



Effect of Exchange Rate Volatility and COVID-19 on Indonesia-United States Bilateral Trade

Rossanto Dwi Handoyo^{1*}, Kabiru Hannafi Ibrahim^{1,2}, Nadia Komaneci¹,
Deni Kusumawardani¹,
Yessi Rahmawati¹, Tri Haryanto¹, Tamat Sarmidi³, Keiichi Ogawa⁴,
Mohd Azlan Shah Zaidi³,
Widya Sylviana¹, Fernanda Reza Muhammad¹, Angga Erlando¹

¹ Department of Economics, Universitas Airlangga, Surabaya 60286, Indonesia

² Department of Economics, Federal University Birnin Kebbi, Birnin Kebbi 860101, Nigeria

³ School of Economics, Universiti Kebangsaan Malaysia, UKM Bangi 43600, Malaysia

⁴ Graduate School of International Cooperation Studies, Kobe University, Kobe 650-0001, Japan

Corresponding Author Email: rossanto_dh@feb.unair.ac.id

Copyright: ©2024 The authors. This article is published by IETA and is licensed under the CC BY 4.0 license (<http://creativecommons.org/licenses/by/4.0/>).

<https://doi.org/10.18280/ijstdp.190107>

ABSTRACT

Received: 27 March 2023

Revised: 27 November 2023

Accepted: 5 January 2024

Available online: 31 January 2024

Keywords:

exchange rate volatility, asymmetric effect, bilateral trade, GARCH, ARDL, NARDL

Exchange rate volatility has created many uncertainties and thus hampering bilateral trade flows among countries. These uncertainties are enormous and are affecting exporters' and importers' decisions regarding trade due to their risks and the resultant negative effect on profit in most countries. Indonesia and the United States were not an exception in this regard. Trade policies that are linked to uncertainties caused by exchange rate fluctuation are needed to stimulate trade among countries. To this end, this study analysed the effect of positive and negative changes in exchange rate volatility and the COVID-19 pandemic on the Indonesia-US bilateral commodity trade flow. A time series of data comprising 30 commodity exports and imports at harmonized system 2-digit code were scrutinized for the period 2010:M01-2021:M01. Our empirical strategies using the GARCH modelling approach, linear and nonlinear autoregressive distributing lag models revealed that: (i) linear ARDL exchange rate volatility asserts a positive effect on 9 commodity exports and 6 commodity imports from the US, (ii) in nonlinear ARDL 12 commodity exports and 8 commodity imports were positively affected by the exchange rate volatility. These findings indicate that exporters and importers tend not to care about the risk associated with exchange rate volatility, and (iii) the finding further revealed that in the export of commodities HS71, HS94, and HS95 there is evidence of asymmetric effect that differed in coefficient, sign, size, and duration. The practical significance of these findings is that policymakers should sidestep the strategy of a one-sided exchange rate policy to accommodate different risk behaviour as exhibited by exporters and importers. This would help maintain the stability of the exchange rate and promote trade flows.

1. INTRODUCTION

The break of Bretton Woods has led many countries around the world to shift from the fixed to floating exchange rate regime. This shift has attracted debate among researchers due to its possible impact on foreign trade [1]. This move result has resulted in European Central Banking intervention in the currency market [2]. Theoretical underpinning suggests a negative link between export flow and the volatility of the exchange rate [3]. While empirical studies revealed positive, negative, and mixed nexus between exchange rate volatility and export. Theoretically, the different effects of exchange rate volatility on exports were a result of exporters' behaviour towards risk in trading, assorted methodology, time coverage, and study context [1] among many others.

The issue of exchange rate volatility and trade flows has been a topic of much debate due to the lack of a clear pattern of the nexus between the two variables. Volatility reflects the

fluctuations in the exchange rate which from time to time causes risks and uncertainty [4]. Exchange rate volatility causes market uncertainty, inflation, decreased profit, increased risk, and impacts on the cost of production [5]. The fluctuation in exchange which causes uncertainty can affect trade flows between countries. This produces an eminent risk to traders in which risk-averse traders would tend to reduce their trading activities as regards international transactions. On the other hand, the influence of volatility becomes less prevail and vague for exporters that are more prone to take risks resulting from volatility and uncertainty. Therefore, as in the case of the exchange rate, exporters can react asymmetrically to changes in the volatility of the exchange rate. The volatility in exchange is an important factor worth considering in international trade. It can cause a decrease in trading activities due to anticipation of low profits [6]. Popular opinions and findings have it that exchange rate volatility negatively affects foreign trade, which calls for the need for government

exchange rate stabilization policies [7]. However, government policies could worsen the uncertainty created by the volatility of the exchange rate which can affect market equilibrium and result in an asymmetric effect [8]. In an attempt to shun risk associated with the volatility of the exchange rate, business firms may adjust their demand and supply which may affect their profits [9, 10]. More importantly, depending on traders' response to volatility, studies are divided on the effect of exchange rate volatility on trade flow. For instance, studies [11-14] reported that exchange rate volatility reduces trade flow. While studies [15, 16] offered a contrary view.

The positive and negative changes in the exchange rate could affect traders and the trading system because of its prevailing uncertainty [17]. If the anticipated value of import spending decreases or the utility of expected export sales increases, there will be an upward push in exchange rate volatility, which in the long run could increase buying and selling behaviour. Exchange rate volatility is further strengthened by the phenomenon of overshooting conditions, and this confirms that the occurrence of the exchange rate can depreciate or appreciate over time. This shows that when exchange rate volatility occurs it can cause uncertainty due to changes in currency price fluctuations over time which have an impact on foreign trade [18-21].

On the other hand, the COVID-19 pandemic has increased the level of uncertainty in the foreign exchange market leading to fluctuations in exchange rates [22]. The volatility of the exchange rate influences many macroeconomic variables in many countries. The economic lockdown during the peak of the COVID-19 pandemic has resulted in low demand and depreciation of the currency, especially in export-dependent countries.

Most studies report that the volatility of the rupiah exchange rate against other currencies has a negative impact on Indonesian exports. One reason for the negative relationship between exchange rate volatility and trade flows is that real exchange rate volatility can affect exports directly through uncertainty and adjustment costs for risk-averse export investors [23, 24]. Many previous studies have assumed that the impact of exchange rate volatility on trade flows is symmetrical, where if there is an increase in volatility it will reduce trade, and when there is a decrease in volatility it can increase trade by the same proportion [25]. Other studies state that appreciation and depreciation can affect trade flows asymmetrically [20, 25]. Based on the research conducted by Bahmani-Oskooee and Kanitpong [19], when using the NARDL method to analyze the asymmetry of the effect, it was found that the volatility of the exchange rate was greater in the exports of a country's industry or commodity.

As exchange rate volatility cannot be observed directly, this study aims to provide additional contributions to the existing literature on the effect of exchange rate volatility and COVID-19 on Indonesia-US bilateral trade in the top 30 commodities based on HS-2 digits. A study of this nature has not been conducted in this case Indonesia. This represents a gap in the literature to be filled by this study. However, this study will further compare the symmetric and asymmetric effects of exchange rate volatility on bilateral trade between Indonesia and the United States.

To this end the remaining sections of this study are provided in the following headings; Therefore, Section Two presents the literature review, Section Three discusses the data and methodology, Section Four presents the results and analysis, and lastly, Section Five concludes the study and provides

policy recommendations.

2. REVIEW OF RELATED LITERATURE

Many empirical studies with diverse theoretical models have been conducted on the nexus between exchange rate volatility and foreign trade. For instance, projected that without hedging instruments in the market system [9], the volatility of the exchange rate may reduce exports due to a firm's anticipation resulting from exchange rate fluctuations. His tested theoretical model was based on the assumption of a single export market, a single traded commodity, perfect competition, and payment made in terms of foreign currency. In this model, this exists no alternative factor inputs to account for higher input costs and alternative market conditions. This has resulted in exporting firms predicting the volatility of exchange rates to sustain their profit and avoid risk-taking. Clark [9] assumptions have been relaxed by Viaene and De Vries [26]. This has resulted in a possible hedging scenario where with different levels of exchange, trade occurs between different countries [27], in which traded goods allow for substitution and lower input costs [9] and where the prevailing market condition allows for the reallocation of exports [28]. There is a possible harmful effect on trade due to exchange rate volatility which may have prevailed by relaxing these assumptions. This may result in an increased cost, lower profits, and reduced exposure to risk for exporting. There exists reduced uncertainty due to hedging instruments, which again increase trade costs and reduce profits [29]. Apart from firms' reliance on risk distaste behaviour, at different levels exports and output may change considerably [30]. Therefore, from a theoretical background, depending on traders' behaviour substantial exchange rate volatility may result in uncertainty which negatively affects exports [31]. More importantly, the readiness of instruments and variation in traders' risk behaviour implies that the influence of the exchange rate volatility could be positive (+) or negative (-) and this indicates there is mixed evidence from a different model [32].

