

Al-hajj, Ekhlās; Al-Mulali, Usama; Solarin Sakiru Adebola

Article

Oil price shocks and stock returns nexus for Malaysia: Fresh evidence from nonlinear ARDL test

Energy Reports

Provided in Cooperation with:

Elsevier

Suggested Citation: Al-hajj, Ekhlās; Al-Mulali, Usama; Solarin Sakiru Adebola (2018) : Oil price shocks and stock returns nexus for Malaysia: Fresh evidence from nonlinear ARDL test, Energy Reports, ISSN 2352-4847, Elsevier, Amsterdam, Vol. 4, pp. 624-637, <https://doi.org/10.1016/j.egy.2018.10.002>

This Version is available at:

<https://hdl.handle.net/10419/243544>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

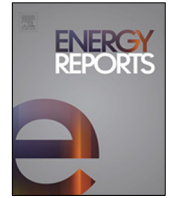
Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by-nc-nd/4.0/>



Research paper

Oil price shocks and stock returns nexus for Malaysia: Fresh evidence from nonlinear ARDL test

Ekhlas Al-hajj*, Usama Al-Mulali, Sakiru Adebola Solarin

Faculty of Business, Multimedia University, 75450 Melaka, Malaysia

ARTICLE INFO

Article history:

Received 12 April 2018

Received in revised form 6 September 2018

Accepted 5 October 2018

Available online 19 October 2018

Keywords:

Stock market returns

Oil price shocks

Nonlinear ARDL

ABSTRACT

In this research, we examined whether appreciation and depreciation in oil price, interest rate, exchange rate, industrial production, and inflation have the same effects on the stock market returns by using nonlinear autoregressive distributed lag (nonlinear ARDL). All nine economic sectors and aggregate stock market are considered in this study. Moreover, monthly data is utilized from January 1990 to November 2016 and from May 2000 to November 2016 for the aggregate market and the nine sectors, respectively. The bound test results showed strong evidence that all sectors (excluding plantation sector) including the aggregate market are cointegrated. Furthermore, the findings of this study implied that oil price shocks have an adverse impact on the stock market returns in most cases regardless whether oil price shocks are in an appreciation or depreciation direction. This shows that the Malaysian market is inefficient and very sensitive to the oil price fluctuations. In addition, the findings showed there is a long run asymmetric link between oil price shocks, interest rate, exchange rate, industrial production, inflation and stock market returns at both aggregate and sectors level in most cases.

© 2018 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

It is well known that stock market is essential in the development of a country because with the existence of stock markets, shares are easily issued and traded to investors. Basically, stock markets are considered as the best way to reflect the economic position of a country (Najaf, 2016). However, the rise and fall in commodities prices (especially oil prices) causes large fluctuations in stock market returns. Hence, oil price volatility and its effect on stock markets is perceived as a great concern from scholars over the years. Therefore, there is a well-established literature that examined the effects of oil price fluctuation on stock market returns. Most of these studies revealed that oil prices impact stock markets in myriad ways whether it is an oil exporting or importing country. Therefore, huge spikes in oil prices impact the fortune of these companies which use oil as one of their main inputs. Therefore, the increase in oil prices will eventually lead to changes in the production in these oil-based companies which in turn leads to profit compression and a loss of the share value and the investor returns.

The studies that examined the nexus between oil price shock and stock market returns showed that equity return is adversely impacted by oil price shocks. Moreover, these studies are mostly

concerned with the developed markets (Jones and Kaul, 1996; Sadorsky, 2001; Narayan and Gupta, 2015; Cuñado and Pérez de Gracia, 2014) while there was less attention paid in developing markets, such as Malaysia. Presently, Malaysia stock market is one of the top leading financial markets in Southeast Asia. Hence, it plays a central role in assisting the growth of Malaysia financial market by offering competitive services and infrastructure as well adopting standard roles and regulations with aims of enhancing the global recognition and relevance of Malaysia's stock market (FTSE Russel, 2016).

Therefore, this paper investigates the influence of oil price shocks on the stock market return in Malaysia at both aggregate and disaggregate levels by applying a newly developed nonlinear autoregressive distributed lag (nonlinear ARDL). The test can reveal the nonlinearity relationships between oil price, interest rate, exchange rate, industrial production, inflation, and the stock market returns. Therefore, the outcome of this research will provide relevant information about oil price volatility and their association with stock market returns in Malaysia which is relevantly not discussed by the previous literature.

2. Literature review

Oil price fluctuations and stock market return nexus received a great concern by economists, investors and more importantly the policy-makers. This is because stock market growth implies that there are appropriate policies implemented to support the

* Corresponding author.

E-mail addresses: ekhlasalhajj@yahoo.com (E. Al-hajj), usama.almulali@mmu.edu.my (U. Al-Mulali), sasolarin@mmu.edu.my (S.A. Solarin).

economic growth. The relationship between oil price shocks on the stock market returns on the aggregate and sectoral level is well studied by several researchers. Jones and Kaul (1996) were among the earliest studies which dealt with the relationship between oil price and stock market performance in the US. Their findings showed a strong negative relationship between oil shocks and stock market return. The characteristics of the country economy and its oil position are very important factors in determining the positive or the negative relationship between oil price and stock markets. At the aggregate level, multiple studies showed that oil price shocks have a positive impact on the oil-exporting countries whereas it negatively impacts the importing countries (Park and Ratti, 2008; Bjornland, 2009; Filis and Chatziantoniou, 2014; Shafi et al., 2015; Luo and Qin, 2017; Davoudi et al., 2018). This is because the increase in oil prices indicates money transfer from oil importing countries to oil exporting countries as oil importing countries spend more amount of money to cover the cost of their local oil demand to the oil exporting countries. Therefore, if these oil exporting countries use the revenue to buy goods and services locally, this will lead to a higher level of economic performance, including the improvement of stock market returns.

Park and Ratti (2008) investigated the U.S and 13 European countries' stock markets to study the impact of oil shocks on the stock market. A multivariate vector autoregression (VAR) analysis was applied from 1986–2005. A significant negative impact of the oil shocks on the stock market was found for all the European countries except Norway as it is a large oil exporting country, yet U. S stock market is not weakened by oil price volatility. Similarly, Shafi et al. (2015) showed that oil price fluctuations have positive consequences on oil-exporting countries' stock market whereas it negatively impacts the oil-importing countries stock market. The same outcome was found by Creti et al. (2013) who showed that oil exporting markets experience greater interdependence between oil and stock market rather than oil importing countries.

For the stock markets at the disaggregate level, the oil price shocks influence the stock values through the expected earnings of the companies. Therefore, a surge in the oil prices greatly impacts the wealth of sectors which use oil as an essential input in their daily production. Hence an increase in the oil price raises the production costs of these sectors which in turn compress their profitability value and investor gains. Therefore, oil price fluctuations vary across the sectors on their impact on the stock market returns. Several studies concluded that positive oil price changes increase the performance of oil-related industries including; oil, gas and mining sectors. However, oil-dependent industries including; transportations, manufacturing, and others tend to suffer from oil price increases which eventually lessen their wealth and investor value. Moreover, the relationship was insignificant for none oil dependent and related sectors. A number of studies such as El-Sharif et al. (2005), Degiannakis et al. (2013), and Kisswani et al. (2017) concluded that the nexus of the relationship between oil price shocks and stock market return is inconclusive because different sectors vary in their exposure which highly depends on the nature of the relationship between oil and the sectors and based on the level that each sector consumes oil and everything that relates to it.

Although most of the previous studies examined the linearity relationship between oil price shocks and stock market returns, there are quite a few studies that examined the asymmetry impacts of oil price on the equity returns. The asymmetry relationship includes both positive and negative changes. A recent study by Jiménez-Rodríguez (2015) considered Canada, Germany, UK, and U.S to study the nonlinearity of oil price on the stock market returns. The outcome revealed evidence of nonlinear relationship where a positive oil price (increase) has a more significant negative impact on the stock market compared to the decrease (negative)

in the oil price impacts. Phan et al. (2015) tested the nonlinear relationship between oil price and firm returns and revealed inconsistent outcome as equity returns vary across the sectors in their response to the positive and negative changes in oil prices. In addition, Narayan and Gupta (2015) examined whether oil price can be used to predict the equity returns by using a predictive regression model in U.S markets. Their findings showed that the negative oil price changes are better in predicting the equity market returns than the positive oil price changes.

Furthermore, Hatemi-J et al. (2016) used asymmetric causality test of Hatemi-J (2012). The findings showed that a rise in the oil prices leads to a good stock market performance in U.S and Japan. On the other hand, a fall in prices depresses the stock market in Germany. The reason was given as high oil prices signify the economy growth and expansion which, in turn, leads to high demand in case of U.S and Japan's positive nexus. However, in that case of Germany, a rise in oil prices leads to the compression of the economy. Also, Ajmi et al. (2014) found that there is nonlinear causal effect between oil price shocks and the stock market returns in Middle East nations.

Recently, Kisswani et al. (2017) studied the nonlinear relationships between oil price and stock market returns in ten Kuwaiti sectors by utilizing nonlinear ARDL approach. The results provided evidence of a negative long-run asymmetry effects that exist between oil price and stock market returns for some sectors including; banks, consumer goods, consumer services, industry and real estate. Similarly, Raza et al. (2016) used nonlinear ARDL to test the nonlinearities between oil price, gold and stock market return in some emerging markets, including Malaysia. They found that oil price adversely impacts the stock market returns in all the emerging markets this is in line with Basher et al. (2012) outcome. Moreover, Zhu et al. (2016) used a two-stage Markov regime-switching approach to test the asymmetry effect of oil shocks and stock returns by separating supply and demand shocks in some oil importing and exporting countries. Their findings implied that demand shocks have more effects on the stock returns compared to supply shocks. Similarly, Hu et al. (2017) used nonlinear ARDL and SVAR models to examine the effect of oil price shocks on the stock market in China as an emerging market. Therefore, the finding implied there demand shocks have great impact on the stock market returns. However, the result did not show any evidence of the asymmetry relationship with exception of the aggregate demand shocks.

