Volume LIX No. 2
ISSN 1655-1516
December 2022

The Philippine Review of Economics

SPECIAL ISSUE ON MONETARY POLICY AND CENTRAL BANKING

Issue Editor **Faith Christian Q. Cacnio**

ARTICLES IN THIS ISSUE

A joint publication of the **University of the Philippines School of Economics** and the **Philippine Economic Society**

PRE

The Philippine Review of Economics

A joint publication of the UP School of Economics (UPSE)
and the Philippine Economic Society (PES)

Aims and Scope: The *Philippine Review of Economics* (PRE) invites theoretical and empirical articles on economics and economic development. Papers on the Philippines, Asian and other developing economies are especially welcome. Book reviews will also be considered.

The PRE is published jointly by the UP School of Economics and the Philippine Economic Society. Its contents are indexed in the *Journal of Economic Literature*, EconLit, and RePec. PRE's readership includes economists and other social scientists in academe, business, government, and development research institutions.

Publication Information: The PRE (ISSN 1655-1516) is a peer-reviewed journal published every June and December of each year. A searchable database of published articles and their abstracts is available at the PRE website (http://pre.econ.upd.edu.ph).

Subscription Information:
Subscription correspondence may be sent to the following addresses:

- css@pssc.org.ph
- PSSC Central Subscription Service,
  PSSCenter, Commonwealth Avenue, 1101, Diliman,
  Quezon City, Philippines.
  P.O. Box 205, UP Post Office, Diliman, Quezon City,
  Philippines 1101
  PHONE: 922-9627, FAX: 924-4178/926-5179

Submissions: Authors may submit their manuscripts to the addresses below:

- pre.upd@up.edu.ph
- The Editor, The Philippine Review of Economics, Rm 237, School of Economics, University of the Philippines, Diliman, Quezon City, 1101.

Manuscripts must be written in English and in MS Word format. All graphs and tables must be in Excel format. Submission of a manuscript shall be understood by the PRE as indicating that the manuscript is not under consideration for publication in other journals. All submissions must include the title of the paper, author information, an abstract of no more than 150 words, and a list of 3–4 keywords. Complete guidelines can be viewed in the PRE's website.

Acknowledgements: The PRE gratefully acknowledges the financial support towards its publication provided by the Philippine Center for Economic Development (PCED). The Review nonetheless follows an independent editorial policy. The articles published reflect solely the editorial judgement of the editors and the views of their respective authors.

The Philippine Economic Society

Founded 1961

The Philippine Economic Society (PES) was established in August 1962 as a nonstock, nonprofit professional organization of economists.

Over the years, the PES has served as one of the strongest networks of economists in the academe, government, and business sector.

Recognized in the international community of professional economic associations and a founding member of the Federation of ASEAN Economic Associations (FAEA), the PES continuously provides a venue for open and free discussions of a wide range of policy issues through its conferences and symposia.

Through its journal, the *Philippine Review of Economics* (PRE), which is jointly published with the UP School of Economics, the Society performs a major role in improving the standard of economic research in the country and in disseminating new research findings.

At present the society enjoys the membership of some 800 economists and professionals from the academe, government, and private sector.

- Lifetime Membership – Any regular member who pays the lifetime membership dues shall be granted lifetime membership and shall have the rights, privileges, and responsibilities of a regular member, except for the payment of the annual dues.
- Regular Membership – Limited to individuals 21 years of age or older who have obtained at least a bachelor's degree in economics, or who, in the opinion of the Board of Directors, have shown sufficient familiarity and understanding of the science of economics to warrant admission to the Society. Candidates who have been accepted shall become members of the Society only upon payment of annual dues for the current year.
- Junior Membership – This is reserved for full-time college or graduate students majoring in economics. Affiliation for junior membership is coursed through the Junior Philippine Economic Society (JPES).

For more information, visit: www.phileconsociety.org.

The Philippine Review of Economics

Vol. LIX No. 2
December 2022
ISSN 1655-1516
DOI: 10.37907/ERP2202D

PRE The Philippine Review of Economics
59(2):135-165. DOI:10.37907/5ERP2202D

How do exchange rates affect the Big One? An empirical analysis of the effect of exchange rates on RCEP exports using the gravity model

Jose Adlai M. Tancangco*
Ateneo de Manila University
and Bangko Sentral ng Pilipinas

The often disparate and conflicting effects of exchange rate on bilateral exports reported by previous literature necessitate a further study of the relationship between monetary and trade variables. This study contributes to the stream of literature by analyzing monetary variables such as exchange rate volatility, exchange rate misalignment, exchange rate regimes, and real effective exchange rates with bilateral aggregate exports through a sample of 15 nations comprising the Regional Comprehensive Economic Partnership (RCEP) region for the years 1996 to 2017 using Ordinary Least Squares and Poisson Pseudo-Maximum Likelihood panel fixed effects regression. Results indicate that a country's real effective exchange rate ratio and the exchange rate volatility for countries under a floating exchange rate regime reduce aggregate exports.

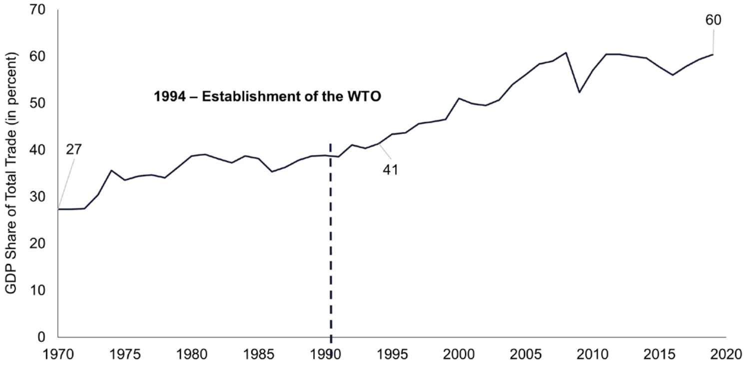
JEL classification: E52, F31, F15
Keywords: exchange rates, volatility, gravity model

1. Introduction

International trade plays an important role in a country's development. World trade accounted for around 60 percent of the global economy or more than one half of the Gross Domestic Product (GDP) in 2019, indicating a rapid increase of trade activities for goods and services across the globe (Figure 1). As the world tries to recover from the pandemic and shift to the new normal, international trade will continue to play a strong role in the economy and a country's growth. This growing share of trade in world GDP can be attributed to developments in trade policy such as the establishment of the World Trade Organization (WTO) in 1994, establishment of preferential trade agreements (PTAs) among countries and free trade agreements (FTAs).

* Address all correspondence to jose.tancangco@obf.ateneo.edu.

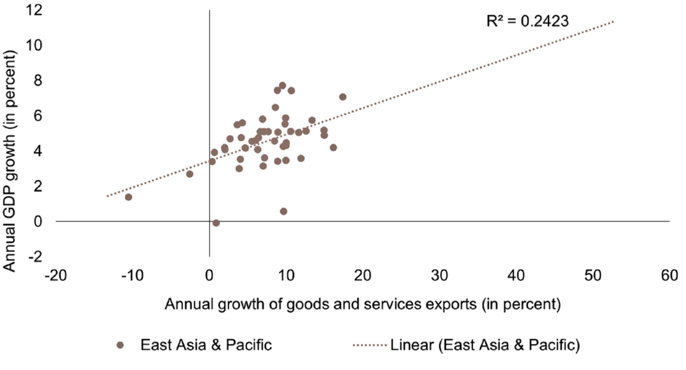
FIGURE 1. Percentage share of total trade in GDP (world aggregate; 1970-2019)



Source: World Bank - World Development Indicators [World Bank 2020e].

Given this relationship, several studies have theorized and observed how trade contributes to economic development such as Andersen and Babula [2008] and Keho [2017]. Both studies have observed that there is a strong complementary relationship between a country's total trade and capital formation and economic growth. Increase of trade through exports has allowed domestic businesses and firms to expand their respective markets. Tan et al. [2019] also explained that exports are considered an important engine of growth and development as it enables the exporting country to benefit from technological spillovers, increased specialization, and positive externalities. This is especially evident in countries in the East Asia and Pacific region where there is a positive relationship between exports and GDP growth (Figure 2).

FIGURE 2. Annual growth of exports and GDP (East Asia and Pacific Region; 1970-2019)



Source: World Bank - World Development Indicators [World Bank 2020a; 2020c].

An important factor that affects the level of trade of countries is the exchange rate. This is because the market prices of traded goods and services are governed by a country's prevailing exchange rate. Given this, the exchange rate is one of the most important price indicators in an open economy.

For example, the price a domestic exporter gets paid for its exports is relative to the exchange rate between the domestic currency and the foreign buyer's currency. If the current exchange rate is 1:1, then a unit of domestic currency is equal to a unit of a foreign currency. If 100 units of the exported good is worth one unit of the domestic currency, then the foreign buyer spends one unit of the foreign currency to purchase 100 units of the exported good. However, if the new exchange rate becomes 1:2, then a unit of the domestic currency is now equal to two units of the foreign currency.

The domestic currency appreciates because it can purchase more of the foreign currency. The foreign buyer can now only purchase half or 50 units of the exported good due to the domestic currency appreciating. This demonstrates how currency appreciation (depreciation) makes exports more expensive (cheaper).

Pomfret and Pontines [2013] point out that exchange rate policy can be considered a substitute for trade policy. A change in exchange rates is equivalent to a combination of changes in import taxes and export subsidies. In simpler terms, changes in exchange rates are tantamount to changes in trade transaction costs and risks that can affect the volume of exports for a country.