Therefore, from an empirical background, different studies have provided mixed findings about the influence of exchange rate volatility on trade flows. Studies concluded that there is a negative nexus between exchange rate volatility and trade flows [19, 33, 34]. Meanwhile, several other studies have found a positive nexus between exchange rate volatility and trade flow [7, 20, 35-37]. Many previous studies have assumed that the impact of exchange rate volatility on trade flow is symmetrical, where if there is an increase in volatility it will reduce trade, and when there is a decrease in volatility it can increase trade by the same proportion [25]. In the case of Nigeria, Umaru et al. [38] used GARCH, ordinary least square, and Granger causality and reported a negative influence of exchange rate volatility on exports. Similarly, Serenis and Tsounis [39] observed the negative influence of exchange rate volatility on exports in Croatia and Cyprus. The same adverse effects on exports are found in the case of emerging Asian economies for instance, in the case of Korean bilateral trade [40], in the case of East Asian emerging economies' trade with developed countries [12], in the case of ASEAN-US trade flows [41], in the case of East Asian economies [34], in the case of Pakistan [1], in the case of China-Japan trade flows [16]. In the developing economies [42, 43] observed a negative influence of exchange rate volatility on exports. Some

empirical literature provides evidence of the positive influence of the volatility of the exchange rate. These studies include among others; in the case of Germany-US trade [32], in the case of Australian exports to the Asian trading partners [15]. However, some mixed findings were reported by Bahmani-Oskooee et al. [44] in the case of US and Brazil trade flows, and in the case of Malaysian exports to the US [25].

A positive change in exchange rate volatility can have both positive and negative effects on trade. When a positive change in the volatility of the exchange rate positively affects foreign trade there will be an increase in potential profits from trade and an increase in trading activities [45]. However, when the effect of positive change in volatility negatively affects trade there will be a decrease in trading activities to minimize losses due to risk-averse behaviour [46] and this signifies that trading activities are elastic to real exchange rate volatility [47]. This also reaffirms that the country's dependence on goods from partner countries has not yet been substituted in the domestic market [48]. Stavarek [49] observed an asymmetric effect of exchange rate volatility on trade in Slovakia, Croatia, and Turkey. An asymmetric effect of exchange rate volatility can occur depending on the response of exporters to volatility [25].

Sharma and Pal [50] used the GARCH, EGARCH, and TGARCH and examine the effect of exchange rate volatility on India's cross-border commodity trade with China, Japan, Germany, and the United States. Their empirical strategy indicates that in the long-run exchange rate volatility has an asymmetric impact on India's export and import to and from these countries. While in the short run, there is no evidence of an asymmetric effect on trade.

Studies that specifically focus on the impact of the volatility of the rupiah exchange rate on Indonesia's exports and imports [36, 51-56]. A study by Zainal [56] used monthly data from 1997:M07-2002:M08 and concluded that exchange rate volatility does not affect Indonesian exports. Other studies [53, 55] found a negative and significant impact of exchange rate fluctuations on Indonesian trade. Bahmani-Oskooee et al. [51] showed that in the short-term 66% of the Indonesia-US trade is influenced by movements in the real exchange rate.

To our best knowledge, none of the existing empirical studies had analysed the influence of exchange rate volatility on Indonesia-US bilateral commodity trade by specifically taking into cognizance the effect of COVID-19 on trade flow. Therefore, this study is novel empirical work that considers the effect of not only exchange rate volatility but also of the COVID-19 pandemic.

3. DATA AND METHODS

This study uses a quantitative approach with monthly time-series data for the period 2010:M01-2021:M01. The study analyzes the effect of exchange rate volatility on Indonesia-US bilateral trade for 30 commodities traded over the study period. The data analyzed were Indonesia's export and import to and from the US, real exchange rate, industrial production index (IPI), exchange rate volatility, and the dummy variable for the COVID-19 pandemic. However, the study used the GARCH (Generalized Auto Regressive Conditional Heteroscedastic) approach to estimate the volatility of the exchange rate. The linear autoregressive distributive lag (ARDL) model and nonlinear ARDL were also applied to estimate the short-run and long-run symmetric and asymmetric influence of exchange rate volatility on bilateral trade flow

between the sample countries.

Based on study of Gujarati [57], we used the following GARCH specification to estimate the volatility of the exchange rate.

$$\sigma_t^2 = \gamma_0 + \gamma_1 u_{t-1}^2 + \rho_1 \omega_{t-1}^2 \quad (1)$$

where, σ_t^2 is the conditional variance, γ_0 is the constant term, γ_1 is the ARCH parameter, ω_t is the GARCH parameter, u_{t-1}^2 is the lag ARCH, and ω_{t-1}^2 is the lag GARCH.

Following Bahmani-Oskooee et al. [51] in this study, we used the export function which expressed exports as a function of IPI of trading partner countries, real exchange rates, and exchange rate volatility. Therefore, the following export and import symmetric models will be estimated using the ARDL approach.

$$\ln EX_t^i = a + b \ln RER_t + c \ln IPI_{US,t} + d \ln VOL_t + e \text{COVIDdum} + \varepsilon_t \quad (2)$$

$$\ln IM_t^i = f + g \ln RER_t + h \ln IPI_{ID,t} + i \ln VOL_t + j \text{COVIDdum} + \varepsilon_t \quad (3)$$

where, EX is the commodity export, IM is the commodity import, RER is the real exchange rate, IPI is the industrial production index, VOL is the volatility of exchange rate, COVIDdum is the COVID-19 pandemic dummy, and ε_t is the error term. While a , f , c , h , d , i , e , and j are the long-run parameters to be estimated. All the variables except the COVID-19 dummy were converted to natural logarithms in order to interpret the coefficient as elasticities. Models (2) and (3) are the long-run export and import functions. Therefore, an error correction model (ECM) is needed to determine the short-run effect. This is because by using the ECM model, we can distinguish short-term effects from long-term effects as follows:

$$\begin{aligned} \Delta \ln EX_t^i &= \alpha_0 + \sum_{k=1}^{n1} \alpha_1 \Delta \ln EX_{t-k} + \sum_{k=0}^{n2} \alpha_2 \Delta \ln RER_{t-k} \\ &+ \sum_{k=0}^{n3} \alpha_3 \Delta \ln IPI_{t-k} + \sum_{k=0}^{n4} \alpha_4 \Delta \ln VOL_{t-k} + \\ &\sum_{k=0}^{n5} \alpha_5 \Delta \text{COVIDdum}_{t-k} + \beta_0 \ln EX_{t-1} + \beta_1 \ln RER_{t-1} \\ &+ \beta_2 \ln IPI_{t-1} + \beta_3 \ln VOL_{t-1} + \beta_4 \text{COVIDdum} + \varepsilon_t \end{aligned} \quad (4)$$

$$\begin{aligned} \Delta \ln IM_t^i &= \delta_0 + \sum_{k=1}^{n1} \delta_1 \Delta \ln IM_{t-k} + \sum_{k=0}^{n2} \delta_2 \Delta \ln RER_{t-k} \\ &+ \sum_{k=0}^{n3} \delta_3 \Delta \ln IPI_{t-k} + \sum_{k=0}^{n4} \delta_4 \Delta \ln VOL_{t-k} \\ &+ \sum_{k=0}^{n5} \delta_5 \Delta \text{COVIDdum}_{t-k} + \gamma_0 \ln IM_{t-1} \\ &+ \gamma_1 \ln RER_{t-1} + \gamma_2 \ln IPI_{t-1} + \gamma_3 \ln VOL_{t-1} \\ &+ \gamma_4 \text{COVIDdum}_{t-k} + \varepsilon_t \end{aligned} \quad (5)$$

where, the variables EX , IM , RER , IPI , VOL , COVIDdum , and ε_t are as defined in Models (2) and (3) and

$\alpha_0, \alpha_1, \alpha_2, \alpha_3, \alpha_4$, and α_5 are short-run export parameters to be estimated. $\beta_0, \beta_2, \beta_3$, and β_4 are the long-run export parameters to be estimated. $\delta_0, \delta_1, \delta_2, \delta_3, \delta_4$, and δ_5 are the short-run import parameters to be estimated. $\gamma_0, \gamma_1, \gamma_2, \gamma_3$, and γ_4 are long-run import parameters to be estimated. The Δ denote change in a given variable. All the variables except the COVID-19 dummy were converted to natural logarithms in order to the coefficient as elasticities. In this study, the volatility variable has been broken down into two to reflect the positive (VOL^{POS}) and negative (VOL^{NEG}) change in the volatility. This is expressed in Eqs. (6) and (7) as follows:

$$VOL^{POS} : \sum_{k=1}^t \Delta \ln Vol_k^{POS} = \sum_{k=1}^t \max(\Delta \ln Vol_j, 0) \quad (6)$$

$$VOL^{NEG} : \sum_{k=1}^t \Delta \ln Vol_k^{NEG} = \sum_{k=1}^t \min(\Delta \ln Vol_j, 0) \quad (7)$$

where, VOL^{POS} is the positive change in exchange rate volatility, VOL^{NEG} is the negative change in volatility of the exchange rate, and Δ denotes a change in a given variable. Therefore, to estimate the asymmetric effect using the NARDL model the volatility in Eqs. (4) and (5) are replaced with the positive (VOL^{POS}) and negative (VOL^{NEG}) volatility as expressed in Models (8) and (9).