There are a number of recent studies that found the relationship between oil price and equity return is a time-varying relationship where oil price is highly influenced by economic factors. The time-varying relationship is supported by Miller and Ratti (2009) who examined the oil price effects on the stock markets by using quasi-time-varying model using the period from 1971 to 2008. The results showed that there is a negative relationship during the periods of 1970s and 1990s, yet in 1980s it was insignificant and after 1999 it turns into a positive relationship. Furthermore, Filis et al. (2011) employed a dynamic conditional correlation generalized autoregressive conditionally heteroskedastic (DCC-GARCH) to investigate the relationship between oil price and the stock market by considering some oil-importing and oil-exporting countries. Their findings showed that stock markets experience a fall during the time when major oil players experience distress in oil supply and demand and instability in oil productions due to some geopolitical events. On the other hand, the stock market experiences a positive relationship when there is an economic recession.

Recently, Marashdeh and Afandi (2018) used U.S, Saudi Arabia, and Russia (as the major oil producers in the world) to test the influence of oil price on the stock market returns by using vector error corrections models over the periods January 2000 to May 2015. They used different indicators such as oil price, interest rate,

industrial production, inflation, exchange rate, oil productions and the stock market returns. Therefore, the findings showed that oil price shocks positively impact the stock market returns in Russia in case if the oil shocks are originated from supply shocks, while oil supply shocks had a negative impact on the U.S stock market. On the other hand, the oil supply shock was unclear in the case of Saudi Arabia stock market returns. Meanwhile, the result suggested that oil price shocks originated from demand positively impacts all the three countries stock market returns.

Also, Davoudi et al. (2018) applied (GARCH) model to examine the influence of oil shocks revenue on the stock market returns on Iran over the period 1993 to 2014. There are a number of indicators were included such as oil price, exchange rate, consumer price index. The results showed oil price and exchange rate positively impact Tehran's stock market, while the consumer price index impacts on the stock market returns was insignificant.

Moreover, a number of studies examined the time-varying relationship between oil prices and stock market returns, for instance Degiannakis et al. (2013) who investigated the time-varying relationship between oil and stock returns while considering some industrial sectors. Their findings supported the time-varying relationship in all industrial sectors including oil-related, substitutes, oil users and even non-oil related industries. The time-varying relationship was also supported by Sadorsky (2012) for technology and energy industries. Jammazi et al. (2017) recently considered six top developed oil-importing countries to study the time-varying relationship between oil and stock returns by employing wavelet analysis and Granger causality. They found a time-varying bidirectional causality which was strongly presented at a time when there are some financial disasters such as the global financial crisis and European debt crises.

The majority of previous studies considered the developed markets to test the relationship between oil price shocks and stock market returns. However, there are very few studies that had focused on Malaysia's stock markets despite its growing importance. Moreover, most of these studies only considered testing the symmetry relationship between oil price shocks and stock market returns, thus, this research will utilize Nonlinear ARDL which is a very recent method on testing the nonlinearities among variables of interest. Testing the asymmetry relationship is very interesting and relevant because it enables practitioners, companies' managers and policy makers to know the direction of the relation between oil price and stock market that is associated with increase and decrease in oil price, hence they can make appropriate action and formulate strategies to deal with these spikes in oil prices.

3. Methodology

The main objective of this research is to investigate the nexus between oil price, interest rate, exchange rate, industrial production, inflation and the stock market returns in Malaysia by utilizing the asymmetric cointegration test developed by Shin et al. (2011). In addition to the aggregate stock market, we also incorporated the nine sectors listed in Bursa Malaysia. The sample period covers the period of January 1990 to November 2016 and for the aggregate, the period is from May 2000 to November 2016 for the sectors. The chosen period is dedicated to the data availability of some variables and sectors indices. Moreover, the monthly data has a higher frequency that can better capture the movement between oil price and stock market indices than annually or quarterly. There are several researchers with related research that used monthly data, such as Bjornland (2009), Apergis and Miller (2009) and Raza et al. (2016). In addition to oil price (OP), other determinates were included such as; interest rate (IR) and consumer price index (CPI) are chosen because Malaysia has recently implemented goods and service tax (GST) and because most of firms rely on external funds

to finance their daily operation and activities. Furthermore, the real effective exchange rate (REER) is chosen because of many reasons such as Malaysia become an open economy, which has a high integration with other international firms, as well as the exchange rate impacts the inflow of the foreign investment. The last independent variable is the industrial production index (IPI) which reflects the growth of the business in relation to the news and events. The main model of this research is presented below;

$$Y_t = F(OP_t^+, OP_t^-, IR_t^+, IR_t^-, REER_t^+, REER_t^-, IPI_t^+, IPI_t^-, \times CPI_t^+, CPI_t^-) \quad (1)$$

where; Y_t represents the aggregate stock market (KLCI) and the nine sectors including; consumer product (KLCSU), construction (KLCON), property (KLPRP), industrial production (KLPRO), trading/services (KLSER), mining (KLTIN), technology (KLTEC), plantation (KLPLN), and finance sectors (KLFIN) which are the study's dependent variables.

According to monetary portfolio model, that increases in interest rate raise the cost of holding the cash (Rozeff, 1974). Moreover, a high-interest rate causes a higher cost of funds and debt thus distort firm profitability, cash flows, and earnings and growth rate which may lead financial distress and depresses the firm liquidity conditions. Eventually, these effects depress the stock value of the firm. There are several studies which had found a negative relationship between interest rate and stock market returns (e.g., Sadorsky, 1999; Maysami et al., 2004; Henriques and Sadorsky, 2008; Thang, 2009).

The exchange rate plays a crucial role in the stock market performance in a trade-oriented country like Malaysia. An exchange rate depreciation creates more opportunities for goods and services to be exported which eventually leads to high foreign capital inflow and investment which will reflect on the country's economic performance (Maysami et al., 2004; Bjornland, 2009). However, portfolio balance model indicated that an increase in local stock market motivates investors to buy more local assets and sell foreign assets to get the local currency which eventually leads to an appreciation in the local currency Granger et al. (2000); Badhani et al. (2009); Tsai (2012); Seong (2013). Most of these studies concluded that a growth in the level of industrial production positively impacts the share price (Chen et al., 1986; Sadorsky, 1999; Wongbangpo and Sharma, 2002; Maysami et al., 2004).

Finally, inflation effect on the stock market is earlier documented by Fisher (1930) hypothesis which indicated that inflation is positively correlated with stock value as it also provides hedging technique for investors. This is because in the case of inflation pressure, the value of shares will increase too which is in line with study by Salisu et al. (2017). In contrast, Fama (1981) argued that inflation is negatively correlated with stock value and does not provide hedging tool for investors, particularly in the long-run. This is because, if there is an increase in the oil price, which implies there is inflation, the usual reaction is that the central bank will try to stabilize the economy by raising the interest rates. As a result, most of the investor in the case of a high-interest rate will prefer to invest in government bonds rather than investing in stocks, thus the stock price will dramatically fall. The same results were shown by Sohail and Hussain (2009) and Kimani and Mutuku (2013).

3.1. Lee and Strazicich (2003) unit root test

Lee and Strazicich (2003) introduced Lagrange Multiplier (LM) test that can accommodate the large size of data and identify the structural breaks. Moreover, it allows for two structural breaks for the null hypothesis and the alternative hypothesis in both level and trend. In this study, LM test was employed to identify the structural breaks in the oil price shocks that would powerfully increase the

Table 1
Lee and strazich results.

Aggregate stock market								
Variable	T-statistic	K	TB1	TB2	DU1	DT1	DU2	DT2
Ln KLCI	−4.299	4	1997:06	2010:10	−37.029 (−0.693)	−37.066*** (−3.462)	−44.893 (−0.844)	42.909*** (3.359)
$\Delta \ln$ KLCI	−10.251***	8	1997:01	2003:10	0.151** (2.340)	−0.098*** (6.904)	−0.197*** (3.049)	0.1233*** (8.357)
Ln OP	−4.777	4	1999:07	2012:04	0.0107 (0.139)	0.0381*** (3.356)	−0.0722 (−0.938)	−0.0266** (−2.201)
$\Delta \ln$ OP	−13.495***	12	2005:02	2009:01	0.152* (1.932)	−0.0490*** (−3.641)	−0.1302* (−1.661)	0.1135*** (6.974)
Ln IR	−4.833	10	1998:12	2003:04	0.0835*** (2.770)	−0.0158*** (−3.735)	−0.0675*** (−3.453)	0.0097*** (2.938)
$\Delta \ln$ IR	−9.260***	11	1998:05	2005:12	0.0169 (0.821)	−0.0195*** (−5.224)	−0.0301 (−1.483)	0.0174*** (5.198)
Ln REER	−4.419	8	1997:08	2011:04	0.0722*** (2.965)	0.0268*** (3.745)	0.0221 (0.954)	−0.0193*** (−2.861)
$\Delta \ln$ REER	−15.522***	10	1997:10	2009:01	0.0694*** (2.895)	−0.0319*** (−8.0698)	0.0251 (1.046)	0.0030 (0.950)
Ln IPI	−4.8456	9	1995:03	2008:09	0.0028 (0.072)	0.0175** (2.184)	−0.0261 (−0.673)	−0.0389*** (−4.367)
$\Delta \ln$ IPI	−20.307***	11	1998:09	2010:10	0.118*** (2.982)	−0.092*** (−13.174)	−0.1465*** (−3.656)	0.141*** (15.739)
Ln CPI	−4.9988	9	1999:12	2006:02	−0.0022 (−0.6128)	−0.0041*** (−5.676)	0.0129*** (3.6685)	0.0018** (3.223)
$\Delta \ln$ CPI	−13.350***	12	2003:10	2008:07	0.0113*** (2.9923)	−0.0064*** (−8.408)	−0.0063* (−1.689)	0.0003 (0.4399)
Sectors								
Ln KLTEC	−4.143	3	2009:10	2013:04	−0.0107 (−0.148)	0.0593*** (3.078)	0.157** (2.191)	0.0142 (0.909)
$\Delta \ln$ KLTEC	−13.072***	0	2009:06	2011:10	0.346*** (4.541)	−0.151*** (−7.638)	−0.1566*** (−2.102)	0.184*** (8.315)
Ln KLCSU	−4.781	8	2003:08	2013:04	−0.0391 (−1.323)	0.0213** (2.738)	0.0573* (1.889)	−0.0061 (−1.1696)
$\Delta \ln$ KLCSU	−8.623***	12	2007:11	2012:10	0.116*** (3.575)	−0.068*** (−7.4597)	−0.2099*** (−6.1922)	0.121*** (8.3423)
Ln KLCON	−4.779	9	2006:10	2009:03	−0.0982* (−1.800)	0.111*** (5.318)	0.0369 (0.680)	−0.0150 (−1.329)
$\Delta \ln$ KLCON	−12.481***	0	2006:06	2008:09	−0.0615 (−1.164)	0.0828*** (5.853)	0.2909*** (5.631)	−0.0984*** (−6.916)
Ln KLPRP	−4.651	9	2004:05	2011:08	0.0024 (0.0413)	0.0411*** (2.950)	−0.0900 (−1.588)	0.0478*** (3.5402)
$\Delta \ln$ KLPRP	−6.879***	9	2009:03	2013:05	0.338*** (5.605)	−0.147*** (−6.41)	−0.3446*** (−5.832)	0.1788 (6.473)
Ln KLPRO	−4.696	9	2007:07	2010:05	−0.135*** (−3.120)	0.039*** (2.790)	−0.0120 (−0.282)	0.0554*** (4.2052)
$\Delta \ln$ KLPRO	−7.472***	9	2003:09	2011:10	0.2074*** (4.370)	−0.113*** (−6.665)	−0.1699*** (−3.4674)	0.125*** (7.219)
Ln KLSER	−4.762	9	2003:09	2013:03	0.1001*** (2.655)	0.0280*** (2.742)	0.0131 (0.348)	0.0106 (1.452)
$\Delta \ln$ KLSER	−8.347***	12	2007:07	2009:12	−0.182*** (−4.811)	0.0920*** (6.9184)	−0.0285 (−0.7548)	−0.0104 (−1.3002)
Ln KLTIN	−5.244	9	2006:12	2010:08	−0.191** (−2.084)	0.0145 (0.786)	−0.1364 (−1.545)	0.129*** (4.707)
$\Delta \ln$ KLTIN	−14.803***	0	2008:06	2010:12	−0.0603 (−0.659)	−0.0080 (−0.412)	−0.2154** (−2.3753)	0.0249 (1.2479)
Ln KLPLN	−4.3802	11	2007:01	2014:08	−0.0129 (−0.2278)	0.0898** (3.7143)	0.0047 (0.0855)	−0.0378*** (−2.8004)
$\Delta \ln$ KLPLN	−11.716***	0	2006:09	2009:02	0.104* (1.855)	−0.045*** (−3.437)	0.0363 (0.6579)	0.0184 (1.5393)
Ln KLFIN	−4.633	9	2004:05	2011:09	0.0101 (0.221)	0.041*** (3.177)	0.0586 (1.311)	0.0110 (1.344)