The relevance of exchange rate policies demonstrates the importance of identifying the significant exchange rate factors and policies that affect a country's level of exports. Following Pomfret and Pontines [2013], exchange rate policies should be included in the arsenal of government trade instruments typically confined to WTO membership, PTA membership, tariff rates, quota restrictions, non-tariff measures (NTMs), and the like. The proliferation of preferential and regional trade agreements in recent decades underscores the importance of studying how exchange rate variables influence the trade dynamics specific to regional economic partnerships.

This issue is especially relevant in the case of the states under the Regional Comprehensive Economic Partnership (RCEP) where international production networks proliferate and governments in the region are perceived to influence their domestic currencies in order to drive their strategic plans. Examining the role of exchange rate policies would be relevant in assessing their effectiveness in inducing trade and growth in the region.

The RCEP region is composed of the following countries: Australia, Brunei Darussalam, Cambodia, People's Republic of China, Indonesia, Japan, Lao People's Democratic Republic, Malaysia, Myanmar, New Zealand, Philippines, Singapore, Republic of Korea, Thailand, and Vietnam. This aggrupation is based on the RCEP, a trading agreement signed last November 15, 2020. As of 2020, RCEP parties contributed 30 percent of the world's GDP [World Bank 2022b], 29 percent of the world's population [World Bank 2022c], and 26 percent of the world's total exports [World Bank 2022a]. This makes the region the largest free trade deal in the world at the present time making it "The Big One."

This paper attempts to determine the relevant exchange rate variables, such as exchange rate volatility, misalignment, real effective exchange rates, and a floating exchange rate regime, that affect the level of RCEP exports through an augmented gravity model estimation. It is highly important to determine the effects of the said variables given that the actual effect of exchange rates on trade is still an open and controversial question due to the mixed theories and empirical results obtained by multiple studies [Nicita 2013]. Moreover, being the largest trading bloc in the world, it is important to determine what direction and by what magnitude exchange rate variables affect exports within the region.

2. Exchange rates and international trade

The following exchange rate variables to be discussed have been theorized and observed to affect the level of trade between countries in past empirical studies. This paper will incorporate the variables in the model along with some recommendations to properly determine the effect of exchange rates on trade in the RCEP region. Table 1 summarizes the different empirical studies found regarding the effect of exchange rates on trade.

2.1. Real Effective Exchange Rates (REER)

The REER is defined as the measure of the real value of a country's currency against a basket of currencies of its trading partners, where an increase in the REER of a country implies currency appreciation [Darvas 2012]. Currency appreciation occurs when less of the domestic currency is needed to purchase a unit of a foreign currency. Benkovskis and Wörz [2013] explained that an increase in REER would generally reduce export competitiveness. Exports from the country whose currency has appreciated would cost more, making exports from other competing countries relatively cheaper. An empirical study by Tan et al. [2019] observed that an increase in REER significantly reduces exports.

2.2. Exchange rate misalignment

Exchange rate misalignment is defined as the difference between the observed exchange rate and an estimated equilibrium exchange rate [Nicita 2013]. This paper follows the approach of Rodrik [2008] wherein a higher level of misalignment yields an undervaluation of the domestic currency. More units of the domestic currency needed to purchase a unit of a foreign currency indicates currency undervaluation. An undervalued currency is expected to make exports competitive since it makes domestic exports cheaper for other countries to purchase, hence increasing export volume.

An empirical study by Nicita [2013] observed that exchange rate misalignment significantly affects trade. However, a recent study by Nasir and Jackson [2019] cautioned that misalignment is not the sole responsible factor in causing trade imbalances. Other factors such as exchange rate volatility should be analyzed in line with misalignment to determine its effect on trade.

2.3. Exchange rate volatility

Exchange rate volatility measures the level of fluctuations a country's exchange rate undergoes over a period of time. Nicita [2013] argued that volatility reduces trade due to the presence of risks and transaction costs these fluctuations cause. However, the significant effects of a lower level of exchange rate volatility are indirect and "originate from long-term exchange rate commitments such as currency unions and pegged exchange rates rather than short-term exchange rate fluctuation" [Nicita 2013].

Similar to the recommendation by Nasir and Jackson [2019] on exchange rate misalignment, Clark et al. [2004] pointed out that the effects of exchange rate volatility on trade should be interacted with monetary policies such as currency unions and exchange rate regimes. This suggests, in theory, that monetary policies and exchange rate policies have to be analyzed jointly rather than individually. Separately, these policies may not significantly affect trade; however, evaluating these policies as a set or through interactions can better demonstrate their effect on trade.

Bahmani-Oskooee and Hegerty [2009] explained that exchange rate volatility can either be trade creating or trade reducing. It can increase trade if exporters and importers decide to increase their trade volumes in order to attain certain levels of income. Trade increases as exporters and importers increase the number of units purchased or sold in order to make up for the possible effects of exchange rate volatility, such as a decrease in the per-unit value of a good. Senadza and Diaba [2018] also posited that exchange rate volatility can increase trade as it encourages producers to increase production in an attempt to evade severe decreases in income.

De Grauwe [2005] also explains that exchange rate volatility allows firms to increase prices not just to compensate the risk of fluctuating rates but also as an opportunity for financial gain. With the expected profit of firms likely to increase given price increases due to higher exchange rate volatility, it is possible that production and exports will increase.

On the other hand, exchange rate volatility can also reduce the levels of trade if risk-averse buyers and sellers foresee losses due to fluctuations in the exchange rate. This leads buyers and sellers not to partake in any deal to trade [Bahmani-Oskooee and Hegerty 2009]. Naseem et al. [2009] further explains that volatility becomes a barrier for trade due to the uncertainties it brings about.

TABLE 1. Summary of previous empirical studies on exchange rates and international trade

Paper	Methodology	Country	Period	Dependent Variable	Independent Variables	Controls	Findings
Banik and Roy [2020]	OLS, Fixed-Effects, and Random-Effects model for panel data	SAARC[1] countries	2005-2018	Bilateral Exports	Real Exchange rate volatility	Level of Output, Level of Income, Distance, Common Language, Common Border	Exchange rate volatility significantly reduces bilateral exports
Clark et al. [2004]	Country-pair time fixed-effects model for panel data	178 countries	1975-2000	Bilateral trade	Real exchange rate volatility, Currency union	GDP product, GDP per capita Product, Distance, Common language, Common border, Landlocked countries, Island countries, Country area product, Common colonizer, Colonial links, FTA membership, WTO membership	Real exchange rate volatility significantly reduces bilateral trade.
Chi and Cheng [2016]	Autoregressive Distributed Lag (ARDL)	Australia	2000-2013 (quarterly)	Volume of Bilateral Exports	Exchange rate volatility	GDP, Bilateral exchange rate	Exchange rate volatility significantly affects the volume of bilateral exports in the long run for majority of trading partners. However, the effect varies per country-pair.
Hayakawa and Kimura [2009]	OLS and exporter-year, importer-year fixed effects model for panel data	Eight countries[2]	1992-2005	Real bilateral exports	Real exchange rate volatility, Unanticipated volatility, Exporter's risk index, Importer's risk index, Tariffs	Exporter GDP, Importer GDP, Distance, Common border, Colonial links, Common colony, Common language, Regional dummy variable	Exporter's risk index and Importer's risk index significantly increase real bilateral exports; Real exchange rate volatility, Unanticipated volatility and tariffs on real exports significantly reduce real bilateral exports.
Hondroyiannis et al. [2008]	OLS, random-effects, fixed-effects, General Method of Moments, random coefficient estimation	12 countries[3]	1977-2003 [4]	World exports	Real exchange rate volatility	Exporter GDP, Relative prices of exporting country, real export earnings of exporting country	No statistically significant long-run relationship between Exchange Rate Volatility and Total Bilateral Trade.

[1] Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri-Lanka.
[2] China, Hong Kong, Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, and Thailand.
[3] Canada, France, Germany, Italy, Japan, United Kingdom, United States, Switzerland, Norway, Ireland, Spain, and Netherlands.
[4] Quarterly data used.

TABLE 1. Summary of previous empirical studies on exchange rates and international trade (continued)

Paper	Methodology	Country	Period	Dependent Variable	Independent Variables	Controls	Findings
Klein and Shambaugh [2006]	Country-pair time fixed-effects model and instrumental variable regression for panel data	181 countries	1973-1999	Bilateral trade	Currency union, Exchange rate volatility, Direct peg, Indirect peg	GDP product, GDP per capita product, Distance, Country area product, Common land border, Common language, Colonial relationship, Landlocked country, Island, Common colonizer, FTA	Direct peg, Indirect peg and Currency union significantly increase bilateral trade; Exchange rate volatility significantly reduce bilateral trade.
Nicita [2013]	Country-pair time fixed-effects model for panel data	100 countries	2000-2009	Bilateral exports	Exchange rate misalignment, Exchange rate volatility, Tariff Trade Restrictiveness Index (TTRI)	Exporter GDP, Importer GDP, Distance, Common border, Colonial links, Common language	Exchange rate misalignment, Exchange rate volatility and TTRI significantly reduce total bilateral exports.
Njoroge [2020]	OLS-Pooled, Fixed-effects, and Random Effects model for panel data	COMESA countries[5]	1997-2019	Bilateral exports	Exchange rate volatility	GDP Product, Distance, Common Language, Common Border, Population	Exchange rate volatility significantly reduces exports.
Pomfret and Pontines [2013]	Country-pair time fixed- and random-effects models for panel data	16 countries[6]	1990-2010	Average bilateral trade	Rate of exchange rate depreciation, Exchange rate volatility, RTA*Rate of exchange rate depreciation, RTA*Exchange rate volatility	GDP product, GDP per capita product, Distance, Country Area Product, Common Land Border, Common Language, RTA	Rate of exchange rate depreciation and RTA*Rate of exchange rate depreciation significantly increase average bilateral trade; Exchange rate volatility and RTA*Exchange rate volatility significantly reduce average bilateral trade.

