Article

The Volatility of Rupiah Exchange Rate Impact on Main Commodity Exports to the OIC Member States

Rossanto Dwi Handoyo [1,*], Agustin Dwi Prihandika Sari [1], Kabiru Hannafi Ibrahim [2] and Tamat Sarmidi [3]

1   Department of Economics, Faculty of Economics and Business, Universitas Airlangga,
     Surabaya 60286, Indonesia; agustin.dwi.prihandika-2017@feb.unair.ac.id
2   Department of Economics, Faculty of Social and Management Sciences, Federal University,
     Birnin Kebbi 860101, Nigeria; kabiru.hannafi@fubk.edu.ng
3   Department of Economics, Faculty of Economics and Management, Universiti Kebangsaan Malaysia,
     Bangi 43600, Selangor, Malaysia; tamat@ukm.edu.my
*   Correspondence: rossanto_dh@feb.unair.ac.id

Abstract: This study analysed the impact of the volatility of the rupiah exchange rate on four main commodities exported from Indonesia to six member countries of the Organisation of the Islamic Cooperation (OIC) (Saudi Arabia, Malaysia, Pakistan, United Arab Emirates, Turkey, and Bangladesh). The study employed monthly data spanning from January 2007 to December 2019 and the EGARCH method to obtain exchange rate volatility, while the ARDL method was used to model both the short-run and long-run impact of exchange rate and its volatility on exports. In the short term, findings revealed that exchange rate volatility has a significant negative effect on five main commodity exports to OIC countries, whereas, in the long-term, volatility of the exchange rate negatively affects twelve main commodity exports to OIC countries. Our results further imply that most of Indonesia's exporters to six OIC Member countries are risk-averse.

1. Introduction

Foreign trade is inseparable from the exchange rate, which plays an important role as a reference when conducting trade transactions for both exporters and importers. Ever since the emergence of the floating exchange rate system in 1973, foreign currencies' face value has kept on changing every day. Policymakers and researchers attempted to evaluate whether the volatility of the exchange rate has a strong influence on the trade of goods and services. Both groups believe that uncertainty in the exchange rate as indicated by its volatility has an impact on the flows of foreign transactions. Previous work has found both positive, negative, and no significant impacts from the occurrence of the exchange rate volatility on trade flows. It is worth noting that, if there is a surge in the exchange rate volatility and traders ignore the value for future trade transactions, it will increase the risk of exchange rate losses, which cause a decline in exports (Hooper and Kohlhagen 1978). If the traders' profits decrease when exchange rate volatility occurs, companies will increase sales and production to replace declining profits, therefore it will increase the exports (Sercu and Vanhulle 1992). Again, when there exists no impact from the occurrence of exchange rate volatility, the relationship cannot be determined (Triplett and Thaver 2017).

Toward the beginning of the 1990s, the Organisation of the Islamic Cooperation (OIC) countries opened their economies by embarking on trade liberalization reform to promote interregional trade, easing factor movement, preferential trade agreements (PTAs) among the member countries. This has resulted in the removal of trade barriers, especially quantitative restrictions among the members of the trading bloc. Before the 1970s, most countries in the world—including a large number of OIC countries—pegged their exchange

rates against a single currency (the US Dollar, which was worth a fixed amount of gold). Pegging the exchange rate to a single currency has helped reduce the risks associated with the exchange rate, the possible cost of the large foreign transactions, and speculation (OIC Outlook Series 2012; Poon and Hooy 2013). This is because the regime choice has a considerable impact on trade, macroeconomic environment, the balance of payment, inflation, and capital flows (OIC Outlook Series 2012). Most OIC countries are emerging economies that faced the risks of capital movement than many other developing countries that adopt flexible exchange rate systems (Poon and Hooy 2013). After the collapse of the fixed exchange rate, which lasted for twenty-five years (1946–1971), countries start adopting flexible exchange rate regimes. Since its inception, there were no single OIC member country with exchange rate arrangements. This is because most OIC countries adopted "other conventional fixed peg arrangements" (OIC Outlook Series 2012). According to OIC Outlook Series (2012), 32 OIC member States peg their exchange rates to a different currency; 12 of these countries peg to the Euro, 16 pegs to the US Dollar, and 4 to composite currency. Therefore, OIC member countries operate under different exchange rate regimes. While a large number of empirical studies have resurfaced since the emergence of the floating exchange rate, most of these studies have focused on the analysis of the nexus between exchange rate volatility on trade flows.

A new empirical study by Vo et al. (2019) divulged an adverse influence of exchange rate volatility on Vietnam's exports. Yunusa (2020) also confirmed an adverse effect of exchange rate volatility on oil exports from Nigeria to Canada, Italy, Brazil, and France. Sugiharti et al. (2020) have reported an adverse effect of exchange rates volatility on several commodities. From these results, it is well indicated that traders attempted to be risk-averse when the volatility of the exchange rate occurs. Furthermore, there exist few studies that reported a positive effect of the exchange rates volatility. Among these studies are Yunusa (2020), which evaluated the export performance of crude oil commodity exports from Nigeria to the UK, the United States, and Spain and found a positive impact.

Studies that focus on OIC member countries are limited. Poon and Hooy (2013) used panel estimates and assessed the influence of exchange rates volatility on trade in 30 OIC member nations over the period 1995–2008. Their finding indicates a negative significant influence of exchange rates volatility on aggregate import and export. Asteriou et al. (2016) studied the impact of the volatility of exchange rate on trade performance in MINT member countries and three OIC member countries. Their empirical strategy shows a significant short-term effect of the volatility of exchange rate on trade in Indonesia and Mexico, while the long-term impact is only observed in the case of Turkey.

The main rationale behind the conduct of this study is to analyse the effect of exchange rate volatility on the main commodity exports supply from Indonesia to the six OIC member countries. The choice of Indonesia and the six OIC member States is based on the fact that Indonesia is the country with the highest Muslim population, and more importantly, OIC member countries have dominant Muslim populations. Indonesia shares similar characteristics with OIC countries in terms of economies, political, social, and cultural characteristics, among others. Indonesia has a huge potential to export to OIC member countries because OIC member countries have chased their aim toward improving commercial and economic cooperation to advance economic relations and harmonization and encounter global challenges together (Alpay et al. 2011). Nowadays, the market share of Indonesia's exports to the OIC Member States has remained significant, with the highest export share going to OIC member countries. As a member of OIC, Malaysia alone accounts for 41% of Indonesia's total exports. Pakistan and Bangladesh held the second and third positions in demanding Indonesia's export supply as 9% of Indonesia's export go to these countries. While 7% of Indonesia's export goes to Saudi Arabia and the United Arab Emirates, followed by Turkey and Egypt, which account for about 5% of Indonesia's export supply, the remaining OIC member countries account for less than 2% of Indonesia's exports. With this fact, the six OIC member States that were chosen in the analysis of this study account for about 64% of Indonesia's export supply to the world. Therefore, with

more than half of Indonesia's exports going to these six countries, these countries must have constituted an economic value and meaningful to Indonesia's economy. In this case, an analysis of the impact of exchange rate volatility on Indonesia's exports to these countries must not be ignored. This is because any external shocks associated with the volatility of exchange may negatively affect Indonesia's exports to these countries. However, there is a need to have a clear understanding of the effect of exchange rate volatility on exports to these countries and offer policy recommendations for sustainable exports to these countries.

Although studies have investigated the links between exchange rate volatility and aggregate trade flow in the context of Indonesia, there is little emphasis on the analysis of such nexus for disaggregated trade flow, more especially of Indonesia's exports to Malaysia, Pakistan, Saudi Arabia, United Arab Emirates, Bangladesh, and Turkey, which accounts for more than half of Indonesia's exports. With this, therefore, the study further aims to utilize a two-digit Harmonized System (HS) export data of the main commodities exported from Indonesia to OIC member countries and analyse the influence of exchange rate volatility on their exports to the selected countries.