(continued on next page)

Table 1 (continued).

Aggregate stock market								
Variable	T-statistic	K	TB1	TB2	DU1	DT1	DU2	DT2
$\Delta \ln$ KLFIN	-7.560***	12	2007:07	2010:10	-0.196*** (-4.428)	0.082*** (6.003)	-0.0609 (-1.4175)	-0.0216** (-2.4605)
LnOP	-4.437	11	2005:02	2014:08	0.0221 (0.274)	0.0864*** (4.001)	0.1187 (1.472)	-0.1318*** (-5.393)
$\Delta \ln$ OP	-9.180***	0	2009:02	2012:04	0.314*** (3.642)	-0.071*** (-3.957)	-0.107 (-1.242)	0.0939*** (4.581)
Ln IR	-4.743	10	2005:10	2009:05	-0.0158 (-1.268)	0.0182*** (3.999)	-0.0021 (-0.147)	-0.0036 (-1.254)
$\Delta \ln$ IR	-7.675***	1	2006:02	2009:05	0.0131 (1.089)	-0.0012 (-0.4777)	-0.0015 (-0.1232)	0.0125*** (4.5052)
Ln REER	-5.120	11	2006:09	2013:03	0.0052 (0.283)	-0.015*** (-3.705)	-0.031* (-1.652)	0.015*** (4.218)
$\Delta \ln$ REER	-8.339***	6	2007:07	2011:08	0.0240 (1.256)	-0.012*** (-3.209)	0.146*** (7.058)	-0.0624*** (-7.602)
Ln IPI	-4.632	12	2003:10	2008:11	-0.0428 (-1.4089)	0.0727*** (4.133)	-0.0813*** (-2.790)	-0.0428*** (-4.206)
$\Delta \ln$ IPI	-10.882***	11	2006:02	2013:03	0.274*** (6.844)	-0.219*** (-10.878)	-0.1747*** (-4.385)	0.221*** (11.090)
Ln CPI	-4.548	7	2005:03	2009:06	-0.0034 (-0.888)	0.0046*** (4.697)	0.0041 (1.048)	-0.0037*** (-4.226)
$\Delta \ln$ CPI	-7.736***	4	2008:02	2013:08	-0.0059 (-1.465)	0.0016** (2.257)	0.0140*** (3.386)	-0.0079*** (-6.153)

Note: *** = 1%, ** = 5%, * = 10%, K = number of lags was set at maximum 12, TB is the time breaks, and () represents the T-statistic.

Table 2
Bounds test for nonlinear cointegration.

Dependent variable	F-statistic	Conclusion	Diagnostic tests					
			χ^2_{NORM}	χ^2_{SERIAL}	χ^2_{ARCH}	χ^2_{RESET}	CUSUM	CUSUMsq
KLCI	5.458***	Cointegration	2.92 [0.000]	0.222 [0.801]	0.343213 [0.558]	1.188 [0.235]	Stable	Unstable
Consumer product	7.540***	Cointegration	2.443 [0.342]	0.042 [0.838]	0.434 [0.511]	1.650 [0.121]	Stable	Stable
Construction	5.865***	Cointegration	1.748 [0.417]	1.542 [0.219]	0.768 [0.382]	0.562 [0.575]	Stable	Stable
Property	7.931***	Cointegration	1.410 [0.494]	2.138 [0.123]	0.053 [0.819]	0.430 [0.669]	Stable	Stable
Industrial production	8.133***	Cointegration	0.380 [0.857]	1.455 [0.230]	0.4799 [0.489]	1.030 [0.529]	Stable	Stable
Trading/services	8.202***	Cointegration	2.241 [0.310]	1.1487 [0.331]	0.187 [0.666]	0.636 [0.526]	Stable	Stable
Mining	12.920***	Cointegration	1.338 [0.512]	2.0144 [0.139]	1.019 [0.314]	1.563 [0.149]	Stable	Stable
Technology	11.197***	Cointegration	0.274 [0.871]	1.348 [0.265]	0.012 [0.912]	0.273 [0.785]	Stable	Stable
Plantation	2.139	No Cointegration	5.584 [0.061]	0.680 [0.509]	2.183 [0.141]	1.685 [0.116]	Stable	Stable
Finance	6.314***	Cointegration	1.595 [0.450]	2.571 [0.112]	2.115 [0.148]	1.554 [0.130]	Stable	Unstable

Critical values		
Significant level	Lower bounds I (0)	Upper bounds I (1)
1%	3.41	4.68
5%	2.62	3.79
10%	2.26	3.35

Note: [] are the probability values, the critical values are obtained from Pesaran et al. (2001) case III. *** = 1%, ** = 5%, * = 10%.

reliability of our results. LM model equation is exemplified as below:

$$\Delta Y_t = \theta' \Delta S_t + \theta Y_{t-1} + \sum_{i=1}^k \gamma \Delta Y_{t-i} + \varepsilon_t \quad (2)$$

The null hypothesis means that the variable has a unit root when $\theta = 0$ whereas the alternative hypotheses indicates that the variable is stationary when $\theta < 0$. S represents structural breaks of the exogenous variables. The LM model allows for two structural breaks in both mean and trend. The main estimation of LM model is $S_t = [1, t, D_{1t}, DT_{1t}]'$ where $DT_{1t} = t$ if $t \geq$

Table 3
Nonlinear ARDL estimation results.

Variable	KLCI	KLCSU	KLCON	KLPRP	KLPRO	KLSEK	KL TIN	KLTEC	KLPLN	KLFIN
Constant	1.110*** (6.251)	1.175*** (5.963)	0.503*** (3.615)	0.919*** (4.411)	1.025*** (6.416)	0.233 (1.167)	1.473*** (6.337)	1.089*** (6.948)	0.543** (2.543)	2.067*** (5.823)
LnS(-1)	-0.173*** (-6.125)	-0.238*** (-6.056)	0.503*** (-3.981)	-0.148*** (-4.650)	-0.246*** (-6.506)	-0.062 (-1.439)	-0.293*** (-6.861)	-0.273*** (-7.553)	-0.075** (-2.571)	-0.246*** (-5.893)
lnOp+(-1)	-0.044** (-2.088)	-0.055** (-2.522)	-0.050 (-1.169)	-0.163*** (-3.291)	-0.072** (-2.207)	-0.035 (-1.080)	-0.310*** (-3.556)	-0.477*** (-5.630)	-0.002 (-0.057)	-0.067* (-1.768)
lnOp-(-1)	0.089** (2.463)	-0.077*** (-3.483)	-0.185*** (-3.878)	-0.184*** (-4.122)	-0.036 (-1.165)	-0.088*** (-2.791)	-0.173** (-2.370)	-0.140** (-2.316)	-0.083** (-1.981)	-0.007 (-0.175)
lnIr+(-1)	-0.198*** (-2.805)	-0.144 (-1.577)	-0.465*** (-2.675)	-0.464*** (-2.686)	-0.363*** (-2.855)	-0.311*** (-2.678)	-0.289 (-0.867)	-0.325 (-1.058)	-0.285* (-1.868)	0.222* (1.713)
lnIr-(-1)	0.0409 (0.892)	0.211** (2.209)	0.444** (-2.185)	1.051*** (4.588)	0.576*** (3.845)	0.546*** (3.917)	2.723*** (6.861)	2.508*** (7.596)	0.067 (0.427)	-0.665*** (-4.271)
lnREER+(-1)	-0.188*** (-2.847)	-0.317*** (-4.322)	-0.020 (-0.136)	-0.192 (-1.250)	0.056 (0.519)	0.054 (0.541)	-0.106 (-0.411)	0.1323 (0.658)	0.123 (-0.904)	-0.109 (-0.886)
lnREER-(-1)	-0.2076** (-2.528)	-0.276*** (-3.049)	0.312* (1.995)	-0.137 (-0.771)	0.068 (0.546)	0.227** (2.018)	-0.294 (-1.010)	-0.233 (-0.947)	0.087 (0.598)	-0.026 (-0.202)
lnIPI+(-1)	0.0717 (1.307)	0.211*** (3.025)	0.077 (-0.576)	0.482*** (3.186)	0.297*** (3.090)	0.073 (0.910)	1.356*** (5.271)	1.170*** (5.552)	0.080 (0.836)	0.161* (1.808)
lnIPI-(-1)	-0.145* (-1.881)	0.073 (0.847)	-0.123 (-0.663)	0.445** (2.211)	0.177 (1.439)	-0.075 (-0.779)	-0.856** (2.693)	-1.033*** (3.782)	0.083 (0.649)	-0.082 (-0.741)
lnCPI+(-1)	0.501 (1.5448)	-0.669** (-2.200)	-0.479 (1.087)	-0.259 (-0.579)	-0.313 (-0.965)	-1.304*** (-3.885)	-3.087*** (-3.634)	0.364 (0.572)	-0.136 (-0.253)	-0.405 (-0.993)
lnCPI-(-1)	-1.811 (-1.544)	0.669 (0.892)	6.451*** (4.224)	6.872*** (4.017)	2.936** (2.488)	3.159** (2.773)	11.077*** (3.932)	7.456*** (3.158)	2.616* (1.834)	2.302* (1.730)
DLS(-1)										0.165** (2.418)
DLS(-2)							-0.211*** (-2.942)			
DLS(-3)			0.178*** (2.730)	0.174** (2.566)	0.209*** (3.241)		-0.185*** (-2.843)			0.137*** (2.003)
DLS(-4)							-0.201*** (-2.999)			
DLS(-5)					0.268 (4.155)		0.111* (1.847)	0.148** (2.273)		0.2119*** (3.433)
DLS(-6)							-0.119* (-1.914)			
DLS(-7)	0.177*** (3.486)	0.142** (2.425)			0.138** (2.367)					0.121* (1.911)
DLOP+(-1)	0.169** (2.178)							0.274** (2.137)		0.162** (2.240)
DLOP+(-3)	0.1407* (-1.923)						0.353** (2.476)		0.181** (2.210)	
DLOP+(-4)								0.296** (2.152)		
DLOP+(-5)								0.324** (2.425)		
DLOP+(-8)							0.257* (1.887)	0.206 (1.589)		
DLOP-(-1)	-0.247*** (-3.498)									-0.144** (-2.060)