[5] Burundi, Comoros, Congo, Dem Rep., Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Sudan, Swaziland, Uganda, Zambia, and Zimbabwe.

[6] Brunei Darussalam, Cambodia, Hong Kong, China, Indonesia, Japan, Republic of Korea, Lao PDR, Macau, Malaysia, Mongolia, Myanmar, Philippines, Singapore, Thailand, and Vietnam.

TABLE 1. Summary of previous empirical studies on exchange rates and international trade (continued)

Paper	Methodology	Country	Period	Dependent Variable	Independent Variables	Controls	Findings
Prajakschitt [2015]	Fixed-effects model for panel data	China and ASEAN 6 countries[7]	2001-2013	Bilateral Imports	Exchange rate volatility	GDP product, Distance, China (Dummy)	No significant relationship between exchange rate and imports.
Santana-Gallego and Pérez-Rodríguez [2019]	High-Dimensional Fixed Effects and PPML model for panel data	191 countries	1970-2016	Bilateral exports	Exchange rate regimes, Presence of crises	RTA	Direct pegs and indirect pegs significantly increase exports
Satawatananon [2014]	Autoregressive Distributed Lag (ARDL)	Thailand and USA	1971-2012	Bilateral exports and imports[8]	Real exchange rate, Real exchange rate volatility	Exporter GDP	Real exchange rate positively affect trade in the short-run for the clothing sector. Real exchange rate volatility reduces trade in the short-run for the textile sector. No significant effect on the clothing and textile sector in the long-run.
Senadza and Diaba [2017]	Autoregressive Distributed Lag (ARDL) [Pooled-Mean Group] model for panel data	11 countries[9]	1993-2014	Real exports	Exchange rate volatility	Nominal exchange rate, GDP of exporter country, Inflation rate of exporter country, Real FDI	Exchange rate volatility significantly reduce real exports in the short-run; Exchange rate volatility significantly increase real exports in the long-run.
Tan et al. [2019]	Country-time fixed effects model for panel data	Eight countries[10]	1995-2011	Real gross exports	Lag of REER, Lag of REER Volatility, Lag of FVA share on gross exports, Lag of FVA share*Lag of REER, Lag of FVA share*Lag of REER volatility	GDP product, Real FDI stock	Lag of FVA share*Lag of REER and Lag of FVA share*Lag of REER volatility significantly increase real gross exports; REER volatility and Share of FVA in gross exports significantly reduce real gross exports.

7 Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam.
8 All Harmonised Product (HS) codes were used. Regressions were performed per products code and using the aggregate.
9 Ghana, Gambia, Kenya, Madagascar, Mauritius, Mozambique, Nigeria, Sierra Leone, Tanzania, Uganda, and Zambia.
10 Brunei Darussalam, Cambodia, Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam.

TABLE 1. Summary of previous empirical studies on exchange rates and international trade (continued)

Paper	Methodology	Country	Period	Dependent Variable	Independent Variables	Controls	Findings
Tarasenko [2021]	Fixed-effects model for panel data	72 countries	2004-2018	Bilateral Exports of different products	Real exchange rate volatility	Real GDP, Average Exchange Rate	Exchange rate volatility significantly reduces exports of manufactured goods, and machinery and transport equipment and significantly increases imports of fuels, textiles, chemicals, and manufactured goods.
Tenreyro [2007]	IV-PPML for panel data	87 countries	1970-1997	Bilateral Trade	Exchange rate volatility	Exporter GDP, Importer GDP, Distance, Common border, Common language, Colonial links, FTA	No statistically significant long-run relationship between Exchange Rate Volatility and Total Bilateral Trade.
Vo et al [2019]	Dynamic Ordinary Least Squares (DOLS) regression for panel data	Vietnam	2000-2015	Bilateral exports[11]	Real exchange rate volatility	Real exchange rate, Importer GDP	For textile and clothing sector, real exchange rate volatility is not significant for ASEAN partner countries and all sample partner countries.
Wong and Chong [2016]	Country-pair time fixed-effects model and instrumental variable regression for panel data	186 countries	1974-2009	Real bilateral trade	Currency union, Direct peg, Indirect peg, Inflation targeting, Exchange rate volatility, Inflation rate	GDP product, Free Trade Agreement (FTA)	Currency union, Direct peg and Inflation targeting significantly increase real bilateral trade; Indirect peg, Exchange rate volatility and Inflation rate significantly reduce real bilateral trade.

[11] Ten sectors were analyzed individually: (1) food products, beverages and tobacco, (2) textiles, wearing apparel, leather and related products, (3) wood and products of wood and cork, (4) paper and printing, (5) chemicals, rubber, plastics and fuel products, (6) non-metallic mineral products, (7) basic metals and fabricated metal products, (8) machinery and equipment, (9) transport equipment, and (10) furniture and other manufacturing.

Côté [1994] and McKenzie [1999] both discuss that the presence of exchange rate volatility forces firms to incur additional costs to mitigate risks on the exchange rate. This additional cost would be shouldered by the firm and will affect the cost of production. The additional cost reduces the quantity of exports supplied by the firm compared to the quantity exported without the additional cost. Due to this, exports are reduced because of exchange rate volatility.

Moreover, Dell'Ariccia [1998] argues that the additional costs can also take the form of transaction costs between trading partners shouldered by both trading parties. This, in turn, can lead to a decline in trading activity since costs increased, possibly forcing firms to redistribute production to local markets or other international markets to avoid the cost.

Clark et al. [2004] argued that although exchange rate volatility poses risks and additional costs for trading countries, the increase in instruments of financial hedging have lessened the risks of exchange rate fluctuations. The increase in these instruments is indicative of the growth of different financial instruments across the globe. Thus, it was posited that exchange rate volatility significantly but weakly reduces trade.

Given this, exchange rate volatility theoretically affects exports due to its effect on additional costs. As stated above, there are numerous studies explaining how exchange rate volatility affects exports. However, views regarding the effect of exchange rate volatility on trade are mixed.

Previous empirical studies analyzing the effects of exchange rate volatility on trade have reported mixed results as well. The empirical study of Hayakawa and Kimura [2009] observed that exchange rate volatility significantly reduces a country's bilateral exports. Additionally, Hayakawa and Kimura [2009] used a smaller sample size of eight countries all within the Asia-Pacific region. Hayakawa and Kimura [2009] analyzed the effects of unanticipated volatility, exporter's risk index, importer's risk index and tariffs on top of exchange rate volatility on exports. Exchange rate volatility was found to significantly reduce exports for the smaller sample size.

This is similar to more recent findings from Njoroge [2020] who saw a significant reducing effect of exchange rate volatility on exports for trade in the Common Market for Eastern and Southern Africa regional bloc and Banik and Roy [2020] who observed the same effect for countries belonging to the South Asian Association for Regional Cooperation bloc.

Other empirical studies, on the other hand, report opposite findings. Hondroyiannis et al. [2008] used a sample of 12 countries mostly located in North America and Europe with quarterly data from years 1977 to 2003. The estimates showed that there is no significant long-run relationship between exchange rate volatility and world exports. This conforms to Tenreyro's [2007] study on a sample of 87 countries located across different regions, where ten countries in the RCEP region are included, ranging from years 1970 to 1997 (28 years).

Tenreyro's results showed that there is no statistically significant relationship between exchange rate volatility and bilateral trade.

These observations were also affirmed recently by Prajakschitt [2015] and Vo et al. [2019]. Prajakschitt [2015] observed that there is no significant relationship between exchange rate volatility and imports after using a fixed-effects model for panel data on China and six Association of Southeast Asian Nations (ASEAN) member states. The results of Vo et al. [2019] also demonstrated that there is no significant effect of exchange rate volatility on textile and clothing exports for trade between Vietnam and 26 partner countries through a Dynamic Ordinary Least Squares model.

Other empirical studies, however, observed mixed results such as Senadza and Diaba [2018]. A sample of 11 Sub-Saharan African countries for the years 1993 to 2014 (22 years) was evaluated using an autoregressive distributed lag-pooled mean group model method. Their study reported that exchange rate volatility significantly reduces exports in the short run. However, exchange rate volatility significantly increases exports in the long run. Senadza and Diaba [2018] pointed out that the changing effect of exchange rate volatility on exports in the short run and long run reflect the vagueness of theoretical outcomes under the general equilibrium models.

Similarly, Satawatananon [2014], Chi and Cheng [2016], and Tarasenko [2021] observed mixed results in their respective models. Satawatananon [2014] observed a negative effect between exchange rate volatility and exports in the short run but no significant effect in the long run for trade between Thailand and the United States of America (USA). Chi and Cheng [2016] found that there is a significant relationship between exchange rate volatility and exports in majority of Australia's trading partners. However, the effect varies per country-pair. The recent study of Tarasenko [2021] also observed that exchange rate volatility's effect on exports varies depending on the commodity exported from Russia to its trading partners.

According to Clark et al. [2004], the mixed results from empirical studies regarding exchange rate variables such as volatility and trade suggest that the effect of the said variables may possibly be an empirical issue or dependent on the sample being analyzed. This could be the reason why the different empirical studies presented earlier vary in results. Moreover, this necessitates the need to determine what effect is dominant in the world's largest trading bloc—the RCEP.

2.4. Exchange rate regimes

Exchange rate regimes refer to the system that the country's monetary authority uses to determine the exchange rate of its currency against foreign currencies [International Monetary Fund 2006]. There are three general classifications for exchange rate regimes: direct peg; indirect peg; and floating. A direct peg is a system wherein the exchange rate is fixed against the value of another currency.

An indirect peg is similar to a direct peg, but monetary authorities can induce small adjustments on the exchange rate based on different factors.