Based on previous studies, it is imperative to note that there is a scarceness of empirical studies that centre on the effect of exchange rates volatility on commodity exports from Indonesia to the OIC countries. Hence, this study aims to bridge this gap in the existing literature by analysing both the short- and long-term effect of the volatility of exchange rate on exports of four key commodities from Indonesia to six-member countries of the OIC such as Malaysia, Pakistan, Saudi Arabia, United Arab Emirates, Bangladesh, and Turkey for the period January 2007 to December 2019.

The remaining parts of this study are structured as follows: Section 2 presents the literature review and overview of some relevant variables. Section 3 presents the data and methodology adopted to achieve the stated objectives. Section 4 explains the research findings and Section 5 concludes the study and offered policy recommendations.

2. Literature Review

2.1. Exchange Rate and Exports

The rate of exchange between countries is the value of a currency against another currency. Currency exchange rates can be divided into two, i.e., nominal and real exchange rates, and all can change over time. The changes are depreciation or appreciation. When an appreciation occurs in a country's currency, domestic manufactured goods become costlier abroad and foreign manufactured goods become cheaper in domestic markets. Meanwhile, when depreciation occurs, domestic manufactured goods become inexpensive abroad and foreign manufactured goods in domestic countries become pricier (Mishkin 2016, p. 424).

Therefore, the exchange rate is one of the main determinants of trade flows. The size of a countries' exports is also caused by several factors, including the domestic price of the export destination country and the exchange rate between countries. When the exchange rate depreciates, the depreciation will make local products cheaper to stimulate export activities. In addition, the depreciation of the exchange rate makes foreign products costlier, thus making a country reduce its trading activities (Krugman et al. 2018, p. 424). This is further supported by Sugiharti et al. (2020), who explained that a country's exports will decrease due to the depreciating exchange rate of its partners.

2.2. Marshall-Lerner Condition

The depreciation of a country's real exchange rate can increase its current account. However, this depends on the response of exports and imports to changes in real exchange rates. Therefore, the Marshall–Lerner condition simply states that the depreciation of the real exchange rate will increase the current account if the volume of exports and imports is sufficiently elastic to the real exchange rate (Krugman et al. 2018, p. 460). Marshall–Lerner conditions can indicate stable or unstable foreign exchange market conditions. This condition may indicate a stable foreign exchange market if, and only if, the summation of absolute exports and imports price elasticity is greater than one and vice versa. Changes

in the real exchange rate will leave the current account unaffected if the total elasticity is exactly one, in absolute terms (Salvatore 2014, p. 516).

2.3. J-Curve Phenomenon

The phenomenon related to the exchange rate depreciation with the current account is described by the J-Curve (Krugman et al. 2018, p. 448). Exchange rate depreciation will initially cause a decrease in the current account. This happened because most of the import and export orders were carried out in the previous few months. Where consumers are not aware of changes in relative prices quickly. In the months following a depreciation, the volume of imports and exports can replicate the purchasing decisions concerning the previous rate of exchange. The depreciation impact is that exports will increase because the price of domestic goods is cheaper. Therefore, on the production side, export producers must increase production. Thus, after some time (i.e., in the long-term), depreciation of the exchange rate will increase export activity.

2.4. Volatility of Exchange Rate and Exports

In a market-oriented exchange system, policy changes might lead to instability in the exchange rate. The volatility of the exchange rate can be regarded as an overreaching phenomenon. An overreaching exchange rate occurs when its temporary response to a disturbance in market essentials is higher than its long-run response. Therefore, in this case, a disproportionately short-run exchange rates impact can be caused by market fundamentals. The phenomenon of foreign exchange rate spikes up is vital as it explains the reason for an intense depreciation or appreciation of exchange rates from day to day (Carbaugh 2015, p. 410).

Depending on traders' level of risk tolerance, exchange rate volatility might assert a positive or negative impact on trade. According to De Grauwe (1988), the consequence of increased risks can be looked at as the income and substitution effect. The former causes a company that avoids risk (risk-averse) to reduce export activity because the anticipated marginal utility of export earnings decreases, while for the latter, it causes the risk-taking company to increase export and to avoid a massive decline in the company's earnings. Sercu and Vanhulle (1992) mentioned that the increment of volatility will increase the value of exporting companies, by increasing sales and production to compensate for declining profits, thereby encouraging increased exports. Kroner and Lastrapes (1993) argued that the company can raise its viable activity because the market will worsen in the upcoming period due to unexpected exchange rate variations. Therefore, the complete control of traders that are risk-taker or risk-averse will govern the eventual effect of exchange rate instability on trade (Bahmani-Oskooee and Aftab 2017; Choudhry and Hassan 2015; Thuy and Thuy 2019).

2.5. Previous Study

Available empirical studies have observed the effects of exchange rate volatility on economic activities and exports, but there exists a contradictory view about such nexus. For instance, Senadza and Diaba (2018) report a positive and significant nexus among the exchange rate volatility and economic activities in eleven African countries for the period 1993–2014. Yunusa (2020) also examined the influence of volatility on Nigeria's crude oil export to Spain, the United Kingdom, and the United States for the period January 2006 to December 2019. His empirical results show a positive effect on exports to these countries. Sugiharti et al. (2020) also observed a similar finding in several commodities for Indonesia's exports to its trading partners.

Studies by Senadza and Diaba (2018) and Hooy and Baharumshah (2015) report a negative nexus between exports and exchange rate volatility. Poon and Hooy (2013) also confirmed a negative effect of the volatility of the exchange rate on exports in 30 OIC members. While applying monthly data to the Chinese exports to Japan, Nishimura and Hirayama (2013) found that volatility of exchange rate negatively affects exports

for the period 2002–2011. Hall et al. (2010) also found a negative effect in the case of emerging and developing countries' exports over the period 1980Q1–2005Q4. In the case of Vietnam's exports to 26 major trading partners, Vo et al. (2019) observed a negative long-term influence of volatility of exchange rate on the performance of export over the period 2000–2015. Findings discovered that the volatility of the exchange rate asserts a negative and significant effect on export performance in the long run. For Nigeria's oil exports to Canada, Italy, Brazil, and France, Yunusa (2020) observed the same negative effect of exchange rate volatility on exports. In the case of non-oil and gas sector exports for the period 1986–2014, Akanbi et al. (2017) found volatility's negative effect on exports. Sugiharti et al. (2020) also found similar results in several primary commodity exports from Indonesia to its main trading partners. On export performance in the ASEAN-5 region (Thailand, Malaysia, Singapore, Indonesia, and the Philippines) Upadhyaya et al. (2020) revealed a negative influence of exchange rate volatility on exports.

A study by Nishimura and Hirayama (2013) observed no significant influence of volatility of exchange rate on exports. Vo et al. (2019) also found a similar result in several commodity sectors. Bahmani-Oskooee et al. (2021), Bahmani-Oskooee and Arize (2020), and Bahmani-Oskooee and Aftab (2017) analysed the asymmetric effect of volatility on export. Their results show that the asymmetric approach was more influential compared to the symmetric approach. Sugiharti et al. (2020) report that exchange rate volatility affects Indonesia's exports performance using both symmetrical and asymmetrical approaches.