(continued on next page)

$T_B + 1, j = 1, 2$ and 0 otherwise. Furthermore, D_{1t} and DT_{1t} are the dummies for the structural break dates for both mean and trend, respectively. LM for both structural breaks are presented as $S_t = [1, t, D_{1t}, D_{2t}, DT_{1t}, DT_{2t}]'$, where $DT_{jt} = t - T_{Bj}$ if $t \geq T_B + 1, j = 1, 2$. In addition, LM introduced ΔY_{t-j} in order to avoid any serial correlation in the variables.

3.2. Nonlinear ARDL

Oil price shocks and stock market returns relations is commonly investigated by scholars using different techniques and methods such as ARDL, Johansen cointegration, VAR, Vector Error Correction Model (VECM), Granger Causality, and others. Although these methods are superior to determine the symmetry of the long- and short relationships yet they are unable to capture the asymmetric

Table 3 (continued).

Variable	KLCI	KLCSU	KLCON	KLPRP	KLPRO	KLSEK	KLTIN	KLTEC	KLPLN	KLFIN
DLOP- (-2)			0.432*** (5.116)							
DLOP- (-3)		0.166*** (4.506)	0.364*** (4.605)		0.253*** (4.520)	0.257*** (4.651)	0.245* (1.949)	0.538*** (4.924)		0.200*** (3.113)
DLOP- (-4)				0.187** (2.476)			-0.682* (-1.738)			
DLOP- (-6)	-0.1860*** (-3.0405)								-0.164*** (-2.660)	
DLOP- (-7)							-0.307** (-2.433)	-0.250** (-2.062)		
DLIR+ (-1)	0.841** (2.308)									
DLIR+ (-2)					-0.953*** (-2.598)	-0.682** (-2.052)				-0.630 (-1.710)
DLIR+ (-3)			-0.811*** (-1.598)	-1.350*** (-2.637)	-1.217*** (-3.463)		2.903*** (3.491)	-1.702** (-2.132)		
DLIR+ (-5)	-0.823** (-2.275)	-0.665** (-2.475)						-1.398* (-1.780)		
DLIR+ (-8)								1.391* (1.945)		
DLIR- (-1)								2.078*** (3.440)		
DLIR- (-2)	-0.946*** (-4.970)			-0.8263** (-2.089)	-0.606** (-2.147)	-0.537* (-1.883)				
DLIR- (-3)							2.146*** (3.161)			0.586* (1.800)
DLIR- (-5)						-0.884 (-3.255)				
DLIR- (-7)	-0.901*** (-5.469)	-0.560** (-2.828)		-0.769* (-1.983)	-0.571** (-2.024)	-0.691** (-2.526)				
DLREER+ (-3)	-0.373* (-1.6518)			0.731** (2.262)	0.599** (2.467)		-1.829*** (-3.448)	0.881* (1.881)		
DLREER+ (-4)							-1.542*** (-4.345)	0.926** (1.988)		
DLREER+ (-8)		-0.338** (-2.172)	0.580* (-1.931)	-0.646* (-1.754)	-0.614** (-2.744)					-0.403 (-1.604)
DLREER- (-1)	-0.394* (-1.703)	-0.388* (-1.876)		-0.905** (-2.382)	-0.862** (-3.141)	-0.663** (-2.514)	-1.657** (-2.837)			-0.792** (-2.468)
DLREER- (-3)					-0.911*** (-3.234)			-2.026*** (-3.514)		
DLREER- (-4)								-1.415** (-2.490)		
DLREER- (-6)							-1.442** (-2.472)	-1.408*** (-2.732)		
DLREER- (-7)						-0.473* (-1.894)	-2.518*** (-4.576)			-0.643*** (-3.247)
DLIPI+ (-1)		-0.351*** (-3.121)	-0.548** (-2.539)	-1.049*** (-4.529)	-0.645*** (-4.339)	-0.483*** (-3.075)	-1.824*** (-4.758)		-0.239* (-1.767)	-0.628*** (-3.590)
DLIPI+ (-2)	-0.372*** (-3.205)	-0.306*** (-4.188)	-0.530*** (-3.331)	-0.904*** (-3.972)	-0.629*** (-4.606)	-0.288*** (-3.009)		-0.836*** (-2.712)	-0.229* (-1.773)	-0.300*** (-2.805)
DLIPI+ (-3)		-0.295*** (-3.857)	-0.448** (-2.257)	-0.813*** (-3.536)	-0.249** (-2.341)	-0.276*** (-2.654)	-1.525*** (-4.246)	-0.832** (-2.496)	-0.234* (-1.927)	-0.248** (-2.114)
DLIPI+ (-5)		-0.209** (-2.544)		-0.489** (-2.519)	-0.228** (-2.009)	-0.461*** (-3.640)	-1.363*** (-3.940)	-0.591** (-2.095)		-0.488*** (-3.468)

(continued on next page)

relationship. Hence, in this paper, nonlinear ARDL cointegration method introduced by Shin et al. (2011) is used to find the long- and short-run asymmetry relationships. It is an extended method of Pesaran et al. (2001) bounds test. However, nonlinear ARDL can

test the asymmetry relationship. Basically, the nonlinear ARDL is able to examine whether the positive shocks of the independent variables have the same effect as their negative shocks on the

Table 3 (continued).

Variable	KLCI	KLCSU	KLCON	KLPRP	KLPRO	KLSEK	KLTTN	KLTEC	KLPLN	KLFIN
DLIPI- (-1)		-0.170* (-1.679)	0.511* (-1.931)	-0.437* (-1.938)	-0.274* (-1.869)					
DLIPI- (-2)	0.422*** (3.110)	-0.378*** (-2.762)	-0.475* (-1.822)	-1.214*** (-4.363)	-0.683*** (-3.770)	-0.450** (-2.414)	-1.427*** (-3.196)	-0.923** (-2.386)		-0.433** (-2.092)
DLIPI- (-3)					-0.461*** (-2.835)		-0.929** (-2.222)	-0.821** (-2.245)		
DLIPI- (-6)		-0.296*** (-2.797)		-0.657*** (-3.187)	-0.401*** (2.887)	-0.482*** (-2.901)	-0.986*** (-3.116)			-0.553*** (-2.986)
DLCPI+ (-1)						1.868** (2.480)		2.728* (1.814)	-3.457* (-3.165)	1.933** (2.211)
DLCPI+ (-3)	-3.759*** (-3.815)		-4.354*** (-3.964)				3.946** (2.196)		-3.165*** (-2.825)	
DLCPI+ (-4)			1.848* (1.696)		-2.971*** (-3.969)					-2.421*** (-2.747)
DLCPI- (-1)			-6.499* (-2.313)							
DLCPI- (-2)	-5.485** (-2.137)			-7.646** (-2.419)	-5.269** (-2.365)	-4.891** (-2.203)	22.678*** (-4.099)	-17.799*** (-3.908)		-7.902*** (-3.246)
DLCPI- (-3)					3.555* (1.706)				4.159 (1.612)	4.411* (1.963)
DLCPI- (-7)								8.560** (2.187)		
R2	0.619	0.689	0.554	0.539	0.629	0.527	0.645	0.555	0.566	0.563
Adj. R2	0.529	0.404	0.355	0.431	0.528	0.421	0.508	0.404	0.388	0.45793
F-statistic	6.869	5.777	4.603	4.996	6.1790	4.968	4.7023	3.684	6.024	5.339
Durbin-Watson stat	2.034	2.223	1.865	2.132	1.925	2.067	2.039	1.861	2.034	2.013

Note: () are the t-statistic.

dependent variables.

