Asian Economic and Financial Review
ISSN(e): 2222-6737
ISSN(p): 2305-2147
DOI: 10.55493/5002.v12i8.4589
Vol. 12, No. 8, 722-730.

URL: www.aessweb.com

DETERMINANTS OF THE EXPORT EFFICIENCY OF VIETNAM'S TEXTILES AND GARMENTS TO EU COUNTRIES – A STOCHASTIC FRONTIER GRAVITY APPROACH

Dang Quang Vinh[1+]
Le Ha Phuong[2]

[1,2]*Faculty of Interdisciplinary Social Sciences, VNU Vietnam Japan University, Ha Noi, Vietnam.*
[1]*Email: dq.vinh@vju.ac.vn Tel: +84 912942076.*
[2]*Email: phuong.14th@gmail.com Tel: +84383462959*

(+ Corresponding author)

Article History
Received: 20 May 2022
Revised: 29 July 2022
Accepted: 12 August 2022
Published: 22 August 2022

Keywords
Export efficiency
Stochastic frontier gravity model
Textiles
Garments
Vietnam
EVFTA
Institutions.

JEL Classification:
F10; F14.

ABSTRACT

While free trade agreements (FTAs) can provide access to new markets, it is not automatic that producers of home countries can export to the maximum level that can be predicted by market size and level of trade liberalization. Hence, it is necessary to know the level of export efficiency and its determinants if countries want to maximize the benefits of their global integration efforts. Textiles and garments are important exports and growth drivers of Vietnam, but their export efficiency has not been studied before. This paper aims to bridge this gap in the literature by estimating the export efficiency of Vietnam's textile and garment exports to 28 EU countries and identifying its determinants, which are both behind and beyond the borders. This paper uses a panel data of Vietnam's textile and garment exports to 28 EU countries over the period from 2007–2019 and a stochastic frontier gravity model (SFGM) with the one-step estimation method for empirical analysis. Its findings suggest that the efficiency of Vietnam's textile and garment exports to EU countries is relatively low but it increases over the period of study. Regarding determinants of efficiency, the paper found that infrastructure, technology readiness, and quality of institutions have significant impacts on the efficiency to various degrees and at different significance levels.

Contribution/Originality: This paper is the first to study factors influencing the export efficiency of Vietnam's textiles and garments industry using a stochastic frontier gravity model with a two-step estimation and updated data. The paper sheds lights on the levels of export efficiency of the industry and factors influencing export efficiency.

1. INTRODUCTION

Standard economics teaching tells us that economies can be more productive on the basis of comparative advantage. Hence, global integration by free trade agreements (FTAs) has been advocated as a sound policy for economic growth. While FTAs can provide access to new markets, producers of home countries cannot automatically export to the maximum level based on market size and trade liberalization. If home exporters do not perform well while foreign exporters do, trade liberalization may bring about negative economic consequences, at least for a certain period, especially for developing countries (Kim & Lin, 2009; Rigobon & Rodrik, 2005). Hence, it is important to understand how economies perform in terms of exports as countries seek to sign new FTAs and integrate further into the global economy.

Textiles and garments (TG) are key export items of Vietnam. Vietnam's TG exports increased from USD 8.6 billion in 2007 to USD 39.42 billion in 2019, ranked second after electrical machinery and equipment. In 2019, Vietnam was the fourth largest TG exporter globally, after China, the EU and Bangladesh (MOIT, 2019). As of December 31, 2018, over 1.8 million people worked in this industry, accounting for 12.6% of all workers in Vietnamese enterprises. From 2014 to 2019, the average growth rate of this industry was about 17% (Trinh, 2020).

The EU is the second largest market of Vietnam's TG products after the USA (MOIT, 2019). In 2019, Vietnam and the EU signed the EU–Vietnam Free Trade Agreement (EVFTA), which came into effect on August 1, 2020. This FTA is expected to give the Vietnamese TG sector a more competitive edge in exchange for better access for the EU to Vietnamese markets. In this context, it is essential to study the efficiency of Vietnam's TG exports to EU countries in order to shed light on Vietnam's export potential of this important industry and find out what should be done to promote it for Vietnam to benefit more from the EVFTA.