There exist several methods of measuring the volatility of the exchange rate. For instance, to obtain the volatility value, Hall et al. (2010), Bahmani-Oskooee and Aftab (2017), Upadhyaya et al. (2020), Bahmani-Oskooee and Arize (2020), Sugiharti et al. (2020), Vo et al. (2019), Yunusa (2020), and Bahmani-Oskooee et al. (2021) used Autoregressive-Conditional-Heteroskedasticity (ARCH) familiarized by Engle (1982) or Generalized ARCH (GARCH) which was developed from the ARCH model by (Bollerslev 1986). In addition, Nishimura and Hirayama (2013) used standard deviation and Exponential GARCH (EGARCH) to estimate the volatility of the exchange rate. The EGARCH method is an extended version of the GARCH model introduced by (Nelson 1991). Hooy and Baharumshah (2015) used the EGARCH method and estimated the volatility of exchange rate which can concurrently account for asymmetric volatility and the influence of good and bad news on the currency exchange market. Good news means that information will assert a positive influence on increasing the value of volatility, for instance, an unexpected appreciation in the currency value will increase volatility, while bad news means that information will have a negative impact, for example, an unexpected depreciation in currency values will increase volatility (Nishimura and Hirayama 2013). In addition, Akanbi et al. (2017) used the threshold GARCH (TGARCH) method, which is introduced by (Glosten et al. 1993).

Additionally, there were various methods used by previous studies to measure the influence of exchange rate volatility on exports. For instance, Hall et al. (2010) used the moment conditions for the dynamic Generalized Method of Moments (GMM) and the estimate of the Time-Varying-Coefficient (TVC). Poon and Hooy (2013) used panel regression and estimates the volatility influence on exports in 30 OIC member countries. Senadza and Diaba (2018) used a Pooled Mean Group (PMG) from a dynamic heterogeneous panel. Upadhyaya et al. (2020) used a fixed effect estimator in ASEAN 5 countries' panel. Vo et al. (2019) and Akanbi et al. (2017) used the Error Correction Model (ECM). Hooy and Baharumshah (2015), Yunusa (2020), and Nishimura and Hirayama (2013) used the Autoregressive Distributed Lag (ARDL) method to estimate time-series data. Besides using the ARDL method Bahmani-Oskooee and Aftab (2017), Bahmani-Oskooee et al. (2021), Bahmani-Oskooee and Arize (2020), and Sugiharti et al. (2020) used Nonlinear ARDL (NARDL) introduced by Shin et al. (2014) which includes the decomposition of negative (−) and positive (+) partial sums of the volatility of exchange rate.

3. Data and Method

3.1. Model

Following previous studies, this study adopted the EGARCH model, as proposed by Nelson (1991). Since exchange rates in the real term are recognized to be serially correlated. Therefore, there is a need to first determine the ARMA model for the rate of change. Then the model of EGARCH (*p, q*) can be presented as:

$$\Delta Y_t = \alpha + \beta_1 AR\,(p) + \beta_2 MA(q) + e_t \tag{1}$$

$$ln\alpha_t^2 = \alpha_0 + \alpha_1 \left| \frac{e_{t-1}}{\sigma_{t-1}} \right| + \cdots + \alpha_p \left| \frac{e_{t-p}}{\sigma_{t-p}} \right| + \varnothing_p \frac{e_{t-p}}{\sigma_{t-p}} + \lambda_1 h\sigma_{t-1}^2 + \cdots + \lambda_q h\sigma_{t-q}^2 \tag{2}$$

Equation (1) displays the conditional mean and is defined as the Autoregressive Moving Average (ARMA) model. Here, *Y* is the currency rate of exchange; Δ represent the first difference; *p* refers to the best lags number required in the Autoregressive (AR) model; *q* is the best lags number required in the Moving Average (MA) model; *AR* is Autoregressive; *MA* is a moving average; e_t is an error term.

In Equation (2), $ln\alpha_t^2$ is the conditional variance equation and is defined as the EGARCH (*p, q*) model; α, λ are parameter coefficient; $\left| \frac{e_{t-1}}{\sigma_{t-1}} \right|$ is magnitude effect; $\frac{e_{t-p}}{\sigma_{t-p}}$ is sign effect that asymmetry effect can be captured if the value is not equal to zero ($\varnothing$).

The ARDL model, as proposed by Pesaran et al. (2001) is used to obtain the short and long-run nexus. The ARDL has an advantage over other estimation techniques because the method allows for the determination of variables' relationship at the level form and irrespective of whether the included explanatory variables are pure of I(0). The benefit of the ARDL model approach is that it can be applied to test the nexus among model's variables in their original form (i.e., in levels), which is appropriate unrelatedly to whether the fundamental regressors are of order I(0) (i.e., stationary) or order I(1) (i.e., first difference stationary).

The short-term ARDL model is formulated as follows:

$$\Delta lnEx_t = \sum_{i=1}^{n1} \beta_{1i}\, \Delta lnEx_{t-i} + \sum_{i=0}^{n2} \beta_{2i}\, \Delta lnVol_{t-i} + \sum_{i=0}^{n3} \beta_{3i}\, \Delta lnRER_{t-i} + \delta ECT_{t-1} + \varepsilon_t \tag{3}$$

The long-term ARDL model is formulated as follows:

$$\Delta lnEx_t = \sum_{i=1}^{n1} \beta_{1i}\, \Delta lnEx_{t-i} + \sum_{i=0}^{n2} \beta_{2i}\, \Delta lnVol_{t-i} + \sum_{i=0}^{n3} \beta_{3i}\, \Delta lnRER_{t-i} + \sigma_1 lnEx_{t-1} + \sigma_2 lnVol_{t-1} + \sigma_3 lnRER_{t-1} + \mu_t \tag{4}$$

Equations (3) and (4) show the ARDL model used in this study, where Δ indicates variable at the first difference; *Ex* is export; β is short-term parameter coefficient; *Vol* is exchange rate volatility; *RER* is real exchange rate; *ECT* error correction term; *n1, n2, n3* are lag order; *ln* is natural logarithmic; σ is long term parameter; and ε_t and μ_t are the error terms.

3.2. The Data

The present study used the data sourced from the international trade centre and the international financial statistics (see Table A1 in the Appendix A). The data comprise time series monthly data covering the period 2007:M1–2019:M12. The exchange rates used in the present study are real term exchange rates of Indonesian Rupiah against the Malaysian Ringgit, Pakistan Rupee, United Arab Emirates Dirham, Saudi Riyal, Turkish Lira, and Bangladeshi Taka. The real exchange rates were calculated based on a common procedure that takes into account both the domestic prices and foreign prices of trading partners. Therefore, the real exchange rates in this regard depend on Indonesia's Rupiah nominal exchange rates, Indonesia's domestic prices, and foreign prices. The use of real

exchange rate over nominal exchange rate in this study is more prominent. This is because it shows not only how much can be traded for a unit of Indonesian Rupiah but also shows how much goods and services in Indonesia can be traded for goods and services in the exports destination countries. Additionally, we used the real exchange rate because the real exchange rate has been widely used in many empirical studies. While projecting the conditional variances, which are a proxy of volatility, the present study applied the EGARCH method because of its ability to reveal leptokurtosis in the data set and higher conditional moments. Exports used in this study are exports of four main commodities exported from Indonesia to six OIC member countries based on the two-digit Harmonized System (HS). The exports data are measured in monetary terms. However, to account for the current flow of export and exchange rate fluctuations, nominal exports data were used for the analysis of this study.

4. Empirical Findings

4.1. Variables Descriptive Statistics

Table 1 displays the variables descriptive measures of each variable as used in the present study. The data includes exports of four main commodities to six OIC member countries, exchange rates, and exchange rate volatility from January 2006 (M1) to December 2019 (M12), with 156 observations.

Table 1. Variables descriptive statistics.

