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Global Oil Price Uncertainties and Exchange Rate Co-Movement: Evidence from South-East Asian Countries

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Abstract

This research paper investigates the intricate relationship between global oil price uncertainties and exchange rate co-movements in Southeast Asian countries of countries such as Malaysia, Indonesia, and Brunei for the period from 2009 to 2021. The complex and often asymmetric relationship wherein change in oil prices impact exchange rates, potentially leading to volatility and policy challenges for countries heavily reliant on oil imports and exports has been a topic issue yet to be resolved. To make it robust, the paper employs an asymmetric Baba, Engle, Kraft, and Kroner (BEKK) model. The major findings from the estimated model suggest that own shock is a major factor in contributing to the volatility of both global oil prices and the exchange rates of the selected South-East Asian countries. Contrary to prevailing hypotheses, this study does not support the notion that foreign exchange rate market news follows a process akin to a meteor shower hitting the Earth as it revolves. In light of these findings, the paper recommends that policymakers are urged to adopt a proactive stance in managing exchange rates, taking into account the multifaceted nature of global oil price uncertainties. Moreover, the importance of crafting exchange rate policies that focus on country-specific factors, acknowledging the significant impact of domestic shocks on exchange rate stability.

Keywords; *Exchange rate, oil price, volatility, asymmetric BEKK, South-East Asia*

Introduction

The slow pace of global economic growth during the 1970s led to the implementation of new policies to turn the world economy around, particularly involving dramatic changes to the international monetary system in terms of a shift from a pegged exchange rate, which had been the dominant system since the Bretton Woods conference in 1944, to a regime of flexible exchange through managed rates (Dornbusch, 1983). This paradigm change affected the exchange rates of economies across the world and caused them to fluctuate wildly, leading to high volatility in exchange rates across countries which still prevails today. Coincidently, the shock in oil prices during the 1970s happened during the same period as the change from pegged (fixed) exchange rates to where exchange rates were allowed to float (flexible exchange rates). The substantial increase in oil prices during that period put paid to any hopes of restoring the pegged exchange rate system, and both oil prices and exchange rates became highly volatile internationally. Since then the relationship between the two has been the subject of numerous scholarly works (e.g., Ozturk et al., 2008).

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The underlying relationship between oil price volatility and exchange rate volatility is rooted in the economic interdependencies between oil markets and exchange rate dynamics. These relationships are crucial to understanding how fluctuations in global oil prices can lead to shifts in exchange rates, which, in turn, can impact international trade, investment, and economic stability. Oil price volatility can also have indirect effects on exchange rates through its influence on investor sentiment and expectations. For instance, if rising oil prices are perceived as a sign of global economic growth, investors may buy currencies of oil-exporting countries, driving up their exchange rates. Conversely, falling oil prices might lead to a flight of capital from such economies, causing their currencies to depreciate.

Laurent et al. (2012) presented empirical findings demonstrating that financial volatilities exhibit a synchronized movement over time and across different economic factors. This suggests that the correlation in volatility among economic variables may lead to a spill-over effect between them. For example, there may be volatility spill-over effects from global oil prices to exchange rates, or from exchange rates in Malaysia to those in Indonesia or Brunei, stemming from both fundamental and non-fundamental connections between these economies. Akram (2002) argued that oil-exporting countries face appreciation of exchange rates when global oil prices rise and depreciation when prices fall, with the volatility of oil prices affecting exchange rates because transactions for crude oil are carried out using an international currency. Therefore, a shock generated by a fluctuation in global oil prices affects exchange rates, and exchange rate volatility can be transmitted from oil-exporting countries to their partners (Suryanto, Haseeb, & Hartani, 2018).

The spread of the Asian financial crisis due to the collapse of the Thai baht in July 1997 demonstrates the integration of Asian countries and how crises can spread across them. The Southeast Asian region is known for strong economic relationships between countries, several of whom are oil-exporting countries, increasing the likelihood of the transmission of shocks from oil exporters in the region. Coleman et al. (2011) argued that in most oil-exporting countries there is a tendency for exchange rates and oil prices to co-move together. This paper therefore selects the South-East Asian oil-exporting countries of Malaysia, Indonesia, and Brunei and analyzes the co-movement of exchange rates and oil prices, particularly how oil price shocks affect their exchange rates.