A floating regime is a system where the exchange rate is completely market-determined or when the monetary authority tries to influence the rate without a particular path. It has been theorized that direct pegs are expected to generate currency stability and foster bilateral trade with other fixed currencies [Klein and Shambaugh 2006]. This has been empirically observed by Wong and Chong [2016] in their model; countries that have a fixed peg regime significantly increase trade. However, no previous literature was found incorporating floating regimes.

Klein and Shambaugh [2006] observed that pegging to a foreign currency such as the United States Dollar (USD) fosters bilateral trade with the USA and all other countries that peg to the USD. Moreover, a currency peg is expected to generate macroeconomic stability as it reduces a country's exchange rate volatility.

A more recent study by Santana-Gallego and Pérez-Rodríguez [2019] similarly observed that countries that peg their currency to the USD or to a currency union experience greater trade flows. Moreover, indirect pegs were also found to be significantly trade increasing with its magnitude dependent on the anchor currency.

However, there is not enough evidence to suggest that floating exchange rate regimes are ultimately trade reducing in theory. It is still possible to be trade creating given the currency stabilizing mechanisms present in a floating exchange rate regime.

2.5. Exchange rates in the RCEP region

It is important to analyze the effects of exchange rate volatility and the rest of the variables on trade within the RCEP region. Following findings from Tan et al. [2019], competitive devalued exchange rates[12] are crucial to promote exports. This makes managing volatility an important priority for all countries in the RCEP region. Given that ten out of 15 countries in the RCEP region are ASEAN member states, analyzing the effects of exchange rate volatility, paired with monetary variables, on exports is of great importance. The lack of consensus on the relationship between exchange rate volatility and trade calls for an empirical evaluation of exchange rate volatility on an aggregate level, and to determine whether trade creating or trade reducing effects dominate the region.

[12] There are some cases where devalued exchange rates do not work in promoting trade such as in Pakistan [McCartney 2015]. In this case, the devaluation of the currency was not competitive compared to that of other countries.

3. Methodology and data

3.1. The gravity model and PPML estimation

The gravity model has been regarded as the "workhorse of the applied international trade literature" and has generated "some of the clearest and most robust findings in empirical economics" [Shepherd 2016]. Tinbergen [1962] presented the fundamental form of the trade flow equation as seen below:

$$E_{ij} = \alpha_0 \, Y_i^{\alpha_1} \, Y_j^{\alpha_2} \, D_{ij}^{\alpha_3} \tag{1}$$

where E_{ij} represents the exports of country i to country j, Y_i represents the Gross National Product (GNP) of country i, Y_j represents the GNP of country j, and D_{ij} represents the transportation costs assumed to correspond with the geographical distance between country i and country j. This model exhibits that distance acts as a determinant of export levels [Tinbergen 1962].

Anderson [1979] provided a theoretical explanation for the gravity equation concerned with the trade of commodities. Since then, the gravity model has been widely utilized in the study of international trade and has been enhanced to acclimate the other definitions for "distance."

This study uses an augmented gravity model to determine the effect of exchange rates on a country's exports. Additional variables such as exchange rate variables and control variables to proxy for trade costs were added to the model. The gravity model has been augmented to incorporate monetary variables as seen below:

$$\begin{aligned}\ln(Exports)_{ij,t} = \alpha_0 + \beta_1 \ln(GDP_{i,t} * GDP_{j,t}) + \beta_2 \ln(dist)_{ij} + \beta_3 contig_{ij} + \\ \beta_4 comlang\_off_{ij} + \beta_5 comcol_{ij} + \beta_6 \ln(REER)_{ij,t} + \beta_7 Misalign_{ij,t} + \\ \beta_8 Float_{ij,t} * \ln(Volatility)_{ij,t} + \beta_9 cty_{ij,t} + \varepsilon_{ij,t}\end{aligned} \tag{2}$$

where *Exports* represents aggregate exports of country i to country j at time t, α is the constant term, $GDP_{i,t}$ and $GDP_{j,t}$ represent the nominal GDP of the exporting and importing country, respectively, *distance* represents the geographical distance between each country-pair, *contig* is a dummy variable equal to one if the country-pair share a common land border and zero otherwise, *comlang_off* is a dummy variable equal to one if the country-pair share a common official language and zero otherwise, *comcol* is a dummy variable equal to one if the country-pair was previously under the same colonizer and zero otherwise, *REER* represents the bilateral real effective exchange rate between country-pairs, *Misalign* represents the bilateral exchange rate misalignment between country-pairs, *Float* is a dummy variable equal to one if the country-pair observes a floating exchange rate regime and zero otherwise, *Volatility* is the bilateral exchange rate volatility between country-pairs, *cty* are a set of proxy variables for time-varying outward and inward multilateral resistance terms, and ε represents the error term.

The inclusion of multilateral resistance terms in the gravity model came from Anderson and Van Wincoop [2003]. These terms capture how exports between two countries depend on trade costs across all possible export markets. Moreover, it captures how imports between two countries depend on trade across all possible suppliers. These terms remove several violations regarding the standard economic theory.

Aside from an Ordinary Least Squares (OLS) estimation, a Poisson Pseudo-Maximum Likelihood (PPML) estimator is utilized. The PPML estimator was developed by Santos Silva and Tenreyro [2006] in order to deal with the problem of possible bias in the estimates. Shepherd [2016], Yotov et al. [2016], Gauto [2012], and Siliverstovs and Schumacher [2008] explain how the PPML estimator is regarded as the "workhorse gravity estimator." First, the PPML estimator is consistent even with fixed effects estimation. Similar to that of OLS, fixed effects estimation through PPML can be done by using dummy variables. This demonstrates that multilateral resistance variables can be proxied in the PPML estimator through exporter and importer dummy variables.

Second, the PPML estimator accommodates observations that contain zero values of trade. OLS models tend to drop observations with zero values of trade due to the natural logarithm of zero being undefined. Including observations with zero values of trade removes the possible sample selection bias OLS models can possibly generate.

Third, the interpretation of coefficients regressed using the PPML estimator follows that of the OLS. Shepherd [2016] explains that the dependent variable, such as trade values, must be in levels rather than in logarithms. For example, instead of taking the natural logarithm of exports, exports must be reported in millions or thousands of dollars. On the other hand, independent variables can still be presented in logarithms.

Coefficients of the PPML estimator can still be interpreted as simple elasticities, even though the dependent variable is not specified in logarithmic form (Shepherd [2016]; Santos Silva and Tenreyro [2006]). For all these reasons, it is recommended to base the results of this study on the PPML estimator. For robustness purposes, both the OLS and PPML regression results are reported in the succeeding part of this study.

The augmented PPML econometric model can be seen below:

$$\left(\frac{Exports}{1{,}000{,}000}\right)_{ij,t} = \exp[\beta_1 \ln(GDPi_{,t} * GDPj_{,t}) + \beta_2 \ln(dist)_{ij} + \beta_3 contig_{ij} + \beta_4 comlangoff_{ij} + \beta_5 comcol_{ij} + \beta_6 \ln(REER)_{ij,t} + \beta_7 Misalign_{ij,t} + \beta_8 Float_{ij,t} * \ln(Volatility)_{ij,t} + \beta_9 cty_{ij,t}] + \varepsilon_{ij,t} \quad (3)$$

Note that the variables included in the augmented gravity model have unique observations for each country-pair, such that no value of a variable is constant for a specific reporting country over different country-pairs. According to

Shepherd [2016], variables to be integrated in a fixed effects gravity model must vary bilaterally. This is because variables that do not vary bilaterally would be perfectly collinear with fixed effects and would be absorbed by the fixed effects.

This is the reason why the GDP product variable was used instead of the standard where individual GDPs of the reporting and partner countries are included. The GDP product variable has similarly been used by other studies incorporating the gravity model such as Clark et al. [2004], Klein and Shambaugh [2006], Pomfret and Pontines [2013], and Wong and Chong [2016] for the same reasons.

3.2. Classification and data

This paper covers observations from 15 countries comprising the RCEP region from 1996 to 2017 from various sources listed in Table 2.

TABLE 2. Definition and sources of empirical variables used

Variable	Description	Period	Source
$Export_{ij,t}$	Total exports of country *i* to country *j* in current USD at time *t*	1996-2017	United Nations Comtrade [2020]
$GDP_{i,t}$	Gross Domestic Product of country *i* at time *t*, in current USD	1996-2017	World Bank [2020b]
$GDP_{j,t}$	Gross Domestic Product of country *j* at time *t*, in current USD	1996-2017	World Bank [2020b]
$Distance_{ij}$	Geographical distance between country *i* and country *j*	N/A	Mayer and Zignago [2011]
$Contiguity_{ij}$	Dummy variable, equals 1 if countries *i* and *j* share a common land border	N/A	Mayer and Zignago [2011]
$Common\ Colony_{ij}$	Dummy variable, equals 1 if countries *i* and *j* were both under the same colonial power	N/A	Mayer and Zignago [2011]
$REER_{i,t}$	Annual Real Effective Exchange Rate index of country *i* weighted for 171 partner countries at time *t*	1996-2017	Bruegel [2020]
$REER_{j,t}$	Annual Real Effective Exchange Rate index of country *j* weighted for 171 partner countries	1996-2017	Bruegel [2020]
$REER_{ij,t}$	Annual Ratio of Real Effective Exchange Rate index of countries *i* and *j* weighted for 171 partner countries, respectively at time *t*	1996-2017	Author's Computation
$XRAT_{i,t}$	Nominal year average exchange rate of country *i* to a unit of USD at time *t*	1996-2017	Feenstra et al. [2015]
$PPP_{i,t}$	Purchasing Power Parity/Price Level for household consumption of country *i* at time *t*	1996-2017	Feenstra et al. [2015]

TABLE 2. Definition and sources of empirical variables used (continued)

Variable	Description	Period	Source
$Real\ GDP_{i,t}$	Per capita Gross Domestic Product of country *i* at time *t*, in 2010 USD	1996-2017	World Bank [2020d]
$Misalign_{i,t}$	Difference between actual "real" exchange rate and estimated equilibrium "real" exchange rate of country *i* at time *t*	1996-2017	Author's computation
$ER_{i,m}$	Nominal month average exchange rate of country *i* to a unit of USD at month *m*	1996-2017	International Monetary Fund [2020]
$ER_{j,m}$	Nominal month average exchange rate of country *j* to a unit of USD at month *m*	1996-2017	International Monetary Fund [2020]
$Float_{ij,t}$	Dummy variable, equals 1 if countries *i* and *j* observe a floating exchange rate regime relationship (*de-facto* classification) at time *t*	1996-2017	Harms and Knaze [2018]

Due to incomplete data availability from the data sources presented in the table, several observations are automatically dropped during the regression. Table 3 demonstrates the number of observations missing per variable included in the regression model.

