Available online at www.centmapress.org

Int. J. Food System Dynamics 15 (4), 2024, 388-396

DOI: https://dx.doi.org/10.18461/ijfsd.v15i4.L4

INTERNATIONAL JOURNAL ON FOOD SYSTEM DYNAMICS

Vietnam rice value: Gravity model for transitional export period 2011-2021

Le Canh Dung[1] and Nguyen Hoang Tinh[2]

[1]*Mekong Delta Development Research Institute, Can Tho University, Can Tho City, Vietnam*
[2]*School of Economics, Can Tho University, Vietnam*
lcdung@ctu.edu.vn; *nhtinhctu@gmail.com*

Received September 2023, accepted February 2024, available online June 2024

ABSTRACT

This study examined the factors affecting Vietnam's rice export value in the transitional period of 2011–2021 using panel data of 45 importers comprising 90% of Vietnam's rice export value. The generalized least square model was used for estimation, and the results reveal that the factors of world rice export prices, importing country's population, membership in the Comprehensive and Progressive Agreement for Trans-Pacific Partnership, European–Vietnam Free Trade Agreement, and multilateral or bilateral relationship positively affect export value. However, the importing country's GDP and self-produced food output and Vietnam's inflation negatively influence rice export turnover. Consequently, several policy recommendations are suggested.

Keywords*: GLS model, rice export, value, Vietnam, world price.*

1 Introduction

Owing to economic reforms, Vietnam has become a rice exporter since 1989 (Doanh, 1991; Ronnas and Sjoberg, 1995) and has progressively become one of the world's foremost rice exporters after India and Thailand (FAO-AMIS, 2021). However, for previous years of export, Vietnam's rice primarily went to Asian markets, mainly China and the Philippines, (66.7%), followed by Africa (18.9%) and other markets at a minimal price of about 340.91 USD/ton (VFA, 2021; Nielsen, 2003; Ba et al., 2019). Although Vietnam is one of the largest exporters, its rice sector has been environmentally and economically challenged due to the long history of rice farming intensity associated with low-quality segment exported (Brown et al., 2018; Tran et al., 2018; Tin, 2017; Phong and Tam, 2015).

Recently, the agriculture and rice sector, specifically, have positively transitioned toward improved economic efficiency as well as sustainable development marked by several relevant policies. The overarching policy is officially stated in Resolution 120 (Government, 2017) as well as rice sectoral policies issued previously such as the Rice Industry Restructuring Program (Government, 2017; MARD, 2016; MARD, 2021). Building the Vietnamese rice brand (Prime Minister, 2015) has modified the view of the importance of establishing rice quality rather than quantity, as previously emphasized. Moreover, a new trade liberalization policy expressed by Decree 107 (Government, 2018) has led processing and exporting enterprises to become more proactive in discovering and entering new markets with demand for high-quality rice (Dung et al., 2022). Specifically, in recent years, bilateral and multilateral free trade agreements (FTAs), such as the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (WB, 2018) and the European–Vietnam Free Trade Agreement (EVFTA; Nga et al., 2020), have certainly produced the effects of two-way trade in general and the rice exports of Vietnam in particular.

During the transitional period 2011–2021, the rice industry's manufacturing and export shifted its focus from quantity to quality and began to export to new markets with higher value. Factors influencing rice export turnover during this transitional period must be studied. Among parametric models commonly used to establish the influences of trade and export turnover, the gravity model, where multiple dimensions of time, context, and the complexity of variables interact with one another, has elicited a large amount of interest.

The gravity model was first used by Tinbergen in 1962 to identify factors influencing the export value and was popularly followed by others who pursued perfecting the theoretical foundation of the model. For example, Rahman (2003) analyzed the gravity model of trade of Bangladesh. Blomqvist (2004) applied the gravity model to elucidate the trade flows of Singapore. Peci (2010) recognized the determinants of the trade agreement of Kosovo. Hatab et al. (2010) and Elshehawy et al. (2014) examined the export decision of agricultural products of Egypt. Other authors such as Binh et al. (2014) applied the gravity model to investigate the trade activities of Vietnam. Irshad et al. (2018) also examined the trade pattern of China. Obeng et al. (2023) used the gravity model to study the export performance of Ghana. Balogh and Borges Aguiar (2022) examined the agricultural trade decisions of Latin America and the Caribbean. These studies confirmed that several internal factors influence a country's exports: GDP, population, geographic distance, consumer price index, foreign direct investment, and exchange rate. Exports are not only influenced by internal factors; external factors also have a bearing on the export value of a product such as the self-produced food output of importing countries and participation in the new generation of trade agreements (FTAs).