Variable	Max.	Min.	Mean	Std. Dev.
Saudi Arabia				
Vehicles other than railway	11.6294	8.2983	10.3502	0.6732
Animal, vegetable fats, and oils	10.6995	5.6699	9.1457	1.0531
Wood and articles of wood	10.1587	6.6294	9.2135	0.5534
Paper and paperboard	9.98151	8.3703	9.1910	0.3201
Vol	343.0053	8.7324	69.8940	42.0046
RER	4969.21	2252.451	3329.862	900.0188
Malaysia				
Mineral fuels, mineral oils, etc.	13.1016	9.8812	12.1846	0.6268
Animal, vegetable fats, and oils	13.0536	9.0734	11.2647	0.6317
Iron and steel	2.56906	2.2053	2.4201	0.0563
Copper and articles thereof	2.5691	2.2053	2.4201	0.0563
Vol	277.749	32.6116	63.6158	30.7471
RER	4459.518	2270.037	3435.325	645.4047
Pakistan				
Animal, vegetable fats, and oils	12.1754	6.3368	10.7238	1.1746
Paper and paperboard	9.5160	7.9993	8.7066	0.3043
Man-made staple fibres	9.6406	7.3537	8.7184	0.5779
Vehicles other than railway	9.9769	5.5872	7.8665	1.0554
Vol	17.2005	0.7762	3.3339	2.5997
RER	193.4061	71.1762	115.7762	30.4566
United Arab Emirates				
Paper and paperboard	10.7660	8.3899	9.3099	0.4178
Natural or cultured pearls	11.7971	5.4250	8.5498	1.2710
Elect. machinery, equipment and spare parts	10.5867	8.4251	9.3937	0.4361
Vehicles other than railway	10.4805	5.8051	9.0777	0.9705
Vol	217.7973	19.9847	69.5693	34.9399
RER	5253.316	2246.875	3520.241	1018.006

Table 1. *Cont.*

Variable	Max.	Min.	Mean	Std. Dev.
Turkey				
Animal, vegetable fats, and oils	10.9847	3.37367	8.9102	1.3399
Rubber and articles thereof	10.5072	7.62950	9.3734	0.4505
Man-made filaments	10.5954	8.3064	9.6022	0.4905
Man-made staple fibres	10.5458	8.4994	9.9533	0.3382
Vol	535.478	43.4599	149.9039	81.4011
RER	8460.006	1485.002	4896.653	1861.939
Bangladesh				
Animal, vegetable fats, and oils	12.0062	8.1056	10.7856	0.6391
Paper and paperboard	8.7994	6.8211	7.8511	0.3681
Cotton	9.0777	6.8550	8.0011	0.428601
Man-made staple fibres	9.7455	7.1724	8.5807	0.6235
Vol	11.3977	1.2691	3.2948	1.4155
RER	183.5992	100.7474	138.2074	17.2203

Source: Authors' computation using Eviews 12. Note: The descriptions of the commodities were given in Table A2 of the Appendix A.

4.2. Estimated Results

The ARDL test was carried out after obtaining the exchange rate volatility of the selected EGARCH model (see Appendix A Table A3). The test was carried out to obtain the short-term and long-term influence of the real exchange rate and the volatility of the real exchange rate on main commodities exported to six OIC countries.

Table 2 displays the short-term ARDL estimate for the effect of the exchange rate in real terms on four main commodity exports from Indonesia to six OIC countries. For each country, only valid models with negative and significant ECT values are reported in Table 2. An estimate for a commodity is only reported if the estimate is valid in which ECT is statistically significant and negative. The result revealed exchange rate to have possessed a positive effect in the short term on Indonesian exports to Saudi Arabia (HS48), Malaysia (HS74), Pakistan (HS48), United Arab Emirates (HS87), Turkey (HS40), and Bangladesh (HS15, HS48, and HS55). In addition, the exchange rate asserts a positive and negative influence on different lags in Malaysia (HS72). The exchange rate also asserts a significant adverse influence in the short term in the United Arab Emirates (HS48 and HS85).

Table 2. Estimated short-run impact of real exchange rate on Indonesia's main exports to OIC countries.

Code	Exported commodities	$\Delta lnRER_t$	$\Delta lnRER_{t-1}$	$\Delta lnRER_{t-2}$	$\Delta lnRER_{t-3}$	$\Delta lnRER_{t-4}$
Saudi Arabia						
HS48	Paper andand paperboard	1.61 (1.82) *				
Malaysia						
HS72	Iron andand steel	−4.68 (−1.76) *	2.94 (0.93)	4.77 (1.69) *		
HS74	Copper and articles thereof	−1.03 (−0.68)	6.17 (3.31) ***			
Pakistan						
HS48	Paper andand paperboard	−0.24 (−0.33)	−0.51 (−0.67)	0.19 (0.26)	2.36 (3.24) ***	

Table 2. *Cont.*

	United Arab Emirates					
Code	Exported commodities	$\Delta lnRER_t$	$\Delta lnRER_{t-1}$	$\Delta lnRER_{t-2}$	$\Delta lnRER_{t-3}$	$\Delta lnRER_{t-4}$
HS87	Vehicles other than railway	3.80 (1.98) **	5.19 (1.96) **			
HS48	Paper and paperboard	−1.61 (−1.80) *	0.04 (0.89)	−2.70 (−2.87) ***		
HS85	Electrical machinery, equipment andand spare parts	−0.44 (−0.56)	−0.89 (−1.06)	−1.84 (−2.27) **		
	Turkey					
Code	Exported commodities	$\Delta lnRER_t$	$\Delta lnRER_{t-1}$	$\Delta lnRER_{t-2}$	$\Delta lnRER_{t-3}$	$\Delta lnRER_{t-4}$
HS40	Rubber andand articles thereof	1.17 (2.52) **				
	Bangladesh					
Code	Exported commodities	$\Delta lnRER_t$	$\Delta lnRER_{t-1}$	$\Delta lnRER_{t-2}$	$\Delta lnRER_{t-3}$	$\Delta lnRER_{t-4}$
HS15	Animal, vegetable fats, andand oils	2.04 (1.08)	3.88 (1.94) *			
HS48	Paper andand paperboard	−1.54 (−1.61)	3.43 (3.03) ***			
HS55	Man-made staple fibres	0.36 (0.46)	2.78 (2.93) ***	0.72 (0.80)	2.59 (3.07) ***	

Source: Authors' computation using Eviews 12. Note: The t-statistics were in brackets; *** indicates *p*-value < 0.01, ** indicates *p*-value < 0.05, * indicates *p*-value < 0.1.

Table 3 illustrates the short-term ARDL estimate for the exchange rate volatility on exports. The finding indicates that the exchange rate volatility asserts a significant negative effect on Indonesia's main exports to Saudi Arabia (HS48), Bangladesh (HS48 and HS55). Moreover, volatility possessed both increasing and decreasing impacts on different lags in Saudi Arabia (HS44) and United Arab Emirates (HS87). It is worth noting that in Table 3, only an estimate of four countries was reported. For Malaysia and Turkey, we could not find a valid estimate for all the selected main commodities exported from Indonesia to these countries; this is because ECTs for the whole commodities' estimate were not negative and is statistically insignificant.

Table 4 displays the long-term ARDL estimate. The real exchange rate asserts a significant and positive influence in Saudi Arabia (HS87), United Arab Emirates (HS71 and HS87), Bangladesh (HS15 and HS55). The real exchange rate also asserts a significant negative impact on main commodity export to Saudi Arabia (HS48), Malaysia (HS74), United Arab Emirates (HS85), Turkey (HS54), and Bangladesh (HS48). In addition, exchange rate volatility asserts a negative influence on exports to Saudi Arabia (HS87), Malaysia (HS15, HS27, HS74), United Arab Emirates (HS87), Turkey (HS15 and HS54), Bangladesh (HS15 and HS55). Furthermore, the volatility of the real exchange rate positively affects exports to Saudi Arabia (HS44), United Arab Emirates (HS85), and Bangladesh (HS48).