TABLE 3.Tally of missing observations in the augmented model dataset

Variable	Number of missing observations	Percentage of missing observations
ln of Nominal GDP product	112	2.42
ln of Exchange Rate Volatility	8	0.17
ln of REER Ratio	616	13.33
Exports	584	12.64
ln of Exports	584	12.64
Float peg (dummy)	264	5.71
Float peg (dummy) * ln of Exchange Rate Volatility	272	5.89

The percentages of missing observations in the dataset are less than that of the missing observations from various empirical studies discussed earlier. Previous empirical studies discussed reported varying percentages of missing observations ranging from 12.52 percent to 61.27 percent.[13] The use of the PPML

[13] Hayakawa and Kimura [2009] reported 12.52 percent missing observations in the model that included 60 countries and 13.45 percent missing observations in the model that included eight Asian countries. Pomfret and Pontines [2013] reported 23.11 percent missing observations. Klein and Shambaugh [2006] reported 27.5 percent missing observations. Nicita [2013] reported 34.58 percent missing observations in the model that did not include exchange rate volatility and 61.27 percent missing observations in the full model that included exchange rate volatility.

estimator compensates for the missing observations in the dataset. According to Kareem et al. [2016] and Martin [2020], PPML estimates report lower biases in the presence of missing or zero trade values. Therefore, the PPML estimates aid the dataset's missing observations compared to the OLS estimator.

3.3. Computation of specific variables

3.3.1. Bilateral real effective exchange rates

The bilateral REER between country-pairs was computed similar to that of Nho and Hương [2015]. It is the ratio between the REER index of the exporting country and the importing country. The equation below demonstrates the computation similar to Nho and Hương [2015] where $REER_{i,t}$ is the REER of country i at year t and $REER_{j,t}$ is the REER of country j at year t.

$$REER_{ij,t} = \frac{REER_{i,t}}{REER_{j,t}} \tag{4}$$

3.3.2. Bilateral exchange rate misalignment

The bilateral exchange rate misalignment between country-pairs was computed using a four-step process similar to that of Rodrik [2008] and Nicita [2013]. First, a hypothetical "real" exchange rate (RER) was obtained from deflating a country's nominal exchange rate to the USD (XRAT) using a country's purchasing power parity conversion (PPP) factor as seen below.

$$\ln RER_{i,t} = \ln\left(\frac{XRAT_{i,t}}{PPP_{i,t}}\right) \tag{5}$$

This hypothetical "real" exchange rate must not be confused with the REER. An increase in the value of the hypothetical "real" exchange rate indicates that the domestic currency depreciated, while an increase in the REER index indicates a domestic currency appreciation.

Second, given that non-tradable goods are cheaper in poorer countries,[14] the hypothetical "real" exchange rate must be adjusted through the Balassa-Samuelson effect. The Balassa-Samuelson effect posits that there is a tendency for consumer prices to be higher in developed countries than developing countries [Rodrik 2008]. This was computed by regressing the hypothetical "real" exchange rate with the real GDP per capita of a country with time fixed effects.

$$\ln RER_{i,t} = \alpha + \beta \ln RGDPPC + \phi_t + \varepsilon_{i,t} \tag{6}$$

[14] Example of non-tradable goods are electricity, water supply and local transportation [Jenkins et al. 2011]. It is evident that these goods are cheaper in poorer countries. For example, the taxi flat rate (in USD) in the Philippines is cheaper compared to Singapore (0.83 USD vs. 2.40 USD).

where RER represents the hypothetical "real" exchange rate of country i at time t, α is the constant term, $RGDPPC$ represents the real GDP per capita, ϕ represents time fixed effects, and ε represents the error term.

Third, the level of exchange rate misalignment was computed by taking the difference between the actual hypothetical "real" exchange rate and the estimated/fitted equilibrium "real" exchange rate adjusted for the Balassa-Samuelson effect.

$$Misalign_{i,t} = \ln RER_{i,t} - \ln \widehat{RER}_{i,t} \tag{7}$$

Lastly, the bilateral exchange rate misalignment per country pair was obtained through the sum of exchange rate misalignment between the two countries.

$$Misalign_{ij,t} = Misalign_{i,t} + Misalign_{j,t} \tag{8}$$

Following Rodrik [2008], a positive level of misalignment demonstrates an undervalued currency compared to its equilibrium exchange rate. Therefore, an increase in the level of misalignment between countries indicate a weaker currency.

3.3.3. Bilateral exchange rate volatility

The bilateral exchange rate volatility is computed similar to that of Nicita [2013].

$$ER_{ij,t} = ER_{i,t} - ER_{j,t} \tag{9}$$

$$Volatility_{ij,t} = std.dev[ER_{ij,m} - ER_{ij,m\text{-}1}] \tag{10}$$

where $ER_{i,t}$ represents the nominal exchange rate of country i to a USD at time t, $ER_{ij,t}$ represents the difference between the nominal exchange rate of country i and country j, $ER_{ij,m}$ represents the difference between the monthly average of the nominal exchange rate of both countries at month m, and *Volatility* represents the standard deviation of the exchange rates for a given year t. The difference between both countries was adapted by Nicita [2013] to highlight the presence of hard peg exchange rate regimes where $ER_{ij,t}$ and $Volatility_{ij,t}$ are both equal to zero.

4. Results and discussion

4.1. Baseline model results

Estimation results for the baseline gravity models are reported in Table 4. Gravity model specifications are estimated as follows: Column 1 presents estimates using the OLS estimator; and Column 2 presents the estimates using the PPML estimator. The dependent variable for OLS estimates is the natural logarithm of exports while the dependent variable for PPML estimates is in levels (exports in millions).

TABLE 4. Baseline model regression results

Method Dependent Variable	[1] OLS ln of Exports	[2] PPML Exports[m]
ln of Nominal GDP Product	**1.213*** **	**0.840*** **
	(0.0672)	(0.0458)
ln of Distance	**-0.993*** **	**-0.565*** **
	(0.140)	(0.0445)
Constant Term	-37.81***	-33.63***
	(3.869)	(2.770)
Observations	3,994	3,994
R-squared	0.887	0.949
Country pair FE	**Yes**	**Yes**

[m] Exports in millions

Both estimates of the baseline model utilize 3,994 observations and demonstrate an *R*-squared statistic of 0.89 for the OLS estimator and 0.95 for the PPML estimator. Both estimation methods yield high *R*-squared statistics demonstrating high levels of goodness-of-fit. Moreover, both the natural logarithm of the Nominal GDP product and the natural logarithm of distance between countries are significant at the 1 percent level for both the OLS and PPML estimator.

For the OLS estimates of the baseline model, a 1 percent increase in the GDP product of trading countries significantly increases a country's exports by 1.21 percent, ceteris paribus. Moreover, a 1 percent increase in the distance between trading countries significantly decreases a country's exports by 0.99 percent, ceteris paribus. For the PPML estimates of the baseline model, a 1 percent increase in the GDP product of trading countries significantly increases a country's exports by 0.84 percent, ceteris paribus. Also, a 1 percent increase in the distance between trading countries significantly decreases a country's exports by 0.57 percent, ceteris paribus. The results of the baseline model are consistent with the hypothesized signs of the variables.

4.2. Augmented model results

The augmented gravity model includes variables such as contiguity, common language, common colonizer, REER ratio, exchange rate misalignment, and the interaction variable between a floating exchange rate regime and exchange rate volatility. Both estimates of the augmented model utilize 3,563 country-pair observations ranging from years 1996 to 2017. The OLS panel fixed effects estimator reports an *R*-squared statistic of 0.91. On the other hand, the PPML panel fixed effects estimator reports an *R*-squared value of 0.95.

Both estimation methods demonstrate high levels of goodness-of-fit and provide good promise in analyzing the value of exports between country-pairs.

Furthermore, the improved *R*-squared statistic for the PPML regressions may indicate that PPML estimator is a more suitable method to estimate the effect of certain policies on trade through an augmented gravity model [Shepherd 2016].

The OLS panel fixed effects estimator reported six significant coefficients. All six coefficients are significant at the 1 percent level. On the other hand, the PPML fixed effects estimator reported four significant coefficients. Three coefficients are significant at the 1 percent level while one coefficient is significant at the 5 percent level (Table 5).

