prices and weak macroeconomic activity primarily affected global economies, particularly the US economy. As a result, it became critical to thoroughly examine the connection between macroeconomic indicators and oil prices (Mehrara & Mohaghegh, 2011). Hamilton (1983) and early academics who studied the connection between oil price shocks and macroeconomic factors claimed that positive oil price shocks were responsible for about 88 percent of the economic slump in the United States after World War II.

Studies indicate or show that there has been a rise in inflation, causing a lower level of industrial production owing to price shocks related to the cost of oil. While it has been argued that monetary policy in the hands of the Federal Reserve is a significant driver of economic performance, other researchers have argued or provided empirical evidence that there is no link between oil price shocks and macroeconomic performance (Dotsey & Reid, 1992; (Bernanke et al., 1997) in studies published in 2012 by Mehrara and Mohaghegh.

Regardless, other researchers such as Hickman et al. (1987) have argued that an energy-intensive country (be it an importer or net-importer) is faced with a trade shift as they import oil from the oil producer country. This shift in terms of trade affects the other macroeconomic variables. Thus, the larger the country depends on energy, the more significant the trade and the economy's shift, which takes its toll on macroeconomic indicators.

For instance, interest rate increases reduce the present value of future dividend payouts, which weakens stock prices; conversely, low-interest rates result in reduced borrowing opportunity costs, encouraging investment and market-induced economic activity. As a result, a negative causation coefficient is often anticipated between interest rates and stock prices (Andrieș, Ihnatov, & Tiwari, 2014). Vardar and Tunc (2011) found that the stock market and interest rate are negatively related in their study.

Soar in the price of oil influences capital expenditure, consumption and employment negatively. As mentioned earlier, Changes in oil prices cause households and firms to alter their consumption and investment behaviors. For individuals, an increase in oil price reduces the disposable income as fuel price also increases. This increase in fuel prices lowers the ability of individuals to consume more. If individuals think that the price increase will continue in the future, they cut down present expenses; thus, they consume less now and save for the future. Turning to firms as a vital resource as oil is to them, an increase in oil price induces a rise in production cost. Depending on the output's elasticity, an additional cost is passed onto consumers in the form of higher prices. However, suppose firms are unable to pass the extra cost to consumers. In that case, they may resort to restructuring the production process, such as introducing a different way of production or being forced to decrease their workforce, causing unemployment.

Additionally, higher oil prices decrease the returns for heavily oil-dependent firms. As a result, these firms may not have an option other than to reduce their investment (Lescaroux & Mignon, 2008, p. 348). Gounder and Bartleet (2007, p. 20) investigated the connection between changes in oil prices and economic growth using error variance decomposition and generalized impulse response models. The study discovered that although changes in oil prices are directly linked to economic growth, exchange rates and inflation rates are indirectly related to oil price shocks.

2.3. Oil Prices and Economic Growth

Without discounting oil's impact on economic growth, its significance for development cannot be overstated. This explains why nations strive to accumulate sufficient reserves to maintain or expand industrial and economic activity. Mork (1989) established a linear connection between oil prices and economic growth using empirical data. He asserts that the decline in oil price in the mid-1980s had a ripple effect, extending to the worldwide price of oil. Mehrara and Mohaghegh (2011) demonstrated that price shocks result in significant increases in the gross domestic product and money supply for oil-exporting countries using a panel VAR technique.

An increase in the money supply would inadvertently generate more investment as the interest rate is lowered, thereby bringing more money into consumers' pockets, consequently stimulating spending. As consumer spending increases, industries (or businesses) respond by increasing raw materials orders, thereby increasing production. This situation is not expected to increase inflation as the fundamentals driving the money supply are not happening out of thin air. Mehrara and Mohaghegh (2011) have empirically found that "oil shocks are not necessarily inflationary."

Most research on oil price shocks and economic development has focused on oil price fluctuations on macroeconomic variables in oil-importing industrial countries (Hamilton 1983, 1996; Pindyck & Rotemberg 1983; Bernanke et al. 1997, 2004; Devlin & Lewin 2004; Cologoni & Manera, 2007). As important as the oil commodity is, there is a demand for it most of the time. They are thereby making oil to be a good source of income for net oil-exporting countries. The governments of these countries make a budget and plan based on this revenue source. The public expenditure rises as the price of oil increases. However, because the oil price is highly volatile, reducing public expenditure is not proportional to the public sector's substantial public deficits when oil prices decline. If the country is oil revenue dependent, then this public deficit leads to increased public debt. However, some oil-exporting countries have started to establish institutions to manage oil funds. Norway pioneered it, and then other countries such as Indonesia, Kuwait, and others are gradually following Norway's example (Mehrara & Mohaghegh, 2011).

2.4. Oil Prices and Exchange Rate

The apparent connection between oil prices and currency values varies throughout time and between datasets (Lizardo & Mollick, 2010; Basher et al., 2012; Miller & Ratti, 2009; Narayan et al., 2008). Lizardo & Mollick (2010) have shown that rising oil prices almost always lead to a depreciation of the US dollar against the currencies of oil-producing countries. However, oil-dependent countries have seen their currencies depreciate against the US dollar. As for oil-neutral countries, the currencies gain value against the USD when oil prices are increased, confirming a nexus and transfer of information between the world's currency market and oil prices. Using daily data on the Fijian economy, Narayan et al. (2008) discovered that the Fijian currency increases in value versus the US dollar when oil prices climb.

Current research shows that real oil prices and currency exchange rates are interrelated, and this relationship can be investigated further. The researchers looked at monthly panel data for the G7 countries from January 1972 to October 2005. The authors found a negative relationship between actual exchange rates and oil prices. In this case, assertiveness can imply that this source of information moves the latter. Amano and Norden (1998), and Chaudhuri and Daniel (1998), established the accuracy of the findings.

Amano and Norden (1998) discovered a significant connection between oil prices and exchange rates using data from three advanced economies (Japan, Germany, and the United States). Amano and Norden assert that oil prices are not a proxy for other macroeconomic factors influencing long-term exchange rates. In contrast, other macroeconomic variables, such as oil prices or currency values, can impact oil prices and exchange rates. While this is possible, oil prices seem to have an impact on exchange rates. In contrast, alternative theories are not supported by evidence.

2.5. Oil Prices and Stock Market

A fluctuation in the price of oil may influence a number of equities. Material costs go up as the price of oil goes up, which increases the cost of completed products (consumption). An increased price of the finished product leads to a decrease in the demand *ceteris paribus*. The decrease in demand translates to decreased revenue (profit) if the good in question has an elastic demand. It could be because most goods have relatively elastic demand, leading to a decrease in profit and consequently the dividends. Also, as the price of oil rises, the price of everything else goes up. To counteract this, the Central Bank may reduce the interest rate subtracted from the stock prices to compute their value (Basher et al. 2012).

