# OIL PRICE SHOCKS AND STOCK RETURNS IN EMERGING MARKETS UNDER LOW VOLATILITY AND HIGH VOLATILITY REGIMES

**Sharif Bakar KOMBO**

**(Doktora Tezi)**

**Eskişehir, 2019**

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## FINAL APPROVAL FOR THESIS

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## ÖZET

DÜŞÜK VOLATİLİTE VE YÜKSEK VOLATİLİTE REJİMLERİ ALTINDA PETROL FİYATI ŞOKLARI VE GELİŞEN PİYASALARDA HİSSE SENEDİ GETİRİLERİ

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Bu çalışma, düşük volatilite ve yüksek volatilite rejimleri altında, petrol fiyatı şokları ile gelişen piyasalardaki hisse senedi getirilerinin ilişkilerini Brezilya, Çin, Şili, Ürdün, Hindistan, Meksika, Güney Afrika, Tayvan ve Türkiye piyasalarında araştırmaktadır. Çalışmada Ocak 1997-Nisan 2017 dönemine ait aylık veriler kullanılmıştır. Ham petrol fiyatlarının hisse senedi getirilerine etkisinin incelenmesi amacıyla Markov Switching (MS) modeli kullanılmıştır. Ham petrol fiyatı şokları gelişen piyasalardaki hisse senedi getirilerini etkilemektedir. Petrol ihraç eden ülkelerde genellikle petrol fiyatlarındaki artışlar, azalışlara göre hisse senedi getirileri üzerinde daha önemli etkiye sahiptir. Öte yandan, petrol ithal eden ülkelerin çoğunda, petrol fiyatlarındaki artışların ya da azalışların, düşük volatilite rejiminde hisse senedi getirilerini etkilemediği veya asgari seviyede etkilediği, ancak yüksek volatilite rejiminde anlamlı ve negatif olarak etkilediği bulunmuştur.



**Anahtar Kelimeler:** Markov Switching Model, Asimetrik Etkiler, Petrol Fiyatı Şokları, Hisse Senedi Getirileri, Gelişen Piyasalar

## ABSTRACT

OIL PRICE SHOCKS AND STOCK RETURNS IN EMERGING MARKETS UNDER LOW VOLATILITY AND HIGH VOLATILITY REGIMES

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Department of Business Administration

Anadolu University, Graduate School of Social Science, May 2019

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This study examines the relations of oil price shocks and stock returns of emerging markets in Brazil, China, Chile, Jordan, India, Mexico, South Africa, Taiwan and Turkey under the low volatility and high volatility regimes. Monthly data was used for the period January 1997- April 2017 in the study. Markov Switching (MS) model was employed to examine the impact of crude oil prices on stock returns. Crude oil price shocks seem to have a significant impact on the emerging stock market returns. For oil-exporting markets, oil price increases have a more significant impact on stock market returns than an oil price decreases in general. On the other hand, for most oil-importing countries, both increases and decreases of crude oil prices have a null or minimal impact on stock returns in the low volatility regime. However, both increases and decreases of crude oil prices have a significant and negative impact on stock returns in the high-volatility regime for most oil-importing countries.



**Keywords:** Markov Switching Model, Asymmetric Effects, Oil Price Shocks, Stock Returns, Emerging Markets

20/03/2019

## ETİK İLKE VE KURALLARA UYGUNLUK BEYANNAMESİ

Bu tezin bana ait, özgün bir çalışma olduğunu; çalışmamın hazırlık, veri toplama, analiz ve bilgilerin sunumu olmak üzere tüm aşamalardan bilimsel etik ilke ve kurallara uygun davrandığımı; bu çalışma kapsamında elde edilemeyen tüm veri ve bilgiler için kaynak gösterdiğimi ve bu kaynaklara kaynakçada yer verdiğimi; bu çalışmanın Anadolu Üniversitesi tarafından kullanılan "bilimsel intihal tespit programıyla tarandığını ve hiçbir şekilde "intihal içermediğini" beyan ederim. Herhangi bir zamanda, çalışmamla ilgili yaptığım bu beyana aykırı bir durumun saptanması durumunda, ortaya çıkacak tüm ahlaki ve hukuki sonuçlara razı olduğumu bildiririm.

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# TABLE OF CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

# 1 INTRODUCTION

As the primary source of energy, the crude oil industry is considered to be one of the most significant sectors in the world. Like a global powerhouse leading almost hundreds of sectors worldwide, it generates hundreds of billions of dollars each year globally and contributes a significant amount to the gross domestic products of national economies. In recent years, oil has become one of the leading indicators of economic activities to any country. Each year, 30 billion barrels of crude oil are estimated to be consumed globally, and it remains the world's leading fuel accounting for 32.9%[1] of total global energy consumption.

It is evident that oil is one of the most important necessities of every economy and every change in oil price influences economic growth. Since 1986, crude oil prices have changed dramatically, especially in 2008 during the financial crisis. Since then, the oil market still experiences tremendous price volatility, trading around $150 per barrel in 2008, whereas around $30 per barrel in January 2016.

Following oil price fluctuations since the 1980's, a large body of literature has been developed on the relationship between oil prices and economic activities. Hamilton (1983) indicates that crude oil price shocks were a contributing factor in the United States (U.S) recession after World War II. Mork (1989) proposed asymmetric measures to take into account both oil price increases and decreases since Hamilton (1983) did not take into account the massive oil price declines of 1985–1986. He found that the oil price shocks were still contributing factors in the US economy. However, an asymmetric response is significant, and the real effects of oil price decreases are slightly weaker than from those of oil price increases.

Oil price shocks have either a direct or an indirect effect on emerging stock markets. Spectacular headlines from the financial journal such as "Rising oil prices catch emerging economies at a vulnerable moment" (Economist Journal, September 29, 2018) or "Oil shock has already started in emerging markets" (Bloomberg, October 02, 2018), draw particular attention of stock market commentators, investors and policymakers to this issue.

[1] World energy Council: World Energy Resources Report 2016. Available at https://www.worldenergy.org/wp-content/uploads/2016/10/World-Energy-Resources-Full-report-2016.10.03.pdf

In fact, different empirical studies attempted to shed light on the relationship between oil price shocks and stock markets returns such as Sadorsky (1999), Abhyankar, Xu, and Wang (2013), Degiannakis, Filis, and Kizys (2014). Recent studies include Bastianin and Manera (2015), Bastianin, Conti, and Manera (2016), Diaz, Molero, and de Gracia (2016) Foroni, Guérin, and Marcellino (2017), Bouri, Chen, Lien, and Lv (2017). Basher, Haug, and Sadorsky (2018), Al-hajj, Al-Mulali, and Solarin (2018) and Xiao, Zhou, Wen, and Wen (2018).

Even though there is an extended number of studies on the subject, there are still controversial empirical results or ideas on the oil-stock nexus. Some studies conclude a negative relationship between oil prices and stock markets returns such as Ciner (2013), Asteriou and Bashmakova (2013) and Filis and Chatziantoniou (2014), while other studies indicate a positive relationship such as H.-M. Zhu, Li, and Li (2014) and Silvapulle, Smyth, Zhang, and Fenech (2017). On the other hand, some studies conclude mixed results or no relationship between oil price changes and stock market performance such as Apergis and Miller (2009) Jammazi and Aloui (2010) and Juan C. Reboredo and Rivera-Castro (2014).

The oil-stock nexus depends upon the status of the respected country, whether it is a net oil exporter or importer. Brazil, China, Chile, Jordan, India, Mexico, South Africa, Taiwan and Turkey, like several other emerging nations, attract a large amount of funds from developed economies and depend heavily on capital inflows from foreign investors. These funds are in the form of short-term capital inflows often characterised as “hot money”, which makes the stock market highly sensitive to foreign investors’ sentiment driven by global risk factors.

The primary purpose of this empirical study is to examine the asymmetric relationship between oil price shocks and stock returns indices of a diverse group of nine emerging markets, which depend on foreign investments to a large extent, we examine how and why the oil price shocks affects this capital flows in order to help policy makers and financial investors on how oil price changes asymmetrically affects the stock market returns of emerging countries. Of these nine countries, Brazil and Mexico are oil producers. On the other hand, China, Chile, Jordan, India, South Africa, Taiwan and Turkey are net importers. Thus, countries with different relationships with

the oil markets are studied. The inclusion of these countries in our study was based on three criteria.

First, the value of crude oil (in term of dollars) imported or exported by emerging markets was considered. Almost more than 30 percent of world total oil was imported by the sample countries of the study during 2016, which is equivalent to the amount of 210.6 billion dollars **(see Table 1.1)**, led by China (116.2 billion dollars) and followed by India (60.9 billion dollars) and Taiwan (12.9 billion dollars).

**Table 1.1** *Crude Oil import and export in an amount of $ for the year 2016*

| | **Crude oil imports** | | **Crude oil exports** | |
|---|---|---|---|---|
| **Country** | **(amount in $)** | **%World Total** | **(amount in $)** | **% World Total** |
| China | 116.6 billion | 17.3% | 943.5 million | 0.1% |
| India | 60.9 billion | 9.1% | 0 | 0.0% |
| Taiwan | 12.9 billion | 1.9% | 0 | 0.0% |
| Mexico | 11,000 | 0.000002% | 15.5 billion | 2.3% |
| Turkey | 7.3 billion | 1.1% | 0 | 0.0% |
| South Africa | 6.5 billion | 1% | 122.2 million | 0.02% |
| Brazil | 2.9 billion | 0.4% | 10.1 billion | 1.5% |
| Chile | 2.3 billion | 0.3% | 0 | 0.0% |
| Jordan | 1.2 billion | 0.2% | 0 | 0.0% |
| **Total** | **210.6 billion** | **31.3%** | **26.67 billion** | **3.92%** |

**Source:** *U.S Energy Information Administration official website*

Second, the share of energy consumption of the emerging markets was considered. For the past decade, emerging markets' share in global energy consumption has been growing significantly and accounted for 58.1 percent of the global consumption at the end of 2016. Although Chinese energy consumption growth slowed to just 1.5 percent, India recorded another robust increase in consumption by 5.2 percent during the same year. It is expected that emerging countries' demand for oil will continue to grow by 5 percent between 2016 and 2040[2]. This energy growth is heavily

[2] U.S Energy Information Administration. Annual Energy Outlook projection of 2017. Available at https://www.eia.gov/outlooks/aeo/pdf/0383(2017).pdf

tied to the economic and financial growth of these markets. Therefore, these markets are becoming vulnerable to changes in oil prices.

Third, the amount of capital inflows to these markets was considered. According to the Institute of International Finance Report of October 2017, capital inflows from foreign investors to emerging markets are estimated to have been more than 1 trillion U.S dollars in 2017[3], which is higher since 2014 for the first time, due to strong global economic growth and increasing global risk appetite. This increase makes emerging markets more vulnerable to international portfolio investments.

To analyse monthly data of the sample markets for the period between January 1997 and April 2017, we employ the Markov Switching (MS hereafter) model. The MS model detects two regimes: low volatility regime and high volatility regime. One unique feature of our analysis which differentiates from other studies is that the sample period covers both regional financial crises such as the financial crisis of Turkey in 2000-2001 and Asian financial crisis as well as the global financial crisis of 2007-2008. Our study can be differentiated from the reviews of Gencer and Demiralay (2013) and Raza, Jawad Hussain Shahzad, Tiwari, and Shahbaz (2016) which cover the sample period only for the global financial crisis onward. Besides, to the best of researcher knowledge, this study serves as one of the first studies that adopt a Markov Switching model to investigate the relationships between crude oil prices and stock market returns in emerging economies. Previous empirical literature such as Ghosh and Kanjilal (2016), Kayalar, Küçüközmen, and Selcuk-Kestel (2017), Juan C. Reboredo and Ugolini (2016) and Gencer and Demiralay (2013) have concentrated on non-linear threshold cointegration test, Copulas approach method, Quantile and Conditional quantile method as well as VAR and VECM model respectively, while our concentration is on MS Model.

A particularly useful feature of MS model is its ability to capture frequent changes in times series data that may come as a result of external shocks, government policy, political instability as well as financial crisis, which are common for emerging market economies. The use of the MS model is justified based on the changes related to policies in the stock market of emerging countries, as well as other major domestic and

[3] Institute of International Finance. October 2017 Capital Flows to Emerging Markets. Available at https://www.iif.com/publication/capital-flows-emerging-markets-report/october-2017-capital-flows-emerging-markets

international events. This assumption is modified by implementing a regime-switching model that allows for shifts in drift term as well as for changes in mean and variance.

The dynamic system of oil-stock nexus may lead to the conclusion that oil price shocks may have asymmetric significant impacts on stock returns. However, this result may be biased, if any variable which affects both oil prices and stock returns in the long-run is omitted. To avoid such a bias, we introduce two measurements of oil price shocks, the real of oil price increase and the real of oil price decrease as proposed by Mork (1989). Besides, decomposing this oil price shock helps to capture the asymmetric impact of oil price changes on the stock returns of emerging markets. Moreover, long-term interest rate (10 year interest rate) and Chicago Board of Options Exchange's (CBOE hereafter) S&P 500 market volatility index (VIX) chosen as the proxy for global volatility were included into the analyses to capture their impact, as proposed by (Kilian & Park, 2009) and (Nadal, Szklo, & Lucena, 2017b).

In this study, a systematic analysis of the asymmetric impact of crude oil price shocks on stock market returns of nine emerging markets are presented. To examine whether the real crude oil prices shocks have asymmetric effects on stock returns, we introduce two different measures of shocks. The real oil price increase shocks distinguished from oil price decrease shocks as proposed by Mork (1989). We investigate the effect of each shock on stock returns using Markov Switching models, with shifting mean, slope coefficient and variance to identify the bear and bull regimes. The slope coefficient measures the different impacts that the real oil price shocks has on the stock returns on various states of the economy.

Additionally, we examine the impacts of the other control variables, which are known to affect the stock returns in emerging economies. Then, we make a comparison of those impacts between real Brent Crude oil price shocks and other variables on each economy. This comparison may help to avoid the biases of concluding that oil price shocks may have significant impacts on stock returns, while there are other variables such as long-term interest rates and global market volatility, which may affect both oil prices and stock returns.

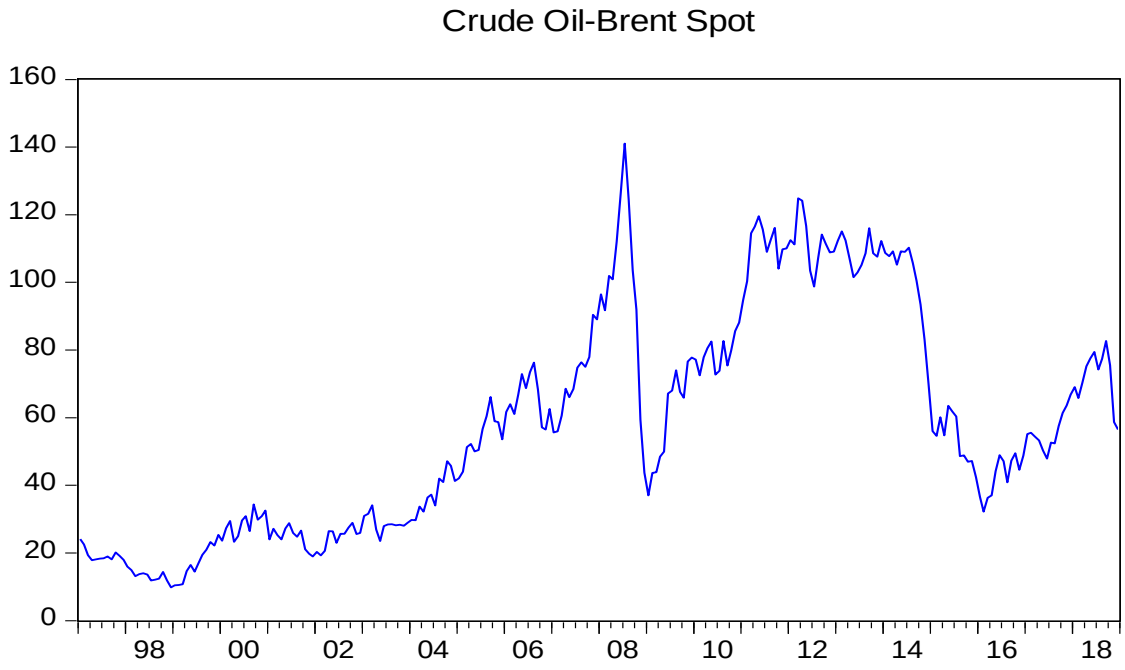
Considering the dramatic policy changes and the frequent financial crisis in emerging economies, this study attempts to provide further empirical evidence of the oil price-stock market returns nexus under the MS model. The rapid rise of the sample

countries as emerging markets and the increasing importance of these economies offer an ideal environment to study the effects of oil price uncertainty on stock returns.

### 1.1. Research Problem

The price of oil is frequently regarded worldwide as a sort of thermometer to measure the wealth of the economy. It is regarded as the major source of energy all over the world. Indeed, over the past years, the recent dramatic change in oil prices of a crude barrel (from around $11 per barrel in March 1986, surged to approximately $150 per barrel in June 2008, then plummeted again to $30 per barrel January 2016, recently started to rise again and closed around $53 in December 2016 (**Figure 1.1**) has generated a lot of interest to the researchers, policymakers as well as investors. These shocks have a significant effect on financial development and economic development of emerging economies.

**Figure 1.1** *Brent Crude Oil Price Changes from January 1997 to December 2018*




Over the last decades, emerging market economies have expanded rapidly. Consequently, oil and fuels liquid consumption has increased at an alarming pace between 2004 and 2016 to match with the economic growth of these markets. At the end of 2016, emerging economies accounted for 58.1 percent of global energy

consumption[4], which was well higher than the last ten years average of 49.4 percent. Besides, the stock markets of these economies went through considerable trade liberalisation and have shown rapid growth regarding market capitalisation value and volume, thereby creating vast investment opportunities and attracting worldwide capital inflows **(see Table 1.2)**.

The number of firms listed in emerging stock markets increased significantly from 8,003 in 2007 to 10,468 in December 2016. Market capitalisation and the stock traded value reached 11,356.9 billion and 20,470.8 billion of US$ respectively in 2016 compared to 9,431.8 billion and 8,857.3 billion of US$ in 2007. Over more than 50 percent of the free-floating shares of the companies traded on an emerging economies stock exchange (such as of 2016, 63.4 percent[5] and 40 percent of the Istanbul Stock Exchange and Brazilian Stock Exchange respectively) are held by foreign portfolio investors.

Consequently, the stock markets of these economies are impacted by various interrelated economic factors, which make them vulnerable to the local and global events resulting in volatile and uncertain conditions. In line with the trends as mentioned above, economic growth and stock market development of these economies seem to have a high degree of dependence on oil and refined products. It is evident that any shocks on oil prices are correlated with the financial market movements. Thus, the impact of Brent Crude oil price shocks on stock returns of emerging economies provides a research gap to be analysed under this study.

[4] World energy Council; world energy resources report 2016. Available at https://www.worldenergy.org/wp-content/uploads/2016/10/World-Energy-Resources-Full-report-2016.10.03.pdf

[5] Borsa Istanbul Annual Report, and Capital Market Boards of Turkey monthly statistical bulletins.

**Table 1.2** *Stock Market performance indicators for the Emerging Countries*

| | Number of Listed firms | | Market Capitalization (billions of US$) | | Market Capitalization (% of GDP) | | Stock traded value (billions of US$) | | Market Liquidity (% of GDP) | | Turnover ratio % | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Country** | **2007** | **2016** | **2007** | **2016** | **2007** | **2016** | **2007** | **2016** | **2007** | **2016** | **2007** | **2016** |
| Brazil | 345 | 338 | 1,369.7 | 758.5 | 98.1 | 42.2 | 655.4 | 561.1 | 42.2 | 31.2 | 47.1 | 73.5 |
| China | 1,530 | 3,052 | 4,478.8 | 7,320.7 | 126.1 | 65.4 | 6,305.4 | 18,295.1 | 177.5 | 163.4 | 140.7 | 249.9 |
| Chile | 238 | 214 | 212.9 | 212.5 | 122.6 | 86.1 | 45.2 | 23.9 | 26.1 | 9.7 | 21.2 | 113.0 |
| Jordan | 245 | 224 | 40.8 | 24.6 | 238.6 | 63.5 | 17.4 | 2.6 | 101.8 | 6.7 | 42.6 | 10.7 |
| Mexico | 125 | 137 | 397.7 | 350.8 | 38.1 | 33.5 | 117.9 | 111.8 | 11.3 | 10.6 | 29.6 | 28.2 |
| India | 4,887 | 5,820 | 1,819.1 | 1,566.7 | 151.4 | 69.2 | 1,143.4 | 791.9 | 95.2 | 34.9 | 62.8 | 50.5 |
| S.Africa | 374 | 303 | 828.2 | 951.3 | 276.9 | 321.9 | 257.7 | 402.4 | 86.1 | 136.2 | 31.2 | 38.4 |
| Turkey | 259 | 380 | 284.5 | 171.7 | 42.1 | 19.8 | 324.0 | 281.8 | 48.1 | 32.6 | 114.2 | 168.6 |
| **Total** | **8,003** | **10,468** | **9,431.7** | **11,356.8** | **1,093.9** | **701.6** | **8,866.4** | **19,758.6** | **588.3** | **425.3** | **489.4** | **732.8** |

**Source:** *World Bank, World Development Indicators (WDI).*

### 1.2. Objectives and Scope of The Study

Considering the significance of this topic in both theoretical and empirical field, the primary goal of this research is the empirical investigation of the possible asymmetric impact of real crude oil price shocks on stock returns in emerging economies under low and high volatility regimes. In detail, this study intends to achieve the following objectives:

i. To examine the asymmetric impact of increases and decreases of the real oil price shocks on the stock returns of emerging markets.
ii. To compare the impacts of real Brent Crude oil price shocks and other local and international macroeconomic factors shocks on stock market returns.

### 1.3. Research Questions

This research addresses the following questions:

i. Do the increases and decreases of the real oil price shocks have an asymmetric impact on the stock returns of emerging markets?
ii. Do the impacts of real Brent crude oil price shocks and local and international macroeconomic shocks on the stock market differ in emerging economies?

### 1.4. The significance of The Study

The findings of this study may enable policymakers and regulators to identify how and why oil price shocks as the potential factor that influences the stock markets for policy formulation in emerging markets. Indeed, the results may help those stakeholders to assess the relationship between global crude oil prices and stock markets. The results of the study may guide investors/potential investors to evaluate on how the oil price changes asymmetrically effects the stock market returns of emerging countries and how this effect may have impacts on their investment decision-making process.

### 1.5. Scope and Limitations of the Study

This empirical study attempts to investigate the impacts of Brent crude oil prices on stock returns in emerging economies. In this study, we focused on nine stock

markets of Brazil, China, Chile, Jordan, India, Mexico, South Africa, Taiwan and Turkey for the period between January 1997 and April 2017.

The remaining of the study is organised as follows: Chapter 2 provides a theoretical and empirical review of the related literature. Chapter 3 presents the data used and the methodology of our study. Chapter 4 discusses the empirical findings, and lastly, chapter 5 concludes and provides a recommendation for further study.

## 2. LITERATURE REVIEW

Since oil prices are one of the most significant indicators of economic activities to any economy after World War II, special consideration has been given to oil prices in the literature. There have been numerous empirical reviews related to the interaction between stock market returns and oil price changes. In this chapter, the study presents a summary of relevant literature about the relationship between oil prices and stock market returns.

The previous works of literature reviews are divided into two parts: The first part includes relevant theoretical studies on the impact of oil price shocks and its asymmetric effects on stock market returns. The second part consists (a) empirical findings of oil prices and stock market returns, (b) others macro-economic factors and stock market returns.