Discovering the factors that influence the export value of a product is imperative for a developing country with an export-oriented agricultural economy such as Vietnam. Therefore, this study aimed to identify the factors that influence the rice exports of Vietnam and suggests solutions to advance rice export activities and ultimately benefit related rice value chain actors, especially rice growers. Extended gravity models, which inherit the economic and trade theories of many previous authors, are used to examine the value of the rice exports of Vietnam in 2011–2021.

2 Methodology

2.1 Theoretical gravity model

The gravity model (also referred to as the trade attractiveness model) is a popular theoretical framework used by many economists to quantify and examine the factors influencing exports between two or more countries. Tinbergen (1962) and Poyhonen (1963) initially applied theory of universal gravitation to economic analysis. Krugman and Obstfeld (2003) presented that the general trade attractiveness model applied in two-way commerce has the following form:

$$T_{ij} = A * \frac{Y_i * Y_j}{D_{ij}^2}, \quad (1)$$

where

A is the attractive/hinder coefficiency,
T_{ij} is the value of trade between contries *i* and *j*,
Y_i is the national economic size of country *i*,
Y_j is the national economic size of country *j*, and
D_{ij} represents the economic distance and other economic differences between countries *i* and *j*.

First, owing to the lack of a theoretical foundation, the gravity model was opposed by economists. However, since the second half of the 1970s, many studies have concentrated on addressing this research gap. Most studies have developed the gravity equation based on the foundation of three major international trade theories: Ricardo theory, Heckscher–Ohlin theory, and new trade theory. Accordingly, researchers have added new factors like income per capita, taxes (Linnemann, 1966), real exchange rates, commodity prices (Bergstrand, 1985), country distance (Rahman, 2010; Balogh and Borges, 2022), consumer price index (Hatab et al., 2010), inflation (Abidin et al., 2013), religious gap, language gap (Stop, 2017), institutional distance (Braha et al., 2017), and openness of the economy (Tu and Hao, 2017; Jagdambe and Kannan, 2020). According to the above studies, the current trade attractiveness model has three main groups of factors influencing the exports or trade flows of countries: supply-side factors (exporting country *i*), group of demand-side factors (importing country *j*), and groups of attractive or hindering factors.

Inspired by the abovementioned authors, this study proposes an expanded trade attractiveness model to examine the factors of Vietnam's rice export turnover to the world market as follows:

$$Ln(EX_{ijt}) = \beta_0 + \beta_1 ln(GDP_{it}) + \beta_2 ln(RER_{ijt}) + \beta_3 ln(WPt) + \beta_4 ln(GDP_{jt}) + \beta_5 ln(PO_{jt}) + \beta_6 ln(SP_{jt}) + \beta_7 (IF_{it}) + \beta_8 CPTPP_{ijt} + \beta_9 EVFTA_{ijt} + \beta_{10} BTA_{ijt} + u_{ijt},$$

where

i is the exporting country (Vietnam);
j is the importing country, which ranges from 1 to 45;
t is the year of export, which ranges from 2011, 2012, … to 2021;
$LnEX_{ijt}$ is the rice export value from the *j* country at the time t (USD);
$LnGDP_{it}$ is the GDP of Vietnam at the time *t* (USD);
$LnRER_{ijt}$ is the real exchange rate between Vietnam currency and the imported country *j* at time *t* (VND);
$LnWP_t$ is the exporting world rice price at time *t* (USD/ton);
$LnGDP_{jt}$ is the GDP of importing country *j* at time *t* (USD);
$LnPO_{jt}$ is the population of importing country *j* at time t (person);
$Ln(1+SP_{jt})$ is the self-produced rice per capita of the importing country *j* at time *t* (kg);
IF_{it} is the inflation rate of Vietnam at time *t* (%);
$CPTPP_{ijt}$ is the dummy value (1/0) indicating the comembership of Vietnam and the importing country *j* at time *t*;
$EVFTA_{ijt}$ is the dummy value (1/0) indicating the comembership of Vietnam and the importing country *j* at time *t*;
BTA_{ijt} is the dummy value (1/0) indicating comembership of either bilateral or multilateral between Vietnam and importing country *j* at time *t*;
β_0, ..., β_{10} are the coefficients of independent variables; and u_{ijt} is the error.