When there is an oil price change, the stock market reacts negatively (Al-Rjoub, 2005). While six Organisation for Economic Co-operation and Development (OECD) countries' stock markets are studied throughout two time periods: 1971 to 1980 and February 1988 to September 1999, evidence from these markets suggests that stock market indices and crude oil prices respond differently. In times of high oil prices, stock indices (such as the Dow Jones Industrial Average, DJIA) will decline (Miller & Ratti, 2009, p. 560).

It can be observed from the above that the results of studies on the relationship between oil prices and stock markets have been mixed. A healthy and booming economy could drive demand for oil up and stock prices to go up. This is against conventional wisdom. Higher oil prices can be associated with a booming economy (where corporations expect their earnings to rise), leading to a performance in stock prices. Miller and Ratti (2009, p. 567), using Vector Error Correction (VEC) model, found that global crude oil prices and stock markets were negatively related. Their research, which spans 1971 to 2008, showed that stock market benchmarks react adversely to rises in oil prices in the long term, which is consistent with Al-Rjoub's (2005) findings. Shocks in the oil markets immediately had a negative effect on the US stock market. Pescatori (2008) used data spanning ten years beginning in 1998 from the S&P 500. He found that both oil prices and the index have mostly moved upward. They sometimes rise and fall together during the period, albeit with frequent movement in the opposite direction. He concluded that the relationship appears to be weak.

The economy under which the study takes place may indicate a positive or negative relationship. For instance, Pescatori (2008) conducted a study for the United States. Basher et al. (2012, p. 237), using Structural Vector Autoregressive (SVAR) data from 1998 - 2008, concluded that oil prices show a positive response to positive shock in emerging markets. They showed that stock prices drop when there is a price increase in oil. This study concludes that developing market stock values are vulnerable to oil price shocks.

CHAPTER III

DATA AND METHODOLOGY

3.1. Definitions and Properties of Data

This study utilized a long series of monthly panel data to conduct this analysis, starting from January 2010 and running through March 2021. The data used for the local stock market, global West Texas Intermediate (WTI) crude oil price, and currency exchange rates come from www.investing.com. Data on inflation is collected from the Thompson Reuters database, and the industrial production index is collected from the OECD database. The inflation and industrial productions index are all 2010 based. All the data are converted to their monthly percentage changes using the formula:

$$Percentage\ Value = (\frac{new - old}{old} * 100\%) \ldots\ldots (0.1)$$

That is the current month's value divided by the prior month's value, multiplied by 100.

The nations studied in this research are categorized by Standard & Poor's as emerging economies and recognized by the World Bank. The countries that make up the list include Brazil, Chile, Czech Republic, Greece, Hungary, India, Indonesia, Malaysia, Mexico, Peru, Philippines, Poland, Russia, Thailand and Turkey. The research initially included many countries such as Saudi Arabia, Egypt, Iran, South Africa, South Korea, China and others. However, due to data unavailability, those countries were excluded. The countries are further grouped into two. Net oil exporters and net oil importers; Brazil, Czech Republic, Indonesia, Malaysia, Mexico, Peru, Poland, Russia and Thailand, are the net oil exporters. While Chile, Greece, Hungary, India, the Philippines, and Turkey form the list of net oil importers countries. The primary stock market indexes of each country are selected for the study.

Table 3.1. List of Countries and Their Primary Stock Market Index

No.	Name of Country	Primary Stock Market Index
1	Brazil	Bovespa (BVSP)
2	Chile	S&P CLX IPSA
3	Czech Republic	PX (PX)
4	Hungary	Budapest SE (BUX)
5	India	BSE Sensex 30 (BSESN)
6	Indonesia	Jakarta
7	Malaysia	FTSE Malaysia KLCI (KLSE)
8	Mexico	S&P
9	Pakistan	Karachi 100 (KSE)
10	Peru	S&P Lima General (SPBLPGPT)
11	Philippines	PSEi Composite (PSI)
12	Poland	WIG20 (WIG20)
13	Russia	MOEX Russia (IMOEX)
14	Thailand	SET Index (SETI)
15	Turkey	BIST 100 (XU100)

Source: www.investing.com , 2021

Oil prices are quoted in USD per barrel using the West Texas Intermediate crude oil (WTI) spot market price. Throughout the study, WTI crude oil was considered the benchmark in the global oil market. An exchange rate weighted index is used to calculate exchange rates. The exchange rate of all countries is how much local currency makes1 US dollar. The Industrial Production Index (IPI) is a macroeconomic indicator that shows the actual production of all factories in the country. The index is updated monthly to highlight near-term changes in industrial production. It tracks changes in production and identifies structural changes in the economy. The monthly rise in the production index is a key indicator of sector growth.[1]

[1] 2021
Board of Governors of the Federal Reserve System (US), Industrial Production: Total Index [INDPRO], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/INDPRO, August 10, 2021.

Table 3.2 Variables and Databases Sources

No.	Variable Name	Unit	Frequency	Data Source
1	Stock market indices	Local currency	Monthly	Investing.com
2	Oil prices	USD per barrel	Monthly	Investing.com
3	Exchange rate	Local currency by USD	Monthly	Investing.com
4	Industrial Production Index	2010 base year	Monthly	OECD database2
5	Consumer production index	2010 base year	Monthly	Federal Reserve of St. Louis website
6	Interest rate	Percentage	Monthly	Thompson Reuters

3.2. Variables used in the analysis

The variables used in the study are described in the table 3.3 below.

Table 3.3 Variable Types and Description

No	Type	Name	Description
1	Dependent	Stock market index	Closing prices of the leading local stock market index
2	Independent	Oil prices	Global WTI oil prices
3	Independent	Exchange rate	Nominal exchange rate denoted by (local currency /USD)
4	Independent	Industrial Production Index	The industrial production index is a proxy for economic growth
5	Independent	Consumer price index	Consumer price index as a measure of inflation.
6	Independent	Interest rate	The central bank's policy rate

Source: Authors table, 2021

[2] https://stats.oecd.org/viewhtml.aspx?datasetcode=MEI_REAL&lang=en#

3.3. Model

$$SMI_{it} = \beta_0 + \beta_1 OIL_{it} + \beta_2 IPI_{it} + \beta_3 CPI_{it} + \beta_4 INTR_{it} + \beta_5 EXC_{it} + \varepsilon_{it} \dots (0.2)$$

where:

SMI is local stock market index

OIL is WTI global oil prices

IPI is industrial production index

CPI is the consumer production index

INTR is interest rates

EXC is nominal exchange rate.

$$\Delta SMI_{it} = \beta_0 + \beta_1 \Delta OIL_{it} + \beta_2 \Delta IPI_{it} + \beta_3 \Delta CPI_{it} + \beta_4 \Delta INTR_{it} + \beta_5 \Delta EXC_{it} + \varepsilon_{it} \dots (0.3)$$

where ΔSMI is monthly percentage changes in local stock market index

ΔOIL is a monthly percentage change in global oil prices

ΔIPI is monthly percentage change Industrial production index

ΔCPI is monthly percentage changes in the Consumer production index

ΔINTR is monthly percentage changes in interest rate

ΔEXC is monthly percentage changes in the nominal exchange rate.