Although studies have been conducted in some regions and currencies, specifically Devpura (2021) who studied selected Asian countries, co-movement in oil-exporting countries has not been specifically examined. This study therefore looks particularly at selected oil-exporting countries in South-East Asia. As well as the interdependence between oil prices, exchange rates, and their volatilities, another issue that warrants further research attention is volatility spillover between the exchange rates of oil-exporting countries, particularly its magnitude. Analyzing the link between uncertainties in oil prices and the co-movement of exchange rates is essential for maintaining economic stability, making well-informed policies, and implementing effective risk management in an interconnected global economy. Moreover, global oil price uncertainties can introduce significant volatility and unpredictability into the exchange rate dynamics of countries heavily reliant on oil exports or imports, making it challenging for businesses and policymakers to manage currency risks effectively. This can lead to increased economic instability and hinder international trade and investment. This study employed a methodology that not only captures the co-movement of volatility exchange rates but also accounts for asymmetric effects on exchange rate volatilities, and how this amplifies volatility in exchange rates. The paper is organized into the following sections: introduction, literature review, methodology, data analysis, estimation and empirical results, and conclusion.

Literature Review

The flow of information between two markets is an important issue that has attracted considerable attention in the empirical literature. Research in this field has analyzed the extent to which a shock in one market affects volatility in other markets, with market volatility being extensively studied using the autoregressive conditional heteroskedasticity (ARCH) model pioneered by Engle (1982), later extended by Bollerslev (1986) and Nelson (1991), and developed into a multivariate form by Kraft and Engle (1982) and later by Bollerslev, Chou, and Kroner (1992). Among these developments was the famous Baba, Engle, Kraft and Kroner (BEKK) model. Empirical evidence from these models postulates many possible reasons for volatility spillover; for instance, Ross (1989) argued that apart from the information contained in a shock, volatility is also an important factor in the relationship between two markets.

The argument that volatility is one of the major factors in a relationship between two markets led Engle et al. (1990) to develop a framework that analyzed exchange rate markets concerning two types of volatility spillover known as heat waves and meteor showers. Further, Lin et al. (1994) explained that markets across the globe fall with a surprising uniformity during crises (such as oil price shocks) and that connections between markets significantly increase after a shock to an individual market (or many markets), measured by the degree to which information moves across markets relative to co-movement in tranquil times.

In this context, studies such as Yousefi and Wirjanto (2004), Stern and Enflo (2013), Odhiambo (2014) and Habib, Bützer and Stracca (2016) provided empirical evidence of the relationship between global oil price shocks and the exchange rates of different countries However, the magnitude to which a global oil price shock affects exchange rates varies from country to country, and between oil-importing and oil-exporting countries. Specifically, Reboredo (2012) argued that the linkages are stronger for oil exporters. This is supported by a study by Basher et al. (2016) which provided evidence that compared with oil supply shocks, energy price shocks have stronger effects on oil exporters' exchange rates.

It is theoretically and empirically clear that a shock in one market (for instance, the exchange rate market) due to a macroeconomic or global event such as an oil price shock can spread from one market to another due to their fundamental or non-fundamental links. Speight and McMillan (2001) analyzed volatility spillover in the conditional variance of six defunct socialist (Eastern European) exchange rates and found limited evidence of volatility interdependence between them. Similarly, Ruiz (2009) used a method developed by Engle and Kozicki (1993) to test the relationship between the exchange rates of 12 Latin American countries, concluding that the variance of each country's exchange rate was largely country-specific. However, McMillan and Ruiz (2009) studied pairwise relationships between the euro (EUR) and the Japanese yen (JPY), the British pound (GBP), and the United States dollar (USD). The relationships studied were JPY/EUR, GBP/EUR, and USD/EUR, with the findings indicating a time-varying spillover between the exchange rates of the three currencies and the EUR. The study concluded that volatility was the driving force in the relationships between the EUR and the foreign currencies.