Table 5 displays the estimated results of the ARDL diagnostic test. Findings from the ECM_{t-1} test showed a significant negative value at the 5% level in all models. The coefficient value of ECM_{t-1} indicates the adjustment process towards the long-run equilibrium. The largest ECM_{t-1} coefficient value is shown in Bangladesh on commodity HS15, which is 0.98, meaning that the speed towards long-term equilibrium is 1.02 months (1/0.98). The Lagrange Multiplier (LM) test shows that there is one model that has autocorrelation problems, namely the HS48 commodity from Pakistan. The findings from the white test indicate that six models reject the H_0 (null hypothesis), which means that there is a heteroskedasticity problem in commodities such as HS48 from Saudi Arabia, HS27 from Malaysia, HS15 from Pakistan, HS87 from the United Arab Emirates, and commodities

HS15 and HS55 from Turkey. This problem was resolved by applying corrected robust standard error.

Table 3. Estimated short-run impact of real exchange rate volatility on Indonesia's main exports to OIC countries.

Saudi Arabia						
Code	**Exported commodities**	**ΔlnVol$_t$**	**ΔlnVol$_{t-1}$**	**ΔlnVol$_{t-2}$**	**ΔlnVol$_{t-3}$**	**ΔlnVol$_{t-4}$**
HS44	Wood andand articles of wood	−0.32 (−0.3.0) ***	9.52 (0.00)	−0.14 (−0.1.33)	0.20 (1.90) *	
HS48	Paper andand paperboard	−0.15 (−2.01) **	−0.25 (−3.24) ***			
Pakistan						
Code	**Exported commodities**	**ΔlnVol$_t$**	**ΔlnVol$_{t-1}$**	**ΔlnVol$_{t-2}$**	**ΔlnVol$_{t-3}$**	**ΔlnVol$_{t-4}$**
HS48	Paper andand paperboard	0.11 (1.12)				
United Arab Emirates						
Code	**Exported commodities**	**ΔlnVol$_t$**	**ΔlnVol$_{t-1}$**	**ΔlnVol$_{t-2}$**	**ΔlnVol$_{t-3}$**	**ΔlnVol$_{t-4}$**
HS87	Vehicles other than railway	−0.53 (−2.00) **	−0.17 (−0.74)	0.36 (1.87) *		
Bangladesh						
Code	**Exported commodities**	**ΔlnVol$_t$**	**ΔlnVol$_{t-1}$**	**ΔlnVol$_{t-2}$**	**ΔlnVol$_{t-3}$**	**ΔlnVol$_{t-4}$**
HS48	Paper andand paperboard	−0.21 (−1.47)	−0.43 (−2.85) ***	−0.25 (−1.85) *	−0.19 (−1.64)	
HS55	Man-made staple fibres	−0.52 (−4.4) ***	−0.29 (−2.56) **			

Source: Authors' computation using Eviews 12. Note: The t-statistics were in brackets; *** indicates *p*-value < 0.01, ** indicates *p*-value < 0.05, * indicates *p*-value < 0.1.

Table 4. The estimated long-run impact of the exchange rate and its volatility on Indonesia's main exports to OIC countries.

Saudi Arabia				
Code	**Exported Commodities**	**Constant**	**lnRER**	**lnVol**
HS15	Animal, vegetable fats, andand oils	2.50 (13.75) ***	1.22 (0.60)	0.74 (1.03)
HS44	Wood and articles of wood	3.94 (4.42) ***	0.95 (1.46)	3.94 (1.96) *
HS48	Paper and paperboard	12.20 (7.41) ***	−0.41 (−1.70) *	0.07 (0.72)
HS87	Vehicles other than railway	0.70 (0.12)	1.57 (1.88) *	−0.74 (−1.98) **
Malaysia				
Code	**Exported commodities**	**Constant**	**lnRER**	**lnVol**
HS15	Animal, vegetable fats, and oils	17.39 (3.35) ***	−0.63 (−0.98)	−0.014 (−3.12) ***
HS27	Mineral fuels, mineral oils, etc.	9.76 (1.25)	0.40 (0.42)	−0.01 (−1.99) **
HS72	Iron and steel	−2.26 (−0.14)	1.39 (0.74)	−0.00 (−0.23)
HS74	Copper and articles thereof	17.41 (8.19) ***	−0.77 (−2.95) ***	−0.008 (−4.42) ***

Table 4. *Cont.*

Pakistan				
Code	**Exported commodities**	**Constant**	**lnRER**	**lnVol**
HS15	Animal, vegetable fats, and oils	21.95 (1.63)	−2.22 (−0.75)	−0.62 (−0.75)
HS48	Paper and paperboard	9.10 (7.91) ***	−0.04 (−0.19)	−0.12 (−1.31)
HS55	Man-made staple fibres	13.77 (5.09) ***	−0.99 (−1.64)	−0.28 (−1.28)
HS87	Vehicles other than railway	−20.50 (−0.56)	6.60 (0.80)	−2.24 (−0.90)
United Arab Emirates				
Code	**Exported commodities**	**Constant**	**lnRER**	**lnVol**
HS71	Natural or cultured pearls	−13.53 (−1.85) *	2.47 (2.36) **	0.48 (0.76)
HS87	Vehicles other than railway	−5.08 (−0.84)	2.49 (2.68) ***	−1.52 (−2.20) **
HS48	Paper and paperboard	14.14 (3.97) ***	−0.62 (−1.17)	0.10 (0.27)
HS85	Electrical machinery and equipment and parts thereof	19.85 (20.16) ***	−1.38 (−9.57) ***	0.19 (2.10) **
Turkey				
Code	**Exported commodities**	**Constant**	**lnRER**	**lnVol**
HS55	Man-made staple fibres	12.54 (2.63) ***	−0.04 (−0.06)	−0.68 (−1.07)
HS15	Animal, vegetable fats, andand oils	9.19 (3.55) ***	0.47 (1.27)	−0.78 (−2.02) **
HS40	Rubber and articles thereof	6.47 (1.70) *	0.74 (1.40)	−0.61 (−1.28)
HS54	Man-made filaments	13.87 (14.14) ***	−0.28 (−2.15) **	−0.30 (−2.29) **
Bangladesh				
Code	**Exported commodities**	**Constant**	**lnRER**	**lnVol**
HS15	Animal, vegetable fats, andand oils	4.37 (1.64)	1.51 (2.63) ***	−0.90 (−4.35) ***
HS48	Paper and paperboard	18.26 (4.33) ***	−2.28 (−2.47) **	0.74 (2.09) **
HS52	Cotton	2.59 (0.38)	1.24 (0.85)	−0.61 (−1.21)
HS55	Man-made staple fibres	13.42 (−0.97)	5.06 (1.67) *	−2.51 (1.67) *

Source: Authors' computation using Eviews 12. Note: The t-statistics were in brackets; *** indicates *p*-value < 0.01, ** indicates *p*-value < 0.05, * indicates *p*-value < 0.1.

Table 5. ARDL Diagnostic Test Results.