3.4. Panel Unit Root

The first issue to check before conducting any analysis regarding the data is to check for stationary. For proper interpretation of conclusions, the data for the analysis must be stationary. The data should be stationary since non-stationary data often results in erroneous findings (Enders, 2008).

In this study, the power of unit root and co-integration tests is enhanced by estimating them using non-stationary panel techniques and data from multiple countries. It also helps in differencing the different statistical features of the various categories of countries. One of the essential steps to check is that the variables are stationary before using this technic. If there is no presence of unit root, then we can proceed with panel VAR analysis to confirm stationarity. The study uses the panel unit root test and Levin, Lin, and Chu (2002) and Im, Pesaran, and Shin (2003). In the IPS test, there is no way to detect unit-roots individually under the alternative hypothesis. Under the null hypothesis, they assume a common unit root for all the instruments.

3.5. Cointegration Test

The Pedroni panel cointegration is an advanced cointegration test that replaces the traditional cointegration test (Shahbaz et al., 2015) and the Engle Granger-based technique which also assumes the first-differentiated stationarity of the variables involved, namely I(1). This test is based on the equation:

$$Xi\,t \;=\; \alpha i \;+\; \delta i\,t \;+\; \beta 1i\,x1i,t \;+\; \beta 2i\,x2i,t + \ldots + \beta Mi\,ZMi,t \;+\; ui,t \ldots \;(0.4)$$

The intercept and slope values, i.e., αi and βMi respectively, vary across the panel cross-sectional levels. Variables X and Z assume first-differentiated stationary as a prerequisite for their estimation. This technique distributes seven test statistics, grouped under panel statistics and group statistics. They assume the null hypothesis without cointegration, namely: $P_1 = 1\ V_i$. P_i serves as an estimate of the residual coefficient. The first alternative hypothesis is the panel statistic which states that it has homogeneous properties, namely H_1: $P1 = P < 1\, V_{1.}$ The name of the second alternative hypothesis is the grouped statistical test (interdimensional), which is based on the heterogeneous nature of P_i, namely H_1: $P < 1\, Vi$

3.6. Econometric model - Panel Regression Model Analysis

A panel regression analysis is conducted to estimate the regression model because more than one country is in the study, each with monthly data from January 2010 to March 2021. This study considers the fixed and random effect models. An underlying assumption of panel data regression helped choose which model (fixed or random) is appropriate for estimating the model. STATA 15(statistical software) is used to carry out the panel regression analysis.

3.7. The Panel Regression Model: Fixed versus Random Effects

3.7.1. Random Effect Model

The random effects model, which is sometimes referred to as the error components model, is an alternative to the fixed effects model. As with fixed effects, the random effects method provides specific intercept terms for each entity, which are expected to be constant across time. The connections between the explanatory and explained variables are the same cross-sectionally and temporally. (Brooks, 2008)

The general equation for the random Effect Model is given below

$$y_{it} = \alpha + \boldsymbol{\beta x_{it}} + u_{it} + \varepsilon_{it} \ldots. (0.5)$$

where,

α (i=1…. n) represent the unknown intercept for each entity (n entity-specific intercepts).

– y_{it} stands for the regressand where i = entity and t = time.

– $\boldsymbol{x_{it}}$ represents one regressor,

– β is the coefficient for that regressors,,

– u_{it} represent the between-entity error

ε_{it} represents the within-entity error

(Torres-Reyna, December 2007)

3.7.2. Fixed Effect Model

$$y_{it} = \alpha_i + \beta 1 x_{it} + \mathrm{u}_{it} \ldots. (0.6)$$

where,

αi (i=1…. n) is the unknown intercept for each entity (n entity-specific intercepts).

– y_{it} represents the regressand where i = entity and t = time.

– x_{it} represents one regressor,

– β1 is the coefficient for that regressors,

– u_{it} is the error term

(Brooks, 2008)

3.7.3. Hausman Test

The Hausman test is a general test procedure used to test the random and fixed-effect model assumptions validity. Thus, the Hausman test examines the following hypotheses:

H_0: $cov(\alpha_i , X_{it}) \; = \;$ 0; thus, the RE model is appropriate

H_1: $cov(\alpha_i , X_{it}) \; \neq \;$ 0; thus, the FE model is appropriate

In the statistical software STATA, the above hypotheses are retained or rejected by paying attention to the "Prob>chi2" value from the Hausman test. Suppose this value is insignificant (i.e., greater than 1%, 5% or 10%). In that case, the fixed effects (FE) model is rejected in favor of the random effects (RE) model. On the other hand, if the Hausman p-value is less than any conventional significance levels: 1%, 5%, or 10%, it implies that the FE model is appropriate. However, where the Hausman test fails to suggest an appropriate model, the FE model is preferred to the RE model.

The following section presents the empirical results of the study.

CHAPTER IV

RESULTS & DISCUSSION

4.1. Introduction

This section starts by giving the general description of the data set in the descriptive statistics. Then the dataset is prepared for analysis by testing for unit root test, cointegration and correlation. After the dataset is ready for analysis, the panel regression results are presented. The later part of this section presents the results of PVAR.

4.2. Descriptive Statistics

The following descriptive statistics summarize the nature of the research variables used in this study. Since there are differences in units of measurement in the variables, it is better to take the monthly percentage changes in the variables before the descriptive statistics.

Table 4.1 Descriptive Statistics for oil importers

Variables	Obs	Mean (%)	Std. Dev.	Min	Max	Skew.	Kurt.
Δsmi	810	10.514	54.477	-95.927	321.785	2.09	9.74
Δoil	810	13.065	58.803	-83.159	260.57	1.336	5.106
Δipi	810	1.259	14.958	-53.925	85.005	1.038	7.364
Δexc	810	5.581	39.681	-90.99	317.216	3.659	23.109
Δcpi	810	2.493	23.271	-59.522	144.692	1.504	8.702
Δintr	810	19.63	94.936	-92.786	750	4.174	26.346

Source: Authors analysis using STATA 15, 2021

Table 4.2 Descriptive Statistics for oil exporters

Variables	Obs	Mean (%)	Std. Dev.	Min	Max	Skew.	Kurt.
Δsmi	1214	2.888	27.164	-90.313	163.546	1.25	7.359
Δoil	1214	13.008	58.337	-81.693	262.368	1.224	4.628
Δipi	1214	0.708	12.946	-47.057	69.316	0.643	6.181
Δexc	1214	3.795	31.539	-99.976	366.659	2.439	20.669
Δcpi	1214	1.127	15.801	-45.821	76.649	0.984	6.546
Δintr	1214	11.909	95.27	-324.32	800	4.19	31.491

Source: Authors analysis using STATA 15, 2021

The monthly mean returns of the local stock market indexes for oil-importing countries is 10.51%, while it is only 2.89% for oil exporting countries. The standard deviation for stock market returns for oil exporters is 54.45% which is almost twice that of the import-dominated countries. The average monthly percentage changes in oil prices are almost the same for the 2 groups of countries, that is 13% and standard deviation of 58%. The monthly percentage changes in the industrial production index (economic growth) are about 1.26% on average and its dispersion from the mean is almost 15% for oil importing countries. The average monthly change in economic growth for oil exporting countries is 0.71% and a standard deviation of 12.95%.