### 2.1. Theoretical Relationship between Oil Prices and Stock Returns

Understanding the theoretical linkage between oil and stock prices has always been a popular subject for investors and policymakers. Consequently, analyses on the oil-stock nexus have been investigated for many years. The empirical studies of in Hamilton (1983) and Mork (1989), are among the first and well known empirical studies that examine oil-stock nexus. Hamilton (1983) provides evidence that oil shocks are a contributing factor to U.S. recessions after the Second World War. He only observed a period of oil price increases, and he did not take into account the massive oil price declines of 1985–1986. Therefore, to examine this oil price decreases, Mork (1989) extends the data to 1988. With the extension of this period, he found that the effects of oil price increases are in line with the Hamilton (1983) findings. However, oil price decreases are observed to have little effects on US economic growth.

The theoretical relationship between oil prices and stock returns could be positive or negative. Following the theoretical rationalisation, most of the literature has attempted to justify the cash flow hypothesis, which states that the asset values of any company are determined by the expected present value of discounted cash flows. Huang, Masulis, and Stoll (1996), state that the price of a share in a company is equal to the present value of discounted future earnings. This discount cash flows analysis is a very powerful tool that is not only used to value companies' shares but also to price

initial public offerings and other financial assets. It is such a powerful tool in economy and finance that it is widely used by all stakeholders such as investors, managers, consultancies and investment banks around the world for a range of activities (Steiger, 2010).

This cash flow hypothesis indicates that there could be a negative or positive relationship between oil prices and stock returns. Oil prices can affect stock prices directly by affecting future cash flows or indirectly by influencing the interest rate that is applied to discount future earnings (Kim, Chung, & Sundetova, 2016).

On the side of the negative relationship, oil is considered a significant input for most companies, and changes in oil prices are expected to cause changes in stock prices. For instance, rising oil prices increase the cost of doing business, decreasing the productivity of a particular firm, reducing expected future cash flows and profitability of the firm and, hence, stock returns (J. W. Park, 2007). Also, rising oil prices may influence respected departments to raise inflation and nominal interest rates. This interest rate is used to discount expected future cash flows, which will depress anticipated future earnings of the firm and, hence reduce stock returns (Smyth & Narayan, 2018). Furthermore, rising oil prices can be passed on to the final consumers in the form of higher prices for final goods and services, which will reduce demand for final products and services and after that expected future cash flows (J. W. Park, 2007).

On the side of a positive relationship between oil prices and stock returns, rises in oil prices will be followed by increasing expected future cash flows and profitability of a particular exporting countries, and hence stimulating economic activities and stock returns. Kollias, Kyrtsou, and Papadamou (2013) indicate that investors always may be influenced by rising oil prices which is associated with a booming economy. Hence, rising oil prices might reflect stronger business performance and improve the stock market returns.

The reactions of oil market performance to the stock market performance are far from definite. The position of the country as a net oil-exporter or net oil-importer provides additional information to these reactions. Many empirical studies consent to the belief that stock markets in oil-exporting countries tend to benefit from an oil price increase, whereas the reverse is true for the oil-importing countries (Arouri & Rault, 2012) and (Mohanty, Nandha, Turkistani, & Alaitani, 2011) among others.

Moreover, theoretically, oil price changes influence stock price through both supply and demand channels. Supply-side oil price shocks take place due to changes in the world oil supply, whereas demand-side oil price shocks are caused by changes in aggregate demand (Hamilton, 2009). Filis, Degiannakis, and Floros (2011) state that the aggregate demand side oil price shocks lead to a positive reaction on the stock market, while precautionary demand oil price shocks lead to a negative response on the stock market.

Nadal, Szklo, and Lucena (2017a) state that the correlations between changes in crude oil prices and stock market returns tend to be positively affected by aggregate demand and precautionary demand shocks. Wei and Guo (2017b) state that the effects of the oil-aggregate demand shocks on the stock returns are positive in the first sub-period, but become negative in the second sub-period.

Bastianin et al. (2016) identify the causes underlying oil price shocks and gauge the impacts that oil demand and oil supply innovations have on financial volatility. The state oil supply shocks do not influence stock market volatility. On the contrary, G7 stock markets volatility is significantly influenced by G7 demand shocks. Abhyankar et al. (2013) using a structural vector autoregressive (SVAR) model, stated that oil price shocks associated with aggregate global demand are positive and significant on Japanese stock market returns. On the other hand, the Japanese stock market reacts negatively to oil price increases related to oil-market specific demand shocks. Finally, they find that supply and demand shocks in the global crude oil market affect returns to the Japanese stock market index through changes to expected real cash flows rather than to changes to expected returns.

### 2.2. Asymmetric Effects of Crude Oil Price Changes on Stock Returns.

Since the study conducted by Mork (1989), several studies have found that increases or decreases in oil prices have asymmetric effects on macroeconomic variables including stock returns. The asymmetric measure proposed by Mork (1989) and other scholar is based on the observation that the relationship between the macro activities and oil price changes presented in Hamilton (1983) pertains to a period of oil price increases and he did not take into account the massive oil price declines of 1985–1986. Mork (1989) found that the negative relationship between oil price increases and

the US economy still exists. However, an asymmetric response is significant, and the real effects of oil price decreases are slightly different from those of oil price increases.

Wan (2005) provides a theoretical reason for the asymmetric effects of oil prices on stock returns. He suggests that the main decision for companies to be listed to raise funds in a stock market is only to pay a dividend to their shareholders when their expected present value of discounted future cash flows is above a certain threshold. An increase or decrease in oil prices could either make the firm to pay a higher dividend to their shareholders or will push the expected present value of future earnings below the threshold. If an increase in the oil price pushes the expected present value of future earnings below the threshold, the firm will decide not to pay dividends to their shareholders, and stock prices will decline. While if the oil price decreases, this pushes the expected cash flows above the threshold, then, the firm will pay a higher dividend to its shareholders, which will likely push the stock price up. Apart from the above reason, Afees A Salisu and Isah (2017) indicate that the asymmetric effect of oil price changes on stock returns may be indirectly through the discount rate if the respective monetary authority responds differently to oil price increases and decreases in interest rates.

Nevertheless, relatively few studies have examined the asymmetric impacts of real oil price on stock returns. Sadorsky (1999) found that oil price increases have more significant effects on stock returns than oil price decreases. Kang, Ratti, and Vespignani (2016) show the importance of disaggregation between the U.S. and non-U.S. oil production shocks for understanding the impact of asymmetric shocks in the oil price on U.S stock returns. The findings reveal that an increase of U.S. oil production shock which associated with decreases of oil prices has a significant positive effect on U.S. real stock returns.

Narayan and Gupta (2015) indicate that US stock returns respond more to negative oil prices than to positive oil prices. They conclude that negative oil price shocks reactions from the oil market are relatively more significant for predicting US stock returns.

Basher et al. (2018) investigate the asymmetric impact of oil-market shocks on stock returns of major oil-exporting countries only using a nonlinear approach. The findings indicate that global oil price shocks have a statistically asymmetric significant impact on stock returns for most of the major oil-exporting countries regardless of the directions of the oil shocks.

Tsai (2015) provides evidence that U.S. stock returns respond positively to the changes in oil prices during and after the financial crisis. The findings suggest that on firm-level analysis, increases and decreases of oil price changes have asymmetric effects on the US stock returns during and after the financial crisis.

Phan, Sharma, and Narayan (2015) investigate how differently the stock returns of oil consumers and oil producers are affected by oil price changes. The findings indicate that oil producers' stock returns are responding positively to oil price changes regardless of increasing or decreasing oil prices. Also, the results suggest that stock returns respond asymmetrically to oil price changes for most sub-sectors.

Regarding emerging markets, previous studies show that stock returns of these markets respond asymmetrically to real oil price changes and the impacts in emerging markets are getting inter-linked with stronger magnitudes due to the frequents global news and events affecting these markets. According to IMF Global financial stability report of October (2017), the changes in the state of the financial system, and volatility of commodities prices including crude oil prices may provide powerful signals about asymmetric risks to future stock market activity for emerging markets.

Afees A Salisu and Isah (2017) re-evaluate the relationship between oil price and stock prices in oil-importing and oil-exporting markets using nonlinear ARDL model. The findings indicate that stock prices respond asymmetrically to oil price changes for both oil importing and oil exporting countries, although the response is stronger in the latter than the former.

Ramos and Veiga (2013) indicate that the asymmetric effects of oil price changes on stock returns of oil-importing and oil-exporting markets run in opposite directions. They show that only stock returns of oil-importing countries respond asymmetrically to oil price changes. Further, the findings suggest that oil price shocks and volatility have a negative impact in stock markets of oil-importing markets and positive in oil-exporting markets.

Moreover, recent studies emphasise the need for analysing the asymmetric impacts of oil price uncertainty on stock returns for emerging market economies. Considering the rapid development of stock markets in developing countries and increasing inter-connection of these stock markets with global economic activity make them even more significant to investigate the asymmetric oil-stock nexus.

Among others, Al-hajj et al. (2018) examined whether increases and decreases of real oil price, interest rate, exchange rate, industrial production, and inflation have the asymmetric effects on the stock market returns of Malaysia by using nonlinear ARDL. The results indicate that real crude oil price shocks have an asymmetric impact on the stock market returns in most cases.

Xiao et al. (2018) investigate the asymmetric impacts of oil price uncertainty on the aggregate and sectoral stock returns in China using a quantile regression model. The findings reveal that crude oil volatility index has significant adverse effects on the aggregate and sectoral stock returns in the bearish market only. In particular, these effects depend primarily on the positive shocks rather than the negative shocks. Meanwhile, the policy reform which took place on March 27, 2013, decreased the impacts of the positive oil price shocks on Chinese stock returns.

Ji, Liu, Zhao, and Fan (2018) investigate the dynamic dependence and risk spill-over between BRICS stock returns and different types of oil shocks. The findings show that the relationship between stock returns of BRICS markets and oil shocks are time-varying. Also, there is a significant risk spill-over from oil-specific demand shocks to stock returns in all the BRICS markets. Moreover, there is a significant asymmetric effect between upside and downside risk spill-overs based on oil aggregate demand shock and oil-specific demand shocks for Brazil, India and Russia.

Overall, most of the literature suggest that oil price changes have asymmetric effects on stock returns, and for those who fail to find the asymmetric effects have used aggregate stock returns rather than disaggregate (sectors/industries/firms) level. Tsai (2015) suggests that for those who use aggregate stock index level to make analysis might mix the heterogeneous effects of increases and decreases of oil price changes on individual stock returns.

However, the previous empirical studies analysing this oil-stock relationship for emerging market economies are minimal, and the existing empirical studies ignore the state dependent dynamics and real oil price measurements proposed by Mork (1989) as they don’t account for asymmetry in the responses to oil price shocks. None of the empirical studies in the literature explicitly model and utilise three different measurements of oil price changes employing a Markov switching framework to reveal the asymmetric relationship between real oil prices and the stock market returns for the emerging markets, except the study of H. Zhu, Su, You, and Ren (2017) for developed

and some emerging markets. They decompose the oil price shocks into oil demand and oil supply shocks to examine the asymmetric impacts of the real oil price shocks on stock market returns through two distinct regimes characterised by low and high volatility regimes. The results indicate that oil supply and demand shocks have a statistically high significant impact in a high volatility regime than in a low volatility regime. They conclude that a positive aggregate demand shock significantly increases stock returns, while a positive specific demand shock decreases stock returns of the countries analysed under the study.

### 2.3. Previous Empirical Literature on Oil Price Shocks and Global Stock Markets

The existence of oil-stock return relationship has been examined by different authors using different frameworks including;

Diaz et al. (2016) examine oil price volatility and stock returns in the G7 economies using monthly data for the period 1970 - 2014 by employing a Vector Autoregressive model (VAR). They consider alternative oil price specifications such as world, national and real prices expressed in both WTI and the UK Brent. They put forward that G7 stock markets respond negatively to an increase in oil price volatility. Findings also show that world oil price volatility (WTI and UK Brent) is more significant for stock markets returns than the national oil price volatility.

Juan C. Reboredo and Ugolini (2016) examine quantile dependence of oil price movements and stock returns of three developed economies and five BRICS countries. Their findings show that the impact of extreme upward and downward oil price changes on the upper and lower stock price quantiles is much smaller before the crisis than after the crisis. Furthermore, the downside spillover effects are more significant than the upside spillover effects for most countries before the crisis and for all countries after the crisis.

Le and Chang (2015) examine the effects of oil price shocks on the stock market performance of Japan, Singapore and Malaysia. Their results indicate that there is no causality between oil prices and stock markets. In Malaysia and Singapore, the effects of oil price shocks on stock market returns are similar, as both markets had a significantly positive response to shocks in oil prices. Juan C. Reboredo and Rivera-Castro (2014) investigate the relationship between the United States as well as European stock markets and oil prices changes at the aggregate and sectoral levels using

wavelet multi-resolution analysis between June 2000 and July 2011. The findings suggest that oil price changes did not affect stock market returns in the pre-crisis period at both levels. However, the results indicate evidence of contagion and positive interdependence between oil price changes and stock market returns in the post-crisis of 2008.

Apergis and Miller (2009) examine how structural oil market shocks affect stock-market returns of eight developed countries between 1981 and 2007. The findings suggest that oil price shocks do not affect these eight international stock market returns in general. They conclude that the significant effects that exist prove small in magnitude.

Apart from the above literature based on developed nations, there are various studies based only on the USA. Ewing and Malik (2016) find no volatility spillovers between oil prices and the US stock market when structural breaks in variance are ignored. However, the findings indicate strong volatility spillover between these two markets after taking into account the structural breaks.

Likewise, Kang, Ratti, and Yoon (2015) state that a positive shock to oil-market specific demand and aggregate demand hurt the US stock returns covariance and volatility. Sim and Zhou (2015) investigate oil prices, US stock returns, and the dependence between their quantiles using Quantile on Quantile Approach (QQ) for 1973 and 2007. They report that a large, negative oil price shocks can affect US equities positively when the US market is performing well. However, the influence of positive oil price shocks is weak.

Afees A. Salisu and Oloko (2015) using VARMA–BEKK–AGARCH framework for US stock market, find a significant positive return spill-over from US stock market to the oil market and bidirectional shock spill-overs between the two markets.

To summarise, there are still controversial empirical results on oil-stock nexus in developed nations as some studies reveal the positive relationship, while others show no or negative correlation. However, the above empirical studies provide new evidence on asymmetries in oil price spill-overs to stock returns and on how the oil stock relationship has changed in recent years with the outbreak of the global financial crisis. Following the global financial crisis, oil-market specific demand shocks impact a much more significant reaction than before the global financial crisis.

Regarding emerging markets and developing nations, previous studies show that crude oil prices and stock markets activity in emerging countries are getting linked with a stronger magnitude for some countries than the others.

For example, Demirer, Jategaonkar, and Khalifa (2015) investigate oil price risk exposure and the cross-section of stock returns for net exporting countries of Saudi Arabia, Kuwait, Qatar, UAE, Oman and Bahrain. The findings indicate that stocks that are more sensitive to oil price fluctuations indeed yield significantly higher returns, suggesting that oil price risk exposure can serve as a return predictor in these stock markets.

Fatima and Bashir (2014) investigate the volatility of international oil prices and stock markets of emerging economies of China and Pakistan by employing Multivariate Co-integration Analysis along with a Vector Error Correction Model. A very low level of reaction of international oil prices fluctuations on the stock market returns is observed.

Bouri (2015a) examines oil volatility shocks and the stock markets of oil-importing MENA economies of Jordan and Lebanon using ARMAX-GARCH model. The main results indicate that the volatility spill-over is more from the global oil market to the Jordanian stock market returns than the other way around, while for Lebanese stock market volatility, the impact was not a good predictor.

Ghosh and Kanjilal (2016) use nonlinear threshold co-integration tests based on Toda–Yamamoto (TY) version of Granger non-causality tests to examine co-movement of international crude oil prices and Indian stock returns using daily data for the period of 2$^{nd}$ January 2003 to 29$^{th}$ July 2011. They divided the data into three phases (before, during and after financial crisis). The long-run equilibrium relationship among the variables is rejected for the entire data span. However, the results reveal that movements of international crude oil price have an impact on the Indian stock market in phases two and three only.

Mamipour and Vaezi Jezeie (2015) investigate the effects of oil price and gold price on the stock market index in Republic of Iran by using three regime Markov Switching Vector Error Correction model during the period January 2003 to December 2014. They found a negative and significant effect of oil price on stock returns in all three regimes; this means that with rising oil prices, stock market returns are reduced.

In addition, Gil-Alana and Yaya (2014) examine the relationship between oil prices and the Nigerian stock market based on fractional integration and co-integration using monthly data from January 2000 to December 2011. They found a positive and significant relationship between oil prices and Nigerian stock returns though with a short memory effect.

Bouri (2015b) employs VAR-GARCH to examine return and volatility linkages between oil prices and the Lebanese stock market in crisis periods. They find a positive causal effect from oil price changes to stock market returns during the whole period. Intuitively, the causal effects peak during the crisis period and then cease afterwards. However, the findings show weak unidirectional return and volatility transmissions from oil prices to the stock returns.

The stock markets of emerging nations are not as developed as the stock markets of developed countries. Moreover, insufficient knowledge of the investors, as well as the inefficiency of markets, restricts some emerging stock markets to capture oil price shocks. The effect of crude oil price shocks is not directly transmitted to the stock market by bringing any impact on the profitability of firms listed in the stock market. Instead, movements of crude oil price indirectly impact the stock market through the channels of fiscal deficit, inflation and uncertainty in the local currency. An increase in crude oil price leads to an increase in the subsidy burden of the government as the cost of imported items goes up. This, in turn, fuels inflation, which discourages investment in financial instruments primarily in the stock market.

Gupta and Modise (2013) investigate the dynamic relationship between different oil price shocks and the South African stock market using a structural VAR approach for the period 1973:01- 2011:07. The results show that South Africa's stock returns react differently to oil shocks, depending on the underlying causes of the increase in oil prices.

Raza et al. (2016) examine the asymmetric impact of gold prices, oil prices and their associated volatilities on stock markets of emerging economies using nonlinear ARDL model for the period January 2008 - June 2015. The results show that oil price shocks have a negative impact on stock markets of all emerging economies under the study. Furthermore, oil price volatilities have an adverse effect on stock markets of all emerging economies in both the short and the long-run.

Kayalar et al. (2017) employ the copula approach to investigate the impact of crude oil prices on financial market indicators of developed and emerging economies. They conclude that, for most emerging economies, the stock market index has a significant positive dependence on crude oil prices.

Berk and Aydogan (2012) investigate the impacts of crude oil price variations on the Turkish stock market returns by employing VAR for the period between 2nd January 1990, and 1st November 2011. The results provide little empirical evidence that crude oil price shocks have been rationally evaluated in the Turkish stock market. Instead, it was global liquidity conditions that were found to account for the highest amount of variation in stock market returns.

Tursoy and Faisal (2018) investigate the impacts of gold prices and crude oil prices on Turkish stock market returns by applying monthly data for the period between January 1986 and November 2016, using the autoregressive distributed lag (ARDL) model. The findings reveal that both short-run and long-run results confirm a positive relationship between crude oil and stock prices.

The study conducted by Broadstock and Filis (2014) using a Scalar-BEKK model for China and US is based on key industrial sectors, namely Metals & Mining, Oil & Gas, Retail, Technology and Banking, for January 1995 - July 2013. They reported that the US stock market is more responsive to oil price shocks compared to the Chinese stock market, although these effects differ widely between industry sectors. The correlations are higher for the US sectors compared to those of China, most apparently for the Technology index.

Furthermore, most studies in the literature find evidence of the heterogeneous relationship between oil prices and stock market returns. These studies suggest that stock market returns response heterogeneously to oil price changes. Therefore, crude oil price changes that are generated from the expectations about future changes in the global economic and financial activity lead the stock price changes in a particular country but that changes depending upon particular circumstances. Among others, H. Zhu, Guo, You, and Xu (2016) examined the heterogeneity dependence between crude oil price changes and industry stock market returns, using Quantile regression model based on fourteen sectors in the stock market of China for the period March 1994 - June 2014. The empirical results reveal that the reaction of market returns to crude oil prices is highly heterogeneous across the conditional distribution of industry stock returns.

There is evidence that this dependence is positive and exists only in recessions or bearish markets with low expected returns. The dependence at low quantiles is not limited to one market but is a common feature across industries.

Doko Tchatoka, Masson, and Parry (2018) revise the debate on the relationship between stock market returns and oil price shocks for the US stock market by using the same method of Sim and Zhou (2015) and extending it to 15 countries. The results of Sim and Zhou (2015) indicate that sizeable adverse oil price shocks can affect US equity returns positively when only the US market is performing well. However, the findings of Sim and Zhou are supported only by China, Japan and India between 1998 to 2007. However, when Doko Tchatoka, Masson, and Parry have extended the sample period to December 2016, the results indicate contrary evidence for Chinese and Indian stock markets. The findings also suggest that large positive oil price shocks affect the stock returns of Canada, Russia, Norway, Malaysia, Philippines and Thailand positively when these markets perform well. Therefore, the findings of these two empirical studies prove that the relationship between oil price shocks and stock market returns are not stable over time in most countries.

Wei and Guo (2017a) investigate the effects of oil price shocks on China's stock market through a structural VAR model by using monthly data from February of 1996 to October of 2015. They categorise oil shocks into three different types, oil supply shocks, aggregate demand shocks and oil-specific demand shocks. Their findings indicate that the relationship between the stock market and oil price shocks are unstable.

Bai and Koong (2018) investigate the trilateral and time-varying correlations between oil prices shocks and stock market returns in the U.S and China using monthly data from February 1991 to December 2015. The findings indicate that the U.S. and Chinese stock markets respond to oil price shocks positively, but with different magnitude, and with more volatility especially after the 2008 global financial crisis for the Chinese stock market.

Caporale, Menla Ali, and Spagnolo (2015) employ the bivariate VAR-GARCH model to examine oil price uncertainty and ten sectoral stock returns in China. They find that oil price uncertainty affects sectoral stock returns positively during periods with aggregate demand-side shocks in all cases, except for the Consumer Services, the Financials and Oil and Gas sectors. The Financials and Oil and Gas sectors are found to respond negatively during periods of supply-side shocks.

Moya-Martínez, Ferrer-Lapeña, and Escribano-Sotos (2014) examined oil price risk on fourteen sectors in the Spanish stock market from January 1993 to December 2010, using Arbitrage pricing theory (APT) model. No significant effect found from oil price shocks on a large set of stock market industries, including Consumer Goods, Technology and Telecommunications, Real Estate, and Utilities. In contrast, Energy, Construction, Basic Resources, Food and Beverages, and Banking emerge as industries with more significant exposure to oil price risks.

Halaç, Taskin, and Cagli (2013) suggest that oil prices are essential indicators of stock prices in Turkey. They provide evidence by employing Dynamic Ordinary Least Square (DOLS) method to analyse the Turkish stock market integration with oil prices, and they find a positive and statistically significant relationship between stock returns and oil prices.

Boubaker and Raza (2017) investigate the spillover effects of volatility and shocks between oil prices and the BRICS stock markets using the multivariate approach and wavelet analysis. The results show that oil price and stock market prices are directly affected by their volatilities and news as well as indirectly affected by the volatilities of other prices.

Fang and You (2014) examine the dynamic interactions between oil price and stock returns using an SVAR approach for China, India and Russia for the monthly data set from January 2001 till May 2012. The results indicate that the impact of oil price shocks on these countries' stock prices has been mixed.