$$\begin{aligned} \Delta \ln EX_t^i &= \alpha_0 + \sum_{k=1}^{n1} \alpha_1 \Delta \ln EX_{t-k} + \\ &\sum_{k=1}^{n2} \alpha_2 \Delta \ln RER_{t-k} + \sum_{k=1}^{n3} \alpha_3 \Delta \ln IPI_{US,t-k} \\ &+ \sum_{k=1}^{n4} \alpha_4 \Delta \ln Vol_{t-k}^{POS} + \sum_{k=1}^{n5} \alpha_5 \Delta \ln Vol_{t-k}^{NEG} \\ &+ \sum_{k=1}^{n6} \alpha_6 \Delta COVIDdum_{t-k} + \delta \ln EX_{t-1} + \\ &\gamma_1 \ln RER_{t-1} + \gamma_2 \ln IPI_{t-1} + \gamma_3 \ln \ln Vol_{t-1}^{POS} \\ &+ \gamma_4 \ln \ln Vol_{t-1}^{NEG} + \gamma_5 COVIDdum_{t-1} + \varepsilon_t \end{aligned} \quad (8)$$

$$\begin{aligned} \Delta \ln IM_t^i &= \delta_0 + \sum_{k=1}^{n1} \delta_1 \Delta \ln IM_{t-k} + \\ &\sum_{k=1}^{n2} \delta_2 \Delta \ln RER_{t-k} + \sum_{k=1}^{n3} \delta_3 \Delta \ln IPI_{ID,t-k} \\ &+ \sum_{k=1}^{n4} \delta_4 \Delta \ln Vol_{t-k}^{POS} + \sum_{k=1}^{n5} \delta_5 \Delta \ln Vol_{t-k}^{NEG} \\ &+ \sum_{k=1}^{n6} \delta_6 \Delta COVIDdum_{t-k} + \beta_0 \ln IM_{t-1} \\ &+ \beta_1 \ln RER_{t-1} + \beta_2 \ln IPI_{t-1} + \beta_3 \ln \ln Vol_{t-1}^{POS} \\ &+ \beta_4 \ln \ln Vol_{t-1}^{NEG} + \beta_5 COVIDdum_{t-1} + \varepsilon_t \end{aligned} \quad (9)$$

where, EX_t^i and IM_t^i are the export and import of Indonesia of commodity i to and from the US at period t , EX_{t-k} and IM_{t-k} are the export and import lag-dependent variables introduced to capture the dynamic adjustment process of the model. RER_{t-k} is the real exchange rate at period $t-k$, $IPI_{US,t-k}$

and $IPI_{ID,t-k}$ are the US and Indonesia indices of industrial production at period $t-k$, and $\ln Vol_{t-k}^{NEG}$ are the positive and negative changes in volatility at period $t-k$, $COVIDdum_{t-k}$ is COVID-19 pandemic dummy at period $t-k$ with the value of 1 = during COVID-19 and 0 = otherwise, $\alpha_0, \beta_0, \delta_0$, and γ_0 are the constant terms, ε_t is the error term, and $\alpha_s, \beta_s, \delta_s$, and γ_s are the parameters to be estimated. Except for the COVID-19 dummy, all the variables were transformed into natural logarithms.

In this study, exports and imports were measured based on the value of Indonesia's commodity shipments to and from the US. The real exchange rate is a measure based on the ratio of the product's nominal exchange rate and domestic consumer price index to the US price index. The IPI is measured by the changes in the volume of goods and services produced from time to time. The volatility of exchange is derived from the exchange rate data using the GARCH modelling approach. COVID-19 is measured using a dummy variable with a value of 1 indicating during the COVID-19 pandemic and 0 otherwise. Export and import data are sourced from the trade map of the International Trade Centre while data for real exchange rate and IPI are sourced from the International Financial Statistics (IFS). COVID-19 data is sourced from the World Health Organization (WTO).

4. RESULTS AND DISCUSSION

Table 1 presents the short-run ARDL estimate for the effect of exchange rate volatility on Indonesia-US bilateral commodity trade. The empirical findings from the ARDL estimate report positive and negative effects of exchange rate volatility on a different product category of Indonesia-US bilateral trade flows. At different lags, commodity exports to the US such as; HS09, HS15, HS20, HS39, HS40, HS61, HS62, HS67, and HS85 are positively affected by the volatility of the exchange. A negative effect of the volatility of exchange on exports to the US is observed in four (4) commodities which are HS17, HS71, HS84, and HS94. A negative effect of volatility on exports is consistent with the theory that risk increases with exchange rate volatility and this makes exporters or traders avert risk by reducing exports [58]. The individual nature of exporters who tend to avoid risk (risk averse) can cause exports to decline [36, 42, 55, 59]. Our findings from the short-term ARDL estimate indicate that the COVID-19 pandemic increases Indonesia's exports to the US in commodities HS09 and HS62 and reduces the exports of HS17, HS32, HS33, HS44, HS71, and HS99. Therefore, of all the analysed commodities exported over the study period, the COVID-19 pandemic has resulted in a decrease in exports more than an increase in exports.

Similarly using ARDL, at different lags findings revealed both positive and negative effects of exchange rate volatility on Indonesia's imports from the US. Volatility asserts a positive effect on the imports of HS44, HS48, HS64, HS87, HS88, and HS99 commodities while a negative effect exists in two (2) commodities HS04 and HS33. The COVID-19 pandemic increases Indonesia's import from the US in commodity HS03 and asserts both positive and negative effects on HS02 and HS23 commodities at different lags. A negative effect of COVID-19 pandemic on import from US occur in HS29, HS29, HS30, HS47, HS64, HS84, and HS87.

Table 1. Short-term ARDL estimate

HS Code	$\ln Vol_t$	$\ln Vol_{t-1}$	$\ln Vol_{t-2}$	$\ln Vol_{t-3}$	$Dummy_t$	$Dummy_{t-1}$	$Dummy_{t-2}$	$Dummy_{t-3}$
Indonesia's exports to the US								
EXP09	0.032	0.03*	0.01	0.03**	-0.03	-0.39	0.27**	-
EXP15	0.02	-0.05	0.09*	0.31***	-	-	-	-
EXP16	-0.00	-	-	-	-	-	-	-
EXP17	-0.05***	-	-	-	0.05	-0.62***	-0.44*	-
EXP18	-	-	-	-	-	-	-	-
EXP20	0.03	0.00	-0.01	0.06***	-0.11	-	-	-
EXP27	0.06	0.07	-	-	-	-	-	-
EXP29	-	-	-	-	-	-	-	-
EXP32	0.03	0.04	-	-	-0.40	-0.99**	-	-
EXP33	-	-	-	-	0.12	-0.09	-0.91***	-
EXP38	-	-	-	-	-	-	-	-
EXP39	0.03**	-	-	-	-	-	-	-
EXP40	-0.01	0.03*	0.03**	-	-	-	-	-
EXP42	0.02	-	-	-	-	-	-	-
EXP44	-	-	-	-	0.20	-0.69***	-	-
EXP48	-0.00	-	-	-	-	-	-	-
EXP61	0.05***	0.02*	-0.00	0.02*	-	-	-	-
EXP62	0.01	0.02	0.01	0.04***	0.18	0.87***	0.43**	-
EXP63	-	-	-	-	-	-	-	-
EXP64	0.00	-	-	-	-	-	-	-
EXP67	-0.00	0.04***	0.02*	0.03**	0.08	-	-	-
EXP71	-0.01	-0.05**	-	-	0.25	-0.29	-0.58*	-2.50***
EXP76	-	-	-	-	-	-	-	-
EXP84	0.01	-0.02**	-0.02**	-	-	-	-	-
EXP85	0.03***	-	-	-	-	-	-	-
EXP87	0.01	-	-	-	-	-	-	-
EXP90	-	-	-	-	-	-	-	-
EXP94	0.01	-0.02*	-0.02*	-	-	-	-	-
EXP95	0.01	-	-	-	-	-	-	-
EXP99	-	-	-	-	0.34	-0.53	-0.93**	-
Indonesia's imports from the US								
IMP02	-	-	-	-	-0.62	-2.64***	1.30*	-
IMP03	-	-	-	-	1.92***	1.59**	1.47**	-
IMP04	0.04	-0.06*	-0.1***	-	-	-	-	-
IMP08	-	-	-	-	-	-	-	-
IMP10	-	-	-	-	-	-	-	-
IMP20	-	-	-	-	0.51	-	-	-
IMP21	-	-	-	-	-	-	-	-
IMP23	-0.00	-	-	-	0.32**	-0.48***	-0.40***	-
IMP24	-	-	-	-	-	-	-	-
IMP27	-	-	-	-	-	-	-	-
IMP28	-	-	-	-	-	-	-	-
IMP29	0.02	-	-	-	-0.83**	-1.6***	-	-
IMP30	-0.01	-	-	-	-0.27	0.35	-0.78**	-
IMP33	-0.01	-0.02	-0.02	-0.05**	-	-	-	-
IMP34	-	-	-	-	-	-	-	-
IMP35	-	-	-	-	0.46	-	-	-
IMP44	0.03*	-	-	-	-	-	-	-
IMP47	-	-	-	-	-0.30	-0.97***	-0.88***	-0.83***
IMP48	0.00	0.05**	0.04*	0.05**	0.31	-	-	-
IMP52	-	-	-	-	0.08*	-1.29	-	-
IMP55	-	-	-	-	-	-	-	-
IMP64	0.00	0.06**	-	-	0.21	-1.22***	-	-
IMP72	-0.10	-	-	-	-	-	-	-
IMP73	0.04	-	-	-	-	-	-	-
IMP76	-	-	-	-	-	-	-	-
IMP84	-	-	-	-	0.02	-0.73***	-	-
IMP87	0.15***	0.11***	-0.00	0.11**	-1.05**	-	-	-
IMP88	0.01	0.21***	0.11	-	-	-	-	-
IMP90	-0.00	0.02	-	-	-	-	-	-
IMP99	0.04**	-	-	-	-	-	-	-

Source: Authors' processed data.

Note: (***) significant at less than 1%, (**) significant at less than 5%; (*) significant at less than 10%.