When examining various forms of exchange rate interdependencies, a central focus is on integrating the analysis of contagion among exchange rates and exploring their co-movements over time. In Farrel's study (2001), which investigated the period from 1985 to 1995, he uncovered empirical evidence suggesting that there was no discernible volatility-induced co-movement in South Africa's dual exchange rates. Specifically, the effects appeared to influence the commercial aspect, spilling over into the financial realm rather than the other way around.

In Raputsoane's research (2008), an augmented exponential generalized autoregressive conditional heteroskedasticity (EGARCH) model was employed to assess the impact of volatility in other exchange rates on the South African exchange rate. The findings revealed a negative relationship in the co-movement of volatility between the South African rand and the currencies of both developed and developing markets in Europe. However, no such relationship was identified between the volatility of the South African rand and currencies in the Asian and Latin American markets.Lastly, McMillan et al. (2010) utilized the realized volatility approach and a causality test to ascertain time-varying co-movements across major exchange rates in the developed world. Their analysis unveiled cross-country volatility spillover in the relationships between JPY/EUR and GBP/EUR, and potentially between JPY/EUR and USD/EUR as well.

In their 2014 study, Kavli and Kotzé examined the spillover effects of exchange rate returns and volatility in both developed and emerging market currencies, drawing from data spanning from 1997 to 2011. Their research indicated a consistent increase in spillovers in exchange rates over time, with a moderate response to economic events. The study also found that shocks played a substantial role in driving overall exchange rate volatility. Additionally, the research delved into whether the surge in volatility spillover was attributed to abrupt shocks or shifts in the stochastic trend of the underlying volatility process. The evidence suggested that, in most cases, the increase was linked to sudden shocks, although in certain instances, country-specific events may contribute to alterations in the trend of underlying volatility spillover. More recently, Leung et al. (2017) explored the exchange rate relationships between the United States (US), the United Kingdom (UK), and Japan. They employed a generalized autoregressive conditional heteroskedasticity (GARCH) model and found a general upswing in spillover between the equity and exchange rate markets during periods of crisis. They identified two main factors contributing to this heightened spillover: pure contagion, which is driven by irrational investor behavior, and fundamental contagion, measured by macroeconomic fundamentals. Vochozka et al. (2020) employed neural networks to investigate the impact of global crude oil prices on the EUR/USD exchange rate, revealing a substantial and precise influence of Brent crude oil prices on the EUR/USD exchange rate. Ehikioya et al. (2020), on the other hand, utilized the Johnson cointegration and vector error correction model to analyze data spanning from 2004 to 2017. Their research examined the relationship between fluctuations in oil prices and real exchange rates in sub-Saharan African countries, including Nigeria, Angola, Equatorial Guinea, Gabon, and the Republic of Congo. It was determined that there exists a dynamic interplay between oil prices and exchange rates in these sub-Saharan nations. Meanwhile, Alam et al. (2020) applied cointegration and vector autocorrelation techniques to investigate the connection between oil prices and the Indian rupee relative to the US dollar. Their research unveiled both long-term and short-term causality between oil prices and exchange rates.

Hameed et al. (2021) conducted an analysis of the relationship between oil price volatility and currency rates in five major oil-exporting and oil-importing countries. Their findings revealed that oil-exporting nations exhibit a higher level of volatility spillover compared to oil-importing nations. An earlier study by Razgallah and Smimou (2011) had already explored this topic. In their investigation of the connection between oil price volatility and exchange rates, Hameed et al. (2021) employed the nonlinear smooth transition paradigm, which allowed them to identify the effects of the transmission of volatility from oil prices to exchange rates. Wang et al. (2022) delved into the topic of volatility spillover between crude oil prices and the Nigerian

Stock Exchange (NSE). Meanwhile, Okorie and Lin's (2022) research uncovered volatility spillover effects reaching gold markets in India and Brazil, while also examining the relationship between oil prices and the exchange rate in China.