TABLE 5. Augmented model regression results

Method **Dependent Variable**	**[1] OLS** **ln of Exports**	**[2] PPML** **Exports[m]**
ln of Nominal GDP product	**1.192***** (0.0512)	**0.840***** (0.0388)
ln of Distance	**-0.564***** (0.148)	**-0.501***** (0.0704)
Contiguity (dummy)	**0.989***** (0.333)	0.0786 (0.122)
Common Official Language (dummy)	-0.213 (0.223)	0.0478 (0.135)
Common Colony (dummy)	**1.148***** (0.438)	0.293 (0.211)
ln of REER Ratio	-0.239 (0.446)	**-0.606**** (0.302)
Exchange Rate Misalignment	**-0.196***** (0.0582)	-0.0302 (0.0401)
Float peg (dummy) * ln of Exchange Rate Volatility	**-0.0909***** (0.0312)	**-0.0585**** (0.0242)
Constant Term	-38.64*** (3.089)	-33.02*** (2.334)
Observations	3,563	3,563
R-squared	0.905	0.952
Country pair FE	**Yes**	**Yes**

[m] Exports in millions

It can also be observed that the values of the coefficients reported from the PPML estimator are less than that of the OLS estimator. However, as stated in the early sections of this study, the PPML estimated coefficients will be analyzed to determine the significance and impact of the independent variables on the dependent variable.

From the PPML estimation, the natural logarithm of a country-pair's nominal GDP product significantly increases a country's exports. On the other hand, the natural logarithm of the distance between country-pairs, the REER ratio between country-pairs, and the natural logarithm of exchange rate volatility for country-pairs under a floating peg exchange rate regime significantly decrease a country's exports.

Among the three key variables of the study, two are significant. The natural logarithm of the REER ratio between country-pairs along with the interaction variable between floating exchange rate regimes and the natural logarithm of exchange rate volatility are both significant at the 5 percent level. A 1 percent increase in the REER ratio between country-pairs leads to a 0.61 percent reduction of the reporting country's exports, ceteris paribus. The negative effects of REER on exports are consistent with the results obtained by Tan et al. [2019].

The significant export reducing effects of REER and exchange rate volatility, as highlighted by the interaction term, are in line with the preliminary findings of previous studies. However, previous studies observed that the export reducing effects of REER and exchange rate volatility are offset and disappear when interacted with the concept of Foreign Value-Added (FVA). The relationship between exchange rates and the concept of FVA as discussed by Tan et al. [2019] is significant in the Asian region.

Although this is not similar to the empirical result of this study, it is worth noting that this highlights that the mixed empirical results observed regarding exchange rate volatility on trade is an empirical issue [Clark et al. 2004]. It is possible that the trade reducing effects of exchange rate variables such as volatility and REER disappear given the presence of FVA share in goods traded.

Note that for REER ratio to increase, the reporting country must have a higher REER index than its partner country. This result is in line with the hypothesized sign of the REER ratio's coefficient. As a country increases its REER index, its exports become less competitive since exports become more expensive compared to other countries.

A one percent increase in the exchange rate volatility of country-pairs under a floating peg exchange rate regime leads to a 0.06 percent decrease in a reporting country's exports, ceteris paribus. This result is also consistent with the hypothesized sign of the interaction variable's coefficient. The higher the exchange rate volatility for the specified countries, the higher the risk it is to trade. This risk can be present in many forms such as unexpected changes in the transaction costs of trade and the like. These risks ultimately make a country's exports less competitive compared to other countries that exhibit a less volatile currency.

Clark et al. [2004] pointed out that the effects of exchange rate volatility on trade needs to be interacted with monetary policies such as currency unions and exchange rate regimes. This suggests, in theory, that monetary policies and exchange rate policies have to be analyzed together rather than separately. Evaluating the effects of exchange rate volatility without considering the presence of other monetary variables can yield insignificant results. Hence, empirically, an interaction variable between exchange rate volatility and floating exchange rate regimes was utilized.

4.3. Alternative models for robustness

4.3.1. Alternative model incorporating FTA membership

With numerous bilateral and multilateral FTAs ratified within the sample period the paper covers, significant trade agreements such as the ASEAN-People's Republic of China Comprehensive Economic Cooperation Agreement signed in 2004, ASEAN-Korea Agreement on Trade completed in 2006, Comprehensive Economic Partnership between ASEAN and Japan signed in 2008, and the ASEAN-Australia-New Zealand Free Trade Area signed in 2009 may have influenced the level of exports within the RCEP region.

To account for this, an additional dummy variable indicating the presence of an FTA between country-pairs was included in the regression model. The variable is equal to one if an FTA is present between the country-pair, and zero otherwise. Data regarding FTAs were obtained from the Asian Development Bank's Asia Regional Integration Center Database [2022].

TABLE 6. Alternative regression model results (LN of exchange rate volatility and float peg dummy variables included)

Method Dependent Variable	[1] OLS ln of Exports	[2] PPML Exports[m]	[3] OLS ln of Exports	[4] PPML Exports[m]
ln of Nominal GDP product	**1.192***** (0.0512)	**0.840***** (0.0388)	**1.200***** (0.0579)	**0.823***** (0.0396)
ln of Distance	**-0.564***** (0.148)	**-0.501***** (0.0704)	**-0.563***** (0.148)	**-0.494***** (0.0698)
Contiguity (dummy)	**0.989***** (0.333)	0.0786 (0.122)	**0.988***** (0.333)	0.109 (0.124)
Common Official Language (dummy)	-0.213 (0.223)	0.0478 (0.135)	-0.214 (0.222)	0.0806 (0.128)
Common Colony (dummy)	**1.148***** (0.438)	0.293 (0.211)	**1.149***** (0.438)	0.270 (0.203)
ln of REER Ratio	-0.239 (0.446)	**-0.606**** (0.302)	-0.107 (0.522)	**-0.789*** (0.429)
Exchange Rate misalignment	**-0.196***** (0.0582)	-0.0302 (0.0401)	**-0.181***** (0.0507)	-0.0594 (0.0373)
Float peg (dummy) * ln of Exchange Rate Volatility	**-0.0909***** (0.0312)	**-0.0585**** (0.0242)	**-0.0910***** (0.0312)	**-0.0548**** (0.0237)
FTA (dummy)			0.0211 (0.130)	-0.146 (0.100)
Constant Term	-38.64*** (3.089)	-33.02*** (2.334)	-39.21*** (3.522)	-31.79*** (2.378)
Observations	3,563	3,563	3,563	3,563
R-squared	0.905	0.952	0.905	0.956
Country pair FE	**Yes**	**Yes**	**Yes**	**Yes**

[m] Exports in millions

Results indicate that the previously significant key variables retain their significance (Table 6). The natural logarithm of the REER ratio is significant at the 10 percent level, wherein a one percent increase in the REER ratio leads to a 0.79 percent decrease in the reporting country's exports. Moreover, the interaction variable between floating exchange rate regimes and the natural logarithm of exchange rate volatility is significant at the 5 percent level. A one percent increase in the variable leads to a 0.05 percent decrease in the reporting country's exports.

4.3.2. Alternative model for interaction term

An alternative regression model was also estimated where exchange rate volatility and floating exchange rate regimes were regressed separately with the interaction term. Results indicate that only the interaction variable is significant (Table 7). This affirms the suggestion of Clark et al. [2004] both theoretically and empirically that volatility needs to be interacted with other monetary policy variables to determine its true effect on trade.

This result provides new insight regarding countries with floating exchange rate regimes. Countries under a floating exchange rate regime are affected by the trade reducing impact of exchange rate volatility. However, the same cannot be said for countries under a direct peg or indirect peg exchange rate regime. The observed negative effects of exchange rate volatility on exports are consistent with those of Clark et al. [2004], Hayakawa and Kimura [2009], Klein and Shambaugh [2006], Nicita [2013], Pomfret and Pontines [2013], Njoroge [2020], and Banik and Roy [2020].

Furthermore, this also reinforces the suggestion from Clark et al. [2004] about estimating multiple monetary policy and exchange rate policy variables. The exchange rate misalignment variable is also aligned with the hypothesized sign of the misalignment variable's coefficient, albeit insignificant.

TABLE 7. Alternative regression model results
(LN of exchange rate volatility and float peg dummy variables included)

Method Dependent Variable	[1] OLS ln of Exports	[2] PPML Exports^m	[3] OLS ln of Exports	[4] PPML Exports^m
ln of Nominal GDP product	**1.020***** (0.0517)	**0.753***** (0.0433)	**0.959***** (0.0555)	**0.730***** (0.0479)
ln of Distance	**-0.576***** (0.147)	**-0.501***** (0.0722)	**-0.575***** (0.147)	**-0.494***** (0.0712)
Contiguity (dummy)	**1.070***** (0.348)	0.0754 (0.123)	**1.069***** (0.349)	0.104 (0.122)
Common Official Language (dummy)	-0.253 (0.222)	0.0405 (0.144)	-0.254 (0.222)	0.0676 (0.143)
Common Colony (dummy)	**0.926*** (0.478)	0.293 (0.222)	**0.927*** (0.478)	0.266 (0.207)
ln of REER Ratio	0.277 (0.433)	-0.175 (0.391)	**1.368***** (0.405)	0.453 (0.313)

TABLE 7. Alternative regression model results (continued)

Method Dependent Variable	[1] OLS ln of Exports	[2] PPML Exports^m	[3] OLS ln of Exports	[4] PPML Exports^m
Exchange Rate misalignment	0.196***	0.102***	0.0627	0.0352
	(0.0407)	(0.0346)	(0.0384)	(0.0240)
Float peg (dummy)	-0.0263	-0.0451	-0.0220	-0.106
	(0.224)	(0.133)	(0.214)	(0.135)
ln of Exchange Rate Volatility	-0.0477	-0.00117	-0.0476	-0.00242
	(0.0346)	(0.0339)	(0.0346)	(0.0315)
Float peg (dummy) * ln of Exchange Rate Volatility	**-0.0727****	**-0.0573****	**-0.0729****	**-0.0517****
	(0.0324)	(0.0267)	(0.0324)	(0.0258)
FTA (dummy)			0.0165	-0.162
			(0.117)	(0.101)
Constant Term	-28.66***	-28.26***	-25.47***	-26.94***
	(3.015)	(2.504)	(3.378)	(2.860)
Observations	3,563	3,563	3,563	3,563
R-squared	0.905	0.952	0.905	0.957
Country pair FE	**Yes**	**Yes**	**Yes**	**Yes**

^{m} Exports in millions

4.3.3. Alternative model controlling for volatility during the Asian Financial Crisis

Data regarding exports and exchange rate volatility demonstrate extreme spikes during years 1997 to 1999 due to the Asian Financial Crisis. Studies similarly indicate that the Asian Financial Crisis is the single most important event in the region where volatility soared to extreme levels.