In Table 2 the long-term ARDL estimate indicates that, of the thirty analyzed commodities, the exchange rate asserts a positive and significant impact on ten (10) commodity exports

to the US (HS15, HS16, HS17, HS32, HS38, HS44, HS62, HS64, HS67, and HS87). This finding is supported by studies who report that the exchange rate had a positive and significant

effect on net exports, bilateral trade balance, and price of domestic goods [36, 37, 60]. The finding also indicates that using the ARLD method there exists a negative and significant effect of exchange rate on two (2) commodity exports (HS40 and HS84). This finding has been supported by scholars who revealed that exchange rate a rise in exchange rate causes a decline in exports in the case of Turkey, Taiwan, and BRICS countries [23, 61, 62].

The ARDL long-term estimation strategy indicates that the IPI asserts a significant and positive impact on exports of nine (9) commodities, which are HS16, HS17, HS33, HS44, HS84, HS90, HS94, HS95, and HS99. This indicates that an improvement in economic activities in the United States will tend to increase Indonesia's exports to the US. This is because higher income levels in export destination countries can also encourage greater exports [54]. The negative influence of the IPI on exports in the ARDL method is only found in four (4) commodities, namely HS27, HS39, HS62, and HS63. This influence of IPI on exports which causes a decline in export commodities can occur when there is competition for domestic products in the international market which can then reduce export demand [50]. In the long run, the volatility of the exchange rate positively affects Indonesia's exports to the US in HS18 and HS33 commodities while a negative effect of volatility is observed in commodity exports of HS15, HS17, HS20, HS38, and HS67. The long-run positive effect of the COVID-19 pandemic is observed in eleven (11) commodities which are HS16, HS17, HS20, HS44, HS71, HS84, HS85, HS87, HS94, HS95, HS99 while the negative effect is reported

to have occurred on HS09, HS27, HS32, HS61, HS62.

In the case of Indonesia's import from the US, our ARDL empirical strategy indicates that in the long run, the real exchange rate has a significant positive effect on five (5) commodity imports (HS03, HS24, HS30, HS48, and HS88). This finding is consistent with the study by Hwang and Lee [63] which reports that the exchange rate increases UK exports. In the case of the ARDL model, a significant negative effect of the exchange rate on imports is observed in commodities HS04, HS08, HS29, HS72, and HS84. This finding has been supported by studies [33, 43, 64] in the case of Korean and OIC imports.

From the ARDL estimate a significant positive influence of IPI on import exists in nine (9) commodities HS20, HS27, HS28, HS33, HS44, HS47, HS64, HS73, and HS76 and a negative influence exists in five (5) commodities HS03, HS24, HS34, HS48, and HS88. Meanwhile, the volatility of the exchange rate positively affects HS02, HS08, HS47, and HS55, commodity imports and negatively affects HS21, HS24, and HS30 commodity imports. The positive effect of COVID-19 pandemic on Indonesia's import from US is observed in HS02, HS08, HS24, HS28, HS30, HS33, HS34, HS48, HS72, and HS84 commodities. This is consistent with the study of Hayakawa and Mukunoki [65]. While the negative effect of the pandemic on imports is in HS04, HS21, HS29, HS35, HS47, HS52, and HS90. The increase in imports resulting from COVID-19 is dominated by medical products such as vitamins, masks, and vaccines.

Table 2. Long-term ARDL estimate

HS Code	C	lnRER	lnIPI_US	lnVol	COVID _{dum}
Indonesia's exports to the US					
EXP_09	7.34***	0.02	-0.66	-0.06	-0.22*
EXP_15	-22.44**	6.58***	0.62	-0.51**	0.23
EXP_16	-8.33***	1.96***	2.65**	-0.03	0.47***
EXP_17	-24.80***	2.22***	3.65***	-0.15***	0.50***
EXP_18	-2.80	1.13	1.46	0.15**	-0.31
EXP_20	0.02	0.34	1.07	-0.12**	0.52***
EXP_27	26.95**	6.42	-24.35***	-0.19	-2.38***
EXP_29	0.42	-0.50	2.84	0.05	0.40
EXP_32	-25.36***	6.09***	0.30	-0.10	-0.79**
EXP_33	-3.65	0.41	1.89*	0.06*	0.17
EXP_38	-13.25**	3.84***	1.08	-0.19*	0.24
EXP_39	12.50***	-0.21	-2.66**	0.01	0.12
EXP_40	14.52***	-1.36***	-1.74	-0.07	-0.12
EXP_42	-6.13**	1.74	8.21	-0.02	0.23
EXP_44	-9.00***	1.60***	2.81*	-0.04	0.59***
EXP_48	0.74	-0.22	2.27	0.07	0.02
EXP_61	13.72051 ***	-0.38164	-1.24395	-0.02	-0.30***
EXP_62	15.93***	0.43**	-1.15**	-0.03	-0.50***
EXP_63	13.48***	-0.20	-8.43**	0.17	-0.03
EXP_64	-6.25**	2.09***	1.71	-0.06	-0.03
EXP_67	-1.56	2.01***	-1.59	-0.16***	-0.27
EXP_71	-5.80	1.64	2.41	-0.04	1.67***
EXP_76	-0.28	-2.07	6.51	0.01	0.05
EXP_84	-1.29	-1.83***	6.90***	0.09	0.80***
EXP_85	10.47***	-0.29	-1.59	0.02	0.35***
EXP_87	-9.40***	3.58***	3.08	-0.11	0.71**
EXP_90	0.04	-1.03	4.28**	0.06	0.04
EXP_94	-3.74**	0.50	3.15***	-1.05E-05	0.71***
EXP_95	-7.38**	0.33	3.69***	-0.04	0.54***
EXP_99	-9.59*	0.47	3.57*	0.05	0.65***
Indonesia's imports from the US					
IMP_02		3.00	-2.70	5.90**	0.69**
IMP_03	-13.47	3.46**	-2.07**	-0.14	0.83
IMP_04	16.49***	-3.16*	1.65	0.16	-1.24***

<i>IMP_08</i>	36.87***	-1.99**	0.01	0.11*	0.65*
<i>IMP_10</i>	21.09	-3.93	3.25	0.29	-0.16
<i>IMP_20</i>	9.86*	-0.62	1.23***	0.04	0.72
<i>IMP_21</i>	2.85	-0.69	1.96	-0.02**	-0.44***
<i>IMP_23</i>	3.44	-0.72	1.15	-0.07	0.19
<i>IMP_24</i>	-17.89*	4.75***	-3.03**	-0.20***	0.45**
<i>IMP_27</i>	1.62	-4.75	10.09**	-0.02	-0.28
<i>IMP_28</i>	8.23	-0.52	1.55***	-0.01	3.26***
<i>IMP_29</i>	32.43***	-4.00***	0.99	0.09	-0.31**
<i>IMP_30</i>	-17.04***	2.10***	0.77	-0.11**	0.93***
<i>IMP_33</i>	1.70	-0.49	1.92***	-0.06	0.50***
<i>IMP_34</i>	6.70	-0.08	-3.22**	-0.11	0.58***
<i>IMP_35</i>	3.90	-0.59	1.33	0.04	-1.06***
<i>IMP_44</i>	10.59***	-0.58	0.46*	-0.01	-0.05
<i>IMP_47</i>	-0.69	-0.33	3.25***	0.17***	-0.32***
<i>IMP_48</i>	-2.32	2.71***	-3.08***	-0.07	0.45**
<i>IMP_52</i>	3.87	-0.93	2.03	-0.06	-0.72***
<i>IMP_55</i>	14.27***	-4.32	1.62	0.31**	-0.29
<i>IMP_64</i>	-9.96*	2.27	2.52*	-0.06	-0.02
<i>IMP_72</i>	30.26*	-15.06*	6.07	0.60	0.67**
<i>IMP_73</i>	11.58*	-3.80	2.81*	-0.12	-0.27
<i>IMP_76</i>	-0.55	-0.89	3.90**	0.04	-0.32
<i>IMP_84</i>	22.15***	-2.52***	0.72	0.05	1.05**
<i>IMP_87</i>	6.58	0.06	-1.75	-0.05	0.08
<i>IMP_88</i>	2.33	4.65*	-7.45***	-0.06	-0.15
<i>IMP_90</i>	-0.73	0.88	0.45	-0.06	-1.69***
<i>IMP_99</i>	7.70**	-1.04	0.85	0.02	0.18

Source: Authors' processed data.

Note: (***) significant at less than 1%, (**) significant at less than 5%; (*) significant at less than 10%.

Table 3 shows the short-run NARDL estimate. In the short-run, our estimate using the NARDL approach indicates that positive change in volatility asserts an increasing impact on Indonesia's exports to the US in commodities such as; HS15, HS27, HS39, HS61, HS67, HS85, HS94, and HS95. At different lags, the positive and negative impact of the increase in volatility on exports has been observed in commodities HS20, HS64, and HS71. The positive change in volatility reduces exports to the US from Indonesia in commodities HS09, HS29, HS62, HS76, and HS99. The negative change in volatility has been found to positively affect HS15, HS42, HS64, HS67, and HS87. A negative effect of a decrease in volatility on exports has been observed in commodities such as HS71, HS94, and HS95. Additionally, a decrease in volatility asserts both positive and negative effects on exports at different lags in commodity HS48. The increase in volatility positively affects exports because when there is an increase in exchange rate volatility, there will be an increase in potential profits from foreign trade, which makes production more profitable which in turn will increase exports [45]. The increase in volatility negatively affects exports because exports become less expensive and less competitive which could result in decreased exports. Additionally, the increase in

exchange rate volatility will also pose a risk so traders with risk-averse behaviour will reduce exports to minimize losses [46].