Devpura (2021) found empirical evidence of exchange rate spillover between Asian countries, with 22% of forecast error variance due to spillovers. Yilmazkuday (2022) employed a structural vector autoregression (SVAR) model to determine the spillover effects between 11 emerging and 12 developing economies during COVID-19 and concluded that economic policies employed to mitigate the pandemic have harmed the economic relationships between the selected countries.

Methodology

ARCH family models are the dominant econometric technique use in analyzing the volatility of exchange rates, along with many other financial and economic time series variables. Engle (1982) and Bollerslev (1986) were pioneering studies that explained the univariate type of model, and they were extended by Nelson (1991) to EGARCH, by Glosten, Jagannathan, and Runkle (1993) to threshold GARCH (TGARCH), and by Baillie, Bollerslev, and Mikkelsen (1996) to fractional integrated GARCH (FIEGARCH), among other models offering greater flexibility to achieve different aims and objectives. The inability of univariate GARCH models to measure co-volatilities between two or more financial and economic variables led to the development of another generation of ARCH family models called multivariate GARCH (MGARCH) models, the first of which was developed by Kraft and Engle (1982) and later by Bollerslev, Chou, and Kroner (1992). These models can allow the conditional variance co-variance matrix of the N-dimensional zero-mean random variable ε_t, which depends on elements of the information set (Caporin & McAleer, 2009). MGARCH estimations have the flexibility to increase the number of variables and also allow for co-variance spillovers and feedback. In addition, the coefficient can be financially interpreted, allowing easy economic deductions and inferences (Fengler and Gisler, 2015).

The development of these models faced a setback due to issues of parametrization, which made the interpretation of the output very difficult. For instance, Bollerslev et al.'s (1988) VEC model proposed that the number of parameters was $n(n+1)(n(n+1)+1)/2$, meaning that even in a simple case with $n = 2(p = 1, q = 1)$, there are still 21 parameters to be estimated. If $n = 3$, there are 78 parameters to be estimated. In addition, it is difficult to guarantee the positivity of H_t without imposing strong restrictions on the parameters (Gourieroux & Monfort, 1997). To solve these problems Gourieroux and Monfort (1997) proposed a version of the model in which the ARCH and GARCH matrices are assumed to be diagonal; this restriction reduces the number of parameters to $n(n+5)/2$, which means that even if $n = 3$, there will only be 12 parameters (Bauwens et al., 2006). Meanwhile, because the ARCH and GARCH matrices are diagonal, each element of H_t depends only on its lag and on previous shock values. This means that the diagonal version of the VEC model cannot capture volatility spillover effects between different markets, and also cannot guarantee that H_t is definitely positive.

Engle and Kroner (1995) proposed the BEKK model, which generates a new parameterization of H_t. In the BEKK (1,1) model, the conditional covariance matrix is defined as follows:

$$H_t = \boldsymbol{C_0}^{*'}\boldsymbol{C_0}^{*} + \sum_{k=1}^{k} \boldsymbol{A}_{1k,t-1}{}^{*'} \mathrm{E}'_{t-1}\varepsilon_{t-1}{}' \boldsymbol{A}_{1k}{}^{*} + \sum_{k=1}^{k} \boldsymbol{G}_{1k}{}^{*'} \boldsymbol{H}_{t-1} \boldsymbol{G}_{1k}{}^{*}$$