4.3. Preliminary test

After the general description of the dataset, the data is now prepared for analysis by testing for heteroskedasticity.

4.3.1. Heteroskedasticity Test

White test

White's test for Ho: homoskedasticity

against Ha: unrestricted heteroskedasticity

chi2(20) = 357.30

Prob > chi2 = 0.0000

Cameron & Trivedi's decomposition of IM-test

Table 4.3 White test

Source	chi2	df	p
Heteroskedasticity	357.300	20	0.000
Skewness	92.820	5	0.000
Kurtosis	-1.04e+05	1	1.000
Total	-1.03e+05	26	1.000

The results of the white test shows that we fail to reject the null hypothesis, meaning the variables have a constant variances.

4.3.2. Pairwise Correlations

Table 4.4 Pairwise Correlations for Oil-Exporting Countries

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) Δsmi	1.000					
(2) Δoil	-0.031	1.000				
	(0.277)					
(3) Δipi	0.328*	-0.180*	1.000			
	(0.000)	(0.000)				
(4) Δexc	0.341*	-0.521*	0.282*	1.000		
	(0.000)	(0.000)	(0.000)			
(5) Δcpi	0.521*	-0.433*	0.399*	0.820*	1.000	
	(0.000)	(0.000)	(0.000)	(0.000)		
(6) Δintr	-0.027	0.066*	-0.117*	0.016	-0.016	1.000
	(0.353)	(0.022)	(0.000)	(0.576)	(0.585)	
*** p<0.01, ** p<0.05, * p<0.1						

Table 0.5 provides an explanation of Pairwise correlations for oil-exporting countries. There is a positive and significant low correlation between Industrial production index and stock market index; Exchange rate and stock market index; Exchange rate and Industrial production index; Interest rate and oil prices: and Consumer price index and

industrial production index. Correlation between Consumer price index and stock market index; and Exchange rate and consumer price index are also positive and significant but the former has a moderate correlation while the latter has higher correlation. However, the correlation between Exchange rate and consumer price index is high. There is a low negative correlation between Industrial production index and oil prices; and Interest rate and Industrial production index while Exchange rate and oil prices are moderately negatively correlated. The negative correlation between the following (Consumer price index and oil prices; Interest rate and Exchange rate; Oil prices and stock market index; Interest rate and stock market index and the Interest rate and consumer price index) are all statistically significant. The following correlations (Consumer price index and oil prices, Interest rate and Exchange rate, Oil prices and stock market index, Interest rate and stock market index, Interest rate and consumer price index) are statistically insignificant.

Table 4.6 Pairwise Correlations for Oil-Importing Countries

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
(1) Δsmi	1.000					
(2) Δoil	-0.368*	1.000				
	(0.000)					
(3) Δipi	0.503*	-0.301*	1.000			
	(0.000)	(0.000)				
(4) Δexc	0.354*	-0.323*	0.610*	1.000		
	(0.000)	(0.000)	(0.000)			
(5) Δcpi	0.661*	-0.407*	0.715*	0.801*	1.000	
	(0.000)	(0.000)	(0.000)	(0.000)		
(6) Δintr	-0.168*	0.246*	-0.163*	0.097*	0.017	1.000
	(0.000)	(0.000)	(0.000)	(0.005)	(0.629)	
*** p<0.01, ** p<0.05, * p<0.1						

According to the table 4-6 above, there exist a high positive correlation between changes in Consumer price index and changes in industrial production index, Exchange rate and consumer price index for oil importing countries. However, the corrections between Industrial production index and stock market index, Interest rate and oil prices, Exchange rate and industrial production index are low and positive The following correlations are negative(Industrial production index and oil prices, Exchange rate and oil prices, Interest rate and Industrial production index, Consumer price index and stock market index, Consumer price index and oil prices, Oil prices and stock market index, and Interest rate and stock market index). The corrections between Interest rate and consumer price index is insignificant.

4.3.3. Panel Unit Root Test

According to Levin-Lin-Chu's unit root test, the null hypothesis is that the Panel has a unit root, while the alternative hypothesis is that the Panel is stationary. There are 15 panels in each period. There are 15 panels in each period. The cross-sectional means have been removed and not been taken into consideration.

Table 4.7 Levin-Lin-Chu Unit-Root Test

	level			
	trend		No constant	
	t-statistics	p-value	t-statistics	p-value
Stock Market index	-20.9353	0.0000	-2.7125	0.0033
Oil price	-23.805	0.0000	-6.4355	0.0000
Industrial Production Index	-20.0946	0.0000	-1.0387	0.1495
Exchange Rate	-21.9354	0.0000	-1.5787	0.0572
Consumer Price Index	-27.7185	0.0000	-1.3222	0.0931
Interest rate	-18.7981	0.0000	-4.5361	0.0000

Levin-Lin-Chu unit-root test

	1st difference			
	trend		No constant	
	t-statistics	p-value	t-statistics	p-value
Stock Market index	-52.9127	0.000	-52.0809	0.0000
Oil price	-54.074	0.000	-53.5567	0.0000
Industrial Production Index	-51.7187	0.000	-51.1966	0.0000
Exchange Rate	-54.8343	0.000	-53.3995	0.0000
Consumer Price Index	-57.4282	0.000	-55.5584	0.0000
Interest rate	-53.2357	0.000	-52.7417	0.0000

Table 4.8 Stationarity test

Augmented Dickey-Fuller t	Pedroni test	Kao test
Statistic	-69.2998	-36.7199
p-value	0.0000	0.0000

According to the results of the Dickey-Fuller augmented t-statistics, which include both tests (Pedroni and Kao), the variables have an almost static mean at the first difference. Based on the above analysis, we conclude that the null hypothesis that Panels have unit-roots is incorrect.