Aimer (2016) employ BEKK-GARCH, DCC_GARCH models to investigate the volatility spillovers and conditional correlations between stock index returns of Middle East countries and global crude oil from March 2000 to March 2015. In their study, the ARCH coefficient parameter is only significant for Turkey, suggesting that oil shocks affect the stock index volatility of Turkey significantly. Moreover, there is strong evidence of substantial transmission of the volatility of the oil market to stock indexes of Turkey. The increase in volatilities of Turkey stock indexes is related to social and political instability.

Najaf (2016) investigates the impact of International oil prices on the stock exchange returns using Correlation and regression analysis for times series data of 15 years of Malaysia and Turkey. The results of correlation show a positive relationship

between oil prices and stock exchange returns. The regression results also show that there is a significant association between stock prices and international oil prices.

Recently, few studies use Markov switching frameworks to analyse the impact of real oil prices on stock market returns. Juan C Reboredo (2010) employed Markov-switching models to investigate whether oil price shocks have nonlinear effects on international stock returns. The results indicate that in one state of the economy, an increase in oil prices has a significant negative effect on international stock prices, while this effect is significantly positive in another state of the economy.

H. Zhu et al. (2017) examine the asymmetric effects of oil price shocks on stock returns of developed and emerging markets using a Markov-switching model with two states. The results indicate that oil supply and demand shocks have a statistically high significant impact in a high volatility regime than in a low volatility regime. They conclude that a positive aggregate demand shock significantly increases stock returns, while a positive specific demand shock decreases stock returns of the countries analysed under the study.

### 2.4. Stock Market Returns and Other Macro-economic Factors.

Over the past years, the relationship between stock market returns and macroeconomic factors has been a critical fundamental study concern in the literature. The existence of mechanisms transition through which macroeconomic indicators affect stock market returns has been extensively analysed in the economic and financial literature. Different macroeconomic variables such as interest rates, global volatility spill-over, yield spread, and other factors to examine this transition have been employed to predict the stock market returns. The increasing role of the stock market in the economy has stimulated research on the relationship between the stock market and other macroeconomic activity.

For instance, the relationship between interest rate and stock market return investigated by Zhou (1996), in his study, analysed the relationship between stock prices and interest rates through a regression analysis. The findings indicated that the interest rates have a significant effect on stock returns over the long-run. Besides, the results reveal that long-term interest rates explained a significant part of the variation in price-dividend ratios and initiated that the high volatility of the stock market is related to the high volatility of long-term bond yields.

Alam and Uddin (2009) investigate the relationship between interest rate and fifteen stock indices of developing and developed countries- Australia, Bangladesh, Canada, Chile, Colombia, Germany, Italy, Jamaica, Japan, Malaysia, Mexico, Philippine, S. Africa, Spain, and Venezuela. The findings indicate that the interest rate has a significant negative relationship with the share price for all ample countries. However, only six out of fifteen states found that changes in interest rate have a significant negative correlation with changes in the share price. More interestingly, the interest rate is seemed to control factor for these countries. Thus, through demand pull and supply push factors; will be the great benefit for these stock market to attract more investors using this monetary policy.

Bjørnland and Leitemo (2009) examine the interdependence between US monetary policy and the S&P 500 stock returns by employing a structural VAR model. The findings indicate that a significant great interdependence between interest rate and the S&P 500 stock prices existed. Furthermore, the results suggest that when the federal funds rate rises by ten basis points, the S&P 500 Stock prices immediately fall by 1.5%.

Recently, some empirical studies examine the relationship between stock market returns and macroeconomic factors such as Jammazi, Ferrer, Jareño, and Hammoudeh (2017) examine the causal relationship between S&P 500 stock returns and the long-term 10-year Treasury bond changes in the United States with emphasis on stress factors, time variation and smooth regime transition. The findings indicate a significant bidirectional causal relationship between long-term interest rate and S&P stock returns over most of the study period, mainly due to the strong simultaneous interactions between the bond interest rate and the stock returns. Besides, the U.S. financial stress indices are the main factors which influence the dynamic relationship between stock returns and the long-term interest rate changes in the United States, especially during the recent global financial crisis.

Balogun, Dahalan, and Hassan (2016) investigate the long-run effects of interest rate liberalisation on stock markets using panel data from 1990 to 2013 for seven sub-Saharan African countries. The finding indicates that interest rate has an adverse long-run effect on stock markets of a sample of seven states. Santis (2018) investigates the relationship between systematic risk factor, economic activities and stock market return over the 1999–2015 periods for the credit spreads for Eurobonds across euro area non-

financial firms. The results indicate that the extracted common latent factor negatively predicts stock market excess returns.

Ahmad and Sharma (2018) examine whether output gap along with the US economic uncertainty can explain the variations in stock market returns of G7 and the emerging market of Brazil, India, and South Africa. US economic policy uncertainty has negative and significant impacts on these stock markets. Also, indicate that the effects of the global output gap are relatively stronger compared to the country-specific output gap on stock market returns. The results show that for emerging markets stock returns variations, global output gap along with economic policy uncertainty has a more significant influence than other factors.

Dakhlaoui and Aloui (2016) analysed the dynamics of volatility spillovers between the US economic policy uncertainty and stock market indices of Brazil, Russia, India and China (BRIC). The results indicate that although the spillover means return between US uncertainty and the stock indices of BRIC countries is negative, the volatility spillover is found to swing between negative and positive values. Besides, the correlation is found to be highly volatile during periods of global economic instability. Thus, it is highly risky for investors to invest in the US and BRIC stock markets simultaneously

Assefa, Esqueda, and Mollick (2017) examine stock returns of 21 developed and 19 developing economies from 1999 to 2013 using quarterly panel data. By employing dynamic panels, the findings indicate that interest rates have statistically significant adverse effects on developed countries' stock returns, consistent with the expected cash flow hypothesis. In the developing markets, however, the results are slightly different from developed countries. This contrasting effect of interest rates change on stock returns can be partially attributed to differing monetary policies between developed and developing countries.

Before the introduction of the euro, most firms from the eurozone countries can raise funds in their home currency in the sizeable common currency market. Korkeamäki (2011) investigates the interest rate sensitivity of the European stock markets before and after the euro introduction. The findings indicate that stock returns in most countries in Western Europe are negatively correlated with interest rate changes before the euro. However, that correlation has disappeared since 1999. The findings

portray that recent growth in European corporate bond markets has played a significant task in influencing firms to manage their interest rate risk exposure.

Papadamou, Sidiropoulos, and Spyromitros (2017) examine the interest rate dynamic effect on stock market returns under different levels of central bank transparency using panel data from1998 to 2008 through an asset pricing model in emerging countries. They find evidence for a negative link between emerging market stock returns and interest rate differences. However, this negative effect is declined significantly under a transparent central bank.

Compared to the previous studies in the literature, including Berk and Aydogan (2012) and Boubaker and Raza (2017) , our study employs Markov-Switching frameworks with two regimes to analyse the impacts of real oil prices on stock returns of diverse group of nine emerging markets, and use the inference from the regime classification measures and regime probabilities to make comparisons among the countries. One advantage of using Markov-Switching models is their ability to capture frequent changes in times series data that may come as a result of external shocks, government policy, political instability as well as financial crisis, which are common for emerging market economies.

Moreover, compared to the other studies, we analyse the impacts for a diverse group of emerging markets, which includes the oil-exporting and oil-importing countries as well as includes such as, Chile which is not common investigated in previous empirical studies. Besides, for each of the countries in our sample, we use a different control variable such as long-term interest rate for each country and a global market volatilities conditions shocks in our analysis. Previous studies such as Gencer and Demiralay (2013), Raza et al. (2016) and Juan C. Reboredo and Ugolini (2016) use only real oil prices data to analyse the impacts on stock market returns. Our study, on the other hand, utilises 10-years long-term interest rate representing the practical side of the market expectations about prospects for the economy, and it has a critical influence on investment decisions and profitability of firms and hence, on their stock market performance. Besides, we utilise global market volatility conditions representing a global market risk such as expectations about the global financial and economic indicators.

In addition, compared to the other studies such as Ghosh and Kanjilal (2016), Kayalar et al. (2017), we introduce increases and decreases of the real oil prices shocks

proposed by Mork (1989) to account for the asymmetric impacts of oil price uncertainty on stock returns. Furthermore, one unique feature of our analysis which differentiates from other study is that the sample period covers both regional financial crises such as the financial crisis of Turkey in 2000-2001 and Asian financial crisis as well as the global financial crisis of 2007-2008.

Finally, we make a comparison of those impacts between real Brent Crude oil price shocks and those variables on each market. This comparison may help to avoid the biases of concluding that oil price shocks may have significant impacts on stock returns, while there are other variables which may affect both oil prices and stock returns.

**Table 2.1** *Summary of Literature Review*

| Authors | Data and Country | Methods | Main Findings |
|---|---|---|---|
| Mamipour and Vaezi Jezeie (2015) | **Country:** Iran<br>**Data:** Monthly data from January 2003 to December 2014 | Markov Switching Vector Error Correction model | Oil price has a significant negative impact on stock returns in all three regimes. |
| Degiannakis, Angelidis, and Filis (2013) | **Country:** U.S.A<br>**Data:** Monthly data from January 1989 to December 2011. | A structural VAR model and Markov Switching Model | An oil price returns and volatility possess the power to forecast the state of stock market returns and volatility. |
| Juan C Reboredo (2010) | **Countries:** USA, United Kingdom, Germany and the Netherlands<br>**Data:** Monthly data from the period of September 1985 to March 2006 | Markov-switching models | An increase in oil prices has a negative and significant impact on stock prices in one state of the economy. |
| Diaz et al. (2016) | **Countries**: Canada, France, Germany, Italy, Japan, the UK and the US<br>**Data:** monthly data for the period 1970 to 2014. | Vector Autoregressive model (VAR) | There is a negative response of G7 stock markets to an increase in oil price volatility. |
| Juan C. Reboredo and Ugolini (2016). | **Countries:** Three developed economies (the US, the UK and the European Monetary Union) and the five BRICS countries (Brazil, Russia, India, China and South Africa)<br>**Data:** Weekly data for the period 7th January 2000 to 19th December 2014. | Quantile and conditional quantile method | The impact of extreme upward and downward oil price changes on the upper and lower stock price quantiles is much smaller before the crisis than after the crisis.<br>Also, a small positive and negative oil price movements have no impact on any stock return quantiles both before and after the crisis |

| | | | |
|---|---|---|---|
| Sim and Zhou (2015) | **Country:** US<br><br>**Data:** monthly data from January 1973 to December 2007. | Quantile on Quantile Approach (QQ) | A large, adverse oil price shocks can affect US equities positively when the US market is performing well.<br><br>However, the influence of positive oil price shocks is weak. |
| Kang et al. (2015) | **Country:** US<br>**Data:** monthly data from January 1973 to December 2013 ( constructed from daily data) | Structural VAR model | Positive shocks to aggregate demand and oil-market specific demand are associated with adverse effects on the covariance of return and volatility. |
| Broadstock and Filis (2014) | **Countries:** China and US based on critical industrial sectors namely Metals & Mining, Oil & Gas, Retail, Technology and Banking<br><br>**Data:** Monthly data from January 1995 to July 2013 | Structural VAR model and GARCH | The US stock market is more responsive to oil price shocks compared to the Chinese stock market.<br><br>The US market is always positively related to the aggregate demand shocks, whereas this does not hold for China |
| Ghosh and Kanjilal (2016) | **Country:** India<br><br>**Data:** daily data for the period of 2nd January 2003 to 29th July 2011. | Nonlinear threshold cointegration tests | The threshold cointegration tests suggest the presence of a long-run relationship between the Indian stock market and international crude oil price in phase III only. |
| Bouri (2015a) | **Countries:** Lebanon and Jordan<br><br>**Data:** daily data from 3 April 2003 to 11 December 2013. | ARMAX-GARCH. | The volatility spillover from world oil price has more effects Jordanian stock market returns than the other way around, whereas this oil spillover is not a good predictor of Lebanese stock market. |
| H. Zhu et al. (2016) | **Country:** China based on 14 sector<br><br>**Data:** monthly data from March 1994 to June 2014. | Quantile regression model | The reaction of market returns to crude oil is highly heterogeneous across the conditional distribution of industry stock returns.<br><br>Also, there is evidence that this dependence is positive and exists only in recessions or bearish markets with low expected returns. |
| Gil-Alana and Yaya (2014) | **Country:** Nigeria<br><br>**Data:** monthly data from January 2000 to December 2011. | Fractionally cointegrated framework | A positive relationship between oil prices and Nigerian stock returns though with a short memory effect. |
| Moya-Martínez et al. (2014) | **Country:** Spanish | Arbitrage pricing | No significant effect from oil |

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| | The 14 industries covered<br>**Data:** weekly data over the period of January 1993 to December 2010 | theory (APT) model | price shocks on a large set of stock industries, including Consumer Goods, Technology and Telecommunications, Real Estate, and Utilities. In contrast, Energy, Construction, Basic Resources, Food and Beverages, and Banking emerge as industries with more significant exposure to oil price |
| Demirer et al. (2015) | **Country:** Saudi Arabia, Kuwait, Qatar, UAE, Oman and Bahrain.<br><br>**Data:** monthly data for the period of 31st March 2004 and 31st March 2013. | Fama-French factors Cross-sectional regression model | The stocks that are more sensitive to oil price fluctuations indeed yield significantly higher returns. |
| Afees A. Salisu and Oloko (2015) | **Country:** US<br><br>Data: daily data for the period from 2nd January 2002 to 4th April 2014. | **(VARMA–BEKK-AGARCH)** | A significant positive return spillover from the US stock market to the oil market and bidirectional shock spillovers between the two markets. |
| Le and Chang (2015) | **Country:** Singapore, Malaysia and Japan<br><br>**Data:** monthly data for the period from January 1997 to July 2013. | VAR | In Malaysia and Singapore, oil price shocks have a significantly positive effect on stock returns. |
| Bouri (2015b) | **Country:** Lebanon<br><br>**Data**: Weekly data from 30 January 1998 to 30 May 2014 | VAR-GARCH | A positive causal effect from oil price changes to stock market returns during the whole period. |
| Halaç et al. (2013) | **Country:** Turkey<br><br>**Data:** Weekly data from January 2nd, 1991 to February 24th, 2010. | Dynamic ordinary least square (DOLS) | A positive and significant relationship between Turkish stock returns and oil prices. |
| Eryiğit (2012) | **Country:** Turkey<br><br>**Data:** Weekly data from 7th January 2005 to 31st October 2008. | VAR model | An oil price shock has a positive impact on the Turkish stock returns index. |
| Aimer (2016)<br>. | Country: **Middle East Countries**<br><br>**Data:** Monthly data from March 2000 to March 2015. | BEKK-GARCH, DCC_GARCH | A significant transmission of the volatility of the oil market to stock indexes of Turkey. |
| Kayalar et al. (2017) | **Country:** Canada, Norway, Russia, Brazil, Australia, Japan, China, India, Turkey and South Africa<br><br>**Data:** Monthly data from January | Copula approach | The results concluded that, for Turkey, the stock market index has a significant positive dependence on WTI prices. |

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| | 2005 to January 2016. | | The dependence is the highest for chemistry and industrial sector indices. |
| Alp, Gökgöz, and Küçükkocaoglu (2016) | **Country:** Turkey<br><br>**Data:** quarterly data covering 2000 and 2012. | Cointegration and VECM approaches | The crude oil price has a positive significance long-run effect on expected returns of BIST Services index and BIST Finance index but has a negative impact on returns scheduled of BIST Industry index. |
| Basher et al. (2018) | **Country:** Oil-exporting country.<br><br>**Data:** Monthly time series data from January 1974 to August 2015 | Markov-switching Model | Oil-market shocks have a statistically asymmetric significant impact on stock returns for most of the major oil-exporting countries |
| Narayan and Gupta (2015) | **Country:** USA<br><br>**Data:** Monthly time series data from October 1859 to December 2013 | A predictive regression model | US stock returns respond more to negative oil prices than positive oil prices do. |
| Kang et al. (2016) | **Country:** USA<br><br>**Data:** Monthly time series data from January 1973 to December 2014 | Structural VAR model | An increase of U.S. oil supply shock has a significant positive effect on U.S. real stock returns. |
| Al-hajj et al. (2018) | **Country: Malaysia**<br><br>**Data:** Monthly time series data from January 1990 to November 2016 | nonlinear ARDL | Real crude oil price shocks have an asymmetric impact on the stock market returns of Malaysia. |
| Xiao et al. (2018) | **Country: China**<br><br>**Data:** Monthly time series data | Quantile regression model | Crude oil volatility index has significant adverse effects on the aggregate and sectoral stock returns in the bearish market only |
| Ji et al. (2018) | **Country: BRICS**<br><br>**Data:** Monthly time series data | Structural VAR approach as well as time-<br>the varying copula-GARCH-based CoVaR framework | Significant asymmetric effect between upside and downside risk spill-over based on oil aggregate demand shock and oil-specific demand shock for Brazil, India and Russia. |
| H. Zhu et al. (2017) | **Country:** Developed and emerging economies<br><br>**Data** | Markov Switching Model | Oil supply and demand shocks have a statistically high significance impact in a high volatility regime than in a low volatility regime. |

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| Bjørnland and Leitemo (2009) | **Country:** USA<br><br>**Date:** Monthly data from January 1983 to December 2002 | Structural VAR model | Significant great interdependence between interest rate and the S&P 500 stock prices |
| Jammazi et al. (2017) | **Country:** USA<br><br>**Data:** Daily time-series data from January 1993 to December 2014 | The multifactor smooth transition regression model | The significant bidirectional causal relationship between long-term interest rate and S&P stock returns |
| Balogun et al. (2016) | **Country:** Seven sub-Saharan African countries<br><br>**Data:** Panel data from 1990 to 2013 | Dynamic heterogonous panel model using PMG techniques. | The interest rate has an adverse long-run effect on stock markets of a sample of seven states |
| Santis (2018) | **Country:** EU countries<br><br>**Data:** Quarterly data from 1999 to 2015 | | The extracted common latent factor negatively predicts stock market excess returns |
| Ahmad and Sharma (2018) | **Country:** G7 and the emerging market of Brazil, India, and South Africa<br><br>Data: Quarterly data | | US economic policy uncertainty has negative and significant impacts these stock markets |
| Alam and Uddin (2009) | **Country:** Australia, Bangladesh, Canada, Chile, Colombia, Germany, Italy, Jamaica, Japan, Malaysia, Mexico, Philippine, S. Africa, Spain, and Venezuela.<br><br>Data: | | An interest rate has a significant negative relationship with share price for all ample countries |
| Dakhlaoui and Aloui (2016) | **Country:** U.S.A, Brazil, Russia, India and China<br><br>**Data: Monthly time-series data** | Cross-correlation function | The volatility spillover is found to swing between negative and positive values |
| Papadamou et al. (2017) | **Country: Emerging countries**<br><br>**Data;** panel data from1998 to 2008 | Assets pricing model | Evidence for a negative link between emerging market stock returns and interest rate differences. |
| Assefa et al. (2017) | **Country:** 21 developed and 19 developing economies<br><br>**Data:** Quarterly panel data from 1999 to 2013 | Dynamic panels model | Interest rates have statistically significant adverse effects on developed countries' stock returns.<br><br>In the developing markets, however, the results are slightly different. |

## 3. DATA AND METHODOLOGY

This chapter presents the practical strategies employed in the study to investigate a systematic analysis of real crude oil prices shocks and stock returns in emerging economies of Brazil, China, Chile, Jordan, India, Mexico, SouthAfrica, Taiwan, and Turkey under the low volatility and high volatility regimes. The dynamic relationships between these variables, with the addition of real oil prices shocks of increases and decreases of real oil prices as proposed by Mork (1989, government long-term interest rates and Chicago Board option volatility index as a proxy for global market volatility condition are examined in the MS model and investigate how different regimes are perceived between different markets.

Moreover, this section describes the formal framework of the Markov switching time series models, which enables us to identify different heterogeneous regimes that are characterised by various parameters such as intercept, slope coefficients and variance structures. We discuss the model selection procedures between linear regression and MS model and the type of test employed and also investigates the fundamental properties of Markov switching models and shows the statistical techniques for specification and estimation of the models to fit our data.

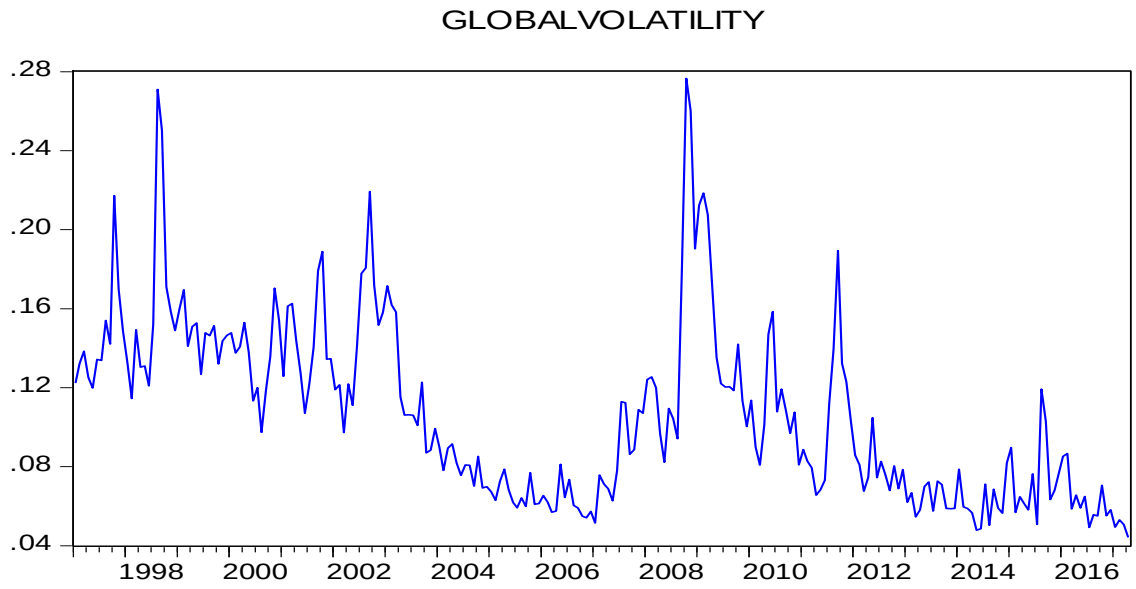
### 3.1.Data Sources and Data Collection

The data of this study consists of monthly secondary data of nine emerging markets indices:

- IBOVESPA index (Brazil),
- SSE Composite Index (China),
- IPSA index (Chile),
- ASE index (Jordan),
- BSE Sensex Index (India),
- BMV index (Mexico),
- JSE index (South Africa),
- TWSE index (Taiwan),
- BIST 100 index (Turkey).

Brent Crude oil spot price, Chicago Board of Options Exchange's (CBOE) S&P 500 market volatility index as a proxy for Global volatility condition shocks (**Figure 3.1)** and 10-year long-term interest rates for each country **(Figure 3.3)** were also employed from January 1997 to April 2017.