The data used for the model were collected from numerous official sources of exporting and importing countries and international organizations. The data on export values and rice prices were sourced from the websites of the International Trade Center and the United Nation Database. The population and GDP of the importing countries were taken from the World Bank. The information of the self-produced rice of the importing country came from the United Nation Food and Agriculture Organization. The real exchange rates were obtained from the IMF and UNCTAD.

2.2 Method of model selection and estimation the model

When using panel data regression, three models could be applied in the estimation depending on the data properties as well as the unique advantages of each model: the pooled ordinary least square (OLS) model, the fixed effect model (FEM), and and random effect model (REM). The pooled OLS model disregards the influences over time and across firms. Thus, the results might not correctly reflect the relationships of the variables cross cases and over time, which is due to the potential auto correlation or heteroscedasticity risks in piling up the data. This approach generates biased estimates of variances, standard deviations, and coefficients that utlimately influence the inferences of intercept and coefficients and their corresponding levels of significance (Gil-García and Puron-Cid, 2013). To address this phenomenon, the Breusch–Pagan Lagrange Multiplier (LM) test (1980) was used. If such kind of potential auto correlation or heteroscedasticity risks in piling up the data did not exist, the pooled OLS model would be the best alternative; conversely, the FEM and REM would be more preferred.

The FEM and REM models could manage the phenomena of the above data in the model, which was part of the model error (u_i). However, when considering u_i, a difference between FEM and REM was observed. Both models confirmed the existence of u_i, but if these separate effects were correlated with independent variables, then the most suitable method was FEM; conversely, if u_i had no correlation with the independent variable (ui ~ (0,σ2)), then REM was more appropriate. To select between REM and FEM, the Hausman (1978) test was used considering the hypothesis H_0 that the REM model was more appropriate, and vice versa.

To guarantee the dependability and suitability of the estimation, model defects like multicollinearity, unequal error variances, and autocorrelation were assessed. Accordingly, the variance inflation factor coefficient was used to verify multicollinearity, the Modified Wald test to check unequal error variances (Greene, 2000), and the Wooldridge test was used to determine the phenomenon of auto correlation (Wooldridge, 2002). If the above phenomena occurred, the generalized least square (GLS) regression model, an extended OLS estimation of the normal linear model treated for the possibly unequal error variances and correlations between different errors, was used (Fox and Weisberg, 2018).

2.3 Vietnam rice export in 2011–2021

The most vital parameters of this study are the value, quantity, and price of rice exported by Vietnam to countries and territories of interest (Figure 1). When 2017 is the limit for the two periods before and after the transition due to the policies of Vietnam, a remarkable change in rice exports is observed in quantity, turnover, and price. The mean amount of rice exported was 6,575 million tons of milled rice in 2011–2016, higher than 6,158 million tons in 2017–2021. The export value of rice in the later period also reflects a decrease compared with the first period. However, export rice prices have began to rise. Particularly, the mean rice price in 2017–2021 was 487 USD/ton, whereas that in the previous period of 2011–2016 was only 459 USD/ton. These data are the dependent variables in the gravity model, and they are validated by the independent variables obtained. The results of model evaluation are discussed in detail in the next section.