Table 4.9 Panel Unit-root test

Variable	Levin-Lin-Chu unit-root test		Im-Pesaran-Shin unit-root test	
	t- Statistic	p-value	t- bar	p-value
ΔStock market indexes	-16.5598	0.0000	-9.375	0.000
ΔOil prices	-20.3036	0.0000	-9.964	0.000
ΔExchange rate	-18.0001	0.0000	-8.953	0.000
ΔInterest rate	-14.7609	0.0000	-8.480	0.000
ΔIndustrial production index	-15.4354	0.0000	-8.619	0.000
ΔConsumer price index	-24.4721	0.0000	-10.944	0.000

4.3.4. Cointegration results

After testing the stationary quality of the variables, this study examines the long-term relationship nature of the series by using the Perron panel cointegration test (Table 4.2). The analysis rejects the null hypothesis of non-cointegration for the within and between dimensions, suggesting that stock market returns (equity returns), oil prices, and exchange rates have a long-term relationship. As shown in although the study variable characteristics contain specific measurements of the unit root, this study embodies the co-movement and convergence to long-term equilibrium.

Table 4.10 Panel Cointegration Results

All panel	statistics	probability
Phillips-Perron	-69.1595	0.000
Augmented Dickey-Fuller	-73.141	0.000
Panel specific		
Phillips-Perron	-103.143	0.0000
Augmented Dickey-Fuller	-74.0352	0.0000

4.4. Panel Regression Results

The result of the panel regression model is as presented in Table3.11 below.

Table 4.11 Regression Output showing Fixed and Random Effects of Oil-Importing and Oil-Exporting Countries

	Oil Exporters		Oil Importers	
	(Random effect)	(Fixed Effect)	(Random Effect)	(Fixed Effect)
	Δsmi	Δsmi	Δsmi	Δsmi
Δoil	0.0994***	0.0987***	-0.0769**	-0.0710**
	(7.76)	(7.67)	(-3.07)	(-2.91)
Δipi	0.285***	0.287***	0.210	0.190
	(5.27)	(5.31)	(1.63)	(1.51)
Δexc	-0.115**	-0.118**	-0.647***	-0.618***
	(-3.09)	(-3.10)	(-11.67)	(-11.31)
Δcpi	1.149***	1.149***	2.260***	2.241***
	(15.61)	(15.55)	(20.76)	(21.16)
Δintr	-0.00345	-0.00297	-0.0624***	-0.0721***
	(-0.51)	(-0.44)	(-4.20)	(-4.80)
cons	0.578	0.587	10.46***	10.48***
	(0.85)	(0.87)	(7.66)	(7.93)
N	1214	1214	810	810

t statistics in parentheses

* p < 0.05, ** p < 0.01, *** p < 0.001

The analysis is again done covering the whole period of study (January 2010 - March 2021). The countries are grouped into two depending on whether they are net oil exporters or importers. The results become more accurate just as for the period before the covid -19.

For oil-exporting countries, the random effects and fixed effects are very close. A 1% increase in the oil price leads to 0.0994 (RE) and 0.0987 (FE) monthly percentage increase in the stock price. These values are significant 1 percent level.
A monthly percentage increase in industrial production leads to 0.285(RE) and 0.287(FE) percentage change stock market. Also, a monthly percentage change in the consumer price index causes a corresponding increase of 1.149 percent in the stock market for both RE and FE. In addition, the stock market index decreases by 0.00345 (RE) and 0.00297 (FE) when the interest rate increases by 1 percent monthly. These coefficients are statistically insignificant. The results also show that if the nominal exchange rate increases by 1 percent, the stock market index decreases by 0.115 (RE) or 0.118 (FE) percent, and these values are statistically significant at 90 percent confidence intervals. Both models, the fixed effect and random effects, have been used to explain the results. However, the Hausman specification test below indicates that the random effect model is the most appropriate for data.

Also, for oil-importing countries, the results of the random effects and fixed effects are very similar. While the result of the random effect shows that the monthly percentage change in oil price leads to a 0.0769 percent decrease in stock market index returns, the result of the fixed effect shows that the decrease is 0.0710 percent. Both coefficients are statistically significant at 1 percent level. A monthly percentage increase in the industrial production index leads to 0.210 and 0.190 percent change in stock market index for RE and FE, respectively. The coefficient of the industrial production index is statistically insignificant. Just as in the oil exporting countries, an increase in the exchange rate decreases the stock market index for both RE and FE (0.647 and 0.618, respectively). A monthly 1 percentage increase in the consumer prices index causes the stock market index to change by 2.260 percent for the random effect and 2.241 percent for the fixed effect. The results also show a negative relationship between monthly percentage changes in interest rate and stock market index. All the above coefficients are statistically significant except for the industrial production index. The fixed-effect model, as indicated by the Hausman specification test is most appropriate for the data.

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
c_oil	.0987186	.0993975	-.000679	.001356
c_ipi	.2873595	.2850305	.002329	.0033018
c_exc	-.117586	-.115466	-.00212	.0062742
c_cpi	1.148904	1.149247	-.0003423	.0057969
c_intr	-.0029696	-.0034456	.0004759	.0008373

```
                   b = consistent under Ho and Ha; obtained from xtreg
    B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test:  Ho:  difference in coefficients not systematic

             chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                     =        0.80
           Prob>chi2 =      0.9773
```

Figure 4.1 Hausman Test: Oil Exporting Countries

```
. hausman fixed random
```

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
c_oil	-.071007	-.076941	.005934	.
c_ipi	.1895804	.2097557	-.0201753	.
c_exc	-.617758	-.6469883	.0292303	.
c_cpi	2.240768	2.259731	-.0189631	.
c_intr	-.0721128	-.0624151	-.0096977	.0021717

```
                   b = consistent under Ho and Ha; obtained from xtreg
    B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test:  Ho:  difference in coefficients not systematic

             chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                     =       14.32
           Prob>chi2 =      0.0137
           (V_b-V_B is not positive definite)
```

Figure 4.2 Hausman Test: Oil Importing Countries

4.5. Robustness Check

For robustness testing, the study conducts Variance Inflation Factor (VIF), optimal lag selection, Eigenvalue Stability Condition, Wald Test, impulse response function and variance decomposition analysis for the expected data.

4.5.1 Variance Inflation Factor

Multicollinearity in regression analysis can be detected using a variance inflation factor (VIF). Multicollinearity occurs when independent variables (i.e. predictors) in a model have a strong correlation with one another; this can have a negative impact on the regression results (Stephanie, 2020). It calculates the inflated variance of a regression coefficient due to multicollinearity in the model, and the VIF estimates this inflated variance.

The results of the variance inflation factor is depicted in Table 4.12. The results shows that there is no presence multicollinearity as the mean VIF les less than 10

Table 4.12 Variance inflation factor

	VIF	**1/VIF**
Δinf	3.420	0.292
Δexc	3.010	0.333
Δipi	1.510	0.664
Δoil	1.280	0.780
Δintr	1.070	0.937
Mean VIF	2.060	.

4.5.2 Lag Selection

Table 4.13 Optimal lag selection

lag	**CD**	**J**	**p-value**	**MBIC**	**MAIC**	**MQIC**
1	0.766	153.389	0.003	-664.718	-62.611	-283.981
2	0.786	82.012	0.197	-463.393	-61.988	-209.568
3	0.553	32.782	0.622	-239.921	-39.218	-113.008

In the PVAR, the determination of optimum lag duration is essential. However, if the lag periods involved are many, the degrees of freedom are squandered (Hsiao, 1981).