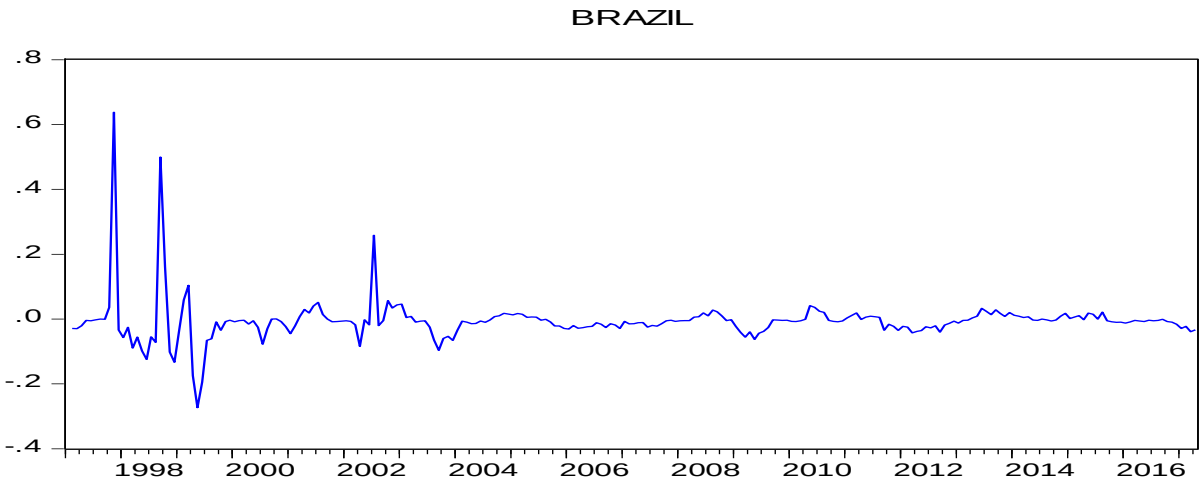
**Figure 3.1** *Global Market Volatility conditions shocks*

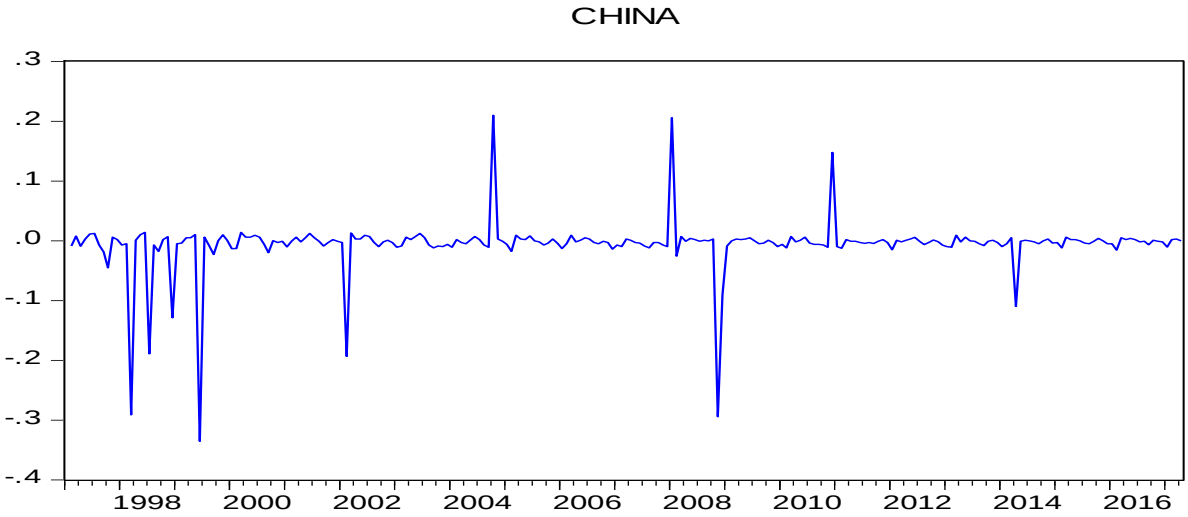


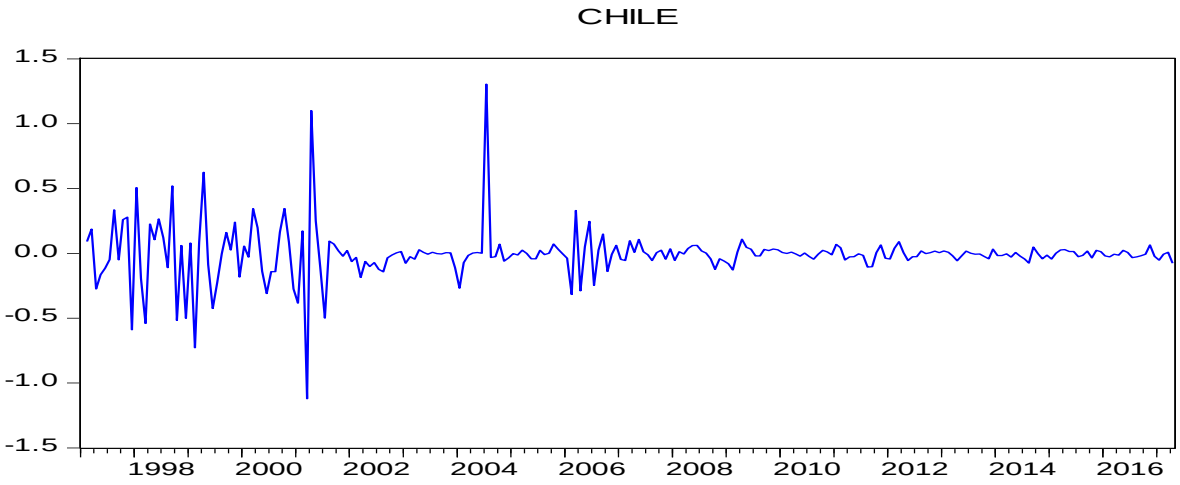

The sample countries of this study are based on the survey conducted by the Internatinal Monetary Fund (IMF) on Global financial stability report of October 2017[6]. The study is concerning the financial conditions indicators on risk to Growth, which indicates that an increase in the financial conditions indicators corresponds to the tighter financial condition, such as higher spreads and global volatility, the uncertainty of asset prices and interest rate volatility, which makes emerging countries more vulnerable. Therefore, we extend this study by including more emerging countries which are sensitive to the indicators as mentioned above by the IMF.

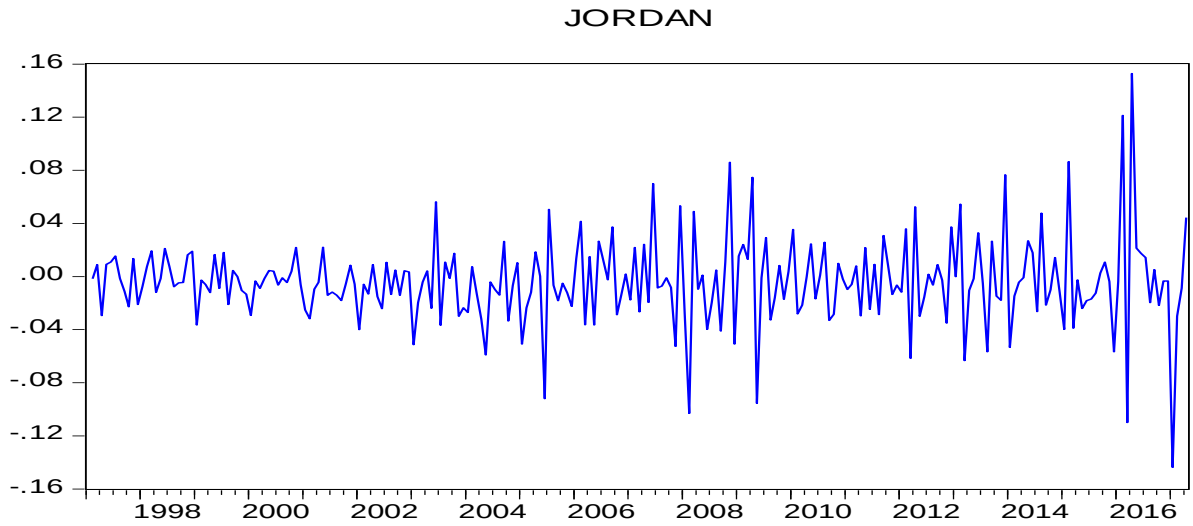
[6] International Monetary Fund. Global Financial Stability Report October 2017: Is Growth at Risk. Available from https://www.imf.org/en/Publications/GFSR/Issues/2017/09/27/global-financial-stability-report-october-2017

**Figure 3.2** *The Real long-term interest rate shocks for emerging markets*

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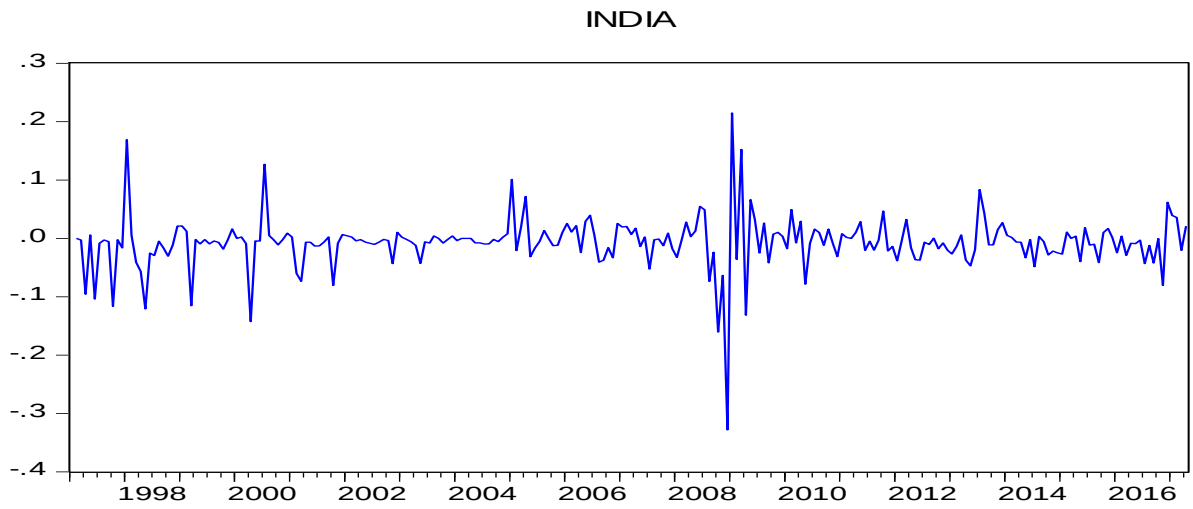
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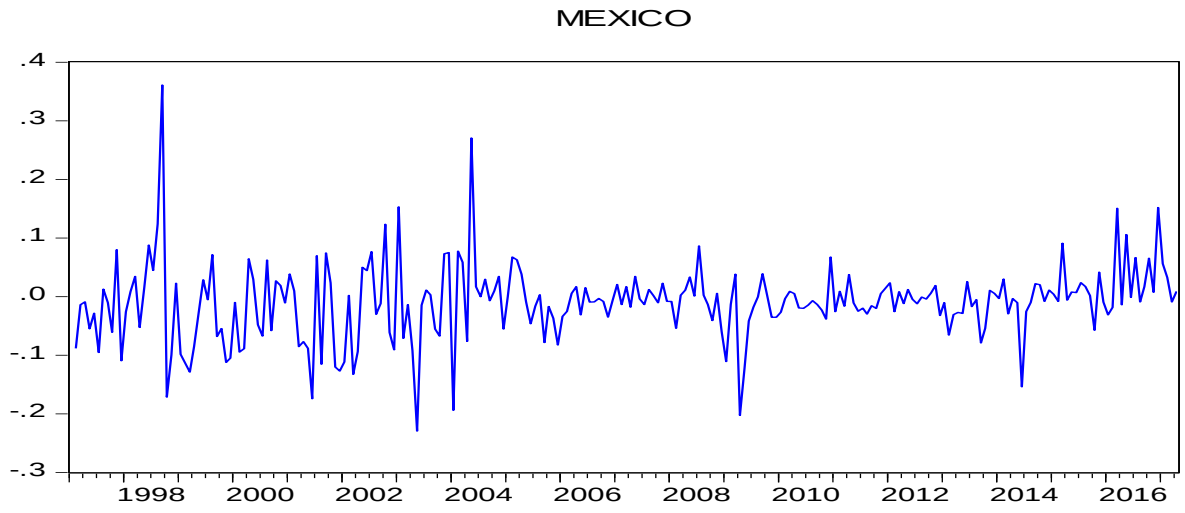
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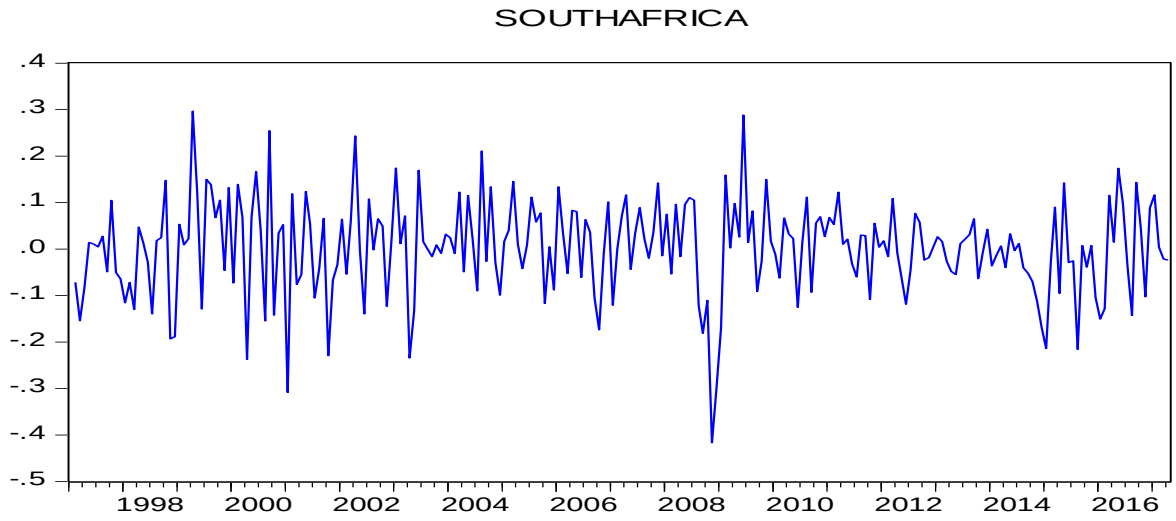
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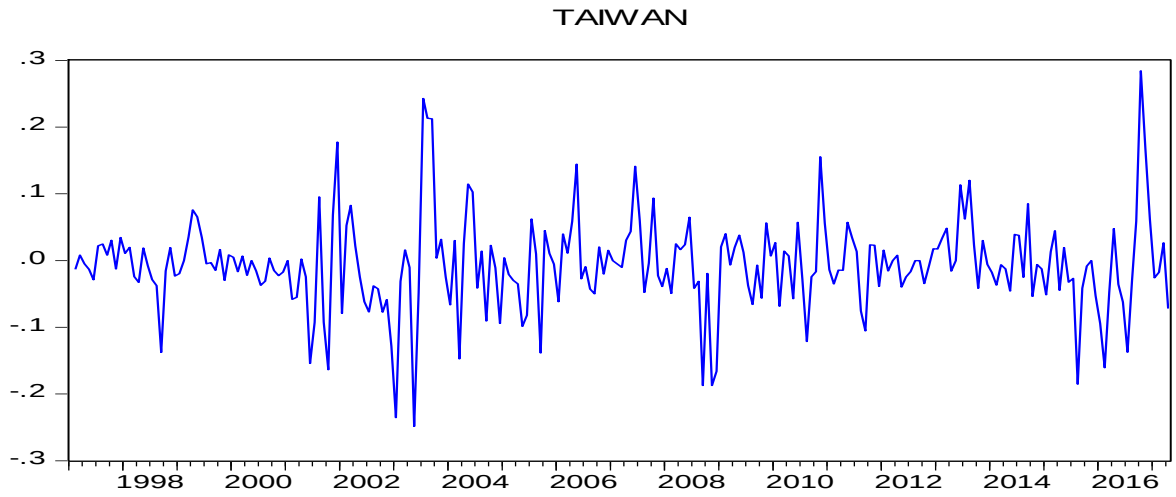
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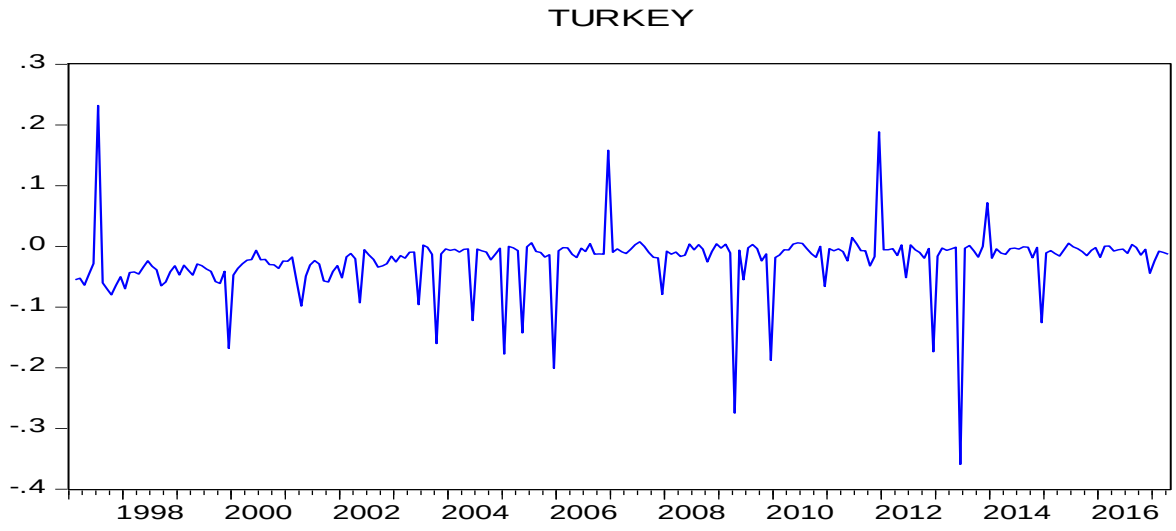
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Monthly data are employed in the study because it is contaminated by less noise and can, therefore, better capture the interactions between variables under the study. Also, monthly data have smaller biases due to the nonsynchronous trading of some individual stocks. We utilized real returns by deflating them using CPI of their respective country. Also, we deflated Brent Crude Oil spot price and the global volatility index using CPI of United State of America. Then, the data were transformed into natural logarithm to test oil price shocks on stock returns index for each of these markets by using monthly return frequencies logarithm formula; $Return_t = ln[P_t - P_{t-1}]/P_{t-1} * 100$. Stock price index returns of each country, Brent Crude oil price and Global market volatility index have been collected from Thomson Reuters official website, while ten years long-term government interest rates of each state and CPI index of each country have been obtained from Federal Reserve Economic Data (FRED).

The Brent Crude oil price, one of the most widely recognised international benchmarks for crude oil prices, is regarded as the global oil price. It is worth pointing out that we abandon country-specific oil prices and use the global oil price in our study. This is because the worldwide oil price can better capture the impact of the oil price shocks on the stock markets than country-specific prices, which reflect the offsetting movements in exchange rates J. Park and Ratti (2008).

To control the effects of local and international macroeconomic factors that are known to affect stock returns of emerging economies, we use long-term interest rates of each country and the Global market volatility index (CBO VIX).

The long-term interest rates that are used in this study are the rates of 10-year government bonds. This data is also utilized by other studies such as Nadal et al. (2017b) and Ghosh and Kanjilal (2016). Long-term interest rates incorporate market expectations about prospects for the economy and can be used as a proxy for the cost of borrowing funds. Accordingly, long-term interest rates presumably will have a critical influence on investment decisions and profitability of firms and hence, on their stock market performance.

Also, Chicago Board of Options Exchange's S&P 500 market volatility index (VIX) was chosen as the proxy for global volatility and included as a control variable. VIX has widely used a measure of market risk, often referred to as the "investor fear gauge." Analysing these "non-physical" market conditions, such as expectations about

the global financial and economic indicators, may highlight the evidence of the empirical variations in stock returns. The evidence of such tri-dimensional interaction was investigated by Kilian and Park (2009).

### 3.2.Oil Price Measures

To account for the asymmetric impacts of oil price shocks, we introduce two different measures of oil price shocks. The first is the real oil price increase shocks and the second is the real oil price decrease shcoks as proposed by Mork (1989). The reason for this nonlinear measure is facilitated by the assumption that oil price changes have an asymmetric impact on the stock returns of emerging markets. The asymmetric measure proposed by Mork (1989) is based on the observation that the relationship between oil prices and the macroeconomy presented in Hamilton (1983) pertains to a period of oil price increases and he did not take into account the massive oil price declines of 1985–1986. Mork (1989) notes *'... all the large oil price movements were upward, and thus it left unanswered the question of whether the correlation persists in periods of price decline'*. He puts more attention to the possibility of asymmetric responses to oil price increases and decreases. Therefore, Mork (1989) assumes that the impact of oil price changes on the macroeconomy including stock markets is asymmetric and suggests two measures.