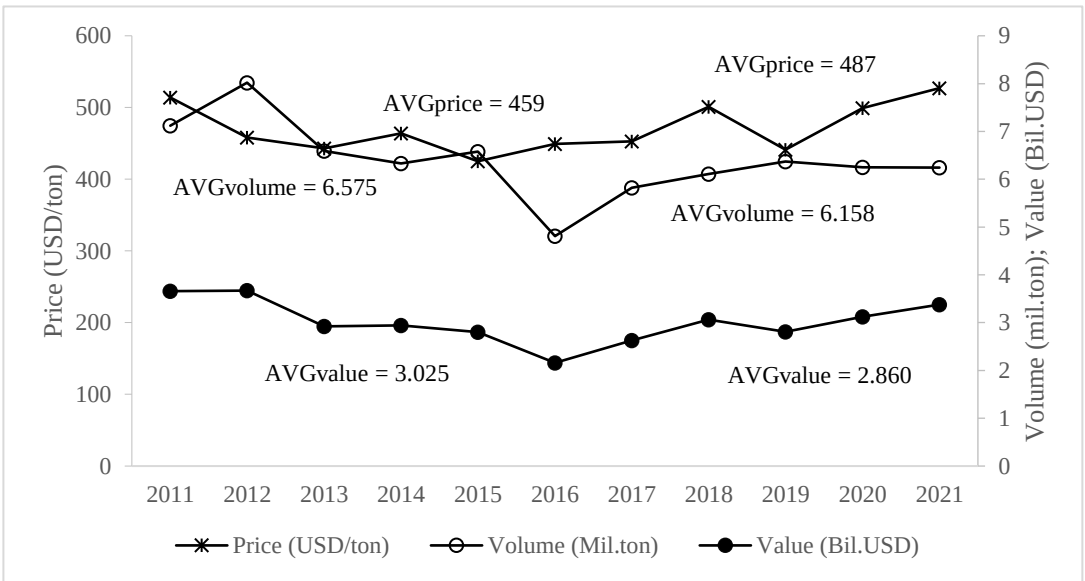

Figure 1. Vietnam's rice export value in 2011–2021.
(Source: Author's calculation)

3 Results and Discussions

3.1 Test results of model selection

As mentioned in Section 2.2 about the evaluation technique for choosing a suitable regression model, the results of the LM test has a p value of 0.0000 that is much less than the critical limit of 0.05. Thus, hypothesis H_0 is rejected. As the pooled OLS model is not appropriate for estimating this problem, one of the two models, FEM or REM, would be used.

To ascertain whether the FEM model or the REM model is appropriate for estimation, the Hausman test result has p value = 0.0002 that is much lower than the critical limit of 0.05. Thus, hypothesis H_0 is rejected, and hypothesis H_1 and the FEM model are accepted. Moreover, the results of the FEM model estimation exhibit the p value = 0.0000. Thus, the model is statistically significant.

The evaluation results of the LM in the FEM model reveal that the p value = 0.0000 < 0.05. Hence, the model exhibits heteroskedasticity. Regarding autocorrelation, the LM test provides the p value = 0.0285 < 0.05, so the model has an autocorrelation phenomenon. Finally, to overcome both the above phenomena, the study used the GLS method for estimation (Fox and Weisberg, 2018), and the estimation results are presented below.

3.2 Results of model estimation

The results of the GLS model estimation after correcting the defects are presented in Table 1. The Wald chi-square test of the model has a value of 356.81, and the probability of difference of the model under indicator of Pro-Chi-Square number is 0.0000. Thus, the GLS model is appropriate. Factors with a statistically significant effect on the rice export turnover of Vietnam include the world export price of rice, the GDP of the importing country, the population of the importing country, the self-produced food output of the country, the inflation rate of Vietnam, the comembership in the CPTPP, and the same membership in a multilateral or bilateral relationship. Each variable has dissimilar directions and levels of influence on the export turnover of Vietnam.