$$Y_t = C + \alpha_1 OP_t^+ + \alpha_2 OP_t^- + \alpha_3 IR_t^+ + \alpha_4 IR_t^- + \alpha_5 REER_t^+ + \alpha_6 REER_t^- + \alpha_7 IPI_t^+ + \alpha_8 IPI_t^- + \alpha_9 CPI_t^+ + \alpha_{10} CPI_t^- + \varepsilon_t \tag{3}$$

$$y_t = \alpha^+ z_t^+ + \alpha^- z_t^- + \varepsilon_t \tag{4}$$

α^+ and α^- represent the long run parameter and z_1 is the vector regressor which is explained as:

$$z_t = z_0 + z_t^+ + z_t^- \tag{5}$$

z_t^+ and z_t^- represent the positive and negative partial sums which is change as below

$$z_t^+ = \sum_{i=1}^t \Delta z_i^+ = \sum_{i=1}^t \max(\Delta z_i, 0) \tag{6}$$

$$z_t^- = \sum_{i=1}^t \Delta z_i^- = \sum_{i=1}^t \min(\Delta z_i, 0) \tag{7}$$

Asymmetric error correction model (AECM) is estimated as follow:

$$\Delta y_t = \rho y_{t-1} + \theta^+ z_{t-1}^+ + \theta^- z_{t-1}^- + \sum_{i=1}^{j-1} \varphi_i \Delta y_{t-i} + \sum_{i=0}^p (\pi_i^+ \Delta z_{t-i}^+ + \pi_i^- \Delta z_{t-i}^-) + \varepsilon_t \tag{8}$$

where; $\theta^+ = \frac{\alpha^+}{\rho y_{t-1}}$ and $\theta^- = \frac{\alpha^-}{\rho y_{t-1}}$

The bound test in nonlinear ARDL framework has very similar procedures to the linear ARDL. A case in point, the estimation of Eq. (8) the null hypothesis $\rho = \theta^+ = \theta^- = 0$.

Furthermore, in nonlinear ARDL the Wald test is employed to find the long run coefficient by $\theta^+ = \theta^-$ and the short run coefficient is $\mu^+ = \mu^-$. Finally, the cumulative dynamic multiplier effects of z^+ and z^- on y_t is examined as follows:

$$m_k^+ = \sum_{i=0}^k \frac{\partial y_{t+i}}{\partial z_t^+} \tag{9a}$$

$$m_k^- = \sum_{i=0}^k \frac{\partial y_{t+i}}{\partial z_t^-} \tag{9b}$$

$k = 0, 1, 2, \dots$, where; $k \rightarrow \infty$, the $m_k^+ \rightarrow \alpha^+$, $m_k^- \rightarrow \alpha^-$, where the long run asymmetric α^+ and α^- is already calculated thus can be used as: $\alpha^+ = \frac{-\theta^+}{\rho}$, and $\alpha^- = \frac{-\theta^-}{\rho}$.

4. Results and discussion

The first step in the analysis is to test the stationarity of the variables. Lee and Strazicich (2003) test results are presented in Table 1. Therefore, the result showed that all the variables are not stationary at level yet when they are converted to their first difference they become stationary. Furthermore, the results for the aggregate stock market are showed in the upper part of Table 1 which implied that most breaks occur in the 1990s particularly during the Asian financial crisis. The 1997 crisis, severely impacted Malaysia's economy including stock exchange and the growth of its industries. For the sector stock market, the results are showed in the lower part of Table 1 which indicated that most of the breaks happened in the 2010, 2011 and 2013. Moreover, other breaks where found in 2004 and 2008/2009. Basically, at these dates oil had witnessed a high volatility because of the turmoil in major oil countries such as the Iraq war in 2003/2004 and the global financial crisis in 2008/2009.

Since the variables are stationary, the bound test for nonlinear cointegration is performed, the results are presented in Table 2.

The bounds test provides strong evidence of cointegration for the aggregate stock market and all the economic sectors (excluding the plantation sector) at 1% level of significance. Therefore, we can reject the null hypothesis and accept the alternative hypothesis which indicates there is a cointegration for all the cases excluding the plantation sectors.

In addition, as far as the diagnostic tests are concerned, several tests were utilized to examine the reliability of the models. Therefore, Jarque–Bera test was utilized and the results showed that our models are normally distributed with the exception of the aggregate stock market. However, since our observation is more than 200, the scholars assume that it is normally distributed. Furthermore, our results implied that our models are free from serial correlation, heteroskedasticity, and error serial correlations. Finally, we examined the stability of our models by utilizing CUSUM and CUSUMSQ (refer to Fig. 1). The results indicate that all models are stable with the exception of the aggregate stock market model and finance sector model. Basically, the diagnostic tests results showed that the models of this research fulfilled the BLUE (Best linear unbiased estimation) requirements.

Since cointegration exists, the short run asymmetry relationship is tested. The results are explained in the lower section of Table 3. The results showed that there is a negative and positive short run asymmetry relationship in most cases. Basically, there is at least one short run relationship at different lag lengths.¹

The positive and negative long run relationship effects are explained in Table 4. The results show that negative shocks in oil prices will impact negatively the aggregate stock market of KLCI and six economic sectors namely consumer product, property, industrial production, mining, technology, and finance sectors. It means, if there is an increase by 1% in oil prices, it will cause a decrease of -1.100 , -1.059 and -1.748 in the stock market return of property, mining, and technology sectors, respectively. A 5% increase in oil prices, will lead to a reduction of -0.254 , -0.231 , and -0.295 in the stock prices of aggregate stock market, consumer product and industrial production, respectively. Moreover, 10% increases in oil price depress the stock market returns of finance sectors by -0.271 . Park and Ratti (2008), Basher et al. (2012) Ajmi et al. (2014), Narayan and Gupta (2015), Raza et al. (2016), and Hu et al. (2017) reached the same outcome.

The phenomenon indicates that the increase in oil prices will cause higher inflation and economic growth reduction. Additionally, the increase in oil prices will influence the prices of goods which are made by petroleum products. Therefore, an increase in the oil prices will influence the cost of production for different goods and services. Therefore, this phenomenon will cause reduction in the supply of the other goods and services because of their high production cost.

In contrast to the previous studies; the negative oil price shocks also have a negative impact on the stock market returns in consumer product, construction, property, mining, technology while it positively impacts the aggregate stock market returns. A 1% decrease in oil price shocks leads to a reduction by -0.324 , -1.705 , and -1.238 in the stock market returns of consumer product, construction, and property sectors, respectively. Moreover, a 5% fall in the oil price depresses the stock return of mining and technology by -0.591 and -0.513 , respectively. However, the positive oil price shocks positively impact the aggregate stock market returns by 0.520 and it is significant at the 5% level. Therefore, oil price volatility, whether it is an appreciation or depreciation, leads to inconsistent effects. Basically, higher oil prices lead to economic crisis due to the high cost of energy which eventually, drive a high rate of inflation and unemployment rate. It means, when

fluctuations in oil price take place, it will increase the risk and uncertainty in stock market returns. Hence, it is clear that oil price shocks have negative effects on the share price value regardless whether it is a positive or a negative shock in the most of Malaysia's economic sectors.

Furthermore, the long run results implied that positive shocks in the interest rate has a negative impact on the aggregate stock market return, construction, property, industrial production while the effect is positive for the finance sectors. The positive shock of interest rate is insignificant for the other remaining sectors. A 1% increase in the interest rate depresses the aggregate stock market returns and industrial production by -1.150 and -1.473 while a 5% increase in interest rates will reduce stock market returns in construction and property sectors by -4.288 and -3.124 . Nevertheless, the increase in the interest rate by 1% raises the finance sectors returns by 0.902. While depreciation in the interest rate as expected has a positive effect on the stock market return in construction, property, industrial production, mining, technology, and consumer product while the effect is negative for the finance sectors. A 10% increase in interest rate will increase the market returns in the construction sector by 4.95. Moreover, 1% and 5% (for the consumer product only) rise in the interest rate will increase the stock market returns of property, industrial production, mining, technology, and consumer product by 7.081, 2.342, 9.297, 9.187, and 0.884, respectively. However, a 1% fall in the interest rate will reduce the stock return of the finance sectors by -2.701 . Theoretically, a higher interest rate leads to a higher cost of funds which eventually impacts the wealth of these companies and the shareholders' values while the reverse is true for the finance sectors. These findings are similar to Maysami et al. (2004), Henriques and Sadorsky (2008), Thang (2009), and Marashdeh and Afandi (2018).

The long-run results show that both negative and the positive coefficients of the exchange rate adversely impact the aggregate stock returns and consumer product and they are significant at the 1% level. The 1% increase in the exchange rate will reduce the stock market return by -1.088 and -1.329 , respectively. Moreover, 1% decreases in the exchange rate will cause a fall in the whole market returns and the consumer product by -1.200 and -1.157 . However, the results were insignificant for the other remaining sectors. Basically, a high currency fluctuation leads to high uncertainty in the stock market; the results are similar to Granger et al. (2000), Badhani et al. (2009), Tsai (2012), Tudor (2012), Seong (2013), and Marashdeh and Afandi (2018).

The long run coefficients of the industrial production show that a positive shock in the industrial production will increase in the stock market returns of consumer product, property, industrial production, mining, technology, and the finance sectors. A 1% increase in the industrial production will increase the stock market returns of consumer product, property, industrial production, mining, and technology by 0.885, 3.244, 1.2056, 4.629, and 4.282, respectively. Furthermore, a 10% increase in the industrial production will increase the finance sector stock returns by 0.654. However, the negative shocks in the industrial production depress the stock market returns of the total stock markets, property, mining, and technology. A 10% decrease in the industrial production depresses the aggregate stock market returns by -0.837 while a 5% fall in the industrial production reduces the stock market returns of property and mining by -2.999 , -2.925 . In addition, a reduction in the industrial production by 1% depresses the stock market returns of technology by -3.783 . This is because an increase in industrial production signifies economic activities and performance which eventually lead to an increase in the firm earnings, thus, increasing the stock market performance. These findings are supported by studies of Chen et al. (1986) and Maysami et al. (2004).

The asymmetry effects of inflation vary across sectors. For instance, the positive shock in the consumer price index depresses

¹ General to specific approach is used to generate the results of nonlinear ARDL as explained by Shin et al. (2011).