The imports of commodities HS28, HS55, HS64, HS84, HS88, and HS99 from the US are positively affected by the positive change in the volatility of the exchange rate. While commodities HS47, HS72, and HS76 are negatively affected by an increase in volatility. Meanwhile, at different lags commodities HS29 and HS90 are positively and negatively affected by the increase in volatility. The negative change in volatility asserts a positive impact on HS44 and HS48 commodity imports and a negative impact on HS04 commodity imports. Additionally, at different lags, the decrease in volatility asserts both positive and negative impacts on HS21 and HS88 commodities imports.

From the short-run estimate, it is observed that the positive and negative changes in volatility produce different coefficients that differ in sign, size, and duration. Based on the different estimates at different time lags an adjustment of asymmetric effect is demonstrated in commodities such as HS09, HS15, HS20, HS61, HS64, HS71, and HS95 and this is consistent with the study of Shin et al. [66].

Table 3. Short-term NARDL estimate

HS Code	$\ln Vol_t^{POS}$	$\ln Vol_{t-1}^{POS}$	$\ln Vol_{t-2}^{POS}$	$\ln Vol_{t-3}^{POS}$	$\ln Vol_t^{NEG}$	$\ln Vol_{t-1}^{NEG}$	$\ln Vol_{t-2}^{NEG}$	$\ln Vol_{t-3}^{NEG}$
Indonesia's exports to the US								
<i>EXP09</i>	-0.00	-0.01	-0.1***	-	0.04	-	-	-
<i>EXP15</i>	-0.03	-0.15	0.32***	-	0.05	-0.01	-0.01	0.44***
<i>EXP16</i>	-	-	-	-	0.01	-	-	-
<i>EXP17</i>	-	-	-	-	-0.01	-	-	-
<i>EXP18</i>	-	-	-	-	-	-	-	-
<i>EXP20</i>	0.06	0.07*	-0.07*	0.12***	0.05	-	-	-
<i>EXP27</i>	0.09	0.29**	-0.09	-	-	-	-	-
<i>EXP29</i>	0.06	-0.07**	-0.13***	-	-	-	-	-
<i>EXP32</i>	-	-	-	-	0.02	-	-	-
<i>EXP33</i>	-	-	-	-	-	-	-	-

EXP38	-	-	-	-	-	-	-	-
EXP39	0.09***	-	-	-	-	-	-	-
EXP40	-	-	-	-	-	-	-	-
EXP42	0.00	-	-	-	0.05**	-	-	-
EXP44	-	-	-	-	-	-	-	-
EXP48	-	-	-	-	-0.05*	-0.09***	-0.01	0.03*
EXP61	0.03	0.04*	-	-	0.01	-	-	-
EXP62	0.02	-0.03	-0.1***	-	-	-	-	-
EXP63	0.06*	-	-	-	-	-	-	-
EXP64	-0.07**	-0.05	0.05	0.13***	0.05*	-	-	-
EXP67	-0.02	0.08***	0.03	0.12***	0.07***	0.09**	0.05***	0.03**
EXP71	0.11*	-0.08	0.004	-0.27***	-0.08**	-	-	-
EXP76	-0.05	-0.17***	-0.11*	-	-	-	-	-
EXP84	-	-	-	-	-	-	-	-
EXP85	0.09***	0.05**	-	-	-	-	-	-
EXP87	-	-	-	-	0.04**	-	-	-
EXP90	-	-	-	-	-	-	-	-
EXP94	0.06**	0.05**	-	-	-0.01	-0.02*	-	-
EXP95	0.18***	0.06*	-	-	-0.11*	-	-	-
EXP99	-0.93**	-	-	-	-	-	-	-
Indonesia's imports from the US								
IMP02	-	-	-	-	0.13	-	-	-
IMP03	-0.15	-	-	-	-0.06	0.03	0.08	-
IMP04	-	-	-	-	-0.05	-0.09***	-0.12***	-
IMP08	-	-	-	-	0.02	-	-	-
IMP10	-	-	-	-	-	-	-	-
IMP20	-	-	-	-	-0.01	-	-	-
IMP21	-	-	-	-	-0.1**	0.01	0.09***	-
IMP23	-	-	-	-	-0.00	-	-	-
IMP24	-	-	-	-	-	-	-	-
IMP27	-	-	-	-	-	-	-	-
IMP28	0.13**	-	-	-	-0.09*	-	-	-
IMP29	-0.16***	-0.07	0.16**	-	-	-	-	-
IMP30	-	-	-	-	0.02	-	-	-
IMP33	-	-	-	-	0.02	-	-	-
IMP34	-	-	-	-	-0.00	0.01	-	-
IMP35	-0.01	-0.08	-	-	-	-	-	-
IMP44	-	-	-	-	0.04**	-	-	-
IMP47	0.03	-0.01	-0.02	-0.14**	-	-	-	-
IMP48	-	-	-	-	0.07**	0.1***	0.04**	0.04**
IMP52	-0.17	-0.21	-	-	-	-	-	-
IMP55	0.07	0.08	0.3***	0.14**	-	-	-	-
IMP64	-0.01	0.07**	-	-	-	-	-	-
IMP72	-0.21	-0.09	-0.04	-0.68***	-0.18	-	-	-
IMP73	0.11	-	-	-	-	-	-	-
IMP76	-0.04	0.09	-0.15*	-0.17**	-	-	-	-
IMP84	0.12***	0.16***	-	-	-	-	-	-
IMP87	-	-	-	-	-	-	-	-
IMP88	0.27	0.22	0.12	0.4**	-0.07	0.48**	0.11	-0.16*
IMP90	0.02	0.10**	-0.04	-0.10**	-	-	-	-
IMP99	0.08**	-	-	-	-	-	-	-

Source: Authors' processed data.

Note: (***) significant at less than 1%, (**) significant at less than 5%; (*) significant at less than 10%.

Table 4 shows that, in the long run, while using the NARDL approach findings indicate that the exchange rate positively affects five (5) commodity exports (HS17, HS27, HS32, HS64, and HS67) of Indonesia-US bilateral trade. The NARDL estimate further reports that the exchange rate negatively affects six (6) commodity exports which include HS29, HS39, HS40, HS42, HS71, and HS84. The NARDL revealed that IPI positively affects Indonesia's exports to the US in commodities HS09, HS16, HS17, HS29, HS33, HS48, HS76, HS84, and HS90. A significant negative influence of IPI on exports is observed in 5 commodities HS27, HS39, HS63, HS67, and HS85.

In the long term, the positive change in volatility of the exchange rate positively affects HS48, HS71, and HS87 commodity exports and negatively affects HS17, HS27, HS29, HS61, and HS67 commodity exports. The positive effect of

decreasing exchange rate volatility on exports only occurred in HS48 and HS71. This is consistent with Chien et al. [62] who found that exports of twelve (12) industries increase with a decrease in exchange rate volatility because these industries are leading industries and are less likely to be affected by exchange rate fluctuations. The negative effect of decreasing volatility on exports is observed in commodities HS17, HS38, HS61, and HS67. The effect of the COVID-19 pandemic using NARDL appeared positive on commodity exports of HS09, HS17, HS84, and HS90 and negative on commodity exports of HS18, HS62, HS67, and HS87. The government's policy regarding restrictions is considered sufficient to accelerate the country's economic recovery which then results in increased export of leading commodities [67].

In the long run, the NARDL revealed that the exchange rates positively affect six commodity imports which include HS24,

HS30, HS34, HS48, HS84, and HS88. For the NARDL exchange rate negatively affect commodity imports HS02, HS04, HS08, HS20, HS27, HS29, and HS35. Meanwhile, the NARDL estimate finding revealed a significant positive influence of IPI on imports of HS21, HS28, HS47, and HS73 and a negative influence on four (3) commodities HS03, HS30, and HS48. The positive influence of IPI on imports is reflected by increased productivity in the US which could result in higher Indonesian imports from the US.

The increase in volatility of the exchange rate increases Indonesia's imports from the US in commodities such as HS02, HS04, HS08, HS10, HS20, HS27, HS35, and HS47 and decreases imports of commodities HS24, HS34, HS48, and HS88. Meanwhile a decrease in volatility increases HS02, HS08, HS20, HS27, HS35, and HS47 commodity imports and

reduces the imports of HS24, HS30, HS34, and HS48. The decrease in imports resulting from decreased volatility [33, 68]. The COVID-19 pandemic only turned out to have a significant negative influence on import activities. Based on the estimate COVID-19 has a significant positive effect on imports of six (6) commodities HS03, HS08, HS20, HS44, HS52, and HS64.

The significant negative influence that occurred on Indonesia-US bilateral trade in both ARDL and NARDL methods is caused by the lockdown policies implemented by the two countries which had an impact on the disruption of export-import activities between Indonesia and the US [69]. The implementation of the lockdown carried out by the government resulted in transportation and logistics restrictions that have contributed to the low supply chain and high relative costs [36].