Table 1.
Results of GLS model estimation

Variables	B coefficients	Standard errors	P value
Intercept	3.823^{ns} (1.32)	2.889	0.186
$LnGDP_{it}$	0.040^{ns} (0.31)	0.127	0.755
$LnRER_{ijt}$	0.046^{ns} (1.05)	0.044	0.295
$LnWP_t$	1.316^{***} (3.72)	0.354	0.000
$LnGDP_{jt}$	-0.401^{***} (−6.0)	0.067	0.000
$LnPO_{jt}$	1.046^{***} (11.35)	0.092	0.000
$LnSP_{jt}$	-0.602^{***} (−13.96)	0.043	0.000
IF_{it}	-0.019^{***} (−2.58)	0.007	0.010
$CPTPP_{ijt}$	0.651^{***} (2.91)	0.224	0.004
$EVFTA_{ijt}$	-0.193^{ns} (−0.80)	0.242	0.426
BTA_{ijt}	0.352^{**} (2.01)	0.175	0.044
Wald Chi-Square	Wald = 356.81		
Prob-Chi-Square	0.0000		
Observations	495		

*t statistics in parentheses, * p < 0.05, ** p < 0.01, *** p < 0.001 (Source: Author's calculation)*

First, the world rice exported price variable has a positive influence on Vietnam's rice export turnover and is statistically significant at the 1% level. When other factors remain unchanged, a 1% increase in world rice export prices causes Vietnam's rice export turnover to increase by an average of 1.32%. This outcome could be explained by one or both of the following reasons. First, when world rice prices increase, Vietnamese rice prices can also increase, thereby increasing

Vietnam's export turnover. Second, when rice prices increase, consumers in importing countries might switch to using rice with average quality and cheaper prices such as rice imported from Vietnam. Since then, world rice prices have increased, leading to a rise in Vietnam's rice export turnover.

Next, the GDP size of the importing country has a negative influence on Vietnam's rice export turnover, and the estimated coefficient is statistically significant at the 1% level. When other factors remained unchanged, a 1% increased in the importing country's GDP could cause Vietnam's export turnover to decrease by 0.40%. This outcome is consistent with the study of Abidin et al. (2013), Kea et al. (2019), Jagdambe and Kannan (2020), Abdullahi et al. (2021), and Balogh and Borges (2022). In recent years, when Vietnam's rice industry did not achieve complete reform, it primarily exported low-quality rice to importing countries with low GDP. Once the importing country's GDP rose, consumer tastes became more discriminating, and the country imported less Vietnamese rice than before. This outcome implies a reduction in Vietnam's rice export turnover.

The population size of the importing country has a positive coefficient and is statistically significant at the 1% level, which means the population size of the importing country has a positive influence on Vietnam's rice export turnover. If other factors remain constant, a 1% increased in the population of the importing country could increase Vietnam's rice export turnover by 1.05%; this result is consistent with the studies of Jagdambe and Kannan (2020) and Abdullahi et al. (2021). Vietnamese rice has been primarily exported to populous countries like China, United States, Philippines, Indonesia, and Russia. However, for countries like Qatar, Norway, Laos, and Lithuania with small population of less than 10 million people, most of the rice export turnover from Vietnam is less than 10 million USD. This explains the hypothesis that a country with a large population imports more rice and one with a smaller population imports less rice from Vietnam.

The importing country's self-produced food output has a negative effect on Vietnam's rice export turnover and is statistically significant at the 1% level. When other factors remain unchanged, a 1% increase in self-produced food output could cause Vietnam's rice export turnover to decrease by 0.60%. This outcome is understandable because when countries produce their own food, the demand for rice imports decreases. For example, Australia, Canada, England, and some EU countries generate their own barley and even export it to other countries, so they reduced their rice imports from Vietnam.

Vietnam's inflation coefficient has a negative sign and is statistically significant at the 1% level. When other factors remain unchanged, a 1% increase in inflation rate could cause Vietnam's rice export turnover to decrease by 1.90%. This result is consistent with the hypothesis and research of Abidin et al. (2013) and Yen and Thao (2017). When inflation increases, domestic goods prices would increase, lessening the competitiveness of domestic enterprises with foreign enterprises, thereby influencing Vietnam's rice exports.

Vietnam's status as a member of the CPTPP organization with the importing country has a positive influence on Vietnam's export turnover and is statistically significant at the 1% level. If Vietnam participates in this organization, its rice export turnover would increase by $e^{0.651}$ - 1 time, equivalent to 92.32% of the previous value. Empirical data show that since CPTPP took effect, it had opened up a favorable opportunity for Vietnam's agricultural industry in general and rice products in particular to diversify markets and conquer numerous potential markets, helping grow the revenue of Vietnam's rice exports.