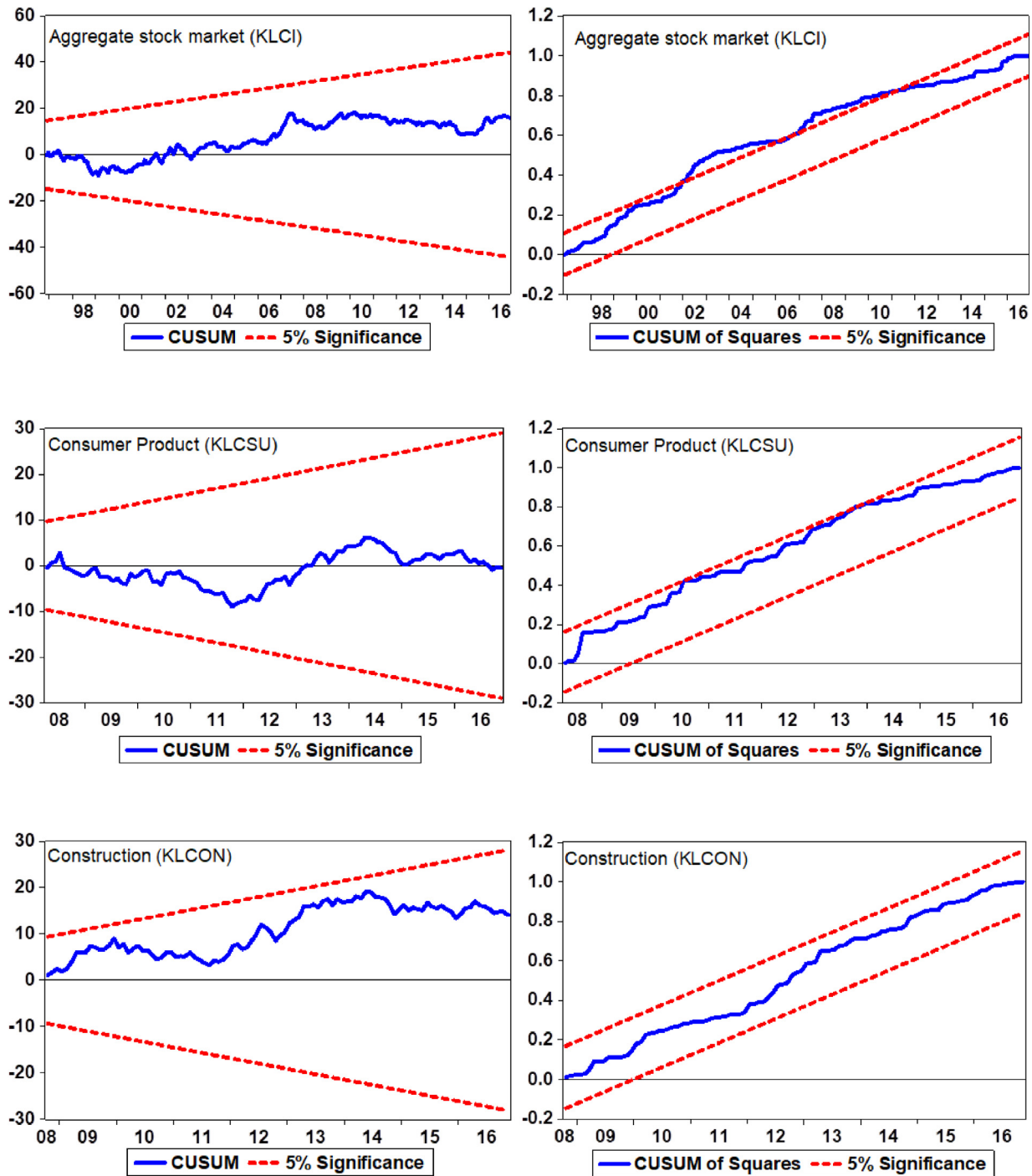


Fig. 1. Plot of cumulative sum and cumulative sum square of recursive residuals.

the stock market return of consumer product and mining. A 1% increase in consumer price index reduces the stock market returns of consumer product and mining by -2.807 and -10.538 , respectively. Basically, a high inflation rate depresses the stock market returns of consumer products and mining sectors. On the other hand, the results showed that deflation leads to a high stock returns which will cause a rise in the stock returns of construction, property, industrial production, mining, and technology. A 1% decrease in the inflation rate rises the stock market returns of consumer product, property, mining, and technology by 59.528 ,

46.281 , 37.815 , and 27.306 , respectively. Also, a decrease in inflation rate leads to a high return of property by 11.930 and it is significant at 5% level.

The last step in the nonlinear ARDL analysis is to test the presence of the asymmetry relationship by utilizing Wald-test of the results presented in Table 4. For the case of oil price, the Wald test results showed that the probability values are significant for the aggregate stock market, construction, and technology sectors. Therefore, the null hypothesis of no asymmetry can be rejected which indicates that coefficients of the increase and decrease in the oil prices differ. Secondly, the Wald test results for interest rate showed that the probability values are significant in

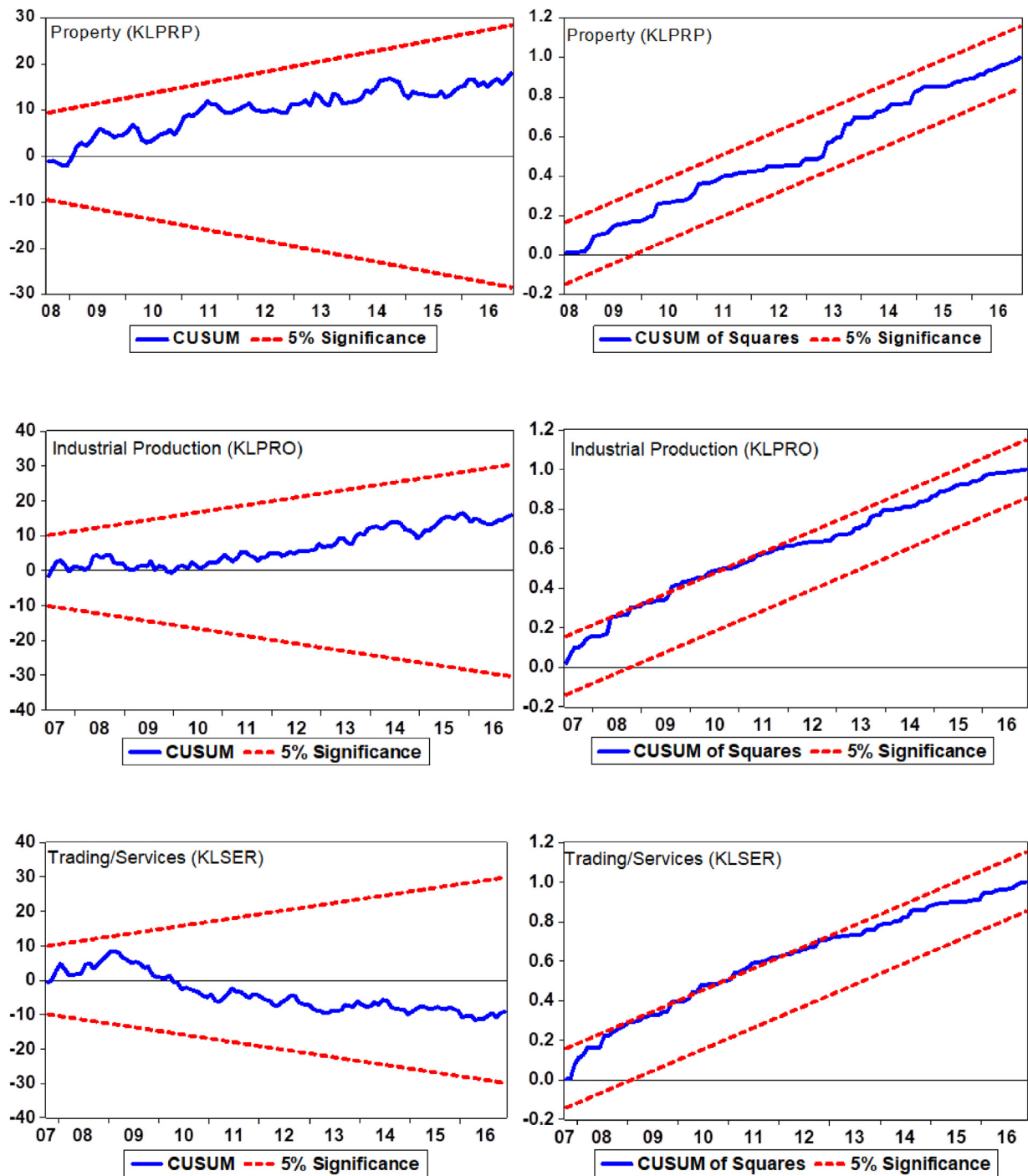


Fig. 1. (continued).

all cases with the exception of trading/service sectors; therefore, the null hypothesis of no asymmetry can be rejected (excluding trading/service sectors). It means the coefficients of the interest rate increase and decrease are not the same. Moreover, for the asymmetry effects of the exchange rate, the Wald test results show that the probability values are insignificant in all cases with exception of construction and technology sectors. Therefore, the null hypothesis of no asymmetry can be rejected for construction and technology sectors. Furthermore, Wald test results of the industrial production show that the probability values are significant in all cases with the exception of construction, property, trading/services, and technology. Finally, the Wald test results for

inflation show that the probability values are significant in all cases with the exception of the aggregate market, consumer product, and trading/services. Therefore, the null hypothesis of no asymmetry is accepted for aggregate stock market, consumer product, and trading/services, while for the rest of the sectors the null hypothesis can be rejected.