Table 4. Long-term NARDL estimate

HS Code	C	lnRER	lnIPI_US	lnVOL ^{POS}	lnVOL ^{NEG}	COVIDdum
Indonesia's exports to the US						
EXP09	-7.96	1.08	3.82*	-0.07	-0.05	0.59*
EXP15	-10.81	2.56	1.40	-0.25	-0.30	-0.20
EXP16	-1.85	0.50	1.98**	0.02	-0.00	0.14
EXP17	-20.01***	1.65**	3.35***	-0.11***	-0.12***	0.39**
EXP18	13.97*	0.04	-3.61	0.06	0.03	-1.27***
EXP20	10.33*	-0.61	-0.67	-0.05	-0.06	0.11
EXP27	-2.98	12.19***	-21.21**	-0.56*	-0.47	-1.54
EXP29	6.28	-2.39**	3.93*	0.14*	0.12	0.36
EXP32	-28.53**	5.94***	2.85	-0.07	-0.07	-0.51
EXP33	-8.10	0.76	2.16**	0.05	0.05	0.27
EXP38	-13.62	3.93	1.11	-0.20	-0.20*	0.26
EXP39	21.25***	-1.62**	-3.24**	0.07	0.06	-0.20
EXP40	19.60***	-2.45***	-1.85	-0.02	-0.03	-0.39
EXP42	8.41	-4.54*	3.50	0.23	0.15	-0.76
EXP44	-3.35	0.66	2.10	0.00	-0.01	0.32
EXP48	-4.55	0.62	3.47**	0.16**	0.18***	0.14
EXP61	5.06	0.46	0.67	-0.05**	-0.04*	-0.02
EXP62	14.32***	0.27	-0.57	0.00	-0.00	-0.45***
EXP63	5.74	1.97	-6.02**	-0.02	0.01	0.42
EXP64	-6.12	1.76*	1.60	-0.10	-0.11	-0.12
EXP67	7.35*	1.21***	-2.26**	-0.13***	-0.14***	-0.50***
EXP71	23.63***	-4.45***	1.18	0.27**	0.20**	0.38
EXP76	-7.46	-2.02	13.00**	0.12	0.13	1.20
EXP84	3.31	-1.78*	3.91**	0.05	0.04	0.54**
EXP85	13.40***	-0.09	-3.13**	0.00	0.00	0.03
EXP87	10.56**	-0.94	-0.02	0.10***	0.04	-0.42**
EXP90	-9.35**	1.30	4.09***	-0.03	-0.01	0.39*
EXP94	7.35**	-0.60	1.04	0.02	0.01	0.19
EXP95	-5.75	0.87	1.82	-0.06	-0.06	0.11
EXP99	-6.46	0.42	2.85	0.01	0.00	0.59
Indonesia's imports from the US						
IMP02	38.27*	-8.94*	-0.45	0.90**	0.75**	-2.36
IMP03	11.38	2.64	-6.81**	-0.07	-0.15	-2.61***
IMP04	-2.61***	-3.84**	-1.39	0.22*	0.18	-0.83
IMP08	68.06***	-3.28***	-1.41	0.21***	0.18**	-0.95**
IMP10	54.20	-6.98	-0.78	0.44*	0.34	-0.97
IMP20	25.80**	-1.41**	0.79	0.11**	0.10**	-0.75***
IMP21	-1.99	-0.09	2.85*	-0.11	-0.09	0.59
IMP23	5.99	-1.36	0.64	-0.03	-0.04	0.20
IMP24	-31.23**	5.76***	-1.45	-0.25***	-0.21***	0.35
IMP27	11.90***	-15.50***	2.31	0.54***	0.33**	-0.34
IMP28	1.12	-0.38	2.45**	-0.06	-0.04	-0.12
IMP29	36.18***	-4.80**	-2.32	0.11	0.05	0.05
IMP30	3.68	1.57**	-2.22**	-0.05	-0.10**	-0.48
IMP33	7.08	-0.65	0.04	0.02	-0.00	0.03
IMP34	-5.46	2.45**	-1.01	-0.23***	-0.17**	0.00
IMP35	18.60***	-2.10**	-0.23	0.17**	0.13**	-0.39
IMP44	11.63***	-0.62	0.29	-0.01	-0.01	-0.35**
IMP47	-12.95	-0.58	2.75*	0.19***	0.18***	0.34

<i>IMP48</i>	-10.10*	2.66***	-1,21*	-0.08**	-0.06*	-0.02
<i>IMP52</i>	18.72**	-2.42	-1.29	0.13	0.05	-1.24*
<i>IMP55</i>	0.16	0.02	1,85	-0.05	0.01	0.21
<i>IMP64</i>	13.57*	-0.46	-2.88	0.07	-0.04	-1.51***
<i>IMP72</i>	31.73	-17.53	9.13	0.88	0.87	1.70
<i>IMP73</i>	13.38	-4.38	3.35*	-0.04	-0.03	-0.40
<i>IMP76</i>	6.21	-3.42	3.87	0.36	0.33	1.12
<i>IMP84</i>	19.05***	19.05**	0.64	0.02	0.03	0.05
<i>IMP87</i>	8.10	-1.73	1.63	0.07	0.10	0.47
<i>IMP88</i>	-48.73**	7.63***	-0.64	-0.30*	-0.16	0.60
<i>IMP90</i>	-6.85	1.61	1.08	-0.12	-0.10	0.43
<i>IMP99</i>	8.39*	-1.20	0.98	0.03	0.03	0.11

Source: Authors' processed data.

Note: (***) significant at less than 1%, (**) significant at less than 5%; (*) significant at less than 10%.

5. CONCLUSIONS

The present study investigates the influence of exchange rate volatility on food products commodity trade flows between Indonesia and the United States over the period. Our empirical strategy using the ARDL approach revealed that, in the short-run Indonesia-US bilateral food product trade is positively and negatively affected by the volatility of exchange rate. The exchange rate asserts an appositive influence on the exports of commodity codes HS09, HS15, HS20, HS39, HS40, HS61, HS62, HS67, and HS85. While a negative effect has been observed in the export of commodity codes export HS17, HS71, HS84, and HS94. The observed negative effect is aligned with the theory that exporters avert risk by reducing their exports. The crisis exacerbated due to COVID-19 increases food products export to the US of commodities HS09 and HS62 and reduces commodities HS17, HS32, HS33, HS44, HS71, and HS99. However, Imports of HS44, HS48, HS64, HS87, HS88, and HS99 commodities from the US have been positively affected by the exchange rate volatility while a negative effect of exchange rate volatility was found in commodities HS04 and HS33. Furthermore, commodities code HS29, HS29, HS30, HS47, HS64, HS84, and HS87 imports from the US have been affected negatively by the COVID-19 crisis in the short run using the ARDL approach. In the long run, the empirical strategy from the ARDL approach indicates that commodity codes (HS15, HS16, HS17, HS32, HS38, HS44, HS62, HS64, HS67, and HS87) export to the US were positively affected by exchange rate volatility. Our finding further indicates that there exists a negative and significant effect of exchange rate on two commodity codes export (HS40 and HS84). The IPI asserts a positive impact on exports of commodity codes HS16, HS17, HS33, HS44, HS84, HS90, HS94, HS95, and HS99. This implies that an improvement in the US's economic activities tends to increase Indonesia's exports to the US. The negative influence of the IPI on exports is observed in commodities HS27, HS39, HS62, and HS63. In the long-run the positive effect of COVID-19 pandemic is observed in commodities HS16, HS17, HS20, HS44, HS71, HS84, HS85, HS87, HS94, HS95, HS99 while the negative effect is reported to have occurred on HS09, HS27, HS32, HS61, HS62. On the import side, the long-run estimate indicates that the exchange rate positively affects commodity imports (HS03, HS24, HS30, HS48, and HS88). While a negative effect is observed in commodities HS04, HS08, HS29, HS72, and HS84. IPI positively influenced the imports of commodities HS20, HS27, HS28, HS33, HS44, HS47, HS64, HS73, and HS76 and negatively affect HS03, HS24, HS34, HS48, and HS88. The volatility of the exchange rate positively affects HS02, HS08,

HS47, and HS55, commodity imports and negatively affects HS21, HS24, and HS30 commodity imports. The positive effect of COVID-19 pandemic on Indonesia's import from US is observed in HS02, HS08, HS24, HS28, HS30, HS33, HS34, HS48, HS72, and HS84 commodities. While the negative effect of the pandemic on imports is in HS04, HS21, HS29, HS35, HS47, HS52, and HS90.

Based on the NARDL method we conclude that positive change in volatility asserts an increasing impact on Indonesia's exports of commodities HS15, HS27, HS39, HS61, HS67, HS85, HS94, and HS95. The positive and negative effects of an increase in volatility on exports have been observed in commodities HS20, HS64, and HS71. The positive change in volatility reduces exports to the US in commodities HS09, HS29, HS62, HS76, and HS99. The negative change in volatility asserts a positive effect on HS15, HS42, HS64, HS67, and HS87. A negative effect of negative change in volatility on exports is observed in commodities HS71, HS94, and HS95. This also asserts both positive and negative effects on exports at different lags in commodity HS48. The study found that the import commodity codes HS28, HS55, HS64, HS84, HS88, and HS99 were positively affected by the positive change in the volatility of the exchange rate. While commodities HS47, HS72, and HS76 were negatively affected by an increase in volatility. Additionally, at different lags commodities HS29 and HS90 were positively and negatively affected by the increase in volatility. The negative change in volatility increases the imports of commodity codes HS44 and HS48 and reduces the import of HS04 commodities. Additionally, at different lags, the decrease in volatility increases and reduces the imports of commodities HS21 and HS88. Findings also demonstrate the asymmetric exchange rate volatility in HS09, HS15, HS20, HS61, HS64, HS71, and HS95. In the long run, we observed that indicate that the exchange rate positively affects commodity codes (HS17, HS27, HS32, HS64, and HS67) exports. The finding further indicates that the exchange rate negatively affects commodity codes HS29, HS39, HS40, HS42, HS71, and HS84 exports. The IPI positively affects commodity codes HS09, HS16, HS17, HS29, HS33, HS48, HS76, HS84, and HS90 export. A significant negative effect of IPI on exports is observed in commodity codes HS27, HS39, HS63, HS67, and HS85. The positive change in volatility positively affects HS48, HS71, and HS87 commodity exports and negatively affects HS17, HS27, HS29, HS61, and HS67 commodity exports. Commodities HS48 and HS71 were positively affected by negative changes in exchange rates. Commodities HS17, HS38, HS61, and HS67 were negatively affected by the negative change in the exchange rate. The effect of COVID-19 appeared positive on

the export of commodities HS09, HS17, HS84, and HS90 and negative on commodity exports of HS18, HS62, HS67, and HS87. Additionally, exchange rates positively affect the imports of commodities HS24, HS30, HS34, HS48, HS84, and HS88 and negatively affect HS02, HS04, HS08, HS20, HS27, HS29, and HS35. Findings also show a significant positive influence of IPI on the imports of HS21, HS28, HS47, and HS73 and a negative influence on HS03, HS30, and HS48. The positive change in volatility increases imports of commodities HS02, HS04, HS08, HS10, HS20, HS27, HS35, and HS47 and decreases HS24, HS34, HS48, and HS88 commodity imports. Furthermore, a negative change in volatility increases HS02, HS08, HS20, HS27, HS35, and HS47 commodity imports and reduces the imports of HS24, HS30, HS34, and HS48. COVID-19 has had a positive effect on the import of commodities HS03, HS08, HS20, HS44, HS52, and HS64.