Finally, when Vietnam and a partner country have at least the same multilateral or bilateral relationship, Vietnam's rice export turnover increases by an $e^{0.352}$ - 1 times or 42.19%. Currently, Vietnam has leveraged its advantages in rice export by participating in and signing multilateral and bilateral agreements. From these FTAs, Vietnamese rice brands have become more popular, and Vietnam's rice export market has slowly expanded to export to high-end rice consumer markets and sell specialty rice at higher prices than other ordinary white rice, contributing to increasing the value of Vietnamese rice exports.

4 Conclusions and Recommendations

The trade attractiveness model used to examine the factors influencing Vietnam's rice export turnover is certainly appropriate and effective. The model reveals the contribution of the macro factors of Vietnam and importing countries, specifically the recent enactment of trading agreements. Model estimation shows that the factors like world rice price, population of the importing countries, membership of the CPTPP as well as the multilateral or bilateral positively influence increasing Vietnam's rice export turnover. Factors such as the partner country's GDP, self-produced food output, and Vietnam's inflation negatively affect the rice export turnover. According to quantitative scientific findings, the following policy implications are proposed.

First, Vietnam must proceed with strengthening the competitiveness of the rice industry more deeply. A global rice value chain targeting high-income importing countries must be developed. One of the chain upgrading activities is to establish and nurture the Vietnamese rice brand in a multisegment direction to meet the requirements of the

international rice market in accordance with the consumption characteristics of many different countries, not only for traditional markets but also for new importers who have recently signed trading agreements with Vietnam.

Second, rice exports must promote changes toward increasing quality and standardizing products to meet market requirements such as VietGAP, GlobalGAP, SRP, or organic. Both help reduce production costs and lessen greenhouse gas emissions during farming.

Third, Vietnam must harmonize its monetary and fiscal policies to alleviate domestic inflation. It also needs policies to expand credit packages to serve the capital needs of businesses in the rice industry and small producers. Moreover, the state should focus on leveraging lending interest rates to encourage businesses outside the field to invest in the rice industry of Vietnam, contributing to developing the domestic rice market and promoting export activities in the coming period.

Finally, the state needs to focus on developing transportation infrastructure and related supporting industries in the agricultural sector. Meanwhile, functional ministries must coordinate with localities for the swift implementation of policies and regulations promoting the development of high-quality rice area in the Mekong Delta for export.

References

Abdullahi, N. M., Huo, X., Zhang, Q., and Bolanle Azeez, A. (2021). Determinants and potential of agri-food trade using the stochastic frontier gravity model: Empirical evidence from Nigeria. *SAGE Open,* **11**(4): 1-12. doi: 10.1177/21582440211065770.

Abidin, I. S. Z., Bakar, N. A., and Sahlan, R. (2013). The determinants of exports between Malaysia and the OIC member countries: A gravity model approach. *Procedia Economics and Finance*, **05**: 12-19. doi: 10.1016/S2212-5671(13)00004-X.

Ba, H. A., Mey Y., Thorond, S., and Demont, M. (2019). Inclusiveness of contract farming along the vertical coordination continuum: Evidence from the Vietnamese rice sector. *Land Use Policy*, **87**: 104050. doi: 10.1016/j.landusepol.2019.104050.

Balogh, J. M., Borges Aguiar, G. M. (2022). Determinants of Latin American and the Caribbean agricultural trade: A gravity model approach. *Agricultural Economics (Zemedelska Ekonomika),* **68**(4): 127-136. doi: 10.17221/405/2021-Agricecon.

Binh, D. T. T., Nguyen, V. D., and Cuong, H. M. (2014). Applying gravity model to analyze trade activities of Vietnam. *Journal of International Economics and Management*, **69**(69): 3-18.

Blomqvist, H. (2004). Explaining trade flows of Singapore. *Asian Economic Journal*, **18**: 25-43. doi: 10.1111/j.1467-8381.2004.00180.x.