The measure for price increases is given by

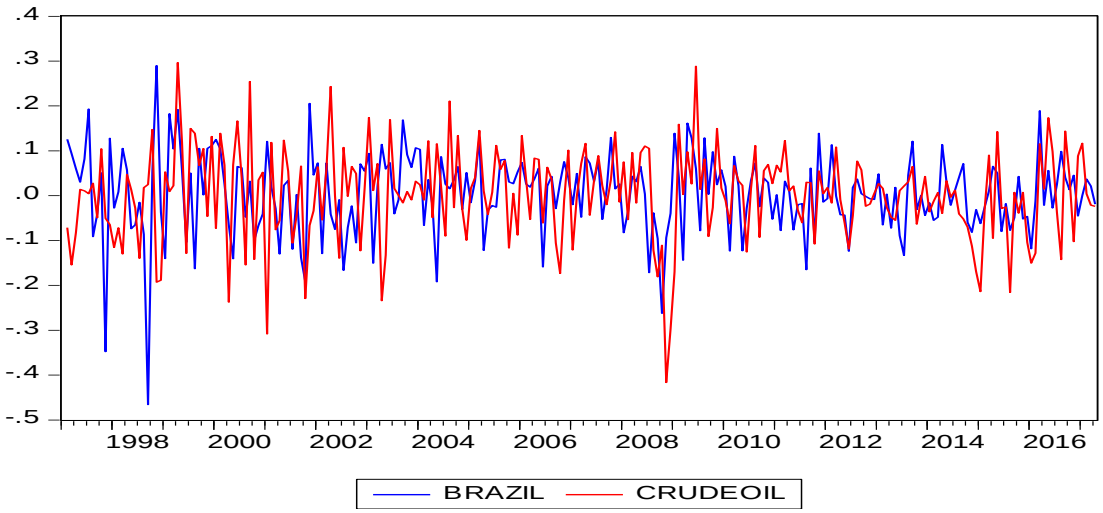
$$CRO_t^+ = \max\left(CRO_t^{real}, 0\right) \qquad (3.1)$$

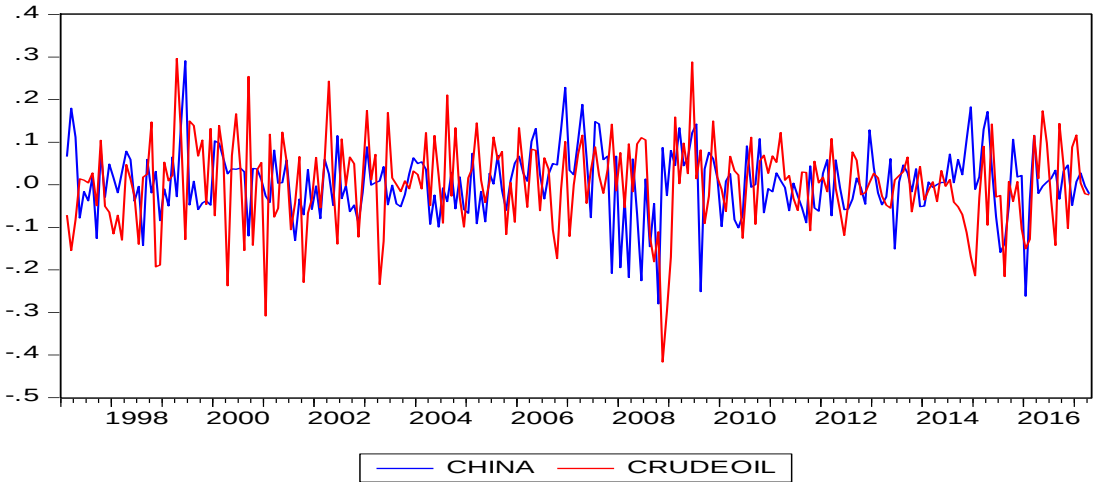
While for oil price decreases, given by

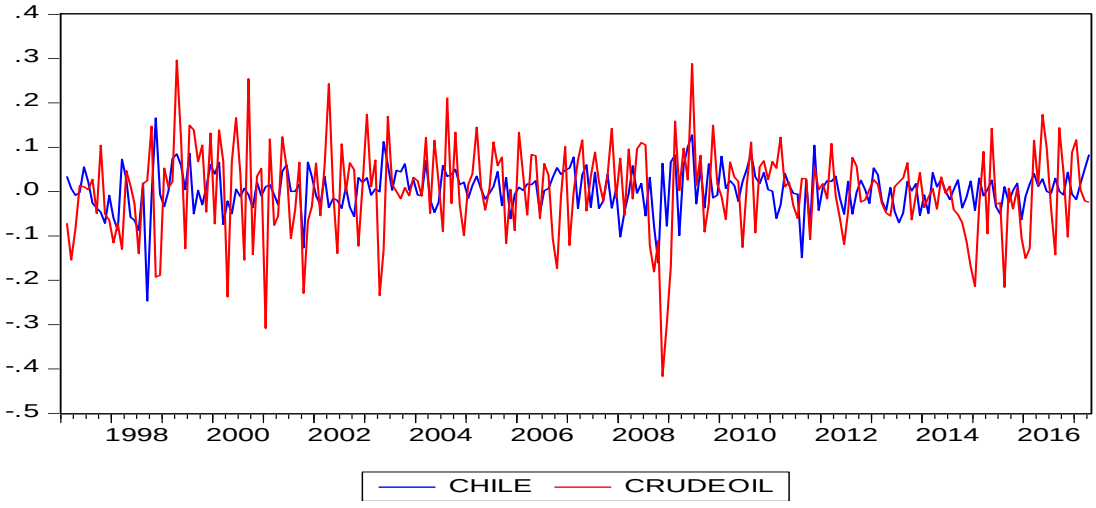
$$CRO_t^- = \min\left(CRO_t^{real}, 0\right) \qquad (3.2)$$

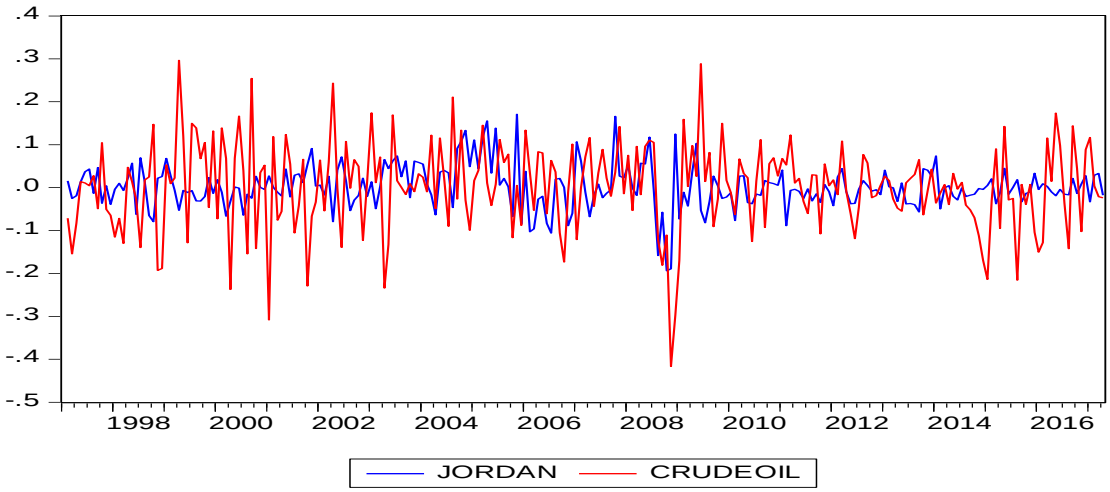
Where $CRO_t^{real}$ denotes the real oil price changes using the CPI index of the U.S.A as quoted above, $CRO_t^+$ and $CRO_t^-$ are the increases and decreases of the real oil price changes, respectively.

**Figure 3.3** *Brent crude oil price change and real stock returns change*

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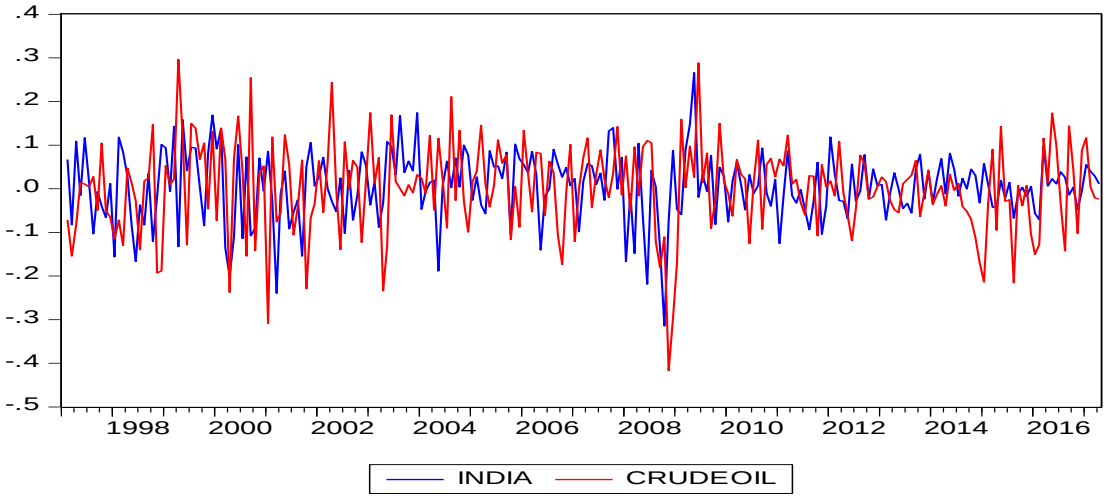
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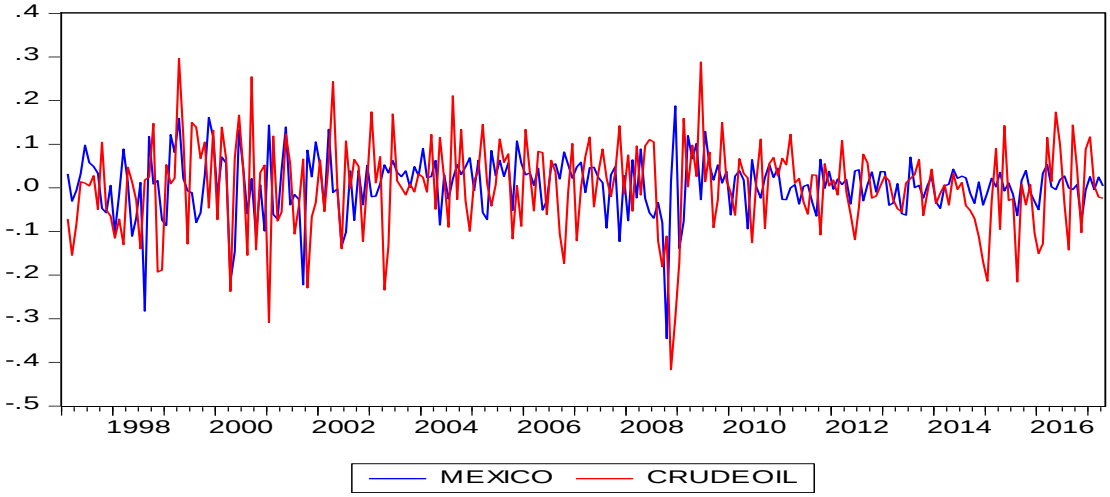
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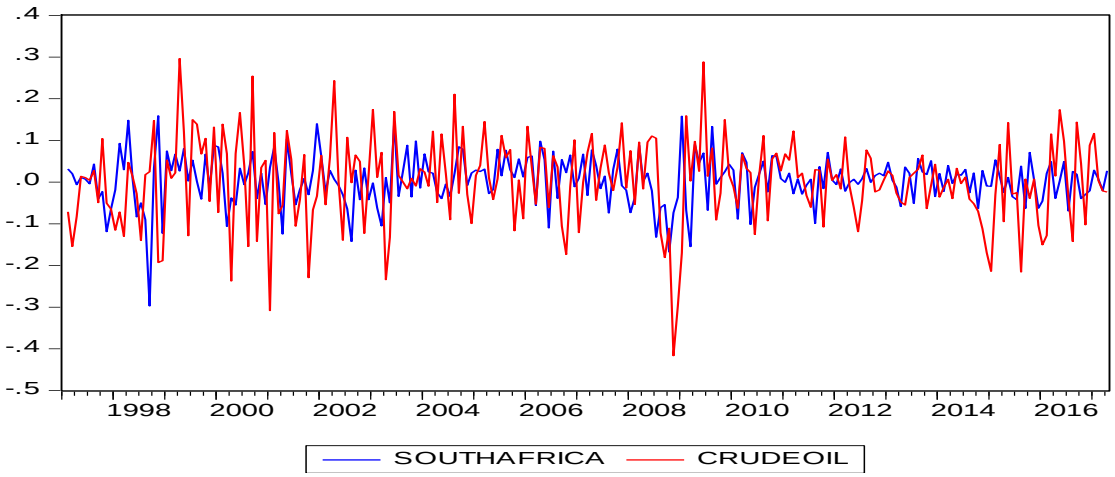
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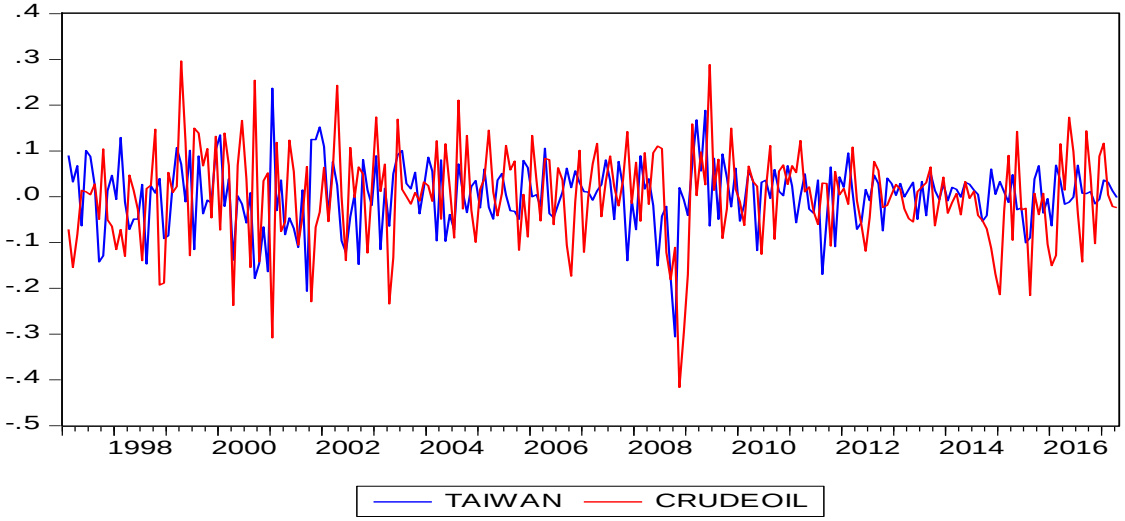
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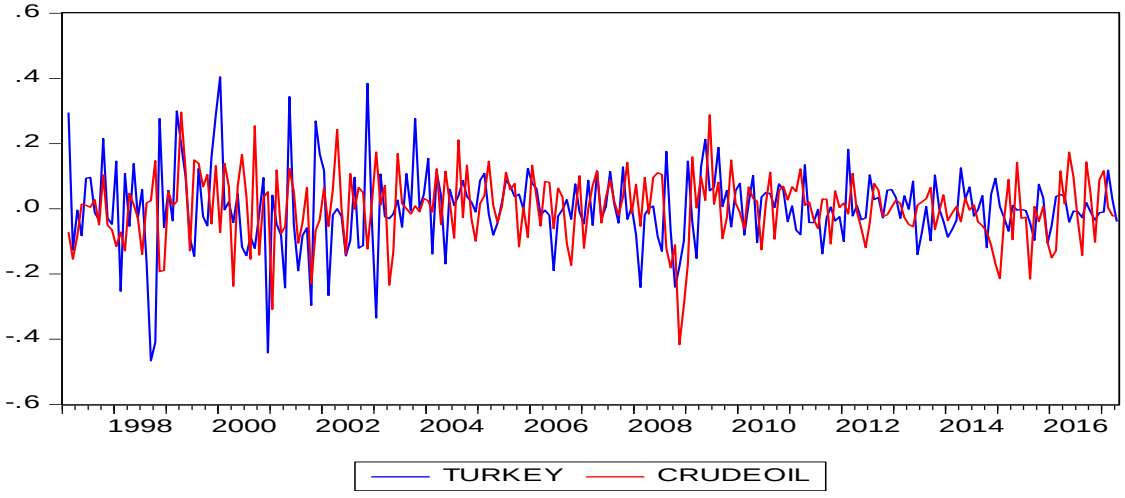
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### 3.3.Unit Root Test

Most time series data are found to be non-stationary. Therefore, Unit root test is conducted with Augmented Dickey-Fuller (ADF) test proposed by (Dickey & Fuller, 1981) and Phillips-Perron test offered by (Phillips & Perron, 1988).

To check the stationarity of the variables; two regression forms are generated:

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \sum_{j=1}^{p} \gamma_j \Delta Y_{t-j} + \varepsilon_t, \qquad (With\ Constant) \tag{3.3}$$

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_1 t + \sum_{j=1}^{p} \gamma_j \Delta Y_{t-j} + \varepsilon_t, \qquad (With\ Constant\ and\ trend) \tag{3.4}$$

for all $t = 1,2, \ldots \ldots, 120$ $and \varepsilon_t$is a white Noise.

Where $\Delta$ is the first lag operator, $\alpha$ the constant and $\beta$ the coefficient of time trend and p is the lag order. The null hypothesis is $\rho = 0$ against the alternative$\rho < 0$. Each variable is expressed in logs return. The choice of the lag length required for the test is based on the Akaike Information Criterion (AIC). Outcomes of those tests are presented in **Table 3.1 and 3.2.** Based on the test, at the level, the null hypothesis of non-stationarity cannot be rejected at 5% level for all the variables except global market volatility conditions and interest rate for China, India and Turkey with a constant as well as constant and trend. However, after the first log difference of our variables, the null hypothesis of unit root tests can be rejected at 1% level for all variables.

**Table 3.1** *Unit root test at Level*

| | ADF | | P.Perron | |
|---|---|---|---|---|
| | **Constant** | **Constant & trend** | **Constant** | **Constant & trend** |
| **Global Variables** | | | | |
| Brent Crude Oil | -1.890 | -1.934 | -1.852 | -1.933 |
| VIX | -3.990** | -5.088** | -3.657** | -4.978** |
| **Emerging Stock Markets** | | | | |
| Brazil | -1.882 | -1.794 | -1.923 | -1.867 |
| China | -2.903 | -3.062 | -2.991 | -3.110 |
| Chile | -0.653 | -2.032 | -0.722 | -2.173 |
| Jordan | -0.743 | -2.346 | -0.722 | -2.173 |
| India | -1.323 | -2.346 | -1.476 | -2.737 |
| Mexico | -0.729 | -2.816 | -0.881 | -2.444 |
| South Africa | -0.963 | -2.488 | -0.963 | -2.481 |
| Taiwan | -3.099 | -3.387 | -2.687 | -3.078 |
| Turkey | -2.942 | -.3.184 | -3.181 | -3.353 |
| **Long term interest rate** | | | | |
| Brazil | -2.420 | -3.412 | -1.765 | -3.486 |
| China | -4.281** | -4.279** | -4.550** | -23.568** |
| Chile | -2.198 | -2.282 | -3.470 | -4.805 |
| Jordan | -2.198 | -2.282 | -3.470 | -4.805 |
| India | -2.980** | -4.781** | -5.187** | -5.482** |
| Mexico | -2.777 | -1.612 | -3.235 | -2.826 |
| South Africa | -2.773 | -1.246 | -2.818 | -2.163 |
| Taiwan | -2.163 | -1.413 | -1.912 | -1.695 |
| Turkey | -5.996** | -6.352** | - 12.298** | -13.336** |

Note: *, ** and *** indicate significance level at 10%, 5% and 1%, respectively. ADF and PP denote the Augmented Dickey Fuller and Phillips Perron tests.

**Table 3.2** *Unit root test at first differences*

| | ADF | | P.Perron | |
|---|---|---|---|---|
| | **Constant** | **Constant & trend** | **Constant** | **Constant & trend** |
| **Global Variables** | | | | |
| Brent Crude Oil | -12.667*** | -12.668*** | -12.753*** | -12.747*** |
| VIX | -13.543*** | -13.517*** | -21.028*** | -21.086*** |
| **Emerging Stock Markets** | | | | |
| Brazil | -14.828*** | -14.822*** | -14.824*** | -14.817*** |
| China | -8.803*** | -8.785*** | -14.628*** | -14.608*** |
| Chile | -9.317*** | -9.329*** | -15.443*** | -15.424*** |
| Jordan | -9.329*** | -9.317*** | -15.443*** | -15.422*** |
| India | -14.626*** | -14.597*** | -14.646*** | -14.618*** |
| Mexico | -6.646*** | -6.631*** | -15.271*** | -15.240*** |
| South Africa | -16.682*** | -16.647*** | -16.692*** | -16.656*** |
| Taiwan | -7.786*** | -7.907*** | -14.640*** | -14.644*** |
| Turkey | -14.720*** | -14.688*** | -14.737*** | -14.706*** |
| **Long term interest rate** | | | | |
| Brazil | -5.410*** | -5.510*** | -12.997*** | -12.979*** |
| China | -3.631*** | -3.299*** | -15.784*** | -16.051*** |
| Chile | -5.635*** | -5.772*** | -34.828*** | -36.835*** |
| Jordan | -5.635*** | -5.773*** | -34.828*** | -36.833*** |
| India | -12.660*** | -12.867*** | -15.138*** | -15.579*** |
| Mexico | -5.417*** | -5.912*** | -15.122*** | -15.263*** |
| South Africa | -7.570*** | -8.041*** | -12.272*** | -12.378*** |
| Taiwan | -6.848*** | -7.085*** | -11.666*** | -11.704*** |
| Turkey | -5.860*** | -5.066*** | -13.219*** | -14.343*** |

Note: *, ** and *** indicate significance level at 10%, 5% and 1%, respectively. ADF and PP denote the Augmented Dickey Fuller and Phillips Perron tests.

### 3.4.Econometric Model Specification

Various time-series models have been employed to investigate the behaviour of financial and economic variables. Linear models such as Auto Regression model (AR), Moving Averages (MA) and integrated Auto-Regressive Moving Averages (ARMA) model as the common models were employed. Investigating the effect of oil price

uncertainty on each the stock market returns, firstly we adopt the following a regression model proposed by C. M. Jones and Kaul (1996) to provide some baseline results[7]:

$$y_{i,t} = \mu_{0,i} + \beta_{1,i} CRO^{+}_{i,t} + \beta_{2,i} CRO^{-}_{i,t} + \beta_{3i} y_{i,t-1} + \varepsilon_{i,t} \quad (3.5)$$

Where $y_{i,t}$ is the stock market returns for country $i$ at time $t$, and $CRO^{+}_{i,t}$ and $CRO^{-}_{i,t}$ are referred as increases of the real oil price shocks and decreases of the real oil price shocks at time $t$. While $\mu_{0,i}$ and $\varepsilon_{i,t}$ are the constant and the error term for each country $i$ at a time.

In a recent study, Ghosh and Kanjilal (2016) show that the use of only oil price shocks may overestimate the effect of oil price shocks on the stock returns in our model. To overcome this problem, it is suggested to include local and international macroeconomic factors that are known to affect stock returns of emerging economies. Hence we extend Eq. (3.5) with domestic and international macroeconomic factors and obtain

$$y_{i,t} = \mu_{0,i} + \beta_{1,i} CRO^{+}_{i,t} + \beta_{2,i} CRO^{-}_{i,t} + \beta_{3,i} IR_{i,t} + \beta_{4,i} VIX_{i,t} + \beta_{5,i} y_{i,t-1} + \varepsilon_{i,t} \quad (3.6)$$

Where $IR_{i,t}$ and $VIX_{i,t}$ are referred as an interest rate of each country and global volatility shocks respectively.

Although these linear models in many cases are good fitting, they are not adequate to analyse the non-linear dynamic behaviour of variables due to their ability to detect asymmetry. According to Balcilar, Demirer, and Hammoudeh (2013), a significant weakness of the linear regression model (3.6) is that it is based on constant specification where the model parameters are assumed to be constant over time. It ignores the possible structural breaks and regime changes which may impact our results. Stock market returns series, and crude oil prices are characterised by unusual jumps or structural changes in their levels or volatility. The presence of important various

[7] There are two points need to note. First, the lags of the structural oil shocks and other macroeconomics shocks do not be included as explanatory variables in Eq. (3.5 and 3.6). That is because the stock prices are the present value of discounted future cash flows of firms. Therefore, both the current as well as the expected future effects of an oil price shock should be absorbed quickly into stock returns and prices, without having to wait for those impacts to occur (D. W. Jones, Leiby, & Paik, 2004). Second, we include one period lag of the stock market return as an explanatory variable because this specification provided better regression fit and residual diagnostics than a model without the lagged stock market return variable.

economic or non-economic events causes significant non-linearity in the stochastic process. When regime shifts are stochastic rather than deterministic, linear model approaches may lead to biased or at least inefficient results (Clarida, Sarno, Taylor, & Valente, 2006).

### 3.4.1. Markov Switching Model for The Oil Price – Stock Market Returns Relationship

To capture the possible asymmetric responses of stock market returns to oil price shocks, we attempt to employ Markov-Switching (MS) model, which is commonly used by Hamilton (1989), Engel and Hamilton (1990), Abel (1992), Engel (1994) Bauwens, Preminger, and Rombouts (2006), among many others, and have seen some success in capturing the nonlinearity and regime shifts of the underlying time series, and shown some superiority in analysis. We assume that two regimes (low and high volatility regime) are sufficiently describing the dynamic interactions between the oil and stock prices.

Furthermore, when data are modelled with the Markov switching time series framework, the parameters of the model depend on a stochastic and unobservable state variable that represents the different phases of the economy (Baycan, 2013). These regimes are driven by an unobservable stochastic state variable where some or all of the model parameters may take different values concerning the regime prevailing at a given point in time. Our model is extended to test whether Brent crude oil prices affect the stock returns of emerging stock markets. Several studies successfully use MS models to investigate oil price shocks and stock return, such as Juan C Reboredo (2010), Mamipour and Vaezi Jezeie (2015) and (Chen, 2010). Following these empirical studies, we consider the MS model, which, with its rich structure, can accommodate the dynamic impacts of crude oil uncertainty on stock returns.