Garnaut [1998] reported that negative growth in East Asian trade was observed during the crisis. Moreover, Rana [1998] observed how the yearly change of nominal exchange rates for the region drastically dropped and weakened during the crisis. For example, Rana's [1998] computations indicate that for years 1976-1996 the average yearly nominal exchange rate changes were at around 2.43 percent. However, during the crisis, the average yearly nominal exchange rate changes were at around 35.35 percent. This clearly indicates a high level of exchange rate volatility given that Rana [1998] compared the change in the region to that of the United Kingdom which reported a 0.2 percent nominal exchange rate change during the crisis.

Due to this, it is also important to determine if data from the Asian Financial Crisis affects the significance of exchange rate volatility in the model. An augmented model was estimated removing observations before and during the crisis: years 1996 to 1999. Alternatively, an augmented model was also estimated including a dummy variable equal to one for observations during the Asian Financial Crisis (1997 to 1999), zero otherwise (Table 8).

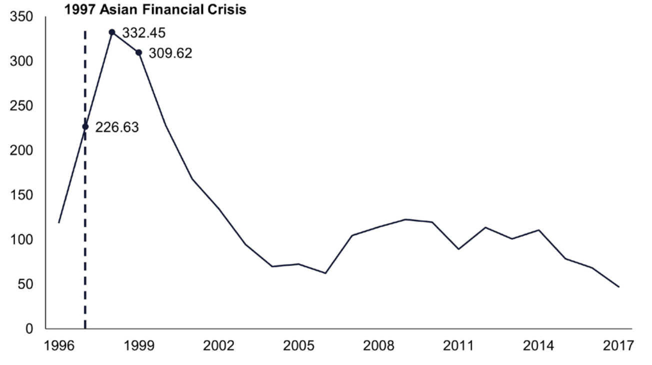
TABLE 8. Alternative aggregate regression model results (years 1996-1999 dropped, AFC dummy variable included)

Method Dependent Variable	[1] OLS ln of Exports	[2] PPML Exports[m]	[3] OLS ln of Exports	[4] PPML Exports[m]	[5] OLS ln of Exports	[6] PPML Exports[m]	[7] OLS ln of Exports	[8] PPML Exports[m]
ln of Nominal GDP product	**1.153***** (0.0488)	**0.796***** (0.0358)	**1.094***** (0.0445)	**0.797***** (0.0324)	**1.112***** (0.0640)	**0.758***** (0.0388)	**1.189***** (0.0513)	**0.834***** (0.0395)
ln of Distance	**-0.541***** (0.149)	**-0.499***** (0.0703)	**-0.542***** (0.148)	**-0.488***** (0.0704)	**-0.564***** (0.148)	**-0.501***** (0.0704)	**-0.563***** (0.148)	**-0.494***** (0.0698)
Contiguity (dummy)	**1.110***** (0.346)	0.0967 (0.122)	**1.110***** (0.347)	0.131 (0.125)	**0.989***** (0.333)	0.0786 (0.122)	**0.988***** (0.333)	0.109 (0.124)
Common Official Language (dummy)	-0.243 (0.233)	0.0472 (0.136)	-0.243 (0.233)	0.0860 (0.129)	-0.213 (0.223)	0.0478 (0.135)	-0.214 (0.222)	0.0806 (0.128)
Common Colony (dummy)	**1.107**** (0.445)	0.260 (0.213)	**1.106**** (0.446)	0.232 (0.204)	**1.148***** (0.438)	0.293 (0.211)	**1.149***** (0.438)	0.270 (0.203)
ln of REER Ratio	-0.212 (0.529)	-0.387 (0.290)	**-2.120***** (0.590)	**-1.264***** (0.480)	**4.164***** (0.648)	**1.493***** (0.434)	-0.325 (0.460)	**-0.564*** (0.337)
Exchange Rate misalignment	**-0.201***** (0.0559)	-0.0384 (0.0457)	**-0.390***** (0.0913)	**-0.110*** (0.0639)	**-0.165***** (0.0400)	-0.0444 (0.0277)	**-0.203***** (0.0588)	-0.0368 (0.0405)
Float peg (dummy) * ln of Exchange Rate Volatility	**-0.0866***** (0.0330)	**-0.0583**** (0.0245)	**-0.0866***** (0.0330)	**-0.0544**** (0.0239)	**-0.0909***** (0.0312)	**-0.0585**** (0.0242)	**-0.0910***** (0.0312)	**-0.0548**** (0.0237)
FTA (dummy)			-0.0160 (0.131)	-0.165 (0.104)			0.0211 (0.130)	-0.146 (0.100)
AFC (dummy)					0.372 (0.424)	0.0741 (0.541)	-0.209 (0.483)	-0.0878 (0.421)
Constant Term	-36.99*** (2.952)	-30.89*** (2.248)	-32.24*** (2.645)	-30.10*** (1.920)	-35.29*** (3.649)	-29.04*** (2.363)	-38.46*** (3.096)	-32.57*** (2.360)
Observations	3,096	3,096	3,096	3,096	3,563	3,563	3,563	3,563
R-squared	0.906	0.952	0.906	0.957	0.905	0.952	0.905	0.956
Country pair FE	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

[m] Exports in millions

Results indicate that the interaction of the natural logarithm of exchange rate volatility with a floating exchange rate regime continues to be significant. This demonstrates that the interaction term is still a significant determinant of exports regardless of an economic crisis occurring in the region.

FIGURE 3. RCEP Exchange rate volatility (three-year moving average; 1996-2017)



Source: Author's computation from International Monetary Fund [2020].

5. Summary and conclusion

This study analyzes the effects of REER, exchange rate volatility, exchange rate misalignment, and a floating exchange rate regime on aggregate exports within the RCEP region for the years 1996 to 2017 (22 years). Through an augmented gravity model approach, this study contributes to the literature exploring the effects of exchange rate volatility on exports by including more exchange rate variables in the model and by employing interactions between exchange rate variables and monetary policy instruments.

Common gravity variables such as the economic size and geographic distance are found to be significant in affecting the aggregate exports of a country in the RCEP region. The GDP product significantly increases exports while the distance between countries significantly reduces aggregate exports. However, other common gravity variables such as contiguity, common colony, and common language were not significant in affecting aggregate exports in the region. These results are interpreted as indicative of high economic integration brought by previously established PTAs in the region. Shared languages, a common colonizer, and the presence of a common border in the region are no longer a significant advantage to exports.

Key estimations performed in this study show that a country's REER ratio significantly reduces its aggregate exports and provides evidence of the aggregate export reducing effects of an appreciating currency relative to the country's trading partners. The results also provide empirical support to the use of interaction terms, as demonstrated by the derived negative effect of exchange rate volatility for countries under a floating exchange rate regime. Finally, the significant but minimal effect of exchange rate volatility estimated in the model is consistent with previous literature.

With this, exchange rates do affect the Big One as they play a hand in determining the level of exports traded within the region. This study also provides strong evidence of the significance of including monetary policy in the empirical analysis of trade policies such as economic integration initiatives. The particular case of the newly formalized RCEP agreement has the potential to re-energize trade in the region post-COVID, and to further prepare ASEAN for its venture towards more sophisticated FTAs in the future. As pointed out in this study, a country's monetary policy decisions and regimes play a vital role in estimating gains from trade out of these partnerships.

For future work, this study recommends expanding the augmented gravity model to include more monetary policy variables such as existence of currency unions and inflation targeting policies. However, these variables can only be considered if more countries are included in the sample data. Because no country in the RCEP region practices the use of currency unions, this variable cannot be analyzed in this paper due to lacks in the variation of the observations. This recommendation thus entails expanding the scope to a global dataset.

The dataset can also be expanded to evaluate a country's world export level on an aggregate and/or sectoral level. Expanding the dataset this way can explore the offsetting effect of FVA on significant export reducing variables such as REER and exchange rate volatility. Structural break dummy variables can also be explored to account for shocks in volatility levels caused by the Asian Financial Crisis.

It is also recommended to analyze the effects of the key variables in this study on other significant and dynamic sectors in the region such as rice and electronic products. The effects of exchange rate fluctuations vary for each product and conducting sectoral level analyses allow for a more nuanced study not afforded in aggregate-level analysis. Results of sectoral level studies can also allow researchers to compare the different levels of significance and magnitude of several key variables per sector or product. Thus, working on other disaggregated data makes the gravity model more efficient in analyzing the effects of independent variables on a country's exports.

Lastly, it is also recommended to re-estimate the model when trade data after the signing of the RCEP are available. This would help determine whether the RCEP, as an FTA, has significantly improved bilateral trade both inside and outside of the region. Although several studies have modelled the theoretical trade creating effects of RCEP, a complementary empirical estimation is needed to provide evidence on RCEP's trade creating effects.

Acknowledgements: I would like to thank everyone behind the BSP-TAS program for giving me the opportunity to submit this study. I would also like to thank Dr. Randy Tuaño for his comments and suggestions that helped enrich the discussions in this article and Mr. Gerald Pascua for his guidance and mentorship through the years regarding this study. Also, I would like to thank the two anonymous referees for their comments and suggestions.