Braha, K., Qineti, A., Cupák, A., and Lazorcakova, E. (2017). Determinants of Albanian agricultural export: The gravity model approach. *Agris On-Line Papers in Economics and Informatics,* **08**: 3-21. doi: 10.7160/aol.2017.090201.

Breusch, T. S., Pagan, A. R. (1980). The Lagrange multiplier test and its applications to model specification in econometrics. *Review of Economic Studies*, **47**(1): 239-253.

Brown, P. R., Tuan, V. V., Nhan, D. K., Dung, L. C., and Ward, J. (2018). Influence of livelihoods on climate change adaptation for smallholder farmers in the Mekong Delta Vietnam. *International Journal of Agricultural Sustainability*, **16**(3): 255-271. doi: 10.1080/14735903.2018.1472858.

Can, N. D., De, N. N. (2016). Agriculture and Rural Development Mekong Delta: Achievements and prospects. Can Tho University Publishing House.

Commercial law (2017). National Political Publishing House, Hanoi.

Doanh, L. D. (1991). Economic renovation in Vietnam: Achievement and prospects. In: Fobes, D.K. and Forbes, D. (Eds), Doi Moi in Vietnam's Renovation Policy and Performance. Australian National University.

Dung, L. C., Tuan, V. V., Thoa, N. T. K., Son, N. P., and Eiligmann, A. (2022). The potential of the rice value chain in the Mekong Delta to develop high value export markets. *International Journal on Food System Dynamics*, **13**(3): 335-348. DOI: doi: 10.18461/ijfsd.v13i3.C7

Dut, V. V. (2017). How do country distance factors affect the exports of the Vietnamese economy? *The UHD-CTU Annual Economics and Business Conference 2017* (tr. 742-754). Can Tho University Publishing House.

Elshehawy, M. A., Shen, H., and Ahmed, R. A. (2014). The factors affecting Egypt's exports: Evidence from the gravity model analysis. *Open Journal of Social Sciences,* **2**(11): 138–148. doi: 10.4236/jss.2014.211020.

FAO-AMIS (2021). AMIS Market database: World - Rice (milled) at a glance. Accessed on 25.7.2021 at http://statistics.amis-outlook.org/data/index.html.

Fox, J., Weisberg, S. (2018). Time-Series Regression and Generalized Least Squares in R*. An Appendix to An R Companion to Applied Regression, third edition. Sage Publications (2019).

Government (2017). Resolution No. 120/NQ-CP dated November 17, 2017, on climate resilient and sustainable development of the Mekong River Delta.

Government (2018). Decree No. 107/2018/ND-CP dated August 15, 2018, on rice export business.

Greene, W. (2000). Econometric Analysis, Upper Saddle River, NJ: Prentice—Hall, 2000

Hatab, A. A., Romstad, E., and Huo, X. (2010). Determinants of Egyptian agricultural exports: A gravity model approach. *Modern Economy,* **01**(3): 134-143. doi: 10.4236/me.2010.13015.

Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica*, **46**(6): 1251–1271. doi: 10.2307/1913827

Irshad, M. S., Xin, Q., Shahriar, S., and Arshad, H. (2018). A panel data analysis of Chinas trade pattern with OPEC members: Gravity model approach. *Asian Economic and Financial Review,* **8**(01): 103-116. doi: 10.18488/journal.aefr.2018.81.103.116.

Jagdambe, S., and Kannan, E. (2020). Effects of ASEAN-India free trade agreement on agricultural trade: The gravity model approach. *World Development Perspectives*, **19**: 100212. doi: 10.1016/j.wdp.2020.100212.

Kea, S., Li, H., Shahriar, S., Abdullahi, N. M., Phoak, S., and Touch, T. (2019). Factors influencing Cambodian rice exports: An application of the dynamic panel gravity model. *Emerging Markets Finance and Trade,* **55**(15): 3631-3652. doi: 10.1080/1540496X.2019.1673724.

Linnemann H. (1966). An Econometric Study of International Trade Flows. Holland Publishing, Amsterdam.

MARD (2016). Decision No. 1898/QD-BNN-TT dated May 23, 2016, about Approving Scheme for Restructuring of Vietnam's Rice Industry by 2020 with vision to 2030.