5.1 Limitations and areas of future research

As part of the limitation of this study, the present study only covers the imports and exports of food products commodities ignoring other vital commodities which may be affected by the volatility of the exchange rate. Additionally, the analysis only focused on Indonesia-US bilateral trade relations. Since the study has a very limited scope in terms of products and countries' coverage, future work on exchange rate volatility should focus more on using more disaggregated commodity levels and different methodological approaches. Future work should also expand the countries' coverage to include more of Indonesia's major trading partners.

REFERENCES

- [1] Aftab, M., Abbas, Z., Nawaz Kayani, F. (2012). Impact of exchange rate volatility on sectoral exports of Pakistan: An ARDL investigation. *Journal of Chinese Economic and Foreign Trade Studies*, 5(3): 215-231. <http://doi.org/10.1108/17544401211263973>
- [2] Bayoumi, T., Eichengreen, B. (1998). Exchange rate volatility and intervention: Implication of the theory of optimum currency areas. *Journal of International Economy*, 45(2): 191-209. [https://doi.org/10.1016/S0022-1996\(98\)00032-4](https://doi.org/10.1016/S0022-1996(98)00032-4)
- [3] Barkoulas, J.T., Baum, C.F., Calgayan, M. (2002). Exchange rate effects on the volume and variability of trade flows. *Journal of International Money and Finance*, 21(4): 481-96. [https://doi.org/10.1016/S0261-5606\(02\)00003-7](https://doi.org/10.1016/S0261-5606(02)00003-7)
- [4] Clarida, R., Gali, J. (1994). Sources of real exchange-rate fluctuations: How important are nominal shocks? *Carnegie-Rochester Confer. Series on Public Policy*, 41(C): 1-56. [https://doi.org/10.1016/0167-2231\(94\)00012-3](https://doi.org/10.1016/0167-2231(94)00012-3)
- [5] Phan, D.H.B., Juhro, S.M. (2018). Can economic policy uncertainty predict exchange rate and its volatility? Evidence from Asean countries. *Bulletin of Monetary Economics and Banking*, 21(2): 265-282. <https://doi.org/10.21098/bemp.v21i2.974>
- [6] Heriqbaldi, U., Widodo, W., Ekowati, D. (2020). Real exchange rate misalignment and currency crises. *Bulletin of Indonesian Economic Studies*, 56(3): 345-362. <https://doi.org/10.1080/00074918.2019.1662885>
- [7] Fang, W.S., Lai, Y.H., Miller, S.M. (2009). Does exchange rate risk affect exports asymmetrically? Asian evidence. *Journal of International Money and Finance*, 28(2): 215-239. <https://doi.org/10.1016/j.jimonfin.2008.11.002>
- [8] McKenzie, M. (2002). The economics of exchange rate volatility asymmetry. *International Journal of Finance and Economics*, 7(3): 247-260. <https://doi.org/10.1002/ijfe.189>
- [9] Clark, P.B. (1973). Uncertainty, exchange risk, and the level of international trade. *Economic Inquiry*, 11(3): 302-313. <https://doi.org/10.1111/j.1465-7295.1973.tb01063.x>
- [10] Ethier, W. (1973). International trade and the forward exchange market. *The American Economic Review*, 63(3): 494-503.
- [11] Arize, A.C., Osang, T., Slotte, D.J. (2000). Exchange-rate volatility and foreign trade: Evidence from thirteen LDC's. *Journal of Business and Economic Statistics*, 18(1): 10-17. <https://doi.org/10.1080/07350015.2000.10524843>
- [12] Chit, M.M., Rizov, M., Willenbockel, D. (2010). Exchange rate volatility and exports: New empirical evidence from the emerging East Asian economies. *World Economy*, 33(2): 239-263. <https://doi.org/10.1111/j.1467-9701.2009.01230.x>
- [13] Hayakawa, K., Kimura, F. (2009). The effect of exchange rate volatility on international trade in East Asia. *Journal of the Japanese and International Economies*, 23(4): 395-406. <https://doi.org/10.1016/j.jjie.2009.07.001>
- [14] Kroner, K.F., Lastrapes, W.D. (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(3): 298-318. [https://doi.org/10.1016/0261-5606\(93\)90016-5](https://doi.org/10.1016/0261-5606(93)90016-5)
- [15] Chi, J., Cheng, S.K. (2016). Do exchange rate volatility and income affect Australia's maritime export flows to Asia? *Transport Policy*, 47: 13-21. <https://doi.org/10.1016/j.tranpol.2015.12.003>
- [16] Nishimura, Y., Hirayama, K. (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. <https://doi.org/10.1016/j.japwor.2013.03.002>
- [17] Senadza, B., Diaba, D.D. (2018). Effect of exchange rate volatility on trade in sub-Saharan Africa. *Journal of African Trade*, 4(1-2): 20. <https://doi.org/10.1016/j.joat.2017.12.002>
- [18] Auboin, M., Ruta, M. (2013). The relationship between exchange rates and international trade: A literature review. *World Trade Review*, 12(3): 577-605. <https://doi.org/10.1017/S1474745613000025>
- [19] Bahmani-Oskooee, M., Kanitpong, T. (2017). Do exchange rate changes have symmetric or asymmetric effects on the trade balances of Asian countries? *Applied Economics*, 49(46): 4668-4678. <https://doi.org/10.1080/00036846.2017.1287867>
- [20] Iqbal, J., Aziz, S., Nosheen, M. (2022). The asymmetric effects of exchange rate volatility on US-Pakistan trade flows: New evidence from nonlinear ARDL approach. In *Economic Change and Restructuring*, 55(1). Springer US. <https://doi.org/10.1007/s10644-020-09310-8>
- [21] Sercu, P., Uppal, R. (2003). Exchange rate volatility and international trade: A general-equilibrium analysis. *European Economic Review*, 47(3): 429-441.