Our estimations follows the original model constructed by Hamilton (1989) where only the intercept switches between regimes. We extend this model by allowing the intercept term, slope coefficient and variance of the error term to be regime-dependent as applied by Juan C Reboredo (2010). The extension of Eq. (3.6) is shown as:

$$y_{i,t} = \mu_{0,i,s_t} + \beta_{1,i,s_t} CRO^{+}_{i,t} + \beta_{2,i,s_t} CRO^{-}_{i,t} + \beta_{3,i,s_t} IR_{i,t} + \beta_{4,i,s_t} VIX_{i,t} + \beta_{5,i,s_t} y_{i,t-1} + \varepsilon_{i,t,s_t} \quad (3.7)$$

With $ND(0 \quad )$

While

Where $S_t = 0,1 \ldots, k$ denotes the unobserved state indicator following a first-order Markov-process, which implies that the current regime depends only on the regime prevailing one period ago. Interpretation of the model depends on the value of k.

Terms $\mu_{S_t}$ and $\sigma_{S_t}^2$ are, respectively, the state dependent mean or intercept and variance in stock returns. Therefore, our MS model distinguishes between different market states by allowing for different levels of market volatility.

The description of Markov trend dynamics becomes complete after defining a probability rule for the transition between different states. As per the literature, we assume that the unobserved state variable, more precisely $S_t$, follows two states Markov-process with transition probability matrix given by:

$$\begin{bmatrix} & \\ & \end{bmatrix}$$

Where $P[S_t = j/S_{t-1} = i] = p_{ij}; i, j = 0,1 \ldots . k$ denotes the probability that the process is in state $j$ at time $t$ given that it had been in state $i$ the previous period, and by the rule of probability; $\sum_{j=1}^{k} p_{ij} = 0$ where $i = 0,1 \ldots, k$ and $0 \leq p_{ij} \leq 1$. The transition probabilities are supposed to be constant over time as in the original Hamilton model.

Besides, the most relevant question when dealing with Markov Switching model is how long, on average, the regime will last. Markov switching model answers this question by considering the expected duration for each regime state under the study. Let $D$ denote the duration of state j whereby $D_j$ follows a geometric distribution. The expected duration for regime j is given by;

$$E(D_j) = \frac{1}{1 - p_{jj}} \tag{3.11}$$

Overall, the MS model specified in Equations (3.7) allows us to gain insight into the effects of oil shocks on stock returns of emerging markets. The model not only accounts for direct effects of crude oil uncertainty but also provides insight into the impact of the local and global macroeconomic conditions on the stock returns as well as on the transitions between different market regimes.

### 3.4.2. Testing for Nonlinearity and a Model Selection Strategy

Two critical issues arise from the recent empirical literature regarding the stock market returns-oil price relationship. Firstly, is the relationship between stock market returns and oil price changes linear or nonlinear? Second, how does one decide which test should be used? The starting point is to test for the presence of non-linearity in the data. As stated by Aloui and Jammazi (2009), we should note that the selection of the regime switching process is difficult because the identification of the nonlinearity in MS models cannot be recognised by the regular likelihood ratio, Wald test or Lagrange multiplier tests since their asymptotic distributions are non-standard. To answer the above two questions, we have used the likelihood ratio test (LR) suggested by Garcia and Perron (1996), which is approximately $X_q^2$ distributed with $q$ restrictions plus the nuisance parameters that are not identified under the null hypothesis. Thus, we test the null hypothesis of no regime switching in stock market returns represented by Equation (3.6) against an alternative specification Equation (3.7) which involves regime switching in the stock market returns. The LR test statistics is defined as $LR = 2\{MS_{Eq.(5)} - Linear\ Reg._{Eq.(4)}\}$ and the critical value is based on the p-values of Davies (1987).

The second step is how to determine the number of regimes required by each country model and assess the quality of the M.S fitted model. Unfortunately, direct and simple criteria statistics cannot be applied. Our strategy follows Balcilar et al. (2013) and Baele (2005) who suggest selecting the number of regimes using likelihood ratio test suggested by Garcia and Perron (1996) and Regime Classification Measure (RCM) proposed by Ang and Bekaert (2002) respectively. A well-fitting M.S model is the one that shows a sharp classification of regimes and has smoothed probabilities. We use the

regime classification measure (RCM) of Ang and Bekaert (2002) to identify the accuracy of the regime M.S model:

The RCM is given for $K > 0$ states by the following:

$$RCM(K) = 100 * \left(1 - \frac{K}{K-1}\frac{1}{T}\sum_{t=1}^{T}\sum_{h=1}^{K}\left\{p_{i,t} - \frac{1}{K}\right\}^2\right) \qquad (3.12)$$

Where $p_{i,t} = Pr[S_t = i \,/\, I_T]$ is the probability of being in regime $i$ at time $t$. The RCM measure range between 0 (perfect regime classification) and 100 (failure to detect any regime classification).

Once the MS model with a correct specific regimes number is obtained for each country, the last important aspects to consider are the below mentioned criteria: model fit based on the residual diagnostic test, value of the log-likelihood function, values of the estimated coefficients in different regimes and the relationship between the macroeconomic factors and the probability of the regime-switching behaviour. Thus, we make a comparison of the selected models based on these criteria.

## 4. EMPIRICAL FINDINGS

This chapter provides the empirical results of systematic and consistent analysis of the impact of crude oil price shocks on stock market returns of nine emerging markets. We present the results in three main sub-sections.

In sub-section one, we examine the non-linear relations for each emerging stock market. After that, several specification tests are applied to find the individual models that best reveal the behaviour of these stock markets. We conduct tests for each market to investigate whether a two or a three-state best captures the impact of crude oil price on stock market returns. We, then, provide regime classification measures for each market to check the accuracy of each regime. Finally, the individual volatility behaviour and persistence of market regimes are further examined for each of the emerging stock markets.

In sub-section two, to examine whether the real crude oil prices shocks have asymmetric effects on stock returns, we compute the coefficients of increase and decrease of oil the real price changes on each economy using a Markov Switching model, with shifting mean, slope coefficient and variance to identify the low and high-volatility states.

In the last sub-section, we examine the impacts of the long-term interest rate shocks and global market volatility condition shocks, which are known to affect the stock returns in emerging economies. Then, we make a comparison of those impacts together with Brent Crude oil price impact for each emerging economy.

### 4.1.Testing for Non-Linear Relations

Since our study aims to investigate the relationships between oil price shocks and stock market returns of emerging economies in regime-switching conditions, the first step in our empirical analysis is verifying whether stock returns of emerging markets display regime-switching properties. For this purpose, we test the null hypothesis of no regime switching against the alternative of a regime-switching MS model.

**Table 4.1** presents the results of the likelihood ratio (LR) test statistics proposed by Garcia and Perron (1996) for testing non-linearity. The results support the alternative hypothesis of Markov Switching model against the null hypothesis of a linear regression model. These findings reject the null hypothesis of no regime shifts for the emerging

stock markets, which means that the nonlinear MS model better explains the behaviour of these markets.

**Table 4.1** *Likelihood ratio test: Linear versus MS specifications*

| Country | $Linear\ Reg._{Eq.(4)}$ | $MS_{Eq.(5)}$ | LR |
|---|---|---|---|
| Brazil | 263.97 | 283.21 | 38.48*** (0.000) |
| China | 273.49 | 302.57 | 58.16*** (0.000) |
| Chile | 393.81 | 418.58 | 49.54*** (0.000) |
| Jordan | 390.71 | 428.13 | 74.84*** (0.000) |
| India | 283.13 | 318.81 | 71.36*** (0.000) |
| Mexico | 329.42 | 376.85 | 94.86*** (0.000) |
| South Africa | 351.82 | 377.55 | 51.46*** (0.000) |
| Taiwan | 304.44 | 333.02 | 57.16*** (0.000) |
| Turkey | 177.16 | 217.63 | 80.94*** (0.000) |

The LR test is nonstandard test since there are unidentified parameters under the null. The p-values of Davies (1987) test are given in square brackets. The asterisks ***, ** and * represent significance at the 1%, 5%, and 10% levels, respectively.

Previous studies, among others, Chkili and Nguyen (2011) and Chkili and Nguyen (2014), find similar results for Brazil, China, South Africa, India, Turkey and other emerging markets. From a theoretical point of view, this behaviour is likely to be observed in these markets. Structural economic reforms (e.g. stock market liberalisation) and occurrence of financial crises at both regional level (e.g.2001-2002 banking crisis in Turkey) and global scale ( e.g. 2007-2008 financial crises ) may lead to regime shifts in emerging markets. Therefore, a MS model seems to be suitable for analysing the impact of crude oil price uncertainty on emerging markets' stock returns under the effects of regime shifts.

### 4.2.Determining The Number of Regimes

The empirical mechanism for constructing a suitable MS model starts with establishing a possible set of models to consider. We conduct tests for each country to investigate whether a two or a three-state best captures the impact of crude oil price on stock markets returns. Since nuisance parameters are unidentified under the null hypothesis, the standard asymptotic distribution theory cannot be applied as explained above in our methodology. Hence, we used the likelihood ratio test (LR) proposed by Garcia and Perron (1996) and regime classification measures proposed by Baele (2005) to choose the number of regimes for each country.

We first start with a three-regime model. The results show that the Markov switching model with the three-regime specification is not suitable for examining the effects of real crude oil price shocks on stock market returns. The findings indicate that a Markov switching model with two-regime specification captures the dynamic impact of crude oil price shocks on stock market returns of the sample countries better than the three-regime specification. The two regimes stand for a low-volatility regime and a high-volatility regime. Therefore, we applied a Markov switching model with two regimes that portray the estimated results given in **Tables 4.2 and 4.4.** We consider regime-dependent variance models because of both the oil price and stock price series span some periods where volatilities vary significantly.

### 4.3. Volatility Behaviour and Persistence on Market Regimes of Emerging Stock Markets

Sigma stands for the standard deviation of each regime. It provides the magnitudes of the volatility of each regime. The findings obtained in **Table 4.2** show that the standard deviations for all emerging markets are positive and statistically significant, while their values indicate the existence of two different regimes. The first regime, referred to as regime 0, is characterised by a low volatility value and the second regime, referred to as regime 1, is characterised by a high volatility value. Generally, a low-volatility regime is regarded as a non-crises period, while a high-volatility regime is considered to be a crisis or a volatile period.

For all emerging markets, the high volatility regime (regime 1) is almost two times as volatile as the low volatility regime (regime 0). Among the emerging stock markets, Turkey, China, India and Mexico have the highest volatility in both the low and high volatility regimes. e.g. with a 16.0 per cent volatility estimate for regime 1 compared to 6.6 per cent volatility estimate for regime 0 for Turkey.

**Table 4.2** *Estimated coefficients of Markov regime-switching time-series model*

| Country | State | Sigma | Transition Probabilities | | Duration | RCM | LR |
|---|---|---|---|---|---|---|---|
| Brazil | $S_0$ | 0.013*** | 0.592 | 0.407 | 2.453 | 7.765 | 38.48 |
| | | | 0.187 | 0.812 | | | [0.000] |
| | $S_1$ | 0.084*** | | | 5.328 | | |
| China | $S_0$ | 0.054*** | 0.975 | 0.024 | 41.204 | 3.819 | 58.16 |
| | | | 0.056 | 0.943 | | | [0.000] |
| | $S_1$ | 0.100*** | | | 17.694 | | |
| Chile | $S_0$ | 0.035*** | 0.971 | 0.028 | 34.657 | 6.179 | 49.54 |
| | | | 0.107 | 0.892 | | | [0.000] |
| | $S_1$ | 0.066*** | | | 9.300 | | |
| Jordan | $S_0$ | 0.025*** | 0.965 | 0.034 | 28.628 | 5.276 | 74.84 |
| | | | 0.048 | 0.951 | | | [0.000] |
| | $S_1$ | 0.063*** | | | 20.527 | | |
| India | $S_0$ | 0.039*** | 0.980 | 0.019 | 51.321 | 2.744 | 71.36 |
| | | | 0.022 | 0.977 | | | [0.000] |
| | $S_1$ | 0.086*** | | | 44.836 | | |
| Mexico | $S_0$ | 0.035*** | 0.987 | 0.012 | 78.831 | 2.641 | 94.86 |
| | | | 0.024 | 0.975 | | | [0.000] |
| | $S_1$ | 0.085*** | | | 40.154 | | |
| S. Africa | $S_0$ | 0.038*** | 0.980 | 0.019 | 50.720 | 5.228 | 51.46 |
| | | | 0.028 | 0.971 | | | [0.000] |
| | $S_1$ | 0.068*** | | | 35.590 | | |
| Taiwan | $S_0$ | 0.037*** | 0.983 | 0.016 | 59.765 | 1.814 | 57.16 |
| | | | 0.011 | 0.988 | | | [0.000] |
| | $S_1$ | 0.082*** | | | 84.334 | | |
| Turkey | $S_0$ | 0.066*** | 0.982 | 0.017 | 56.879 | 3.443 | 80.94 |
| | | | 0.033 | 0.966 | | | [0.000] |
| | $S_1$ | 0.160*** | | | 30.170 | | |

**Notes:** LR statistics is test calculated as $2\{MS_{Eq(5)} - Linear_{Eq(4)}\}$. LR test represents the null hypothesis of no regime shift. The p-values of Davies (1987) test are given in parenthesis. The asterisks ***, ** and * represent significance at 1%, 5%, and 10% levels, respectively.

Furthermore, the average estimated regime durations in **Table 4.2** indicates that regime 0 (low volatility regime) is more persistent with the longer average regime durations across countries expect Brazil and Taiwan. The highest average duration for regime 0 is 78.831 months in Mexico, followed by 59.76 months and 56.879 months for Taiwan and Turkey respectively, and the lowest average duration for regime 0 is 2.453 months in Brazil followed by 28.628 months and 34.657 months for Jordan and Chile

respectively. Besides, the highest average duration of regime 1 (high volatility regime) is 84.331 months in Taiwan, followed by 44.836 months and 40.154 for India and Mexico respectively, while the lowest average duration for regime 1 is 5.328 months in Brazil followed by 9.300 months and 17.706 months for Chile and China respectively

In addition, the magnitude of the probabilities ( $p_{00}$ and $p_{11}$) indicates that regime 0 is more persistent than regime 1 across sample countries except for Brazil and Taiwan. The probability of being in regime 0 is higher than the probability of being in regime 1, except for two countries, which means that the effects of oil price shocks on emerging stock markets returns tend to stay longer in regime 0 than regime 1. The results show that spikes in probabilities of regime 1 of the emerging stock markets are highly related to the financial crisis periods. The probability of being in regime 0 is 0.987 in Mexico, followed by 0.983 in Taiwan, 0.982 in Turkey, 0.9802 in South Africa, 0.980 in India, 0.975 in China, 0.971 in Chile, 0.965 in Jordan and 0.592 in Brazil, while the probability of being in regime 1 is 0.988 in Taiwan, followed by 0.977 in India, 0.975 in Mexico, 0.971 in South Africa, 0.966 in Turkey, 0.951 in Jordan, 0.943 in China, 0.892 in Chile and 0.812 in South Brazil.

Lastly, the Markov-switching model with two states has the highest regime classification measures (RCM) for Brazil and the lowest for Taiwan. The RCM values are in agreement with plots of the smoothed probabilities of being in a low-volatility regime and a high volatility regime indicated in **Figure 4.1 to 4.8** which identify the accuracy of each regime for emerging stock markets. Taiwan has the lowest RCM values of 1.814 corresponding to a perfect pattern in switching between regime one and regime two followed by Mexico and India (RCM values 2.641 and 2.744 respectively).