5. Conclusion and policy implications

This paper investigated the asymmetry relationships between oil price and the stock market returns at both aggregate and disaggregate level. To achieve this goal, a newly nonlinear ARDL

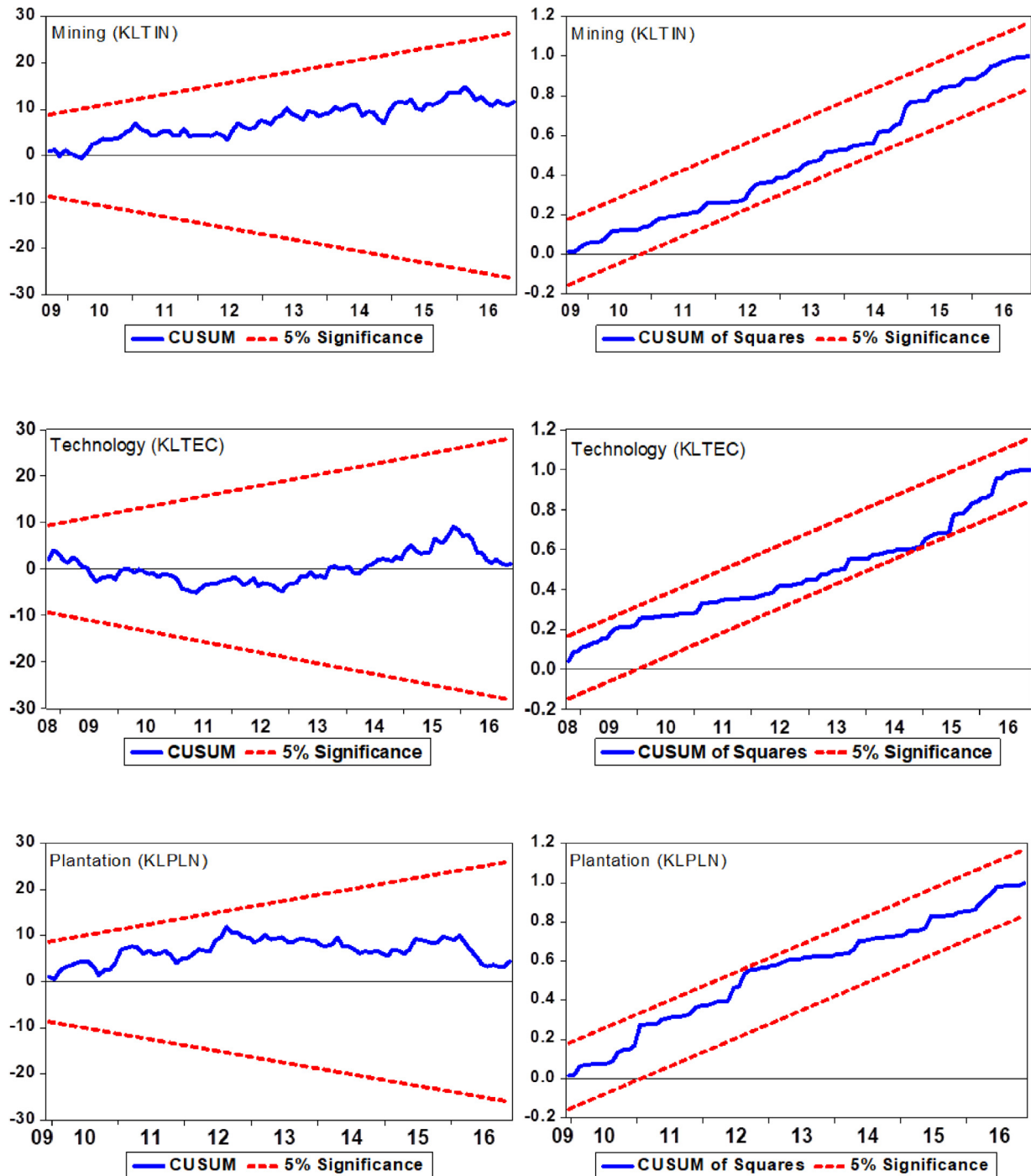


Fig. 1. (continued).

developed by Shin et al. (2011) was utilized. In addition to oil price, other four important determinants to stock market returns were also included; namely interest rate, exchange rate, industrial production, and inflation. The results imply the existence of long-run asymmetry relationship in some cases. The nonlinear ARDL showed that oil price shocks, whether it is an increase or decrease, negatively impact the stock market returns for all sectors except for aggregate stock market return as the decrease in oil price increases the stock market returns. This outcome shows that Malaysia's stock market is inefficient, hence, very sensitive to oil price fluctuations.

For the remaining variables, the findings are in line with the past literature. The results show that the increase in interest rates has a negative impact on the sectors stock return and vice versa. However, the impact of interest rate is positive when interest rate witnesses depreciation. The reason behind this outcome is because a high-interest rate leads to high finance cost which in turn, leads to low profitability and shareholders' wealth reducing the returns of the stock markets. Furthermore, the increase and the decrease in exchange rate negatively impacts the stock returns for all cases excluding aggregate stock market and consumer product sectors. However, for the case of industrial production, the results show that its increase will increase the stock market returns and the

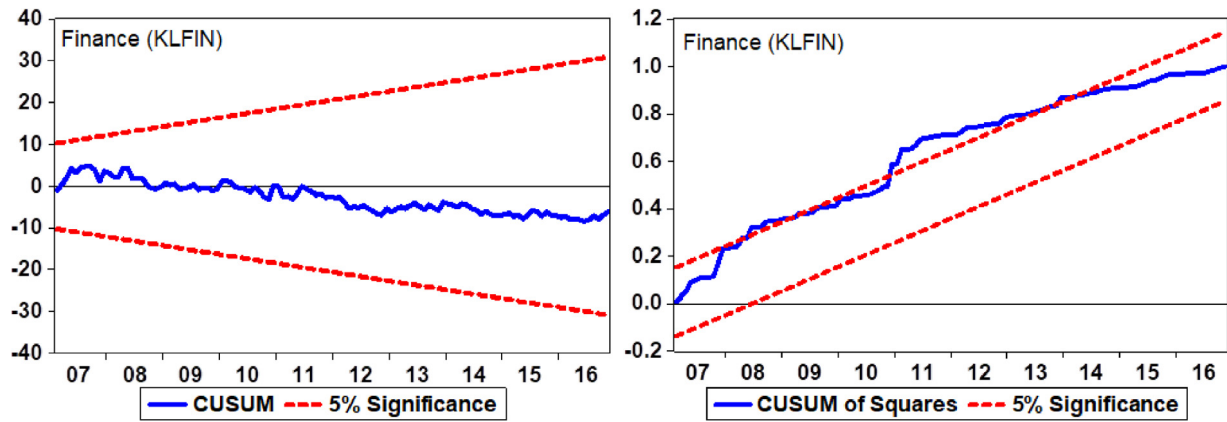


Fig. 1. (continued).

Table 4
Long-run relations and the asymmetry effects.

Variable	KLCI	KLCSU	KLCON	KLPRP	KLPRO	KLSEK	KLTIN	KLTEC	KLFIN
lnOp+	-0.254** [0.113]	-0.231** [0.094]	-0.4581 [0.378]	-1.100*** [0.320]	-0.295** [0.129]	-0.556 [0.617]	-1.059*** [0.269]	-1.748*** [0.279]	-0.271* [0.153]
lnOp-	0.520** [0.218]	-0.324*** [0.111]	-1.705*** [0.503]	-1.238*** [0.4202]	-0.145 [0.128]	-1.413 [1.176]	-0.591** [0.277]	-0.513** [0.235]	-0.029 [0.169]
lnIr+	-1.150*** [0.406]	-0.603 [0.394]	-4.288** [1.869]	-3.124** [1.379]	-1.473*** [0.566]	-5.013 [3.931]	-0.989 [1.140]	-1.192 [1.132]	0.902*** [0.529]
lnIr-	0.237 [0.262]	0.884** [0.391]	4.095* [2.240]	7.081*** [2.103]	2.342*** [0.710]	8.821 [6.858]	9.297*** [1.815]	9.187*** [1.523]	-2.701*** [0.744]
lnREER+	-1.088*** [0.298]	-1.329*** [0.282]	-0.1803 [1.307]	-1.293 [0.965]	0.227 [0.448]	0.875 [1.874]	-0.363 [0.872]	0.484 [0.739]	-0.447 [0.484]
lnREER-	-1.200*** [0.382]	-1.157*** [0.322]	2.881 [1.829]	-0.922 [1.115]	0.275 [0.519]	3.661 [3.633]	-1.005 [0.994]	-0.855 [0.895]	-0.105 [0.515]
lnIPI+	0.414 [0.292]	0.885*** [0.260]	0.707 [1.272]	3.244*** [1.009]	1.2056*** [0.347]	1.177 [1.203]	4.629*** [0.857]	4.282*** [0.738]	0.654* [0.336]
lnIPI-	-0.837* [0.483]	0.304 [0.356]	-1.136 [1.773]	-2.999** [1.455]	0.721 [0.491]	-1.223 [1.891]	-2.925** [1.147]	-3.783*** [1.019]	-0.332 [0.452]
lnCPI+	2.898 [1.828]	-2.807*** [0.962]	-4.420 [4.264]	-1.745 [3.016]	-1.273 [1.320]	-21.056 [15.215]	-10.54*** [3.239]	1.334 [2.333]	-1.646 [1.653]
lnCPI-	-10.474 [6.730]	2.808 [3.235]	59.528*** [19.812]	46.281*** [16.341]	11.930** [5.292]	50.996 [41.579]	37.815*** [12.303]	27.306*** [10.139]	9.353 [5.771]
$W_{OP+=OP-}$	-3.123 (0.0020)	0.465 (0.496)	4.107 (0.044)	0.0887 (0.766)	0.723 (0.397)	0.692 (0.407)	12.303*** (12.303)	12.117 0.0007	1.277 0.260
$W_{IR+=IR-}$	-3.711 (0.0003)	5.834 (0.017)	5.496 (0.020)	11.057 (0.001)	12.415 (0.001)	1.761 (0.186)	18.114 (0.0000)	23.334 (0.0000)	12.91 (0.000)
$W_{REER+=REER-}$	0.355 (0.723)	0.708 (0.401)	8.102 (0.005)	0.3001 (0.5846)	0.032 (0.859)	1.372 (0.243)	1.26473 (0.263)	7.545 (0.007)	1.359 (0.245)
$W_{IPI+=IPI-}$	3.341 (0.0010)	10.561 (0.001)	0.285 (0.595)	0.134 (0.715)	3.667 (0.057)	2.170 (0.143)	11.597 (0.0009)	0.937 (0.3347)	14.57 (0.0002)
$W_{CPI+=CPI-}$	1.950 (0.0523)	2.459 (0.119)	8.863 (0.003)	7.952 (0.005)	5.477 (0.021)	1.689 (0.196)	12.014 (0.0007)	6.006 (0.016)	3.091 (0.0807)

Note: () are probability values and [] are the standard errors, W represents the Wald test.

reverse is true. In addition, it was found that high inflation negatively influence the stock market returns in most cases while the deflation leads to high stock market returns. Therefore, investors are not willing to invest in Malaysia stock markets when there is a high inflation rate as hedging for their shares is no longer a desirable technique. In summary, the outcome in general indicates that there is a long run asymmetric relationship between oil price shocks, interest rate, exchange rate, industrial production, inflation and stock market returns at both aggregate and disaggregate level.