where *C* is a (4 × 4) lower triangular matrix of parameters, and *A* and *G* are (4 × 4) parameter matrices. The idea for decomposition using the (*) into a product of triangular matrices aims to satisfy the positive semi-definiteness of H_t. The BEKK model guarantees positive semi-definiteness by working with quadratic forms. The *A* matrix captures the ARCH effects that measure the degree of innovation, shock, or news from the markets (i.e., from market *i* to *j*). Similarly, matrix *G* focuses on the GARCH effect, which shows the persistence of the conditional volatility between the markets where the diagonal parameters in matrices *A* and *G* represent the cross-market effects of volatility in the markets. Moreover, the BEKK model is diagonal by assuming the *A* and *G* matrices to be diagonal, and also by restricting the off-diagonal properties in the *A* and *G* matrices to be zero. Therefore, the diagonal elements of matrix *A*, a_{11}, a_{22}, a_{33}, and a_{44}, measure their volatility shocks, while the non-diagonal elements (a_{ij} where $i \neq j$) determine the cross-volatility shocks. Similarly, the diagonal elements of matrix *G*, g_{11}, g_{22}, g_{33}, and $g_{44,}$ determine their volatility spillovers that can be seen as past volatilities on the current volatility, while the non-diagonal elements (where g_{ij} where $i \neq j$) capture the cross-volatility spillovers, which are lagged covolatilities on the current covolatility.

However, since the objective of this paper is also to determine the magnitude of the effect oil price shocks on the exchange rates of oil-producing countries as well as the magnitude of volatility spillover among the exchange rates between these countries, we extend the above model with an asymmetric parameter β, as used in studies such Karunanayake and Valadkhani, (2011) and Li and Giles (2015). The model becomes:

$$H_t = C_0^{*'} C_0^{*} + \sum_{k=1}^{k} A_{1k,t-1}^{*'} \mathrm{E}'_{t-1}\varepsilon_{t-1}{}' A_{1k}^{*} + \sum_{k=1}^{k} G_{1k}^{*'} H_{t-1} G g_k^{*} + \beta' \varepsilon_{t-1}{}' \varepsilon'_{t-1}{}' \beta$$

where β is the asymmetric component of the model. The parameters of the matrix β capture the magnitude of the asymmetric volatility effects. Also, ε_{t-1} = max (0,1) and is similar to Glosten, Jagannathan, and Runkle's (1993) dummy series. The term ε_{t-1} takes the value of 1 for $\varepsilon_{t-1} > 0$ and takes the value of 0 for $\varepsilon_{t-1} \leq 0$ (negative shocks). The significance of the negative values β indicates that increased variance for a negative shock in country *i*. Moreover, the significance of β_{ij} indicates the effects of a negative shock between country *i* and *j* in terms of rising covariance.

Data Analysis

The paper employs weekly time series data for the exchange rates of Malaysia, Indonesia, and Brunei, and the global oil price for the period from 2009 to 2021. The justification for using weekly rather than daily data, especially in a multi-country analysis, is that it limits interference associated with the use of synchronous data since a trading day in one country may be a public holiday somewhere else, helps to avoid time zone issues, and we assume that market participants insure against currency risk. Therefore, weekly data is the most appropriate.

Table 1 presents descriptive statistics for the Malaysia exchange rate (MER), Indonesia exchange rate (IER), and Brunei exchange rate (BER), as well as the global oil price (GOP), for the period from 2009 to 2021. From the table, the mean exchange rate of the Malaysian Ringgit to the USD was 3.52, the Indonesian Rupiah was 10597, and the Brunei Dollar was 1.396 during this period. The minimum global oil price was 28.800 while the maximum was

143.950, showing considerable variation and possible high volatility in the period. Except for MER, the mean of the other variables was greater than the standard deviation, and IER was the most volatile with a standard deviation of 1764.500 followed by GOP with a standard deviation of 26.519.

The return distributions were positively skewed for all variables. Positive skewness implies that positive prices are more common in the markets. The kurtoses of the series were all greater than 3.0, measuring the sharpness of the distribution and indicating that the price series peaked around the mean with thicker tails compared to the normal distribution. Jarque-Bera statistics confirm the result of the skewness, and excess kurtosis in the return series indicates that the return series did not follow a normal distribution. The *p*-values reject the null hypothesis at the 5% level of significance.