An optimal lag of 1 is selected based on MBIC because the fundamental process involves picking models with the lowest values.

4.5.3 Eigenvalue stability condition

The eigenvalue values are presented in Table 4.14 below.

Table 4.14 Eigenvalue Stability Condition

Real	Imaginary	Modulus
-0.478	0	0.478
-0.438	0.029	0.439
-0.438	-0.029	0.439
-0.393	0	0.393
-0.161	0	0.161
-0.107	0	0.107

The unit circle encompasses the whole set of eigenvalues. The stability requirement is met by the variable 'pVAR.' When all of the lags (other than the dependent variable) of all endogenous variables, save the first, are equal to zero, the ALL test is employed.

4.5.4 Granger Causality Wald Test

Figure 4.3 includes PVAR Granger Causality Wald test results. The null hypothesis for this test is no Granger-causal relationship between variables used in the analysis.

The null hypothesis that all the independent variable does not Granger-cause the dependent variable is rejected with 90% confidence. Thus, the independent variables are “helpful” for forecasting the dependent variable, if when added to the forecast model, it reduces the forecasting error. However. Changes in the industrial production index and changes in interest rate are not helpful in predictions of changes in stock markets. The analysis shows that the granger causality holds between changes in the stock market index after rejecting the null hypothesis (changes in global oil price, inflation, and industrial output index) entirely in a combined test with a 99 percent confidence interval.

Equation \ Excluded		chi2	df	Prob > chi2
c_smkt				
	c_oil	14.860	1	0.000
	c_ipi	0.152	1	0.696
	c_exc	4.021	1	0.045
	c_cpi	4.911	1	0.027
	c_intr	0.094	1	0.759
	ALL	25.357	5	0.000
c_oil				
	c_smkt	0.072	1	0.788
	c_ipi	1.942	1	0.163
	c_exc	0.893	1	0.345
	c_cpi	2.877	1	0.090
	c_intr	0.001	1	0.973
	ALL	6.252	5	0.283
c_ipi				
	c_smkt	0.219	1	0.640
	c_oil	5.682	1	0.017
	c_exc	0.010	1	0.919
	c_cpi	1.294	1	0.255
	c_intr	0.000	1	0.996
	ALL	14.976	5	0.010
c_exc				
	c_smkt	0.004	1	0.952
	c_oil	3.931	1	0.047
	c_ipi	0.164	1	0.686
	c_cpi	1.207	1	0.272
	c_intr	2.931	1	0.087
	ALL	8.704	5	0.121
c_cpi				
	c_smkt	0.089	1	0.765
	c_oil	3.381	1	0.066
	c_ipi	0.010	1	0.920
	c_exc	0.080	1	0.777
	c_intr	4.524	1	0.033
	ALL	6.643	5	0.249
c_intr				
	c_smkt	0.038	1	0.845
	c_oil	3.321	1	0.068
	c_ipi	0.002	1	0.966
	c_exc	0.294	1	0.588
	c_cpi	0.222	1	0.638
	ALL	5.202	5	0.392

Figure 4.3 Panel VAR-Granger causality Wald Test

4.5.5 Forecast-Error Variance Decomposition (FEVD)

From the table in (appendix), changes in stock market indexes, changes in oil prices and the changes in interest rates dominate the system in a way because their forecast errors are mainly due to their innovations; own innovations explain 99.2 percent of the stock market index forecast error variance at the first period and 98.9 percent at the end of the 10th month period considered in the variance decomposition.

As for oil prices, about 96% of the variation is attributed to own shock throughout the 10 months. It is interesting to note that changes in the stock market index cause 37.2%, changes in exchange rate cause 31.3%, while changes in the consumer price index cause only 14.3% of own shock. Changes in oil price (8.7%) and industrial production index (8.6%) causes the remaining. This scenario does not change even in the 10th month.

Among all the variables in the study oil prices greatly influence changes in exchange then change in stock market index. In Period 1 changes in oil prices account for 18.6% while changes in the stock markets index account for 13.5%. These even increase as time goes by to 17.8% and 14.1%, respectively. Changes in exchange rates account for 80% in period 1 but gradually decrease to 78.7% in period 10.

CHAPTER V

CONCLUSIONS

5.1. Results and Discussion

This study aims to assess the effect of global oil prices on local equity market indexes in emerging markets based on cross-country analysis. To achieve this, the study assesses the effect of changes in global oil prices on local stock market indexes in emerging markets; and the relationship between changes in world oil prices and macroeconomic variables (economic growth rate, exchange rate, interest rate and inflation rate). This study uses a panel regression model to perform fixed and random effects analysis to determine the best outcome for the model.

The results show that stock prices and changes in oil prices in oil-exporting countries are positively correlated. In other words, an increase in oil price will cause a corresponding increase in the share price. On the other hand, there is a negative relationship between oil prices and the stock market index of oil-importing countries. Although results in the literature have been mixed on the relationship between oil prices and the stock market, a rapidly growing and healthy economy can drive demand for oil and stock prices. In other words, in a booming economy, it is natural that corporations would expect their earnings to rise, thereby leading to stock market performance through the stock valuation channel. This position agrees with Pescatori (2008) who found that oil prices and stock index have mostly moved up within the period from 1998 to 2008 albeit some movement in the opposite direction.

Regarding the relationship between stock market and industrial production index, the results show a positive relationship for both oil-exporting and oil-importing countries. Through the output channel, an increase in oil price leads to an increase in revenues. This means a higher income which leads to higher disposable income. The increased disposable income will mean more money for investment. This higher investment will lead to higher profit, higher stock market prices, and higher companies' growth, leading to economic growth.

However, the positive relationship between stock market indexes and industrial production index is not statistically significant. This result is in line with the literature. Mehrara and Mohaghegh (2011) show that oil price shocks in oil-exporting countries significantly increase gross domestic product.

On inflation, the impact of stock prices and inflation is mixed. Mehrra and Mohaghegh (2011), among other researchers, argue that changes in oil prices are not inflationary, while others Hamilton (1983) argue otherwise. This study shows that the monthly percentage change in the price index on consumption increases the stock market index for both oil-exporting and importing countries. Oil, so the results show that changes in oil prices affect inflation, according to Hamilton (1983).

Stock markets and interest rates are negatively correlated for both oil-exporting and oil-importing countries. However, the relationship between the two variables for oil-exporting countries is not significant. The results showed that changes in interest rates accompanied the adverse reaction of the stock market index. This is following the research of Kasman, Vardar and Tunç (2011). An increase in interest rates reduces the present value of potential dividend payments, which weakens stock prices; instead, low interest rates translate into reduced opportunity costs of borrowing, encouraging market-driven investment and economic activity. As a result, a negative causality coefficient is often expected between interest rates and stock prices (Andrieș, Ihnatov & Tiwari, 2014).