So far, there have been many studies on the export efficiency of various countries (for example, Drysdale, Huang, and Kalirajan (2000); Batra (2006) and Ahsan and Chu (2014)). However, this topic has not received scholarly attention in Vietnam, but there are a few studies on Vietnamese aggregate export efficiency (Doan & Xing, 2018; Trung, Hung, & Hien, 2018) and Vietnamese sectoral export efficiency (Nguyen, 2020; Nguyen & Wu, 2020). More importantly, only a few studies have been trying to analyze factors affecting export efficiency of Vietnam.

This paper contributes to the literature by analyzing the export efficiency of TG, an important sector in Vietnam, and studying the impacts of institutions, infrastructure, market development level (efficiency), and technological readiness on export efficiency. This paper is the first to analyze factors affecting the efficiency of Vietnam's TG exports and thus provides insights into what should be done to improve the efficiency and better realize the potential benefits of trade liberalization in general and the EVFTA in particular. This paper also provides further evidence to support the use of the one-step estimation technique (Battese & Coelli, 1995) in modeling trade efficiency in the framework of the stochastic frontier gravity model (SFGM).

Our empirical results show that the efficiency of Vietnam's TG exports to EU countries is relatively low with an estimated mean score of 0.47–0.49, depending on the model specifications. The efficiency scores of TG exports to Belgium, the Netherlands, and Germany are high, while those of exports to Portugal, Lithuania, and Malta are quite low. Infrastructure, technology readiness, and quality of institutions were found to have significant impacts on the efficiency to various degrees and at varying significance levels.

The outline of this paper is as follows: After the Introduction, Section 2 provides a brief literature review, Section 3 explains the methodology and data, Section 4 presents the empirical results, and the paper is wrapped up in Section 5 with conclusions and limitations.

2. LITERATURE REVIEW

The gravity model was first introduced by Tinbergen (1962), and it has been modified and applied in several empirical studies (Anderson & Van Wincoop, 2003; Deardorff, 2011; Eaton & Kortum, 2002). The SFGM is developed by combining the stochastic frontier model (Aigner, Lovell, & Schmidt, 1977; Meeusen & van Den Broeck, 1977) with the conventional gravity model. The main difference between the SFGM and the conventional gravity model is that the former has two error terms, one is the normal statistical error while the other is the "economic distance" bias or export inefficiency. Besides using the stochastic frontier model with various modifications to measure efficiency, many economists have tried to explain its determinants with different modeling and estimation strategies. Pitt and Lee (1981) and Kalirajan (1981) adopted a two-step estimation method, in which efficiency scores are estimated in the first step by the stochastic frontier model, and then the predicted efficiency cores are regressed on explanatory variables in the second step. However, some studies, such as Huang and Liu (1994); Battese and Coelli (1995) and Greene (2005), suggest a one-step approach in which both the production function and the efficiency function are estimated simultaneously by the maximum likelihood method to avoid biases caused by violation of the estimation assumptions involved in the two-step method (Wang & Schmidt, 2002).

There are numerous international empirical studies on trade efficiency. Abbas and Waheed (2019) used a gravity model to study the trade flow in Pakistan and 47 selected trading partners, from 1980 to 2013. The results show that Pakistan has a higher-than-expected export efficiency with several Asian and European trading partners. Drysdale et al. (2000) studied trade efficiency between China and 57 trading partners and reported that the average efficiency of China as an exporter and importer was low, at 0.28 and 0.27, respectively, over the 1991–1995 period. Kalirajan and Singh (2008) studied the export efficiency of India and China during the 2000–2003 period using the OLS and SFGM methods, considering the effects of the "behind the border" and "beyond the border" factors. They found that India realized only 68% of its export potential and China only 86%. China's export efficiency increased over the surveyed period, while that of India was unchanged.