Table 1: Descriptive Statistics for Weekly Exchange Rates of Malaysia, Indonesia, and Brunei, and the Global Oil Price

Variables	Min	Mean	Max	Standard Deviation	Skewness	Kurtosis	Jarque-Bera
MER	2.962	3.528	4.486	0.408	3.617	16.022	6.865**
IER	8508	10597	14709	1764.500	6.411	4.466	4.954**
BER	1.203	1.396	1.703	0.129	0.304	9.459	4.954**
GOP	28.800	77.839	143.950	26.519	0.437	17.572	2.520**

Note: (**) statistical significance at the 5% level

Estimation and Empirical Results

The estimation of any of the GARCH family models requires a test for ARCH effects on the series to be estimated. This paper employed Engle's (1982) ARCH-LM test, the results of which are presented in Table 2. From these results, there is evidence of ARCH effects in all the four variables, as indicated by the rejection of the null hypothesis of constant variance.

Table 2: ARCH-LM Test

Variables	Obs*R-squared
MER	8515.400**
IER	1219.000**
BER	10.3468**
GOP	3659.101**

Note: (**) statistical significance at the 5% level

The result of the estimated asymmetric BEKK model is presented in Table 3. From the table, it is clear that the means of all the variables are statistically significant, and some of the parameters of the lower triangular matrix *C* are statistically significant while some are not. The results show that the diagonal parameters of the ARCH matrix, a_{11}, a_{22}, a_{33}, and a_{44} (a_{ij} coefficients where $i \neq j$) are all statistically significant with magnitudes of MER = 0.993, IER = 0.996, BER = 0.994, and GOP = 0.991. This implies that own shock has a larger impact on current and future exchange rate volatility compared to shock effects originating from other exchange rates. The high magnitude of the diagonal ARCH parameters indicates that a shock in any of the variables is dominated by own activities rather than spillover from shock in other variables. For example, this implies that domestic issues contribute to shock in MER more than spillover from shock in any of IER, BER, or GOP.

Considering the off-diagonal parameters (a_{ij} coefficients where $i \neq j$), some are significant while some are not. Similarly, though, the magnitude of the coefficients measuring cross shock or innovation is very low relative to their volatility effects. This indicates that exchange rates from all four variables were influenced by each other's shocks, but not as much as by their own market shocks.

Theoretical and empirical implications of volatility spillover and co-movement between oil prices and exchange rates are significant for understanding the dynamics of international financial markets. Theoretically, when oil prices and exchange rates exhibit a high degree of co-movement, it suggests that these two variables are closely linked, possibly due to economic factors like trade balances, or investor sentiment driven by oil market developments. Empirically, identifying volatility spillover from oil prices to exchange rates or vice versa can provide insights into how shocks in one market affect the other. This knowledge is vital for risk management, investment decisions, and policy formulation, as it helps anticipate and mitigate the potential impact of oil price fluctuations on exchange rate stability and, by extension, on a nation's economic well-being.

Table 3 Parameter Estimation for the Mean Equation, and the Variance-Covariance Matrix of the Asymmetric Diagonal BEKK (1,1) Model

Parameters	**Coefficients**			
	MER (i=1)	IER (i=2)	BER (i=3)	GOP (i=4)
Mean	3.390* (0.022)	9321.999* (50.858)	1.405* (0.008)	75.186* (1.828)
C_{11}	0.029* (0.001)			
C_{22}	11.008 (11.768)	80.455 (9.761)		
C_{33}	0.009* (0.001)	-0.666* (0.169)	0.002* (0.048)	
C_{44}	0.145 (0.177)	0.007* (0.001)	-0.639 (0.186)	2.648* (0.131)
A_{11}	0.993* (0.013)	0.020** (0.001)	0.011* (0.022)	0.222* (0.714)
A_{22}	0.010 (0.076)	0.996* (0.008)	0.015** (0.010)	0.196* (0.134)
A_{33}	0.090** (0.080)	0.211** (0.166)	0.994* (0.013)	0.099** (0.244)
A_{44}	0.081 (0.012)	0.111** (0.400)	0.210 (0.017)	0.991* (0.013)
G_{11}	0.013 (0.171)	-0.131 (0.064)	-0.068 (0.082)	0.111** (0.412)
G_{22}	0.019** (0.035)	0.049 (0.171)	-0.071 (0.021)	0.088* (0.431)
G_{33}	0.055 (0.010)	0.129** (0.047)	0.089 (0.168)	0.213** (0.412)
G_{44}	0.277 (0.111)	0.092 (0.082)	0.008 (0.124)	0.079 (0.182)
β_{11}	0.117 (0.068)	- 0.014** (0.022)	0.003 (0.023)	0.120* (0.001)
β_{22}	-0.048* (0.024)	0.061 (0.967)	-0.071** (0.344)	-0.071** (0.021)
β_{33}	-0.040** (0.014)	-0.054 (0.005)	0.118 (0.034)	-0.231 (0.033)
β_{44}	0.008 (0.176)	-0.123* (0.001)	0.761 (0.421)	-0.007 (1.106)