Country	Exported Commodities	ECM$_{t-1}$	LM	White
Saudi Arabia	Animal, vegetable fats, and oils	−0.16 (−2.68) ***	0.86	1.32
	Wood and articles of wood	−0.26 (−3.95) ***	1.56	1.19
	Paper and paperboard	−0.51 (−6.52) ***	0.05	3.05 **
	Vehicles other than railway	−0.18 (−4.09) ***	0.22	0.96
Malaysia	Animal, vegetable fats, and oils	−0.28 (−5.24) ***	0.42	1.01
	Mineral fuels, mineral oils, etc.	−0.14 (−4.17) ***	0.77	4.08 **
	Iron and steel	−0.16 (−2.57) **	0.04	1.06
	Copper and articles thereof	−0.64 (−7.26) ***	0.28	0.77
Pakistan	Animal, vegetable fats, and oils	−0.11 (−2.39) **	1.38	1.53 *
	Paper and paperboard	−0.45 (−5.78) ***	2.95 *	0.61
	Man-made staple fibres	−0.17 (−3.79) ***	0.83	1.11
	Vehicles other than railway	−0.04 (−2.25) **	0.52	1.12
United Arab Emirates	Paper and paperboard	−0.17 (−3.10) ***	0.08	1.02
	Natural or cultured pearls	−0.27 (−3.50) ***	0.40	1.00
	Electrical machinery, equipment andand spare parts	−0.56 (−7.61) ***	1.48	1.54
	Vehicles other than railway	−0.22 (−4.75) ***	0.11	2.34 **
Turkey	Animal, vegetable fats, and oils	−0.36 (−3.86) ***	1.56	1.92 **
	Rubber and articles thereof	−0.12 (−3.46) ***	0.02	0.02
	Man-made filaments	−0.90 (−2.37) **	1.90	0.80
	Man-made staple fibres	−0.27 (−4.44) ***	0.06	3.89 **
Bangladesh	Animal, vegetable fats, and oils	−0.98 (−12.60) ***	1.42	1.06
	Paper and paperboard	−0.36 (−4.18) ***	1.27	0.70
	Man-made staple fibres	−0.16 (−2.83) ***	0.49	0.56
	Cotton	−0.08 (−2.70) ***	1.80	1.17

Source: Authors' computation using Eviews 12. Note: Specifically, for ECM$_{t-1}$ the t-statistics were in brackets; *** indicates *p*-value < 0.01, ** indicates *p*-value < 0.05, * indicates *p*-value < 0.1.

4.3. The Influence of Real Exchange Rate on Exports

Both in the short-term and long-term, the exchange rate asserts a significant positive influence on main commodity exports. In the short term, the result from this study indicates that the exchange rate asserts a significant positive impact on main commodity exports; HS48 to Pakistan, HS74 to Malaysia, HS87 to the United Arab Emirates, HS40 to Turkey, HS15, HS48, and HS55 to Bangladesh. This means that a 1% rise in the exchange rate will increase commodity exports to Malaysia by 6.17% HS74 i.e., copper and its processed goods, (see Table 2), while in the long-term, the exchange rate asserts a significant positive influence on commodity exports; HS87 to Saudi Arabia, HS71 and HS87 to the United Arab Emirates, and HS15 and HS55 to Bangladesh. The finding shows that a 1% increase in exchange rate

increases the export of HS15 commodities (animal/vegetable oil) to Bangladesh by 1.51% (see Table 4).

These results are consistent with the result of Thuy and Thuy's (2019) study, which proves that when the Vietnamese Dong's rate of exchange depreciates against the US Dollar, exports will increase. This finding has been further supported by Vo et al. (2019) for Vietnam's exports to America and Europe area. A study by Hooy et al. (2015) also supports these results which discovered that Renminbi exchange rate depreciation has a positive and significant influence on ASEAN's aggregate exports to China. According to the existing theory, when the exchange rate rises (depreciation occurs), the price of domestic goods becomes cheaper so that sales for exports will increase. In the long run, due to increased consumer demand, export producers must increase production so that exchange rate depreciation will increase export activity (Krugman et al. 2018).

The J-Curve phenomenon occurs in commodity HS72 for Malaysia, which has a negative coefficient in the initial lag and positive in the next lag. Although there were no examples that confirmed the J-Curve phenomenon in the short-term and long-term, HS72 exports to Malaysia could describe that exports initially declined after depreciation (price effect of depreciation), then exports increased in the long run following depreciation (volume effect), which is consistent with Cao-Alvira (2014).

Contrary to existing theory, in the short-term, commodity exports such as; HS72 to Malaysia, HS48 and HS85 to the United Arab Emirates, and HS48 to Bangladesh are negatively affected by a rise in the exchange rate. Meanwhile, in the long term, commodity exports of HS48 to Saudi Arabia, HS74 to Malaysia, HS85 to the United Arab Emirates, HS54 to Turkey, and HS48 to Bangladesh showed significant negative results when there is an upsurge in the rate of exchange. This means that in the long term, with a 1% increase in the exchange rate, the export of commodity HS85 (electrical equipment) to the United Arab Emirates will decrease by 1.38% (see Table 4). Sugiharti et al. (2020) found that the depreciation in the Rupiah exchange rate against China's Renminbi also tends to deteriorate exports of seven out of eleven commodities from Indonesia. They further observed the possibility that the real exchange rate combined with relative changes in prices could lead to an adverse impact. Moreover, the difference in the depreciation of exchange rate impact on exports can be caused by two factors, which are the destination of export commodity and the type of export commodity (Vo et al. 2019).

4.4. The Influence of Exchange Rate Volatility on Exports

Findings indicate that five commodities are influenced by exchange rate volatility in the short term. First, exchange rate volatility asserts a negative influence on export which has been observed in three commodities. These commodities are HS48 commodity exports to Saudi Arabia and HS48 and HS55 to Bangladesh. The finding shows that a 1% rise in the volatility of the exchange rate will decrease the commodity exports of HS48 (paper and cardboard) to Saudi Arabia by 0.25% (see Table 3). These findings are supported by Upadhyaya et al. (2020) findings, which proves that exchange rate volatility asserts an adverse effect on export in the ASEAN-5 region. These findings indicate that traders tend to act as risk-averse.

Other findings for the two commodities show that in the short term, the volatility will have an adverse and positive impact on different lags. These include exports of HS44 commodities (wood and wood-processed goods) to Saudi Arabia and HS87 (vehicles other than railway) to the United Arab Emirates. These results according to Bahmani-Oskooee and Aftab (2017) occur because of the attitude of traders who are risk-takers and risk-averse in exporting commodities to several partners.

The positive and negative impact of volatility, in the long run, appeared in nine commodities. Volatility asserts an increasing impact on the export of HS44 to Saudi Arabia, HS85 to the United Arab Emirates, and HS48 to Bangladesh in the long run. For instance, the findings revealed that a 1% rise in the volatility of the exchange rate will rise the export of commodity HS48, (paper and cardboard) to Bangladesh by 0.74% (see Table 4).

These results were in line with Yunusa (2020), which proved the export performance of crude oil commodities from Nigeria to Spain, the United States, and the United Kingdom. This indicates that traders tend to act as risk-takers. Bahmani-Oskooee and Arize (2020) described that the positive effect of exchange rate volatility depends on the attitude of risk-takers in trading more for today to cover possible losses in the future. Moreover, in the long run, volatility asserts an adverse impact on six commodities, such as exports of commodities; HS87 to Saudi Arabia, HS15, HS27, and HS74 to Malaysia, HS87 to the United Arab Emirates, HS15 and HS54 to Turkey, HS15 and HS55 to Bangladesh. For instance, the finding indicates that, when the volatility increased by 1%, the export of HS87 commodities (vehicles other than railway) to the United Arab Emirates would decrease by 1.52% (see Table 4). These results were consistent with Senadza and Diaba (2018), who observed that the volatility assets an adverse influence on exports for 11 African countries, Hooy and Baharumshah (2015) for Singapre and Indonesia, and Sugiharti et al. (2020) for Indonesia.

The volatility of the exchange rate tends to negatively influence exports of several commodities in the five OIC member countries in both the short term and the long term. This indicates that traders tend to avoid risk (risk-averse), they will hold back on carrying out high-risk exports to minimize the possibility of trade losses. Qian and Varangis (1994) in their study observed these cases in developing countries as the payment method in international trading in foreign currencies tend to have a high dollarization rate, therefore the effect of volatility is significant on economic activity. Additionally, in developing economies, such as Indonesia, the derivatives market is still less developed, in which case the hedging is not only inadequate but also expensive. Another probable description for the long-term adverse effect of volatility is that the greater the risk, the greater the option value, which leads to the cost increment to ensure impending profits, which in the end it reduces the bulk of market transactions.