**Figure 4.1** *Brazil -The smoothed probability of being in regime 0 and regime 1*

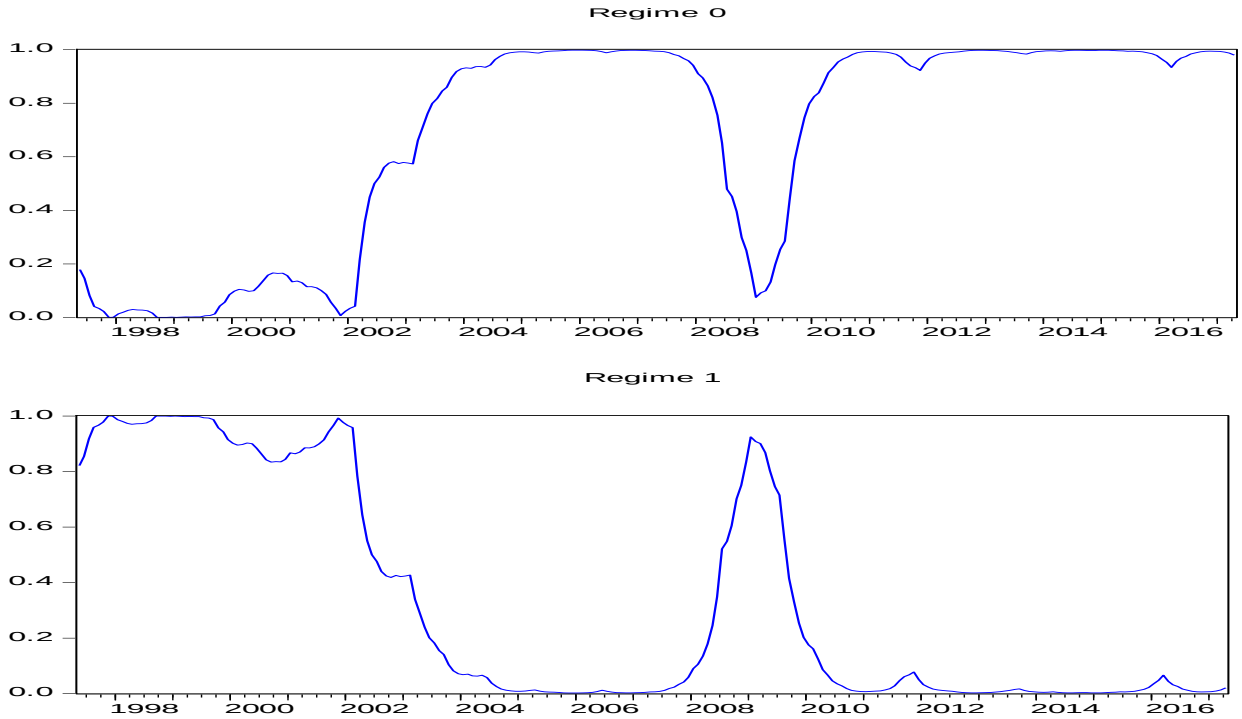



**Figure 4.2** *China - The smoothed probability of being in regime 0 and regime 1*

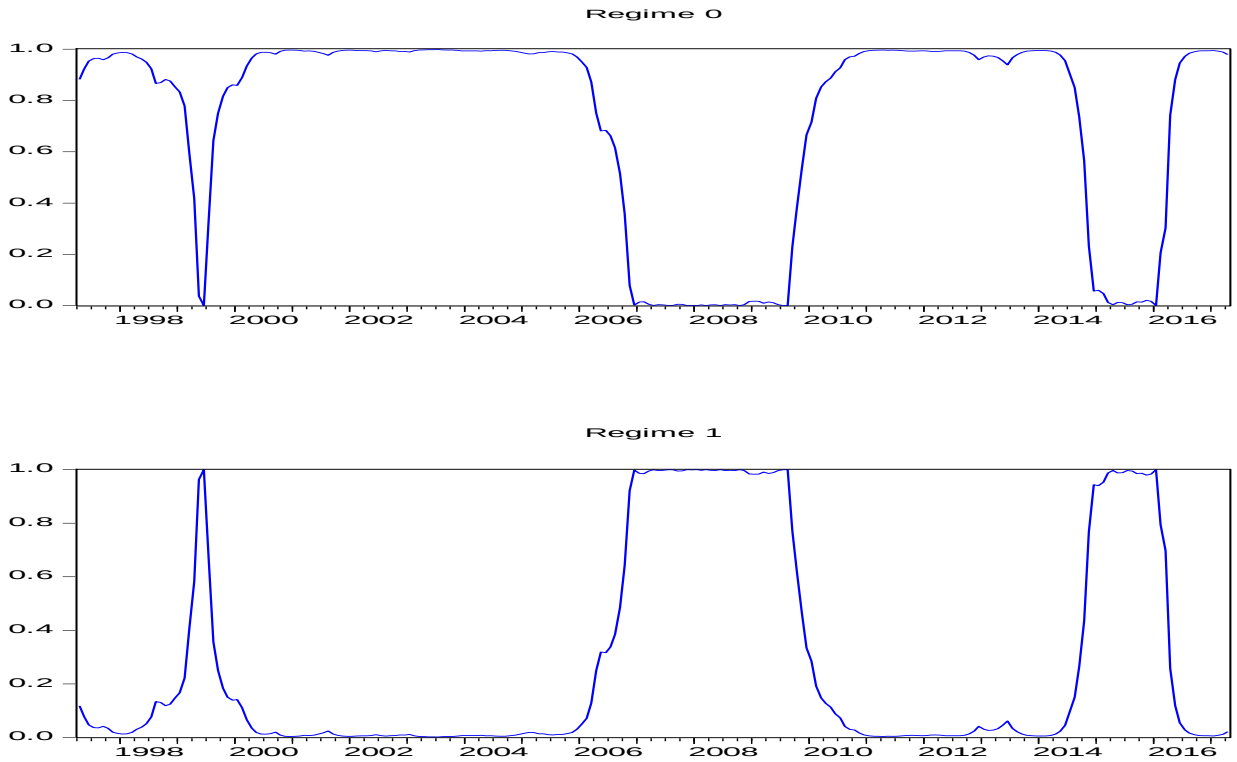


**Figure 4.3** *Chile - The smoothed probability of being in regime 0 and regime*

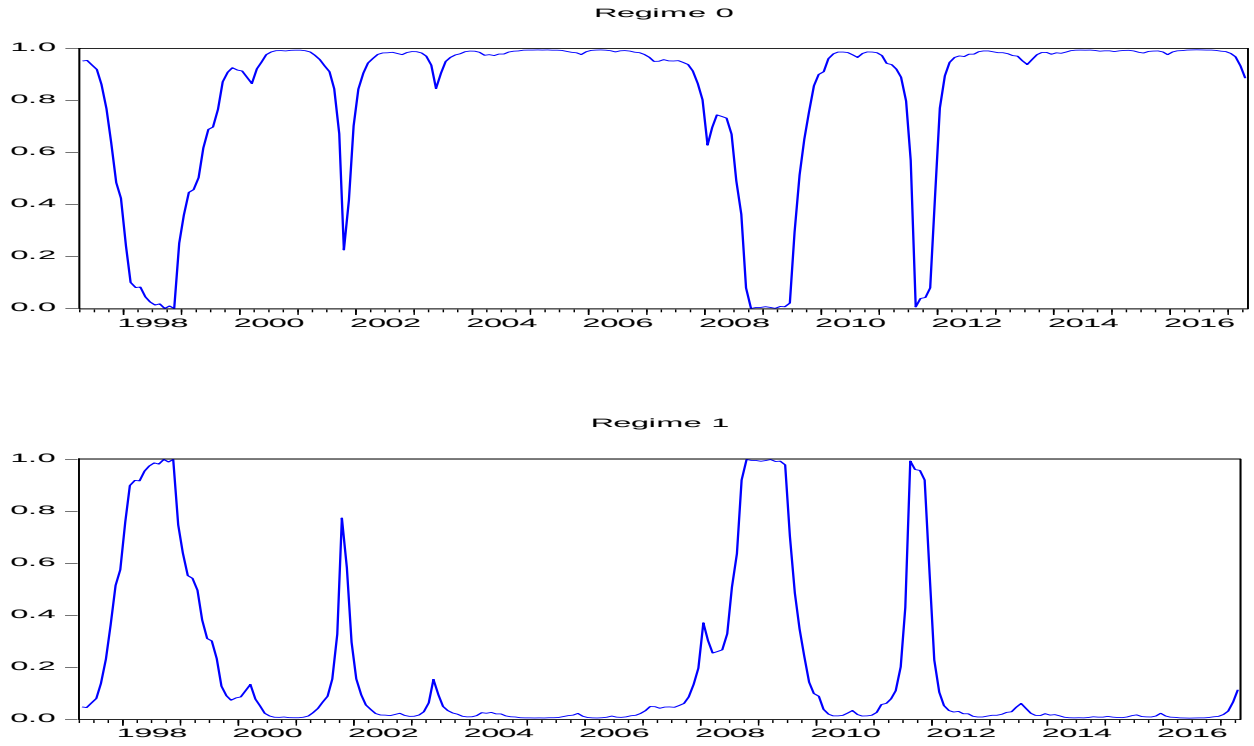



**Figure 4.4** *Jordan - The smoothed probability of being in regime 0 and regime 1*

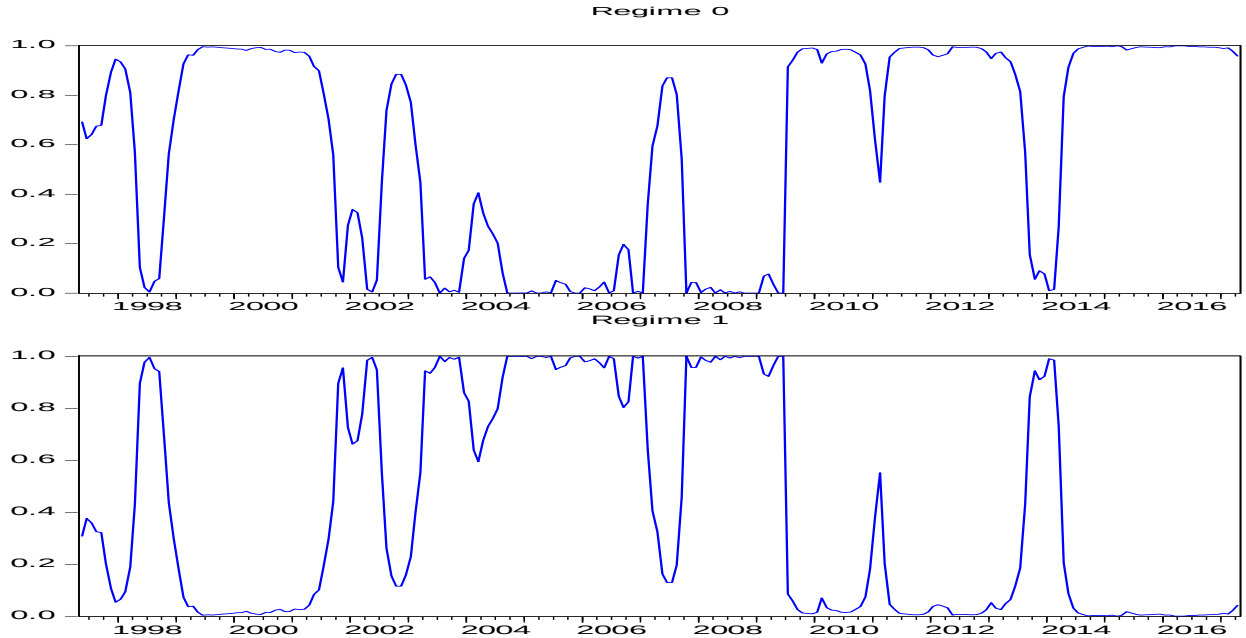


**Figure 4.5** *India - The smoothed probability of being in regime 0 and regime 1*

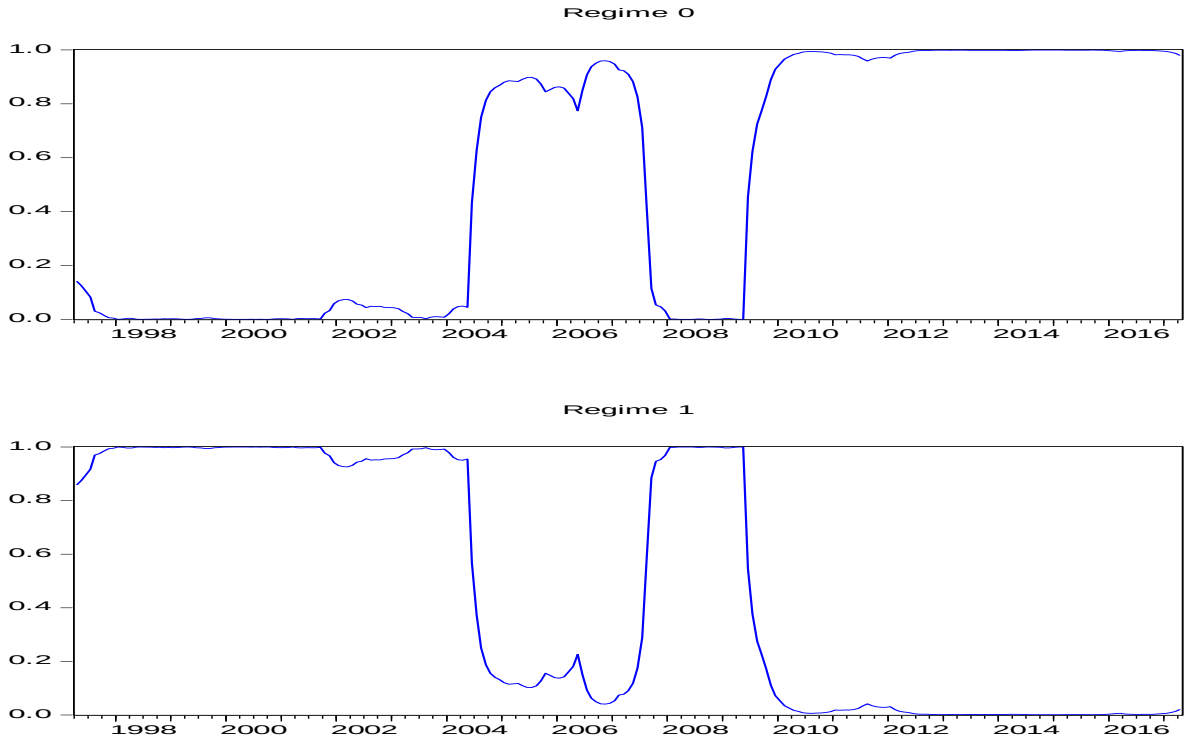



**Figure 4.6** *Mexico - The smoothed probability of being in regime 0 and regime 1*

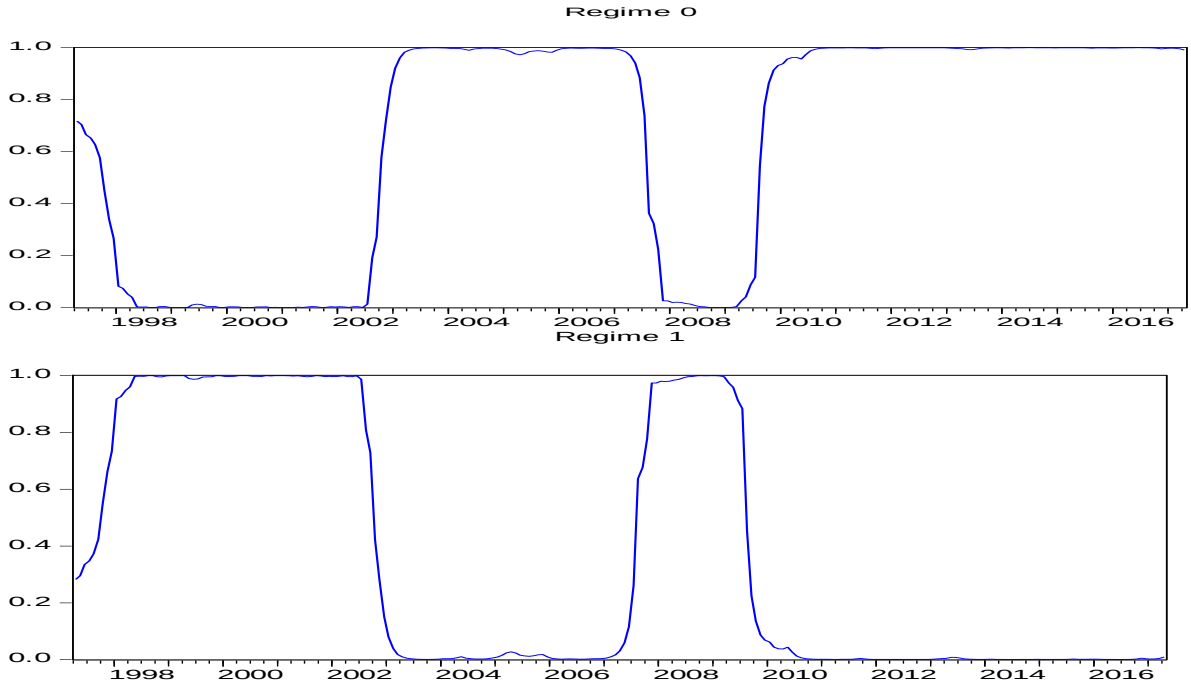


**Figure 4.7** *South Africa - The smoothed probability of being in regime 0 and regime 1*

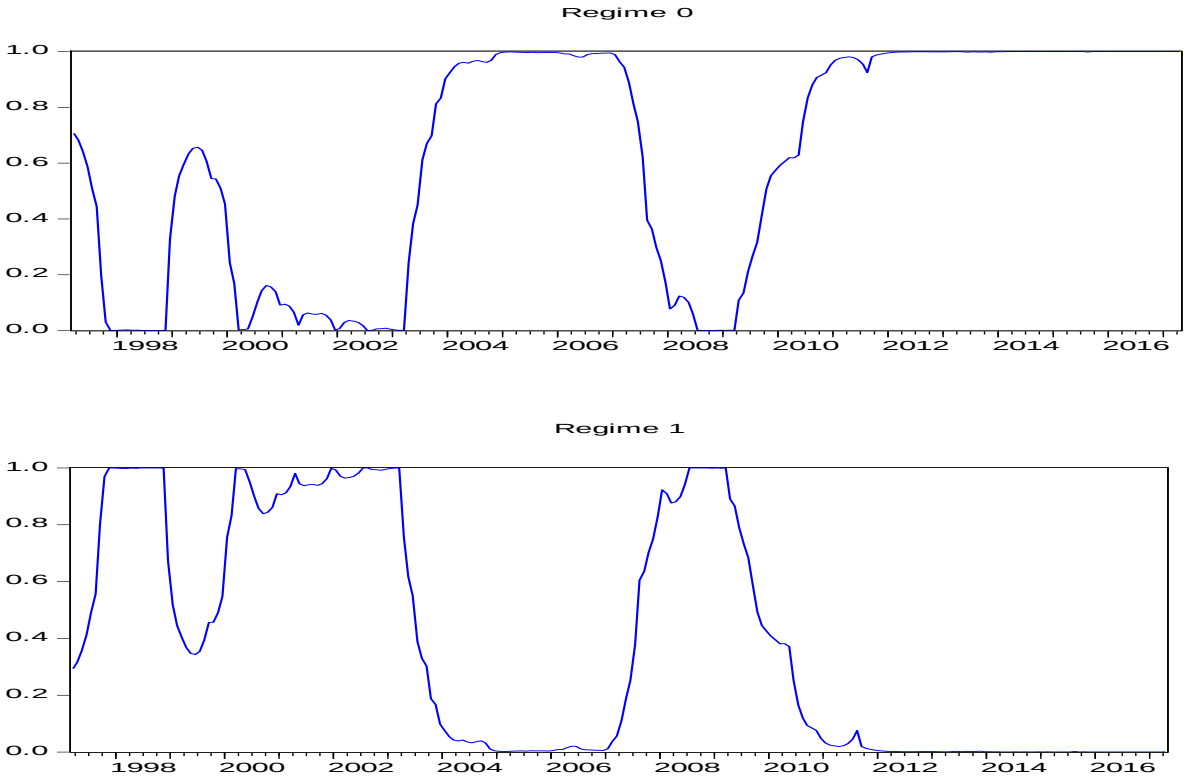



**Figure 4.8** *Taiwan - The Smoothed probability of being in regime 0 and regime 1*

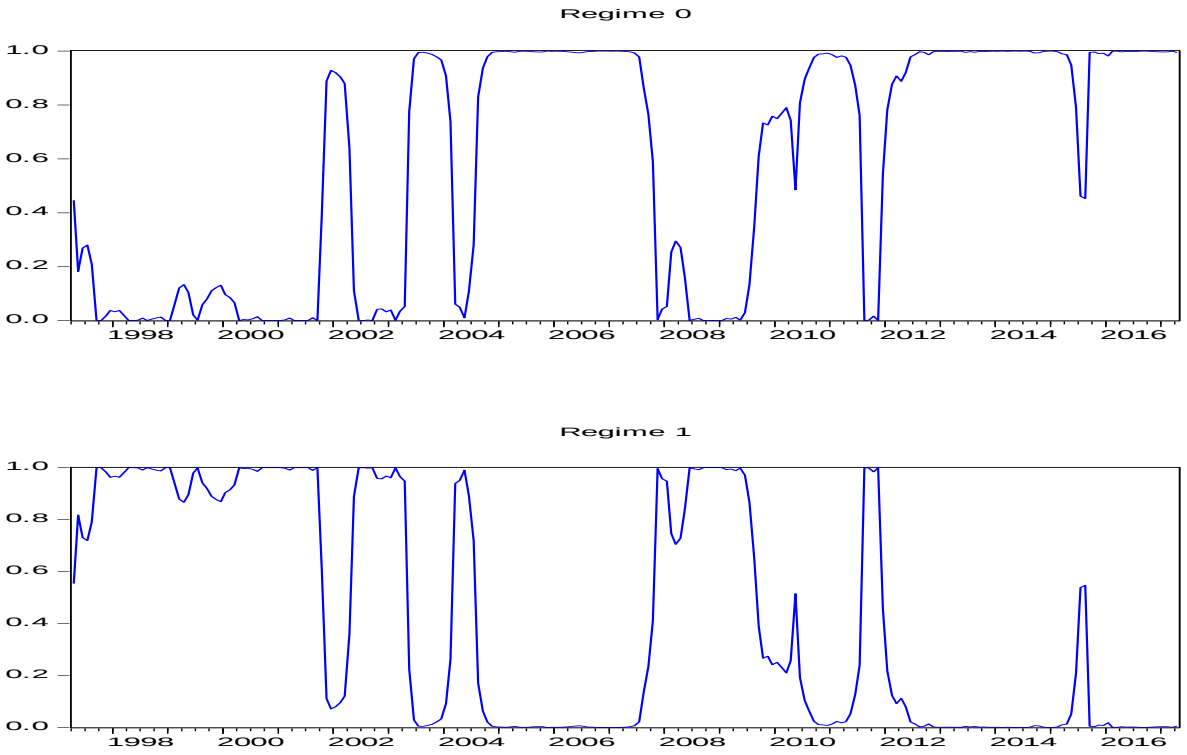
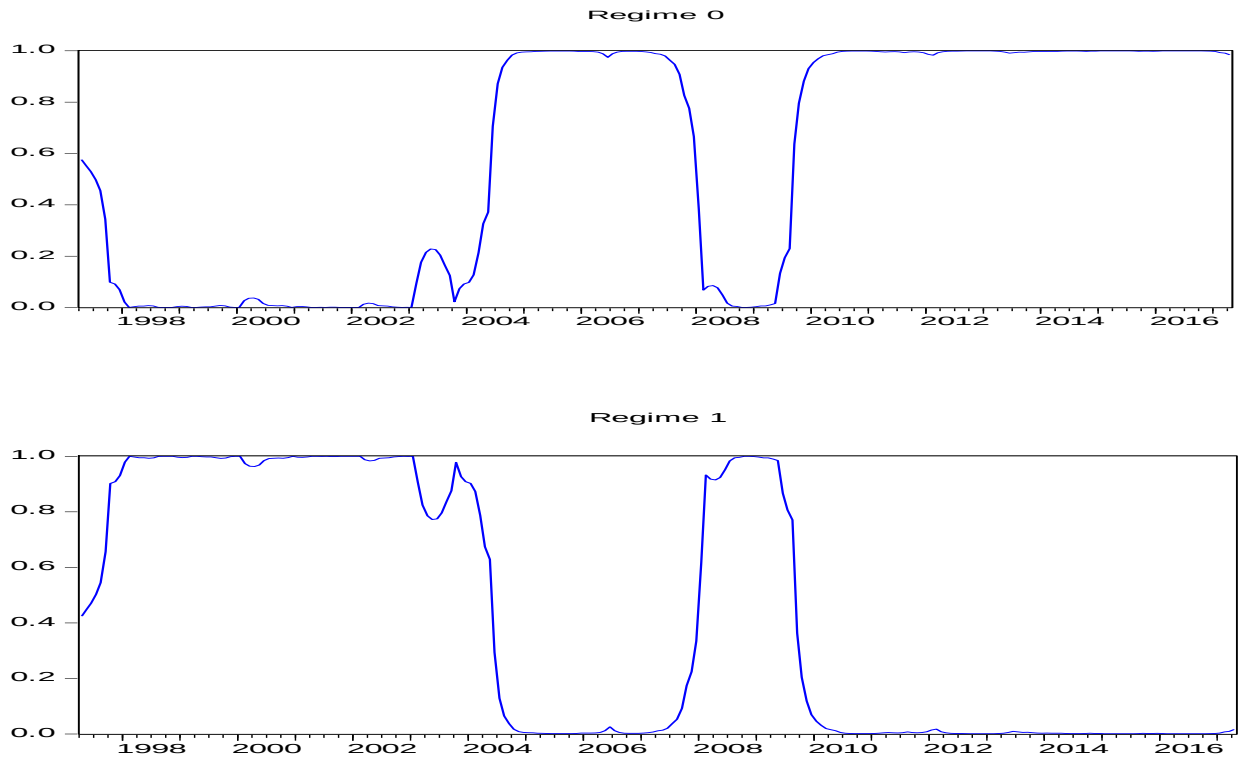


**Figure 4.9** *Turkey - The smoothed probability of being in regime 0 and regime 1*




## 4.4.Findings

### 4.4.1. Effects of Oil Price Shocks on Stock Market Returns

In this section, the effects of real Brent crude oil price shocks on stock market returns are assessed. Firstly, the linear regression model **(equation 3.6)** is estimated for each emerging economy's stock market returns, and the results in **Table 4.3** can be analysed as the baseline results capturing the dynamic effect of oil price shocks and other control factors to emerging market stock returns in the absence of any regime switching impacts. The estimated results of oil price shocks in **Table 4.3** indicate that only Taiwan and India stock markets returns respond to both positive and negative oil price shocks while other markets do not have any statistically significant response to both positive and negative oil price shocks. Overall, only two markets (India and Taiwan) out of nine markets under this study exhibit effects of oil price shocks on stock returns, while the remaining sample countries have no sign of response to oil price shocks. Therefore, it can be suggested that the relationship between stock markets returns of emerging markets and Brent crude oil price uncertainty is asymmetric (non-linear).

**Table 4.3** *Estimated coefficients of the linear regression time-series model*

| Country | $\mu_{i,t}$ | $CRO^{+}_{i,t}$ | $CRO^{-}_{i,t}$ | $IR_{i,t}$ | $VIX_{i,t}$ | $y_{i,t-1}$ |
|---|---|---|---|---|---|---|
| Brazil | -0.084** | -0.013 | -0.008 | -0.525*** | 0.042** | -0.070 |
| | (0.033) | (0.012) | (0.014) | (0.079) | (0.016) | (0.060) |
| China | -0.147* | -0.017 | -0.012 | -0.025 | -0.043** | 0.079 |
| | (0.084) | (0.012) | (0.014) | (0.026) | (0.016) | (0.064) |
| Chile | -0.046** | -0.012 | -0.012 | 0.014 | -0.022** | 0.004 |
| | (0.019) | (0.007) | (0.008) | (0.015) | (0.009) | (0.065) |
| Jordan | -0.054** | -0.014 | -0.012 | -0.248** | -0.029** | 0.166** |
| | (0.019) | (0.017) | (0.008) | (0.097) | (0.009) | (0.062) |
| India | -0.124** | -0.025** | -0.024* | -0.092 | -0.063** | 0.038 |
| | (0.031) | (0.012) | (0.013) | (0.110) | (0.015) | (0.064) |
| Mexico | -0.118*** | -0.015 | -0.012 | -0.307** | -0.060** | -0.134** |
| | (0.026) | (0.009) | (0.011) | (0.065) | (0.012) | (0.064) |
| S. Africa | -0.081** | -0.005 | -0.001 | -0.207** | -0.046** | -0.053 |
| | (0.023) | (0.008) | (0.010) | (0.110) | (0.011) | (0.065) |
| Taiwan | -0.086** | -0.026** | -0.028** | 0.112* | -0.039** | 0.024 |
| | (0.029) | (0.010) | (0.012) | (0.067) | (0.014) | (0.066) |
| Turkey | -0.126** | -0.013 | -0.011 | -0.166 | -0.060** | -0.001 |
| | (0.048) | (0.018) | (0.021) | (0.154) | (0.023) | (0.063) |

The standard errors are reported in parentheses. ***, ** and * denotes coefficients significant at the 1%, 5%, and 10% levels, respectively.

Accordingly, MS models presented in **equation 3.7** are estimated for each of the emerging markets using two crude oil price shocks and two macroeconomic factors elaborated in **Chapter 3**. Following our model selection criteria outlined above, we can select the best model for each emerging country to detect their stock market behaviour. Empirical results are presented in **Table 4.3** and **4.4** as well as in **Figure 4.1 to 4.9** for each selected model. In detail, the behaviour of regime probabilities, the probability of duration of each regime as well as regime classification measures of each country has been analysed.

Concerning oil price shocks, one interesting issue to consider is the existence of asymmetric effects. This means that the impacts of oil price increases and oil price decreases are not the same. According to the literature, oil price increases have a more significant effect on the economy and the stock market than oil prices decreases do. The asymmetric measure proposed by Mork (1989) is based on the observation that the relationship between oil prices and the macroeconomy presented in Hamilton (1983)

pertains to a period of oil price increases and he did not take into account the massive oil price declines of 1985–1986.

In particular, one issue which draws our attention is that the pattern of crude oil price fluctuations has changed dramatically since the mid-1980. Since then, the oil market still experiences tremendous price changes, changing from around $150 per barrel in 2008 to around $30 per barrel in January 2016. The average magnitude of oil price decreases relatively differs from the oil price increases. Therefore, to examine the asymmetric impact of crude oil price changes on emerging stock market returns is our focus.

We estimated the MS model with two regimes by splitting real crude oil price changes into oil price increases and oil price decreases as proposed by Mork (1989), and the results obtained displayed in **Table 4.2 & 4.4**, and **Figure 4.1 to 4.9** show the estimated coefficients of the Markov regime-switching model for each country.

Starting with the oil-exporting countries, Brazil and Mexico, a two-regime MS model with one lag of stock returns has been estimated. The MS results of the two regimes have shown the best performance (see **Table 4.4** and **Figure 4.1**). The results indicate that oil price increase shocks have significant and negative impacts on stock returns in the low volatility regimes for Brazil, while significant and negative impact in the high volatility regime for Mexico. The results may be confusing because, in theory, an increase in oil prices is expected to lead to a rise in revenues for oil-exporting countries like Brazil and Mexico, ultimately stimulating short-term economic activities and cause an increase in stock prices in the short-run. However, in the long run, the increase in oil prices may lead to a decrease in the oil-importing countries' economic activities, hence reducing the oil demand from oil-exporting countries, leading to lower future cash flows and stock prices in these countries, which can explain the adverse effects of oil price increases in these countries.