MARD (2021). Decision No. 555/QD-BNN-TT dated January 26, 2021, about Approving Scheme for Restructuring of Vietnam's Rice Industry by 2025 and 2030.

Nga, L. T. V., Huy, D. T. N., Minh, D. N., Dat, P. M. (2020). European-Vietnam free trade agreement (EVFTA) impacts on imports: A case study. *Journal of Security and Sustainability Issues*, **9**(M): 56-68. doi: 10.9770/jssi.2020.9.M(5)

Nielsen, C. P. (2003). Vietnam's rice policy: recent reforms and future opportunities. *Asian Economic Journal*, **17**(1): 1-26.

Obeng, C. K., Boadu, M. T., and Ewusie, E.-A. (2023). Deep preferential trade agreements and export efficiency in Ghana: Do institutions matter? *Research in Globalization*, **6**: 100-112. doi: 10.1016/j.resglo.2023.100112.

Peci, F., Holzner, M., and Kutllovci, E. (2010). Determinants of Kosovo trade: A gravity model approach. *South East European Journal of Economics and Business,* **5**(2): 33-41. doi: 10.2478/v10033-010-0013-4

Phong, L. T., Tam, H. M. (2015). Environmental effects of three rice production models of Small farmer(s) - Large field, GAP, and conventional farming in the MD. *Scientific Journal of Can Tho University,* **38**(2): 64-75.

Poyhonen, P. (1963). A tentative model for the volume of trade between countries. *Weltwirtschaftliches Archiv*, **90**: 93-100.

Prime Minister (2015). Decision No.706/QD-TTg dated May 21, 2015, on Approval for the Program for Developing Vietnamese Rice Brand by 2020 with vision to 2030.

Rahman, M. M. (2003). A panel data analysis of Bangladesh's trade: The Gravity model approach. *Proceedings of the 5th European Trade Study Group Conference, Madrid, 11-13 September 2003*, pp. 1-54.

Ramón Gil-García, J., Puron-Cid, G. Y. (2013). Using panel data techniques for social science research: An illustrative case and some guidelines. *Ciencia Ergo Sum*, **21**(3).

Ronnas, P., Sjoberg, O., (1995). Economic Reform, Employment and Labour Market Policy in Vietnam. Labour Market paper. International Labour Organization, 1995.

Tin, N. H. (2017). An Overview of Agricultural Pollution in Vietnam: The Crops Sector. The World Bank. General Statistics Office (2010-2021). Statistical Book 2010-2021. Statistical Publishing.

Tinbergen, J. (1962). Shaping the World Economy: Suggestions for an International Economic Policy, New York: The Twentieth Century Fund.

Tran D. D., van Halsema G., Hellegers P. J. G. J., Ludwig F., Wyatt A. (2018). Questioning triple rice intensification on the Vietnamese MD floodplains: An environmental and economic analysis of current land-use trends and alternatives. *Journal of Environmental Management*, **217**: 429-441. doi: 10.1016/j.jenvman.2018.03.116. Epub 2018 Apr 6.

Tu, P. A., Hao P. T. N. (2017). Studying the factors affecting bilateral trade between Vietnam and trading partners by gravity model. *The UHD-CTU Annual Economics and Business Conference 2017* (tr. 648-662). Can Tho University Publishing House.

VFA (2021). Vietnam's rice export in the period 1989-2017. Accessed on 25.7.2021 at https://vietfood.org.vn/xuat-khau-gao-viet-nam-giai-doan-1989-2017/.

Wooldridge, J. M. (2002). Econometric Analysis of Cross Section and Panel Data, Cambridge, MIT Press, 2002

World Bank (2018). Economic and Distributional Impacts of Comprehensive and Progressive Agreement for Trans-Pacific Partnership: The case of Vietnam. Washington, DC: World Bank. License: Creative Commons Attribution CC BY 3.0 IGO .

Yen T. T. B., Thao T. T. T. (2017). Studying the factors affecting bilateral trade between Vietnam and trading partners by gravity model. *The UHD-CTU Annual Economics and Business Conference 2017*. (tr.768-778). Can Tho University Publishing House.