Meanwhile, the effect that occurs in the long term is shown in nine commodities. Six commodities have a negative coefficient, which are Saudi Arabia (HS87), Malaysia (HS15, HS27, HS74), Turkey (HS15, HS54), Bangladesh (HS15 and HS55), and one commodity has a positive coefficient for Bangladesh (HS48). These empirical findings are in line with Vo et al. (2019), who found that volatility increases the export of transportation equipment from Vietnam to three continents (Asia, America, and Europe).

In Pakistan and certain commodities, volatility has no significant influence on exports, both in the short term and long-term. Risk-averse and risk-takers tend to continue export irrespective of the volatility. Hall et al. (2010) have argued that an unregulated capital market may decrease the influence of the fluctuation in the exchange rate on exports.

5. Conclusions and Policy Implication

This study analysed the short and long-term influence of the real exchange rate and its volatility on Indonesia's exports of four main commodities to six OIC countries for the period 2007:M1–2019:M12. Findings indicate that the real exchange rate asserts a significant influence on eleven commodities in the short term and ten commodities in the long term. Other findings demonstrate that volatility asserts a significant influence on five commodities in the short-run and twelve commodities in the long run.

The exchange rate asserts an increasing impact on Indonesian exports to Saudi Arabia (HS48), Malaysia (HS74), Pakistan (HS48), United Arab Emirates (HS87), Turkey (HS40), and Bangladesh (HS15, HS48, and HS55) in the short term. In addition, the exchange rate asserts a positive and negative influence on different lags in Malaysia (HS72). The finding shows that in the short term, the exchange rate has a decreasing impact on exports to the United Arab Emirates (HS48 and HS85), whereas, in the long term, the exchange rate has an increasing impact on exports to Saudi Arabia (HS87), United Arab Emirates (HS71 and HS87), Bangladesh (HS15 and HS55). Moreover, the exchange rate has a decreasing impact on exports to Saudi Arabia (HS48), Malaysia (HS74), United Arab Emirates (HS85), Turkey (HS54), and Bangladesh (HS48).

In the short term, the volatility asserts a decreasing impact on Indonesia's exports to Saudi Arabia (HS48), Bangladesh (HS48 and HS55). Furthermore, the volatility has demonstrated negative and positive impacts on different lags in Saudi Arabia (HS44) and United Arab Emirates (HS87). In the long term, volatility possessed a negative influence on export to Saudi Arabia (HS87), Malaysia (HS15, HS27, HS74), United Arab Emirates (HS87), Turkey (HS15 and HS54), Bangladesh (HS15 and HS55). In addition, in the long-term, the volatility also asserts an increasing impact on exports to Saudi Arabia (HS44), United Arab Emirates (HS85), and Bangladesh (HS48).

The volatility of the real exchange rate tends to have a more adverse influence on several commodities exported to OIC member countries. Therefore, we recommend the need for government to always maintain a stable and competitive Rupiah exchange rate and implement appropriate fiscal and monetary policies. Exporters may be able to take a more risk-taking attitude so that domestic commodities are not less competitive with other countries by meeting the needs of goods consumed by OIC member countries when volatility is high. In addition, governments can assist investors and traders in oriented exports industries to invest in industrial sectors that would gain from the volatility. If the adverse impact of volatility on exports volume is related to high volatility and the positive influence is connected to low volatility, then the influence of volatility on exports volume is non-linear. Therefore, this study can be extended to a non-linear model.

The major limitation of this study is that it focuses mainly on the analysis of the volatility of the Rupiah exchange rate impact on four major commodities exported to six OIC countries. On this note, the study only controls for the exchange rate, exchange rate volatility, and the dynamic adjustments of the exchange rate as the determinants of the main commodity exports to selected OIC countries. With this, therefore, future work should consider incorporating other determinants of exports to OIC countries especially macroeconomic determinants of countries' exports. Therefore, future studies should explore the influence of volatility of the Rupiah exchange rate on not only main commodities exported to six OIC member countries but many more commodities exported to a larger number of OIC countries.

Appendix A

Table A1. Variable Source.

Variable	Data Type	Data Source
Export	Secondary	International Trade Centre
Nominal Exchange Rate	Secondary	International financial Statistic
Consumer Price Index	Secondary	International financial Statistic

Table A2. Commodity Descriptions.

	HS15	Animal, vegetable fats, and oils
	HS27	Mineral fuels, mineral oils, etc.
	HS40	Rubber and articles thereof
	HS44	Wood and articles of wood
	HS48	Paper and paperboard
	HS52	Cotton
	HS54	Man-made filaments
	HS55	Man-made staple fibres
	HS72	Iron and steel
	HS71	Natural or cultured pearls
	HS74	Copper and articles thereof
	HS85	Electrical machinery, equipment, and spare parts
	HS87	Vehicles other than railway

Table A3. EGARCH Estimation Result.

RER	RER IDR/SAR	RER IDR/MYR	RER IDR/PKR	RER IDR/AED	RER IDR/TRY	RER IDR/BDT
AR(1)	0.763 *** (0.068)	0.361 *** (0.070)	−0.418 ** (0.198)	-	-	-
AR(2)	-	-	-	-	-	−0.051 (0.082)
MA(1)	−0.439 *** (0.112)	-	0.710 *** (0.142)	0.258 *** (0.102)	0.231 *** (0.063)	0.334 *** (0.094)
C	38.737 *** (9.387)	16.270 *** (6.628)	−0.397 ** (0.204)	18.701 *** (5.765)	−35.61 *** (9.475)	0.030 (0.277)
C(3)	-	1.124 * (0.682)		1.492 *** (0.458)	0.174 (0.171)	
C(4)	0.722 *** (0.182)	-	−0.424 *** (0.086)	0.544 *** (0.111)	0.698 *** (0.087)	0.033 (0.089)
C(5)	0.351 * (0.212)	0.550 *** (0.120)	0.592 *** (0.115)	0.338 *** (0.087)	0.398 *** (0.148)	0.505 *** (0.136)
C(6)	−0.430 ** (0.223)	0.810 *** (0.087)	0.049 (0.071)	0.770 *** (0.060)	−0.139 *** (0.029)	−0.387 (0.272)
C(7)	0.472 *** (0.069)	-	0.984 *** (0.026)	-	−0.050 * (0.029)	−0.010 (0.224)
C(8)	0.925 *** (0.018)	-	-	-	0.936 *** (1.66)	0.194 *** (0.062)
C(9)	-	-	-	-	-	0.945 *** (0.400)
(*p, q*)	(2, 1)	(1, 1)	(1, 1)	(1, 1)	(2, 2)	(3, 2)
ARCH-LM Test (*p*-value)	0.135	0.802	0.640	0.185	0.714	0.066
Sign-Bias Test (*p*-value)	0.213	0.687	0.851	0.606	0.526	0.489

Table A3. *Cont.*

RER	RER IDR/SAR	RER IDR/MYR	RER IDR/PKR	RER IDR/AED	RER IDR/TRY	RER IDR/BDT
Negative-Bias Test (*p*-value)	0.867	0.510	0.241	0.554	0.196	0.438
Positive-Bias Test (*p*-value)	0.182	0.723	0.697	0.875	0.579	0.248
Joint-Bias Test (*p*-value)	0.535	0.745	0.4129	0.935	0.536	0.564

Source: authors' computation using Eviews 12. Note: std. errors were in brackets; *** indicates $p < 0.01$, ** indicates $p < 0.05$, * indicates $p < 0.1$.