Note: (*) and (**) imply 1%, and 5% levels of significance, respectively

Standard errors are reported in parentheses.

The coefficients of the diagonal GARCH matrix, g_{11}, g_{22}, g_{33}, and g_{44}, which measured the persistence and spillover effects between the variables, had high magnitudes but were statistically non-significant. However, some of the off-diagonal parameters g_{ij} where $i \neq j$, also measuring persistence and direct spillover effects between the variables, were significant but with very low magnitudes relative to the diagonal parameters. This suggests evidence of volatility spillover between the variables. Furthermore, the asymmetric parameters in the β

matrix, the diagonals β_{11}, β_{22}, β_{33}, and β_{44}, had positive signs but were statistically non-significant, while some of the off-diagonal parameters were negative and statistically significant. This indicates that while asymmetric effects were significant in increasing the volatility of some variables, they did not affect other variables.

The results of the asymmetric BEKK model have revealed that the magnitudes of innovation or shock effects within each variable were higher compared with cross-innovation and volatility spillover from other variables in the model. This indicates that domestic activities concerning exchange rates and oil prices are the most important factors leading to volatility, and are more influential than other external factors. This finding supports studies by Kozicki (1993) and Farrell (2001), which found that relationships involving the exchange rate variance of individual countries are largely country-specific. The result further supports Odhiambo (2014), De Schryder and Peersman (2016), and Hameed and Nadeem (2021) in suggesting that a shock in global oil prices affects exchange rates, but the magnitude to which global oil price shocks affect exchange rates varies from country to country. The non-significance of the diagonal GARCH parameter indicates a lack of persistence in volatility, which shows that the effect dies immediately. The findings related to the asymmetric parameter do not support Engle et al.'s (1990) notion of heat waves, suggesting that foreign market news follows a process like a meteor shower hitting the earth as it revolves, but they do support Lin et al.'s (1994) observation that markets across the globe fall with surprising uniformity.

Conclusion

This paper has used an asymmetric diagonal BEKK model to determine the magnitudes of exchange rate volatility spillover effects among selected oil-exporting countries in Southeast Asia, namely Malaysia, Indonesia, and Brunei. This research is necessary because knowledge of the interconnectedness of oil price shocks and exchange rates is highly significant for the economic and financial growth of oil-exporting countries.

The findings reveal that the effects of shocks emanating from own exchange rates are greater than cross shocks from other countries and global oil prices. The non-significance of the GARCH parameter suggests that despite the effects of own and cross shocks from other countries, there is no evidence of persistence in any of the countries' exchange rates or global oil price volatility. This indicates that shocks die out rapidly.

Further, the results do not offer evidence in relation to the effects of asymmetry in increasing co-volatility between exchange rates and global oil prices among the countries in the study. The paper therefore recommends that policies regulating exchange rate volatility and the effects of global oil price shocks on the exchange rates of the selected countries in South-East Asia, namely Malaysia, Indonesia, and Brunei, should place more emphasis on country-specific factors that affect exchange rate volatility.

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