Furthermore, the results show a negative relationship between the stock market and exchange rates. The results always depend on the type of country (importer-dominated or exporter-dominated). An increase in exchange rates (currency appreciation) in export-dominated countries causes price competitiveness in export markets to decline, lowering domestic stock prices. On the other hand, where the country is a net oil importer, an increase in the value of the local currency (appreciation) leads to a stronger currency relative to other currencies and a reduction in the cost of imported foreign inputs. Lower input costs lead to higher returns, hence higher earnings per share, hence higher share prices. In short, the exchange rate affects a firm's ability to compete by changing the price of funds and the amount of revenue. The results of this study follow Lizardo and Mollick (2010). They show that an increase in oil prices almost always causes the depreciation of the US dollar against the currencies of oil-producing countries.

5.2. Conclusion

The results show that world oil prices are negatively correlated with stock market indexes in oil-importing countries. On the other hand, research results show that world oil prices positively correlate with stock market indexes in oil-exporting countries. The results also reveal that interest rates, consumer price indices, exchange rates and industrial production indices affect emerging market equity markets for oil-exporting and oil-importing countries. The stock market price index moves in the opposite direction to interest rates and exchange rates in oil-exporting and oil-importing developing countries. The stock market price index moves in line with the industrial production index and the consumer price index.

This finding has political implications. As the findings in this paper show, equity markets in developing countries respond to changes in oil prices and economic fundamentals such as interest rates, inflation rates, exchange rates, and economic growth. The stock market index is often seen as a leading economic indicator. An unexpected shock in world oil prices could shatter expectations of economic growth in developing countries. Therefore, the central bank should use the necessary monetary policy tools to offset the consequences of oil price shocks.

5.3. Recommendation

This finding has political implications. As the findings in this paper show, equity markets in developing countries respond to changes in oil prices and changes in critical macroeconomic variables such as interest rates, inflation rates, exchange rates, and economic growth. The stock market is often seen as an important economic indicator. The rapid rise in global oil prices in developing countries could dampen expectations of more tremendous economic growth in the future. Therefore, the central bank needs to consider a monetary policy that offsets the consequences of oil price shocks.

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APPENDIXES

APPENDIX A

panel v: $T^2 N^{\frac{3}{2}} (\sum_{i=1}^{N} \sum_{t=1}^{T} \widehat{L}_{11i}^{-2} \widehat{e}_{i,t-1}^{2})^{-1}$

panel ρ: $T\sqrt{N} (\sum_{i=1}^{N} \sum_{t=1}^{T} \widehat{L}_{11i}^{-2} \widehat{e}_{i,t-1}^{2})^{-1} \sum_{i=1}^{N} \sum_{t=1}^{T} \widehat{L}_{11i}^{-2} (\widehat{e}_{i,t-1} \Delta \widehat{e}_{i,t} - \widehat{\lambda}_i)$

panel t: $(\widetilde{\sigma}_{N,T}^{2} \sum_{i=1}^{N} \sum_{t=1}^{T} \widehat{L}_{11i}^{-2} \widehat{e}_{i,t-1}^{2})^{-\frac{1}{2}} \sum_{i=1}^{N} \sum_{t=1}^{T} \widehat{L}_{11i}^{-2} (\widehat{e}_{i,t-1} \Delta \widehat{e}_{i,t} - \widehat{\lambda}_i)$

panel ADF: $(\widetilde{s}_{N,T}^{*2} \sum_{i=1}^{N} \sum_{t=1}^{T} \widehat{L}_{11i}^{-2} \widehat{e}_{i,t-1}^{*2})^{-\frac{1}{2}} \sum_{i=1}^{N} \sum_{t=1}^{T} \widehat{L}_{11i}^{-2} \widehat{e}_{i,t-1}^{*} \Delta \widehat{e}_{i,t}^{*}$

Figure A.1. Cointegration- Panel statistics

Source: Neal (2014)

group ρ: $T \frac{1}{\sqrt{N}} \sum_{i=1}^{N} (\sum_{t=1}^{T} \widehat{L}_{11i}^{-2} \widehat{e}_{i,t-1}^{2})^{-1} \sum_{t=1}^{T} (\widehat{e}_{i,t-1} \Delta \widehat{e}_{i,t} - \widehat{\lambda}_i)$

group t: $\frac{1}{\sqrt{N}} \sum_{i=1}^{N} (\widehat{\sigma}_i^{2} \sum_{t=1}^{T} \widehat{e}_{i,t-1}^{2})^{-\frac{1}{2}} \sum_{t=1}^{T} (\widehat{e}_{i,t-1} \Delta \widehat{e}_{i,t} - \widehat{\lambda}_i)$

group ADF: $\frac{1}{\sqrt{N}} \sum_{i=1}^{N} (\sum_{t=1}^{T} \widehat{s}_i^{*2} \widehat{e}_{i,t-1}^{*2})^{-\frac{1}{2}} \sum_{t=1}^{T} \widehat{e}_{i,t-1} \Delta \widehat{e}_{i,t}$

Figure A.2. Cointegration-Group statistics

Source: Neal (2014)

APPENDIX B

Forecast-Error Variance Decomposition (FEVD)

Table A2.1 Forecast-Error Variance Decomposition (FEVD)

Response variable and Forecast horizon	Impulse variable					
	c_smi	c_oil	c_ipi	c_exc	c_cpi	c_int
Changes in Stock market index						
0	0	0	0	0	0	0
1	1	0	0	0	0	0
2	0.992	0.006	0.000	0.000	0.002	0.000
3	0.989	0.008	0.000	0.000	0.003	0.000
4	0.988	0.009	0.000	0.000	0.003	0.000
5	0.988	0.009	0.000	0.000	0.003	0.000
6	0.988	0.009	0.000	0.000	0.003	0.000
7	0.988	0.009	0.000	0.000	0.003	0.000
8	0.988	0.009	0.000	0.000	0.003	0.000
9	0.988	0.009	0.000	0.000	0.003	0.000
10	0.988	0.009	0.000	0.000	0.003	0.000
Changes in oil prices						
0	0	0	0	0	0	0
1	0.033	0.967	0	0	0	0
2	0.036	0.962	0.000	0.000	0.002	0.000
3	0.037	0.960	0.000	0.001	0.002	0.000
4	0.037	0.960	0.000	0.001	0.003	0.000
5	0.037	0.960	0.000	0.001	0.003	0.000
6	0.037	0.960	0.000	0.001	0.003	0.000
7	0.037	0.960	0.000	0.001	0.003	0.000
8	0.037	0.960	0.000	0.001	0.003	0.000
9	0.037	0.960	0.000	0.001	0.003	0.000
10	0.037	0.960	0.000	0.001	0.003	0.000
Changes in industrial production index						
0	0	0	0	0	0	0
1	0.178	0.016	0.806	0	0	0
2	0.181	0.026	0.792	0.001	0.001	0.000
3	0.182	0.028	0.788	0.001	0.001	0.000
4	0.182	0.028	0.787	0.001	0.001	0.000
5	0.182	0.028	0.787	0.001	0.001	0.000
6	0.182	0.028	0.787	0.001	0.001	0.000
7	0.182	0.028	0.787	0.001	0.001	0.000
8	0.182	0.028	0.787	0.001	0.001	0.000
9	0.182	0.028	0.787	0.001	0.001	0.000
10	0.182	0.028	0.787	0.001	0.001	0.000