References

Akanbi, Sa'ad Babatunde, Halimah Adedayo Alaghe, Hammed Agboola Yusuf, and Musibau Hammed Oluwaseyi. 2017. Exchange Rate Volatility and Non-oil Exports in Nigeria: An Empirical Investigation. *Journal of Emerging Economies & Islamic Research* 5: 5–15. [CrossRef]

Alpay, Savas, Murat Atlamaz, and Esat Bakimli. 2011. Trade among OIC Countries: Limits of Islamic Solidarity. *Insight Turkey* 13: 145–70.

Asteriou, Dimitrios, Kaan Masatci, and Keith Pılbeam. 2016. Exchange rate volatility and international trade: International evidence from the MINT countries. *Economic Modelling* 58: 133–40. [CrossRef]

Bahmani-Oskooee, Mohsen, and Augustine C. Arize. 2020. On the Asymmetric Effects of Exchange Rate Volatility on Trade Flows: Evidence from Africa. *Emerging Markets Finance and Trade* 56: 913–39. [CrossRef]

Bahmani-Oskooee, Mohsen, and Muhammad Aftab. 2017. On the asymmetric effects of exchange rate volatility on trade flows: New evidence from US-Malaysia trade at the industry level. *Economic Modelling* 63: 86–103. [CrossRef]

Bahmani-Oskooee, Mohsen, Toan Luu Duc Huynh, and Muhammad Ali Nasir. 2021. On the asymmetric effects of exchange-rate volatility on trade flows: Evidence from US–UK Commodity Trade. *Scottish Journal of Political Economy* 68: 51–102. [CrossRef]

Bollerslev, Tim. 1986. Generalized autoregressive conditional heteroskedasticity. *Journal of Econometrics* 31: 307–27. [CrossRef]

Cao-Alvira, José J. 2014. Real Exchange Rate Volatility on the Short- and Long-Run Trade Dynamics in Colombia. *International Trade Journal* 28: 45–64. [CrossRef]

Carbaugh, Robert J. 2015. *International Economics*, 16th ed. Boston: Cengage Learning.

Choudhry, Taufiq, and Syed S. Hassan. 2015. Exchange rate volatility and UK imports from developing countries: The effect of the global financial crisis. *Journal of International Financial Markets, Institutions and Money* 39: 89–101. [CrossRef]

De Grauwe, Paul. 1988. Exchange Rate Variability and the Slowdown in Growth of International Trade. *Staff Papers International Monetary Fund* 35: 63–84. [CrossRef]

Engle, Robert F. 1982. Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation. *Econometrica* 50: 987. [CrossRef]

Glosten, Lawrence R., Ravi Jagannathan, and David E. Runkle. 1993. On the Relation between the Expected Value and the Volatility of the Nominal Excess Return on Stocks. *The Journal of Finance* 48: 1779–801. [CrossRef]

Hall, Stephen, George Hondroyiannis, P. A. V. B. Swamy, George Tavlas, and Michael Ulan. 2010. Exchange-rate volatility and export performance: Do emerging market economies resemble industrial countries or other developing countries? *Economic Modelling* 27: 1514–21. [CrossRef]

Hooper, Peter, and Steven W. Kohlhagen. 1978. The effect of exchange rate uncertainty on the prices and volume of international trade. *Journal of International Economics* 8: 483–511. [CrossRef]

Hooy, Chee-Wooi, and Ahmad Zubaidi Baharumshah. 2015. Impact of exchange rate volatility on trade: Empirical evidence for the East Asian economies. *Malaysian Journal of Economic Studies* 52: 75–95.

Hooy, Chee-Wooi, Law Siong-Hook, and Chan Tze-Haw. 2015. The impact of the Renminbi real exchange rate on ASEAN disaggregated exports to China. *Economic Modelling* 47: 253–59. [CrossRef]

Kroner, Kenneth F., and William D. Lastrapes. 1993. The impact of exchange rate volatility on international trade: Reduced form estimates using the GARCH-in-mean model. *Journal of International Money and Finance* 12: 298–318. [CrossRef]

Krugman, Paul R., Maurice Obstfeld, and Mack Melitz. 2018. *International Finance: Theory and Policy*, 11th ed. Upper Saddle River: Pearson Education, Inc.

Mishkin, Frederic S. 2016. *The Economics of Money, Banking and Financial Markets*, 11th ed. Upper Saddle River: Pearson Education, Inc.

Nelson, Daniel B. 1991. Conditional Heteroskedasticity in Asset Returns: A New Approach. *Journal Econometrica Society* 59: 347–70. Available online: http://www.jstor.org/stable/2938260 (accessed on 12 December 2020).

Nishimura, Yusaku, and Kenjiro Hirayama. 2013. Does exchange rate volatility deter Japan-China trade? Evidence from pre and post-exchange rate reform in China. *Japan and the World Economy* 25–26: 90–101. [CrossRef]

OIC Outlook Series. 2012. Exchange Rate Regime in the OIC Member Countries. A Publication of the Statistical, Economic and Social Research and Training Centre for Islamic Countries (SESRIC). Available online: https://sesricdiag.blob.core.windows.net/sesric-site-blob/files/article/445.pdf (accessed on 9 February 2021).

Pesaran, M. Hashem, Yongcheol Shin, and Richard J. Smith. 2001. Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics* 16: 289–326. [CrossRef]

Poon, Wai-Ching, and Chee-Wooi Hooy. 2013. Exchange-Rate Volatility, Exchange-Rate Regime, and Trade in OIC Countries. *Journal of Asia-Pacific Business* 14: 182–201. [CrossRef]

Qian, Ying, and Panos Varangis. 1994. Does exchange rate volatility hinder export growth? *Empirical Economics* 19: 371–96. [CrossRef]

Salvatore, Dominick. 2014. *Managerial Economics in a Global Economy*, 8th ed. Oxford: Oxford University Press.

Senadza, Bernardin, and Desmond Delali Diaba. 2018. Effect of exchange rate volatility on trade in Sub-Saharan Africa. *Journal of African Trade* 4: 20. [CrossRef]

Sercu, Piet, and Cynthia Vanhulle. 1992. Exchange rate volatility, international trade, and the value of exporting firms. *Journal of Banking and Finance* 16: 155–82. [CrossRef]

Shin, Yongcheol, Byungchul Yu, and Matthew Greenwood-Nimmo. 2014. Festschrift in Honor of Peter Schmidt. In *Festschrift in Honor of Peter Schmidt*. New York: Springer. [CrossRef]

Sugiharti, Lilik, Miguel Angel Esquivias, and Bekti Setyorani. 2020. The impact of exchange rate volatility on Indonesia's top exports to the five main export markets. *Heliyon* 6: e03141. [CrossRef] [PubMed]

Thuy, Vinh Nguyen Thi, and Duong Trinh Thi Thuy. 2019. The Impact of Exchange Rate Volatility on Exports in Vietnam: A Bounds Testing Approach. *Journal of Risk and Financial Management* 12: 6. [CrossRef]

Triplett, Russell E., and Ranjini L. Thaver. 2017. Volatility and Trade: The Case of South Africa's Exports to China. *Journal of Developing Areas* 51: 273–85. [CrossRef]

Upadhyaya, Kamal P., Dharmendra Dhakal, and Franklin G. Mixon Jr. 2020. Exchange Rate Volatility and Exports: Some New Estimates from the ASEAN-5. *Journal of Developing Areas* 54: 65–73. [CrossRef]

Vo, Duc Hong, Anh The Vo, and Zhaoyong Zhang. 2019. Exchange Rate Volatility and Disaggregated Manufacturing Exports: Evidence from an Emerging Country. *Journal of Risk and Financial Management* 12: 12. [CrossRef]

Yunusa, Lateef Adewale. 2020. Exchange rate volatility and Nigeria crude oil export market. *Scientific African* 9: e00538. [CrossRef]