This research provides a better understanding of the nonlinearity relationships between oil price, interest rate, exchange rate, industrial production, inflation and the stock market returns in Malaysia. Therefore, Malaysia's government can create an independent wealth fund to manage the revenues during the oil price hikes.² This policy is important because it can reduce the oil price fluctuations. In addition, it is important to formulate appropriate

² Norway has the largest sovereign funds in the world which worth US\$860 billion where the money saved in the funds is invested in bonds and shares.

strategies to reduce the oil shocks harmfulness on the sectors' returns. For instance, implementing alternative energy sources can help reduce the dependency on oil in their production. Moreover, policy-makers can make more efforts to control the volatility of economic factors in order to promote Malaysia's competitiveness in the international market.

In addition, knowing the nonlinearity relationships are very crucial for investors to make appropriate investment decisions because it will enable them to determine the best performing stock and the right time to invest. Moreover, they need to consider other economic factors and their exposure to the stock market performance.

Acknowledgments

The authors gratefully acknowledge funding from the Multimedia University's Graduate Research Assistant (GRA) scheme (MMUI/160103). Moreover, we gratefully acknowledge Multimedia University for the financial support.

References

- Ajmi, A., El-montasser, G., Hammoudeh, S., Nguyen, D., 2014. Oil prices and MENA stock markets: new evidence from nonlinear and asymmetric causalities during and after the crisis period. *Appl. Econ.* 46 (18), 2167–2177.
- Apergis, Miller, 2009. Do structural oil-market shocks affect stock prices?. *Energy Econ.* 31, 569–575.
- Badhani, K.N., Chhimwal, R., Suyal, J., 2009. Exchange rate volatility: Impact on industry portfolios in Indian stock market. *J. Appl. Finance* 15 (6), 33–48.
- Basher, S., Haug, A., Sadorsky, P., 2012. Oil prices, exchange rates and emerging stock markets. *Energy Econ.* 34 (1), 227–240.
- Bjornland, H., 2009. Oil price shocks and stock market booms in an oil exporting country. *Scott. J. Political Econ.* 56 (2), 232–254.
- Chen, N., Roll, R., Ross, S., 1986. Economic forces and the stock market. *J. Bus.* 59 (3), 383–403.
- Creti, A., Ftiti, Z., Guesmi, K., 2013. Oil Price Impact on Financial Markets: Co-spectral Analysis for Exporting Versus Importing Countries. *Cahier De Recherche.*
- Davoudi, S., Fazlzadeh, A., Fallahi, F., Asgharpour, H., 2018. The impact of oil revenue shocks on the volatility of Iran's stock market return. *Int. J. Energy Econ. Policy* 8 (2), 102–110.
- Degiannakis, S., Filis, G., Floros, C., 2013. Oil and stock returns: Evidence from European industrial sector indices in a time-varying environment. *J. Int. Financ. Mark. Inst. Money* 26, 175–191.
- El-Sharif, I., Brown, D., Burton, B., Nixon, B., Russell, A., 2005. Evidence on the nature and extent of the relationship between oil prices and equity values in the UK. *Energy Econ.* 27, 819–830.
- Fama, E., 1981. Stock returns, real activity, inflation, and money. *Am. Econ. Rev.* 71 (4), 545–565.
- Filis, G., Chatziantoniou, I., 2014. Financial and monetary policy responses to oil price shocks: evidence from oil-importing and oil-exporting countries. *Rev. Quant. Financ. Account.* 42 (4), 709–729.
- Filis, G., Degiannakis, S., Floros, C., 2011. Dynamic correlation between stock market and oil prices: The case of oil-importing and oil-exporting countries. *Int. Rev. Financ. Anal.* 20 (3), 152–164.
- Fisher, I., 1930. *The Theory of Interest.* Macmillan, New York.
- FTSE Russel. 2016. FTSE Bursa Malaysia KLCI. Malaysia index series. FTSE.com. Retrieved 12 March 2018, from <http://www.ftse.com/products/indices/bursa-malaysia>.
- Granger, C.J., et al., 2000. A bivariate causality between stock prices and exchange rate: evidence from recent Asian flu. *Q. Rev. Econ. Finance* 40, 337–354.
- Hatemi-J, A., 2012. Asymmetric causality tests with an application. *Empir. Econ.* 43, 447–456.
- Hatemi-J, A., Al Shayeb, A., Roca, E., 2016. The effect of oil prices on stock prices: fresh evidence from asymmetric causality tests. *Appl. Econ.* 49 (16), 1584–1592.
- Henriques, Sadorsky, 2008. Oil prices and the stock prices of alternative energy companies. *Energy Econ.* 30, 990–1010.
- Hu, C., Liu, X., Pan, B., Chen, B., Xia, X., 2017. Asymmetric impact of oil price shock on stock market in China: A combination analysis based on SVAR model and NARDL model. *Emerg. Mark. Financ. Trade* 54 (8), 1693–1705.
- Jammazi, R., Ferrer, R., Jareño, F., Shahzad, S., 2017. Time-varying causality between crude oil and stock markets: What can we learn from a multiscale perspective? *Int. Rev. Econ. Finance* 49, 453–483.
- Jiménez-Rodríguez, R., 2015. Oil price shocks and stock markets: testing for non-linearity. *Empir. Econ.* 48 (3), 1079–1102.
- Jones, C.M., Kaul, G., 1996. Oil and stock markets. *J. Finance* 51, 463–491.
- Kimani, D.K., Mutuku, C., 2013. Inflation dynamics on the overall stock market performance: The case of Nairobi securities exchange in Kenya. *Econ. Financ. Rev.* 2 (11).
- Kisswani, K., Elian, M., Kruse, R., 2017. Exploring the nexus between oil prices and sectoral stock prices: Nonlinear evidence from Kuwait stock exchange. *Cogent Economics & Finance* 5 (1), 1286061.
- Lee, J., Strazicich, M., 2003. Minimum lagrange multiplier unit root test with two structural breaks. *Rev. Econ. Stat.* 85 (4), 1082–1089.
- Luo, X., Qin, S., 2017. Oil price uncertainty and Chinese stock returns: New evidence from the oil volatility index. *Finance Res. Lett.* 20, 29–34.
- Marashdeh, H., Afandi, A., 2018. Oil price shocks and stock market returns in the three largest oil-producing countries. *Int. J. Energy Econ. Policy* 7 (5), 312–322.
- Maysami, C., Howe, L., Hamzah, A., 2004. Relationship between macroeconomic variables and stock market indices: Cointegration evidence from stock exchange of Singapore s. All-S sector indices. *J. Pengurusan* 24, 47–77.
- Miller, J.L., Ratti, R.A., 2009. Crude oil and stock markets: Stability, instability, and bubbles. *Energy Econ.* 31 (4), 559–568.
- Najaf, R., 2016. Impact of international oil prices on the stock exchange of Malaysia and Turkey. *J. Account. Mark.* 5, 204.
- Narayan, P.K., Gupta, R., 2015. Has oil price predicted stock returns for over a century? *Energy Econ.* 48, 18–23.
- Park, J., Ratti, R.A., 2008. Oil prices and stock markets in the U.S. and 13 European countries. *Energy Econ.* 30, 2587–2608.
- Pesaran, M., Shin, Y., Smith, R., 2001. Bounds testing approaches to the analysis of level relationships. *J. Appl. Econometrics* 16 (3), 289–326.
- Phan, D.H.B., Sharma, S.S., Narayan, P.K., 2015. Oil price and stock returns of consumers and producers of crude oil. *J. Int. Financ. Mark. Inst. Money* 34, 245–262.
- Raza, N., Jawad Hussain Shahzad, S., Tiwari, A., Shahbaz, M., 2016. Asymmetric impact of gold, oil prices and their volatilities on stock prices of emerging markets. *Resour. Policy* 49, 290–301.
- Rozeff, 1974. Money and stock prices. *J. Fin. Econ.* 1, 245–302.
- Sadorsky, 1999. Oil price shocks and stock market activity. *Energy Econ.* 449–469.
- Sadorsky, 2001. Risk factors in stock returns of Canadian oil and gas companies. *Energy Econ.* 23, 17–28.
- Sadorsky, P., 2012. Correlations and volatility spillovers between oil prices and the stock prices of clean energy and technology companies. *Energy Econ.* 34 (1), 248–255.
- Salisu, A., Isah, K., Oyewole, O., Akanni, L., 2017. Modelling oil price-inflation nexus: The role of asymmetries. *Energy* 125, 97–106.
- Seong, L., 2013. Reactions of exchange rates towards Malaysia stock market: Goods market approach and portfolio balanced approach. *J. Contemp. Res. Bus.* 5 (8).
- Shafi, K., Hua, L., Idrees, Z., Nazeer, A., 2015. Oil prices & stock market: Evidence from KSE & BSE. *Am. J. Bus. Econ. Manage.* 3 (2), 40–44.
- Shin, Y., Yu, B., Greenwood-Nimmo, M., 2011. Modelling Asymmetric Cointegration and Dynamic Multiplier in a Nonlinear ARDL Framework. Mimeo, New York, NY.
- Sohail, N., Hussain, Z., 2009. Long-run and short-run relationship between macroeconomic variables and stock prices in Pakistan the case offshore stock exchange. *Pak. Econ. Soc. Rev.* 47 (2), 183–198.
- Thang, F., 2009. Impact of Interest Rate and Exchange Rate on the Stock Market Index in Malaysia: A Cointegration Analysis (Master of Business Administration). Universiti Sains Malaysia.
- Tsai, I.C., 2012. The relationship between stock price index and exchange rate in Asian markets: A quantile regression approach. *J. Int. Financ. Mark. Inst. Money* 22 (3), 609–621.
- Wongbangpo, P., Sharma, S., 2002. Stock market and macroeconomic fundamental dynamic interactions: ASEAN-5 countries. *J. Asian Econ.* 13 (1), 27–51.
- Zhu, H., Su, X., You, W., Ren, Y., 2016. Asymmetric effects of oil price shocks on stock returns: evidence from a two-stage Markov regime-switching approach. *Appl. Econ.* 49 (25), 2491–2507.

Therefore, as a big exporter country yet the country does not have a panic from oil price fluctuations.