Changes in exchange rate						
0	0	0	0	0	0	0
1	0.135	0.168	0.083	0.614	0	0
2	0.140	0.177	0.083	0.599	0.001	0.000
3	0.141	0.178	0.083	0.597	0.001	0.001
4	0.141	0.178	0.083	0.596	0.001	0.001
5	0.141	0.178	0.083	0.596	0.001	0.001
6	0.141	0.178	0.083	0.596	0.001	0.001
7	0.141	0.178	0.083	0.596	0.001	0.001
8	0.141	0.178	0.083	0.596	0.001	0.001
9	0.141	0.178	0.083	0.596	0.001	0.001
10	0.141	0.178	0.083	0.596	0.001	0.001
Changes in consumer price index/ inflation						
0	0	0	0	0	0	0
1	0.372	0.087	0.086	0.313	0.143	0
2	0.372	0.094	0.084	0.307	0.142	0.001
3	0.372	0.096	0.084	0.306	0.142	0.001
4	0.372	0.096	0.084	0.306	0.142	0.001
5	0.372	0.096	0.084	0.306	0.142	0.001
6	0.372	0.096	0.084	0.306	0.142	0.001
7	0.372	0.096	0.084	0.306	0.142	0.001
8	0.372	0.096	0.084	0.306	0.142	0.001
9	0.372	0.096	0.084	0.306	0.142	0.001
10	0.372	0.096	0.084	0.306	0.142	0.001
Changes in interest rate						
0	0	0	0	0	0	0
1	0.010	0.012	0.005	0.034	0.001	0.938
2	0.011	0.016	0.005	0.035	0.002	0.931
3	0.011	0.016	0.005	0.036	0.002	0.930
4	0.011	0.016	0.005	0.036	0.002	0.930
5	0.011	0.016	0.005	0.036	0.002	0.930
6	0.011	0.016	0.005	0.036	0.002	0.930
7	0.011	0.016	0.005	0.036	0.002	0.930
8	0.011	0.016	0.005	0.036	0.002	0.930
9	0.011	0.016	0.005	0.036	0.002	0.930
10	0.011	0.016	0.005	0.036	0.002	0.930

Table A2.2 Panel Vector Autoregresssion

	Coef.	Std.Err.	z	P>z	95%Conf.	Interval]
Changes in stock market						
Changes in stock market index						
L1.	-0.262	0.042	-6.270	0.000	-0.344	-0.180
Changes in oil						
L1.	0.059	0.015	3.850	0.000	0.029	0.089
Changes in industrial production index						
L1.	0.023	0.059	0.390	0.696	-0.093	0.139
Changes in exchange rate						
L1.	0.109	0.054	2.010	0.045	0.002	0.215
Changes in cpi						
L1.	-0.254	0.115	-2.220	0.027	-0.479	-0.029
Changes in interest rate						
L1.	-0.002	0.007	-0.310	0.759	-0.016	0.012
Changes in oil						
Changes in stock market index						
L1.	-0.013	0.049	-0.270	0.788	-0.110	0.083
Changes in oil						
L1.	-0.298	0.025	-11.690	0.000	-0.348	-0.248
Changes in industrial production index						
L1.	-0.167	0.120	-1.390	0.163	-0.402	0.068
Changes in exchange rate						
L1.	-0.110	0.116	-0.940	0.345	-0.337	0.118
Changes in cpi						
L1.	0.372	0.219	1.700	0.090	-0.058	0.802
Changes in interest rate						
L1.	-0.000	0.014	-0.030	0.973	-0.027	0.026
Changes in industrial production index						
Changes in stock market index						
L1.	0.004	0.009	0.470	0.640	-0.013	0.022
Changes in oil						
L1.	0.014	0.006	2.380	0.017	0.002	0.025
Changes in industrial production index						
L1.	-0.271	0.037	-7.380	0.000	-0.343	-0.199

Changes in exchange rate						
L1.	0.002	0.022	0.100	0.919	-0.042	0.046
Changes in cpi						
L1.	-0.047	0.042	-1.140	0.255	-0.129	0.034
Changes in interest rate						
L1.	0.000	0.005	0.000	0.996	-0.009	0.009
Changes in exchange rate						
Changes in stock market index						
L1.	-0.001	0.021	-0.060	0.952	-0.043	0.041
Changes in oil						
L1.	0.031	0.015	1.980	0.047	0.000	0.061
Changes in industrial production index						
L1.	-0.023	0.057	-0.400	0.686	-0.135	0.089
Changes in exchange rate						
L1.	-0.212	0.061	-3.460	0.001	-0.332	-0.092
Changes in cpi						
L1.	-0.124	0.113	-1.100	0.272	-0.345	0.097
Changes in interest rate						
L1.	-0.008	0.005	-1.710	0.087	-0.017	0.001
Changes in cpi						
Changes in stock market index						
L1.	-0.004	0.014	-0.300	0.765	-0.032	0.024
Changes in oil						
L1.	0.015	0.008	1.840	0.066	-0.001	0.032
Changes in industrial production index						
L1.	-0.003	0.031	-0.100	0.920	-0.065	0.058
Changes in exchange rate						
L1.	0.008	0.029	0.280	0.777	-0.048	0.065
Changes in cpi						
L1.	-0.349	0.055	-6.350	0.000	-0.456	-0.241
Changes in interest rate						
L1.	-0.005	0.002	-2.130	0.033	-0.010	-0.000
Changes in interest rate						
Changes in stock market index						
L1.	-0.030	0.153	-0.190	0.845	-0.330	0.270
Changes in oil						
L1.	-0.098	0.054	-1.820	0.068	-0.203	0.007

Changes in industrial production index						
L1.	0.014	0.318	0.040	0.966	-0.609	0.636
Changes in exchange rate						
L1.	-0.252	0.465	-0.540	0.588	-1.162	0.659
Changes in cpi						
L1.	0.400	0.848	0.470	0.638	-1.262	2.062
Changes in interest rate						
L1.	-0.183	0.035	-5.170	0.000	-0.252	-0.113

Instruments: l (1/4). (c_smi, c_oil c_ipi c_exc c_cpi c_intr)

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