Our findings regarding the impact of oil price increase shocks on stock market returns are in line with that of Raza et al. (2016) and H. Zhu et al. (2017) indicating that an increase in the prices of oil market decreases stock returns of Brazil and Mexico in long-run.

**Table 4.4** *Estimated coefficients of Markov regime-switching time-series model*

| Country | State | $\mu_{i,t}$ | $CRO^{+}_{i,t}$ | $CRO^{-}_{i,t}$ | $IR_{i,t}$ | $VIX_{i,t}$ | $y_{i,t-1}$ |
|---|---|---|---|---|---|---|---|
| Brazil | $S_0$ | 0.100*** | -0.048** | -0.005 | -0.684*** | -0.061*** | -0.138** |
| | | (0.019) | (0.014) | (0.007) | (0.049) | (0.009) | (0.022) |
| | $S_1$ | -0.074 | -0.018 | -0.013 | -0.657*** | -0.044* | -0.094 |
| | | (0.048) | (0.017) | (0.018) | (0.109) | (0.022) | (0.080) |
| China | $S_0$ | -0.080 | -0.002 | -0.002 | -0.004 | -0.036** | -0.047 |
| | | (0.081) | (0.012) | (0.014) | (0.025) | (0.016) | (0.075) |
| | $S_1$ | 1.054** | -0.102** | -0.029 | -0.403** | -0.083** | -0.051 |
| | | (0.276) | (0.031) | (0.033) | (0.103) | (0.036) | (0.123) |
| Chile | $S_0$ | -0.033 | -0.014* | -0.012 | 0.006 | -0.021 | 0.102 |
| | | (0.031) | (0.008) | (0.008) | (0.013) | (0.015) | (0.090) |
| | $S_1$ | -0.303** | 0.089** | -0.118** | -0.052 | -0.103** | -0.282* |
| | | (0.106) | (0.039) | (0.051) | (0.049) | (0.042) | (0.152) |
| Jordan | $S_0$ | -0.026 | -0.009* | -0.010 | 0.017 | -0.010 | 0.023 |
| | | (0.019) | (0.005) | (0.006) | (0.072) | (0.011) | (0.098) |
| | $S_1$ | -0.107** | -0.043* | -0.049* | -0.590** | -0.028 | 0.157* |
| | | (0.050) | (0.022) | (0.028) | (0.201) | (0.029) | (0.093) |
| India | $S_0$ | -0.302** | -0.010 | -0.012 | -0.659** | -0.142*** | -0.144* |
| | | (0.045) | (0.011) | (0.011) | (0.117) | (0.020) | (0.084) |
| | $S_1$ | -0.256** | -0.108** | -0.132** | -0.078 | -0.094** | -0.016 |
| | | (0.068) | (0.026) | (0.033) | (0.158) | (0.030) | (0.086) |
| Mexico | $S_0$ | -0.041 | -0.012 | -0.006 | -0.161** | -0.039** | -0.116 |
| | | (0.027) | (0.007) | (0.008) | (0.056) | (0.016) | (0.086) |
| | $S_1$ | -0.344** | -0.075** | -0.093** | -0.387** | -0.145** | -0.248** |
| | | (0.100) | (0.031) | (0.038) | (0.133) | (0.044) | (0.112) |
| S. Africa | $S_0$ | 0.027 | 0.002 | 0.009 | -0.117 | -0.109 | -0.302** |
| | | (0.036) | (0.008) | (0.008) | (0.117) | (0.014) | (0.088) |
| | $S_1$ | -0.286** | -0.061** | -0.073** | -0.310 | -0.124** | -0.040 |
| | | (0.073) | (0.023) | (0.028) | (0.195) | (0.033) | (0.105) |
| Taiwan | $S_0$ | -0.187** | -0.002 | 0.001 | -0.058 | -0.074** | -0.077 |
| | | (0.075) | (0.012) | (0.012) | (0.070) | (0.026) | (0.111) |
| | $S_1$ | -0.226** | -0.099** | -0.122** | 0.169* | -0.081** | -0.092 |
| | | (0.063) | (0.023) | (0.029) | (0.100) | (0.029) | (0.085) |
| Turkey | $S_0$ | -0.020 | -0.003 | -0.001 | 0.023 | -0.023 | -0.144 |
| | | (0.055) | (0.014) | (0.016) | (0.108) | (0.022) | (0.089) |
| | $S_1$ | -0.454** | -0.085** | -0.109 | -0.787 | -0.178** | -0.026 |
| | | (0.183) | (0.012) | (0.070) | (0.502) | (0.079) | (0.010) |

The standard errors are reported in parentheses. ***, ** and * denotes coefficients significant at the 1%, 5%, and 10% levels, respectively.

Moreover, crude oil price decrease shocks have negative and statistically significant effects on stock returns of Mexico in the high volatility regime. A decrease in oil prices does not cause an increase in oil demand for oil-importing countries in the short-run and thus leads to lower profits and future cash flows for companies in oil-exporting countries, henceforth stock prices may decline. This findings are in line with the cash flow hypothesis, and since Mexico is a net oil exporter, decreases in crude oil prices during high volatility conditions will be followed by reducing in productivity and revenue for Mexican firms and ultimately slow down the economic performance of Mexico, henceforth driving up stock prices.

Mexico's stock market returns are more sensitive to increases oil price shock and decreases of oil price shock effects during high volatility regimes because energy exports have driven more than 30% of Mexico's economic activities over the past years. However, the decrease in crude oil price does not have any influence on Brazilian stock markets during both low and high volatility regimes.

Turning now to the oil-importing countries, with the estimation of the MS model with two regimes and one lag of the dependent variable; the results indicate that the MS model outperformed the linear regression model for all oil-importing countries. The results indicate that oil price increases have a negative and statistically significant impact on stock returns in China, India, South Africa, Taiwan and Turkey in the high volatility regime only. Similarly, oil price increases have a negative and statistically significant impact in Chile and Jordan, however in both low and high volatility regimes. This is in line with the theory and can be attributed to the negative impact of increases in oil prices on the national economic activities of oil-importing countries.

Generally, increases in oil prices will result in higher industry costs for oil-importing countries, which will negatively affect the stock markets. J. W. Park (2007) state that a rising oil prices increase the cost of doing business, decreasing the productivity of a particular firm, reducing expected future cash flows and profitability of the firm and, hence, stock returns. This is consistent with the findings in Raza et al. (2016) for emerging countries and Xiao et al. (2018) for China. On the other hand, the effects are not statistically significant for China, India, South Africa, Taiwan and Turkey in the low volatility regime.

Specifically, in the case of Turkey, these results are different from the findings of Tursoy and Faisal (2018), who find positive effects. The possible reason for this

difference is that we employ a non-linear framework, while Tursoy and Faisal (2018) apply a linear structure. Besides, for Turkey, it was reported that its oil consumption has been increasing dramatically since the 2010s. Therefore, increasing consumption of oil may cause an increase in demand for foreign currency, particularly US Dollar against Turkish Lira, hence raising its oil imports and causing depreciation of Turkish Lira. Depreciation of Turkish Lira makes the benchmark BIST 100 look weaker from the perspective of international investors in a high volatility regime, who would then liquidate their stock portfolio investments and pull out funds from the market, which would cause BIST 100 to fall.

Moreover, the negative effects of positive oil price shocks are more persistent and stronger in India, followed by China, Taiwan and Turkey in a high volatility regime than other oil-importing countries and this can be attributed to the higher economic growth rate of these countries. Higher economic growth is related to higher crude oil consumption in these countries. Hence, higher oil consumption and oil imports during higher oil prices may lead to decreases in future cash flows and stock prices.

Furthermore, for Chile, Jordan, India, South Africa and Taiwan, crude oil price decrease shocks have negative and significant effects on the stock returns in a high volatility regime. Since crude oil prices are becoming an international barometer for future growth expectations, falls in crude oil prices indicate an upcoming global slowdown and crises, hence causing the stock market index of these four oil-imported countries to fall. Our findings are in line with studies in existing literature such as Raza et al. (2016) for India, South Africa and Chile in the short run, indicate that these stock markets are more vulnerable to bad news and events happening in the other markets in the short run such as oil markets.

One interesting point for all emerging stock markets is that when their economies are in a stable condition and no turbulence at all, neither the stock markets of exported no imported countries respond to crude oil price decrease shocks in a low volatility regime.

Concerning with China, an investigation of the coefficients of crude oil price decrease shocks, which are all negative but not statistically significant in both high and low volatility regimes. The findings suggest that the SSE Composite Index returns of China are not influenced by any shocks of oil price decreases. These findings are different from the findings in Caporale et al. (2015), who find a relationship between oil

price changes and some sectors of China's stock market returns. These differences may arise as Caporale et al. (2015) examine the impacts at the disaggregate level (Sectors level), while we examine the impacts at the aggregate level.

Apart from the above reason, China has grown to be the second largest oil importer in the world after the USA. However, SSE Composite index indicates that there has been a controversial relationship between the long-term Chinese economic growth in terms of annual GDP growth rate from the 1990s to 2010s (around 9.23% in 1997, 14.23% in 2007 and 10.63 in 2010) and the low performance of SSE index returns between 1990s and 2005. Hence, crude oil prices may influence other Chinese economic activities rather than its stock market.

The findings indicate that stock returns of emerging markets respond asymmetrically to oil price changes. Oil price increases tend to have a stronger impact on most countries than real oil prices decreases do. Sadorsky (1999) found that oil price increases have more significant effects on stock returns than oil price decreases. In summary, for oil-exporting markets, oil price increases seem to have a more significant impact on stock market returns than an oil price decreases, regardless of the regimes and markets in general.

However, in oil-importing markets, there are mixed asymmetric response impacts. In some oil-importing countries such as China and Turkey in high volatility regime, oil price increases seem to have a more significant impact than oil price decreases. On the other hand, in some oil-importing counties such as India Chile, and South Africa, in a high volatility regime, oil price decreases seem to have a more significant impact than oil price increases. However, the impact of an oil price increases is a little more dominant. Afees A Salisu and Isah (2017) re-evaluate the relationship between oil price and stock prices in oil-importing and oil-exporting markets. They conclude that the stock returns respond asymmetrically to oil price changes for both oil importing and oil exporting countries.

The evidence of these different impacts of the increases and decreases in real crude oil prices on emerging market stock returns are driven by their currency market situation, level of economic activities, interest rates, political situation as well as inflation rates. However, these results may differ once we observe the effect at the disaggregate level (at industry or firm level) for each stock market, because different firms or sectors may react differently to oil price changes.

### 4.4.2. Impacts of Macroeconomic Shocks on Stock Market Returns

Long-term interest rates and global market volatility conditions are considered among the most influential macroeconomic factors which explain the movements of the emerging stock markets, and they are essential tools in investment decisions. There is an argument that interest rates and global market volatility conditions are a significant channel for oil price shocks to affect stock market returns because long-term interest incorporates market expectations of investors and global volatility conditions influence risk appetite of investors. Therefore, we examine whether the impacts of oil price shocks, long-term interest rate shocks and global market volatility shocks on emerging stock returns differ from each other. **Table 4.4 and Figure 4.1 to 4.9** indicate the estimated coefficients of the MS model for each country.

Starting with oil-exporting countries, both interest rate shocks and global volatility condition shocks have negative and statistically significant effects on stock returns in both low and high volatility regimes for Brazil and Mexico. These findings are in line with the existing literature such as Bjørnland and Leitemo (2009), Dakhlaoui and Aloui (2016), Jammazi, Ferrer, Jareño, and Hammoudeh (2017) and Ahmad and Sharma (2018) among others.

For the interest shock effect, this finding makes sense because these two countries depend more on oil exports for their economic growth and in times of shocks, most investors shift from holding risky assets such as stocks into fixed-income assets such as long-term government bonds. The process of shifting would cause sell-off in the stock market, making the index fall.

For the global volatility condition shock, this finding implies that with increasing integration with the world economic system, oil exporting economies have become more vulnerable to be influenced by world business cycles. The findings are in line with the findings of Ahmad and Sharma (2018) who show that for emerging market stock returns, global output gap along with economic policy uncertainty has more significant influence than other factors.

Regarding the oil-importing countries, in China and Jordan, interest rate shocks have a negative and statistically significant effect on stock market returns in a high volatility state, the same effects for India in a low-volatility state, consistent with the expected cash flow hypothesis. As interest rate rises in these countries, it becomes more attractive to buy government bonds rather than stocks, and henceforth stock prices will

fall. This is consistent with the findings in Alam and Uddin (2009), who found a negative relationship for emerging countries. However, during the high volatility regime, the impacts are positive significant for Taiwan only.

Furthermore, the financial analysts and investors are using interest rate to discount expected future cash flows of the firm, this will depress anticipated future earnings and, hence reduce stock returns. Thus, in those emerging countries which use monetary policy tools to prevent inflation when oil prices increase, stock prices may decline. However, during a high-volatility state, interest rate shock has a significant positive effect on Taiwan stock market returns.

One interesting point for China is that interest rate shocks seem to influence stock market returns in the Markov-switching model in a high volatility state, while no significant effects were found in the linear regression model.

The global volatility condition shock has negative and statistically significant effects on stock market returns in both low and high volatility states for China, India and Taiwan, while only in the high-volatility state for Chile, South Africa and Turkey. This provides evidence that most of the emerging stock markets are becoming increasingly more influenced by international factors as they have become more integrated into global financial markets.

However, there is no statistically significant effect from global volatility condition shocks on the Jordanian stock market. This implies that the Jordanian economy is not significantly sensitive to on-going global risks. In this regard, some features of this stock market such as low liquidity and dominance of local investors may have hindered the influence of global news into the Jordanian stock market.

### 4.5. Summary Responses of Stock Market Returns in Markov Regime-Switching Model

**Table 4.5** represents the summary of the significant findings regarding the impacts of the real oil price uncertainty, increases and decreases of real oil price changes, interest rate shocks and global market volatility condition shocks on stock returns of emerging markets. Obviously, stock market returns of emerging markets respond asymmetrically to real oil price changes and the results in volatility regimes are heterogeneous. These findings may motivate further research to use Markov-switching models to investigate the impacts of real oil price shocks on stock returns.

The results indicate the stock returns of China and Turkey do not seem to respond to the structural shocks of decreases of real oil prices in either the Markov-switching framework or linear regression framework. Fatima and Bashir (2014) and Berk and Aydogan (2012) investigate the relationship between international oil prices and stock markets of emerging economies of China and Turkey respectively. They also observed a shallow level of effect of global oil prices fluctuations on the stock market returns of these two markets. The effect of oil price changes on Chinese and Turkish stock returns are more of a myth than reality, especially during oil price decreases.

**Table 4.5** *Summary responses of stock market return to real oil price uncertainty in Markov regime-switching model*

| | **Increases in oil prices** | | **Decreases in oil prices** | |
|---|---|---|---|---|
| **Country** | **High vol.** | **Low vol.** | **High vol.** | **Low vol.** |
| ***Oil-Exporting Countries*** | | | | |
| Brazil | | - | | |
| Mexico | - | | - | |
| ***Oil-Importing Countries*** | | | | |
| Chile | - | - | - | |
| Jordan | - | - | - | |
| India | - | | - | |
| China | - | | | |
| S.Africa | - | | - | |
| Taiwan | - | | - | |
| Turkey | - | | | |

Note: + denotes statistically significant positive effects, and - denotes statistically significant negative effects, and Blank indicates no statistically significant effects

In addition, signalling that the stock markets of Chile, South Africa and Turkey are emerging as a market-driven functioning, rather than a government policy (monetary policy) driven operation since during neither low nor high volatility regimes, interest rates shocks do not have any significant impacts on those stock markets.

**Table 4.6** *Summary responses of stock market return to other macroeconomic variables in Markov regime-switching model*

| | Interest rate shocks | | Global volatility | |
|---|---|---|---|---|
| **Country** | **High vol.** | **Low vol.** | **High vol.** | **Low vol.** |
| ***Oil-Exporting Countries*** | | | | |
| Brazil | - | - | - | - |
| Mexico | - | - | - | - |
| ***Oil-Importing Countries*** | | | | |
| Chile | | | - | |
| Jordan | - | | | |
| India | | - | - | - |
| China | - | | - | - |
| S.Africa | | | - | |
| Taiwan | + | | - | - |
| Turkey | | | - | |

Note: + denotes statistically significant positive effects, and - denotes statistically significant negative effects, and Blank indicates no statistically significant effects

# 5. CONCLUSION

The primary objective of this research to contribute to the empirical literature on the subject of oil-stock nexus in emerging countries. In this section, the study presents a conclusion as well as recommendations and policy implications.

## 5.1.Conclusion

In this dissertation, a systematic analysis of the impact of crude oil price shocks on the stock market returns of the diverse group of nine emerging markets of Brazil, China, Chile, Jordan, India, Mexico, South Africa, Taiwan and Turkey are presented. This study adopts a Markov Switching model with shifting mean, slope coefficient and variance to investigate the relationships between crude oil prices and stock market returns using monthly data from the period of January 1997 to April 2017.

The Markov-Switching model detects two regimes, where the two regimes correspond to low volatility and high volatility regimes. To examine whether the real crude oil prices shocks have asymmetric effects on stock returns, we introduce two different measures of oil price shocks. Namely, an oil price increase shocks and oil price decrease shocks respectively which are analyzed separately as proposed by Mork (1989). Lastly, we examine the impacts of the long-term interest rate shocks and global market volatility condition shocks as well, which are known to affect the stock returns in emerging economies. Then, we make a comparison of those impacts together with Brent Crude oil price impact for each emerging economy.

Crude oil price shocks seem to have a significant impact on the emerging stock market returns. However, under linear regression models, only two markets (India and Taiwan) out of nine markets exhibited effects of oil price shocks on stock returns. Therefore, from those results, we decided to employ a non-linear framework. Under the MS model, the impact of oil price shocks on the emerging stock market returns varies between regimes as well as between oil-exporting and oil-importing countries.

One interesting issue in our study is the asymmetric effect. According to the literature, oil price increases have a more significant impact on the economy and the stock market than oil prices decreases do. Similarly, the asymmetric impacts of oil shocks on stock returns are in line with the literature for oil-exporting markets. However, for oil-importing markets, the asymmetric response impact is a little different.

For oil-exporting countries, both increases and decreases of real crude oil prices have statistically significant and negative impacts on stock returns in the high volatility regimes for Mexico, whereas only increases of real oil prices have a negative effect in the low volatility regime for Brazil. For oil-exporting markets, the real oil price increases have a more significant impact on stock market returns than an oil price decreases in general.

On the other hand, for most oil-importing countries, our findings show that both increases and decreases of real crude oil prices have a null or minimal impact on emerging stock returns in the low volatility regime and a statistically significant negative impact on emerging stock returns in the high-volatility regime. In those oil-importing markets, there are mixed asymmetric response impacts. It means that in some oil-importing markets such as China and Turkey in the high volatility regime, oil price increases have a more significant impact than oil price decreases, while in some oil-importing markets such as India, Chile and South Africa oil price decreases have a more significant impact than oil price increases in the high-volatility regime,. However, the effect of oil price increases is a little bit more dominant.

For all oil-exporting and in most of the oil-importing countries in both low and high volatility regimes, interest rate shocks seem to be the most influential (compared to global market volatility shocks and real crude oil price shocks) on emerging stock markets. Moreover, global volatility condition shocks seem to be more influential than real crude oil price shocks. However, in the high volatility regime, the effects of real crude oil price shocks have a more significant influence than the global volatility shocks for China, India and Taiwan on the stock market returns.

### 5.2.Recommendations and Policy implications

The findings of this study provide exciting implications to policymakers and investors regarding how emerging stock market returns respond to oil price shocks, interest rate shocks and global volatility shocks during low and high-volatility regimes. The Asian financial crisis of 1997, Turkish financial crises of 2001 as well as the global financial crisis of 2008 seem to have strengthened the link between the emerging stocks markets and the global oil market. Our findings confirm the strong correlation between emerging stock markets and oil markets during the high volatility regimes. The main reason behind this strong correlation is the negative response of international investors

especially during high volatility regime due to the increase in the uncertainties in both markets. As market players (including policymakers and investors) revise their positions and expectations of the market, then, also the relationship between stock markets and oil prices change. Therefore, it is recommended that policymakers and investors should be aware that the increases in oil prices during high volatility as an important signal for the emerging market stock returns to decline.

On the other hand, a common question that arises is ‘what are the portfolio allocation and management implications for international investors that could be derived from these regimes-dependent hypotheses?'. From the perspective of transition probabilities, both regimes appeared to be persistent above 50 per cent. This persistence of each regime has some implications with respect to international investment management strategies. For example, suppose that an international investor knows that the economy of Turkey is currently in the high volatility regime-, since there is 96% probability that the Turkish economy will continue to be in the high volatility regime during the next period, the international investor will likely either to target assets which have higher expected pay off in Turkey or invest in the stocks of a country that is in the low volatility regime.

The implications of these findings are useful for the policy makers, investors as well as for the portfolio managers. They can use the findings of this study to formulate the optimal oil-emerging stock markets portfolios in developing their hedging strategies. Our analysis provides interesting implications regarding how oil prices and emerging stock markets respond to each other during either low or high volatility regimes. The results support a portfolio allocation policy that is regime-dependent. The results suggest that when the oil prices are increasing, investing in the stock markets of India, Mexico, South Africa, China, Taiwan and Turkey during the low volatility regime and Brazil during the high volatility regime may help the investors improve expected return.

On the side of decreasing of oil prices, the results suggest that investing in the stock markets of the most of the emerging markets during low volatility regime may help the investors improve expected returns, since the decreasing oil prices do not have any significant effects on the emerging stock markets when these markets are in low volatility period.

Moreover, as emerging economies have been in the phase of economic and financial liberalization and transformation for the past years, foreign investment,

especially in the form of ‘hot money', has become very significant for the achievement and persistence of higher economic and financial growth in these countries, but this rapidly growing, transformation and industrialization were accompanied by a corresponding increase in its energy consumption especially crude oil.

Since those emerging market countries which have the large capital inflows from developed countries such as China, India, Turkey and Brazil, and which are benefited the most from these inflows are those which commonly have strong interconnections with the global oil markets and their energy consumption has increased significantly. These countries have a high magnitude of adverse effects of positive oil price shocks in a high volatility regime than other countries, and this can be attributed to the higher economic growth rate of these countries.

As per our findings concern, during either low or high volatility regimes, both increases and decreases of crude oil prices have a significant adverse impact on the emerging stock markets, the policymakers should formulate policies to reduce those impacts. The governments of these countries should formulate and create a conducive environment for attracting long-term foreign direct investment and focus stronger domestic growth activities rather than this hot money. The governments may reduce the dependence on crude oil and may establish stable oil reserves, and thus protect themselves from the risk of the global oil price shocks. Last but not least, the governments and companies may consider oil-saving measures such as promoting energy conservation policies, improving energy efficiencies and use of alternative energy sources.

The findings suggest that apart from oil prices shocks, policymakers and investors should also be aware of the other macroeconomic shocks that may influence the stock markets of emerging countries. This finding highlights that the long-term interest rate and global volatility shocks are also influential and may be incorporated in investment and hedging decisions.

In conclusion, oil price shocks have significant asymmetric impacts on the emerging stock markets, whether they are oil-importing or oil-exporting countries. Due to the heterogeneous responses of emerging stock markets to real oil price increases and decreases, interest rate shocks and global market volatility shocks, investors and policymakers should treat these emerging stock markets differently. Therefore, it is

critical for them to adopt an integrated investment and risk management approach subject to country-specific circumstances as well as international circumstances.

The findings of this study offer several areas for future research. Future work may examine the effects of asymmetric oil price shocks on stock returns at the industry level using Markov-Switching models. The analysis may also be extended by employing other macroeconomic variables as control variables.

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