- [https://doi.org/10.1016/S0014-2921\(01\)00175-1](https://doi.org/10.1016/S0014-2921(01)00175-1)
- [22] Sharma, S., Yadav, M.P., Jha, B. (2022). Impact of the COVID-19 outbreak on the currency exchanges of selected countries. *International Journal of Sociotechnology and Knowledge Development*, 14(2): 73-91. <https://doi.org/10.4018/IJSKD.2022040105>
- [23] Ekanayake, E.M., Dissanayake, A. (2022). Effects of real exchange rate volatility on trade: Empirical analysis of the United States exports to BRICS. *Journal of Risk and Financial Management*, 15(2): 73. <https://doi.org/10.3390/jrfm15020073>
- [24] Osei-Assibey, K. (2014). Sign asymmetry and exchange rate market volatility: Empirical evidence from two developing countries. *International Journal of Monetary Economics and Finance*, 7(2): 107-121. <https://doi.org/10.1504/IJMEF.2014.065087>
- [25] Bahmani-Oskooee, M., Aftab, M. (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(2017): 86-103. <https://doi.org/10.1016/j.econmod.2017.02.004>
- [26] Viaene, J.-M., De Vries, C.G. (1992). International trade and exchange rate volatility. *European Economics Review*, 36(6): 1311-1321. [https://doi.org/10.1016/0014-2921\(92\)90035-u](https://doi.org/10.1016/0014-2921(92)90035-u)
- [27] Cushman, D.O. (1986). Has exchange risk depressed international trade? The impact of third-country exchange risk. *Journal of International Money and Finance*, 5(3): 361-379. [https://doi.org/10.1016/0261-5606\(86\)90035-5](https://doi.org/10.1016/0261-5606(86)90035-5)
- [28] Broll, U., Eckwert, B., (1999). Exchange rate volatility and international trade. *Southern Economic Journal*, 66(1): 178-185. <https://doi.org/10.1002/j.2325-8012.1999.tb00232.x>
- [29] Obstfeld, M., Rogoff, K., (1998). Risk and exchange rates. National Bureau of Economic Research working papers 6694. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=122308.
- [30] Clark, M.P.B., Wei, S.J., Tamirisa, M.N.T., Sadikov, M.A.M., Zeng, L. (2004). A new look at exchange rate volatility and trade flows. IMF Occasional Paper 235.
- [31] Doğanlar, M. (2002). Estimating the impact of exchange rate volatility on exports: Evidence from Asian countries. *Applied Economics Letters*, 9(13): 859-863. <http://doi.org/10.1080/13504850210150906>
- [32] McKenzie, M.D. (1999). The impact of exchange rate volatility on international trade flows. *Journal of Economic Surveys*, 13(1): 71-106. <https://doi.org/10.1111/1467-6419.00075>
- [33] Kim, C.B. (2017). Does exchange rate volatility affect Korea's seaborne import volume? *Asian Journal of Shipping and Logistics*, 33(1): 43-50. <https://doi.org/10.1016/j.ajsl.2017.03.006>
- [34] Pino, G., Tas, D., Sharma, S.C. (2016). An investigation of the effects of exchange rate volatility on exports in East Asia. *Applied Economics*, 48(26): 2397-2411. <https://doi.org/10.1080/00036846.2015.1122730>
- [35] Handoyo, R.D., Alfani, S.P., Ibrahim, K.H., Sarmidi, T., Haryanto, T. (2023). Exchange rate volatility and manufacturing commodity exports in ASEAN-5: A symmetric and asymmetric approach. *Heliyon*, 9(2): e13067. <https://doi.org/10.1016/j.heliyon.2023.e13067>
- [36] Handoyo, R.D., Sari, A.D.P., Ibrahim, K.H., Sarmidi, T. (2022). The volatility of rupiah exchange rate impact on main commodity exports to the OIC member states. *Economies*, 10(4): 78. <https://doi.org/10.3390/economies10040078>
- [37] Yildirim, A.E., Saraç, T.B. (2022). Exchange rate volatility and turkey-germany bilateral trade: An asymmetry analysis. *Journal of International Trade and Economic Development*. <https://doi.org/10.1080/09638199.2021.2022742>
- [38] Umaru, A., Sa'idu, B.M., Musa, S. (2013). An empirical analysis of exchange rate volatility on export trade in a developing economy. *Journal of Emerging Trends in Economics and Management Sciences* 4(1): 42-53. <https://hdl.handle.net/10520/EJC132591>
- [39] Serenis, D., Tsounis, N. (2013). Exchange rate volatility and foreign trade: The case for Cyprus and Croatia. *Procedia Economics and Finance*, 5(2013): 677-685. [https://doi.org/10.1016/s2212-5671\(13\)00079-8](https://doi.org/10.1016/s2212-5671(13)00079-8)
- [40] Baek, J. (2014). Exchange rate effects on Korea-US bilateral trade: A new look. *Research in Economics*, 68(3): 214-221. <https://doi.org/10.1016/j.rie.2014.05.002>
- [41] Ramli, N., Podivinsky, J.M. (2011). The effects of exchange rate volatility on exports: Some new evidence for regional Asean countries. <https://dam.ukdataservice.ac.uk/media/263176/normiah-paper.pdf>.
- [42] Bahmani-Oskooee, M., Gelan, A. (2018). Exchange-rate volatility and international trade Performance: Evidence from 12 African countries. *Economic Analysis and Policy*, 58(2018): 14-21. <https://doi.org/10.1016/j.eap.2017.12.005>
- [43] Arize, A.C., Osang, T., Slottje, D.J. (2008). Exchange-rate volatility in Latin America and its impact on foreign trade. *International Review of Economics and Finance* 17(2008): 33-44. <https://doi.org/10.1016/j.iref.2006.01.004>
- [44] Bahmani-Oskooee, M., Harvey, H., Hegerty, S.W., (2013). The effects of exchange-rate volatility on commodity trade between the US and Brazil. *North American Journal of Economics and Finance*, 25(2013): 70-93. <https://doi.org/10.1016/j.najef.2013.03.002>
- [45] Broil, U., Eckwert, B. (1999). Exchange rate volatility and international trade. *Southern Economic Journal*, 66(1): 178-185. <https://doi.org/10.1002/j.2325-8012.1999.tb00232.x>
- [46] Bahmani-Oskooee, M., Arize, A.C. (2022). The effect of exchange rate volatility on U.S. bilateral trade with Africa: A symmetric and asymmetric analysis. *Economic Systems*, 46(1): 100879. <https://doi.org/10.1016/j.ecosys.2021.100879>
- [47] Ardiyanti, S.T. (2015). The impact of real exchange rate volatility on Indonesia-US trade performance. *Buletin Ilmiah Litbang Perdagangan*, 9(1): 79-93. <https://doi.org/10.30908/bilp.v9i1.17>
- [48] Odili, O. (2015). Real exchange rate volatility, economic growth and international trade in an emerging market economy: Evidence from Nigeria. *International Journal of Academic Research in Business and Social Sciences*, 5(7): 179-201. <https://doi.org/10.6007/ijarbs/v5-i7/1730>
- [49] Stavarek, D. (2014). On asymmetry of exchange rate volatility in new EU member and candidate countries. Silesian University, School of Business Administration. MPRA Paper No. 7298. Munich Personal RePEc

- Archive.
- [50] Sharma, C., Pal, D. (2018). Exchange rate volatility and India's cross-border trade: A pooled mean group and nonlinear cointegration approach. *Economic Modelling*, 74: 230-246. <https://doi.org/10.1016/j.econmod.2018.05.016>
- [51] Bahmani-Oskooee, M., Harvey, H., Hegerty, S.W. (2015). Exchange-rate volatility and commodity trade between the USA and Indonesia. *New Zealand Economic Papers*, 49(1): 78-102. <https://doi.org/10.1080/00779954.2014.901136>
- [52] Bustaman, A., Jayanthakumaran, K. (2007). The impact of exchange rate volatility on Indonesia's exports to the USA: An application of ARDL bounds testing procedure. *International Journal of Applied Business and Economic Research*, 5(1): 1-21.
- [53] Siregar, R., Rajan, R.S. (2004). Impact of exchange rate volatility on Indonesia's trade performance in the 1990s. *Journal of the Japanese and International Economies*, 18(2): 218-240. [https://doi.org/10.1016/S0889-1583\(03\)00050-9](https://doi.org/10.1016/S0889-1583(03)00050-9)
- [54] Sugiharti, L., Esquivias, M.A., Setyorani, B. (2020). The impact of exchange rate volatility on Indonesia's top exports to the five main export markets. *Heliyon*, 6(1): E03141. <https://doi.org/10.1016/j.heliyon.2019.e03141>
- [55] Upadhyaya, K.P., Dhakal, D., Mixon, F.G. (2020). Exchange rate volatility and exports: Some new estimates from the Asean-5. *The Journal of Developing Areas*, 54(1). <https://doi.org/10.1353/jda.2020.0004>
- [56] Zainal, A.A. (2007). Exchange Rate pass-through, exchange rate volatility, and their impacts on export: Evidence from Indonesian data. Dissertation, Kansas State University, Manhattan.
- [57] Gujarati, D.N. (2009). *Basic Econometrics* (5th Edition). McGraw-Hill, New York, United States.
- [58] Backman, M. (2006). Exchange rate volatility: How the Swedish export is influenced. Master's Thesis, Jönköping International Business School Jönköping University, Sweden.
- [59] Thuy, V.N.T., Thuy, D.T.T. (2019). The impact of exchange rate volatility on exports in Vietnam: A bounds testing approach. *Journal of Risk and Financial Management*, 12(1): 6. <https://doi.org/10.3390/jrfm12010006>
- [60] Nyeadi, J.D., Atiga, O., Atogenzoya, C.A. (2014). The impact of exchange rate movement on export: Empirical evidence from Ghana. *International Journal of Academic Research in Accounting, Finance and Management Sciences*, 4(3): 56-65. <https://doi.org/10.6007/ijarafms/v4-i3/980>
- [61] Dincer, N., Kandil, M. (2011). The effects of exchange rate fluctuations on exports: A sectoral analysis for Turkey. *Journal of International Trade and Economic Development*, 20(6): 809-837. <https://doi.org/10.1080/09638190903137214>
- [62] Chien, M.S., Setyowati, N.U.R., Cheng, C.Y. (2020). Asymmetric effects of exchange rate volatility on bilateral trade between Taiwan and Indonesia. *Singapore Economic Review*, 65(4): 857-888. <https://doi.org/10.1142/S021759082050006X>
- [63] Hwang, H.D., Lee, J.W. (2005). Exchange rate volatility and trade flows of the U.K. in 1990s. *International Area Studies Review*, 8(1): 173-182. <https://doi.org/10.1177/223386590500800109>
- [64] Poon, W.C., Hooy, C.W. (2013). Exchange-rate volatility, exchange-rate regime, and trade in OIC countries. *Journal of Asia-Pacific Business*, 14(3): 182-201. <https://doi.org/10.1080/10599231.2013.772843>
- [65] Hayakawa, K., Mukunoki, H. (2021). The impact of COVID-19 on international trade: Evidence from the first shock. *Journal of the Japanese and International Economies*, 60: 101135. <https://doi.org/10.1016/j.jjie.2021.101135>
- [66] Shin, Y., Yu, B., Greenwood-Nimmo, M. (2014). Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework. In *Festschrift in Honor of Peter Schmidt: Econometric Methods and Applications*. <https://doi.org/10.1007/978-1-4899-8008-3>
- [67] Ugurlu, E., Jindřichovská, I. (2022). Effect of COVID-19 on international trade among the Visegrad countries. *Journal of Risk and Financial Management*, 15(2): 41. <https://doi.org/10.3390/jrfm15020041>
- [68] Asteriou, D., Masatci, K., Pilbeam, K. (2016). Exchange rate volatility and international trade: International evidence from the MINT countries. *Economic Modelling*, 58: 133-140. <https://doi.org/10.1016/j.econmod.2016.05.006>
- [69] Nur Syamsiyah, M., laili, R.T.J.J. (2021). The effects of COVID-19 pandemic on Indonesia foreign trade. *Jurnal Ekonomi*, 26(2): 267. <https://doi.org/10.24912/je.v26i2.750>