References

Andersen, L. and R. Babula [2008] "The link between openness and long-run economic growth", *Journal of International Commerce and Economics*:1-15.

Anderson, J. [1979] "A theoretical foundation for the gravity equation", *American Economic Association* 69(1):106-116.

Anderson, J. and E. van Wincoop [2003] "Gravity with gravitas: a solution to the border puzzle", *American Economic Review* 93(1):170-192.

Asia Regional Integration Center [2022] "Free trade agreement", *Asia Regional Integration Center, Asian Development Bank*. Accessed December 5.

Bahmani-Oskooee, M. and S. Hegerty [2009] "The effects of exchange-rate volatility on commodity trade between the United States and Mexico", *Southern Economic Journal* 75(4):1019-044.

Banik, B. and C. K. Roy [2020] "Effect of exchange rate uncertainty on bilateral trade performance in SAARC countries: a gravity model analysis", *International Trade, Politics and Development* 5(1):32–50.

Benkovskis, K. and J. Wörz [2013] "Non-price competitiveness of exports from emerging countries", *European Central Bank Working Paper* No. 1612.

Bruegel [2020] "Real effective exchange rates for 178 countries: a new database (August 8, 2020 version)", https://www.bruegel.org/publications/datasets/real-effective-exchange-rates-for-178-countries-a-new-database/.

Chi, J. and S.K. Cheng [2016] "Do exchange rate volatility and income affect Australia's maritime export flows to Asia?", *Transport Policy* 47(April):13–21.

Clark, P., N. Tamirisa, S. Wei, A. Sadikov and L. Zeng [2004] "Exchange rate volatility and trade flows - some new evidence", *Policy Papers* 23.

Côté, A. [1994] "Exchange rate volatility and trade: a survey", *Bank of Canada Staff Working Paper* 1994-5.

Darvas, Z. [2012] "Real effective exchange rates for 178 countries: a new database", *Bruegel Working Paper* No. 6.

De Grauwe, P. [2005] *Economics of monetary union*. 6th ed. Oxford: Oxford University Press.

Dell'Ariccia, G. [1998] "Exchange rate fluctuations and trade flows: evidence from the European Union", *IMF Working Paper* No. 107.

Feenstra, R., R. Inklaar and M. Timmer [2015] "The next generation of the Penn World Table", *American Economic Review* 105(10):3150-3182.

Garnaut, R. [1998] "Exchange rates in the East Asian Crisis", *ASEAN Economic Bulletin* 15(3):328-337.

Gauto, V. [2012] "Paraguay and Mercosur: a sensitivity analysis of gravity model estimation techniques".

Harms, P. and J. Knaze [2018] "Bilateral de-jure exchange rate regimes and foreign direct investment: a gravity analysis", *Working Papers* No. 1808, Gutenberg School of Management and Economics, Johannes Gutenberg-Universität Mainz.

Hayakawa, K. and F. Kimura [2009] "The effect of exchange rate volatility on international trade in East Asia", *Journal of The Japanese and International Economies* 23(4):395-406.

Hondroyiannis, G., P.A.V.B. Swamy, G. Tavlas, and M. Ulan [2008] "Some further evidence on exchange-rate volatility and exports", *Review of World Economics* 144 (1):151-180.

International Monetary Fund [2006] "De facto classification of exchange rate regimes and monetary policy framework", https://www.imf.org/external/np/mfd/er/2006/eng/0706.htm. International Monetary Fund.

International Monetary Fund [2020] "International financial statistics (IFS)", https://data.imf.org/?sk=4C514D48-B6BA-49ED-8AB9-52B0C1A0179B.

Jenkins, G.P., C. Kuo and A. Harberger [2011] "Cost-benefit analysis for investment decisions: Chapter 11 (Economic prices for non-tradable goods and services)", http://econ.tu.ac.th/archan/sakon/ME%20701/Cost%20benefit%20analysis%20Jerkins,%20Kuo,%20Harberger/chapter%2011.pdf.

Kareem, F.O., I. Martinez-Zarzoso and B. Brümmer [2016] "Fitting the gravity model when zero trade flows are frequent: a comparison of estimation techniques using Africa's trade data", *GlobalFood Discussion Papers* No. 77.

Keho, Y. [2017] "The impact of trade openness on economic growth: the case of Cote D'Ivoire", *Cogent Economics & Finance* 5(1):1-11.

Klein, M. and J. Shambaugh [2006] "Fixed exchange rates and trade", *Journal of International Economics* 70(2):359-383.

Martin, W. [2020] "Making gravity great again", *World Bank Policy Research Working Paper* No. 9391.

Mayer, T. and S. Zignago [2011] "Notes on CEPII's distances measures: the GeoDist database", *CEPII Working Paper* 2011-25.

McCartney, M. [2015] "The missing economic magic: the failure of trade liberalization and exchange rate devaluation in Pakistan, 1980–2012", *The Lahore Journal of Economics* 20(SE):59-86.

McKenzie, M. D. [1999] "The impact of exchange rate volatility on international trade flows", *Journal of Economic Surveys* 13(1):71–106.

Naseem, N.A.M., H. Tan, and M.S. Hamizah [2009] "Exchange rate misalignment, volatility and import flows in Malaysia", *International Journal of Economics and Management* 1(3):130–50.

Nasir, M.A. and K. Jackson [2019] "An inquiry into exchange rate misalignments as a cause of major global trade imbalances," *Journal of Economic Studies* 46(4):902-924.

Nho, P.V. and V.T. Hương [2015] "Analyzing the determinants of service trade flows between Vietnam and the European Union: a gravity model approach", https://www.freit.org/WorkingPapers/Papers/TradePatterns/FREIT743.pdf.

Nicita, A. [2013] "Exchange rates, international trade and trade policies", *Policy Issues in International Trade and Commodities Study Series* No. 56.

Njoroge, L. [2020] "The effects of exchange rate volatility on exports in COMESA: a panel gravity model approach", *Journal of Applied Finance & Banking* 10(6):203–23.

Pomfret, R. and V. Pontines [2013] "Exchange rate policy and regional trade agreements: a case of conflicted interests?" *ADBI Working Paper Series* No. 436.

Prajakschitt, P. [2015] "Exchange rate volatility and trade: the case of trade among China and ASEAN countries", http://lup.lub.lu.se/student-papers/record/7793864.

Rana, P. [1998] "The East Asian financial crisis: implication for exchange rate management", *EDRC Briefing Notes* No. 5.

Rodrik, D. [2008] "The real exchange rate and economic growth", *Brookings Papers on Economic Activity* 2008(2):365-412.

Santana-Gallego, M. and J.V. Pérez-Rodríguez [2019] "International trade, exchange rate regimes, and financial crises", *The North American Journal of Economics and Finance* 47(January):85–95.

Satawatananon, K. [2014] "The effects of exchange rate volatility on commodity trade flows between the US And Thailand", PhD dissertation.

Santos Silva, J.M.C. and S. Tenreyro [2006] "The log of gravity", *Review of Economics and Statistics* 88(4):641-658.

Senadza, B. and D.D. Diaba [2018] "Effect of exchange rate volatility on trade in Sub-Saharan Africa", *Journal of African Trade* 4(1-2):20-36.

Shepherd, B. [2016] "The gravity model of international trade: a user guide (an updated version)", https://www.unescap.org/sites/default/files/GravityUserGuide-REVISED-02.pdf.

Siliverstovs, B. and D. Schumacher [2008] "Estimating gravity equations: to log or not to log?" *Empirical Economics* 36(3):645-669.

Tan, K.G., L.N. Trieu Duong, and H.Y. Chuah [2019] "Impact of exchange rates on ASEAN's trade in the era of global value chains: an empirical assessment", *The Journal of International Trade & Economic Development* 28(7):873-901.

Tarasenko, I. [2021] "The impact of exchange rate volatility on trade: the evidence from Russia", *Russian Journal of Economics* 7(3):213–32.

Tenreyro, S. [2007] "On the trade impact of nominal exchange rate volatility", *Journal of Development Economics* 82(2):485-508.

Tinbergen, J. [1962] *Shaping the world economy: suggestions for an international economic policy*. New York: Twentieth Century Fund.

United Nations Comtrade [2020] "International trade statistics (September 2020 version)", https://comtrade.un.org/data.

Vo, D.H., A.T. Vo, and Z. Zhang [2019] "Exchange rate volatility and disaggregated manufacturing exports: evidence from an emerging country", *Journal of Risk and Financial Management* 12 (1):1-25. doi:10.3390/jrfm12010012.

Wong, K. and T.T. Chong [2016] "Does monetary policy matter for trade?", *International Economics* 147(October):107-125.

World Bank [2020a] "Export of goods and services (annual % growth)", https://data.worldbank.org/indicator/NE.EXP.GNFS.KD.ZG

World Bank [2020b] "GDP (current US$)", https://data.worldbank.org/indicator/NY.GDP.MKTP.CD.

World Bank [2020c] "GDP Growth (Annual %)", https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG

World Bank [2020d] "GDP per capita (constant 2010 US$)", https://data.worldbank.org/indicator/NY.GDP.PCAP.CD

World Bank [2020e] "Trade (% of GDP)," https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS

World Bank [2022a] "Exports of goods and services (current US$)", https://data.worldbank.org/indicator/NE.EXP.GNFS.CD.

World Bank [2022b] "GDP (current US$)", https://data.worldbank.org/indicator/NY.GDP.MKTP.CD.

World Bank [2022c] "Population, total", https://data.worldbank.org/indicator/SP.POP.TOTL.

Yotov, Y., R. Piermartini, J. Monteiro, and M. Larch [2016] *An advanced guide to trade policy analysis: the structural gravity model*. World Trade Organization. https://www.wto.org/english/res_e/booksp_e/advancedwtounctad2016_e.pdf.