Roperto and Edgardo (2014) estimated the export efficiency of the Philippines and analyzed factors affecting it using SFGM with export data of the Philippines with 69 key trading partners in the 2009–2012 period. They also examined the impacts of "beyond the border" factors on the Philippines' export inefficiency, such as fiscal freedom, corruption and the business freedom of importers. They found that APEC, ASEAN, common language, freedom from corruption, and labor freedom had positive impacts on export efficiency. They suggested that future studies should analyze "behind the border" factors to further explain export efficiency.

Ravishankar and Stack (2014) examined the efficiency of trade integration between ten new members of the European Union and 17 established members from 1994 to 2007 using the SFGM. The results show that after the collapse of the Council for Mutual Economic Assistance (CMEA), the EU East–West trade performance was high since the estimation results show that the new member countries achieved two-thirds of their trade potential with the established EU countries in the period of study.

Regarding Vietnam's trade efficiency, there have been some studies with different sectoral and time coverages. The study by Nguyen and Doan (2017) is the first paper that uses the SFGM to study determinants of Vietnam's trade efficiency. The authors examined Vietnam's trade efficiency with 30 partners (both ASEAN and non-ASEAN) over an 11-year period (1995–2015). Their two-step estimation results show that Vietnam's trade efficiency was low, especially with the EU and NAFTA countries. In 2015, the average Vietnam's export and import efficiencies with the EU were only 21.21% and 19.78%, respectively. Doan and Xing (2018) also used the SFGM two-step estimation to study Vietnam's export efficiency with its 28 importers in the 1995–2013 period. Their results show that from 1995 to 2013 Vietnam export efficiency improved significantly, from 19.7% to 37.9%. On average, Vietnam only achieved about one-third of its export potential with its EU partners and achieved the highest export efficiency with Belgium, the Netherlands, Germany, UK, and France (61.28%, 59.26%, 43.48%, 40.63%, and 40.28%, respectively). Based on the results of the second step estimation, the authors recommend that Vietnam should try to reduce trade barriers, such as the rule of origin and tariff and non-tariff measures, and attract more FDI if it wants to raise its export efficiency.

Trung et al. (2018) also adopted the SFGM to analyze the effect of the ASEAN–India Free Trade Agreement (AIFTA) and the ASEAN–China Free Trade Agreement (ACFTA) on Vietnam's trade efficiency in the 2000–2015 period. Similar to other studies, the paper shows that Vietnam's trade efficiency is low and its export efficiency is 15% higher than its import efficiency. It also reveals that, after joining WTO, Vietnam's export efficiency decreased slightly from 47.4% to 46.3%. The figures for import efficiency before and after joining the WTO are estimated at 33.8% and 32.6%, respectively. The authors report that ASEAN FTAs has a negative effect on Vietnam's trade efficiency, except for AIFTA.

Nguyen and Wu (2020) used a two-step SFGM to estimate Vietnam's export efficiency and examine the effect of Vietnam's bilateral governance performance on this efficiency from 1996–2014. They posit that while export efficiency is positively affected by bilateral governance indicators and regional trade agreements (RTAs), it is negatively affected by import tariffs. The researchers also applied a one-step approach developed by Battese and Coelli (1995) to estimate export efficiency scores. Their results show that the export efficiency increased, which is different from previous studies. Their study also reveals that the estimated mean export efficiency scores of Vietnam is 48%. The export efficiency with main trading partners is high, except for China, and Vietnam achieves high export efficiencies with Germany (79%), Belgium (78%), and the UK (78%).

3. METHODOLOGY AND DATA

3.1. Methodology

This paper follows Kalirajan. and Singh (2008) and applies the following SFGM for empirical analysis:

$$\ln X_{jt} = \beta_0 + \beta_1 \ln Y_{jt} + \beta_2 \ln y_{jt} + \beta_3 \ln DISTANCE_j + \beta_4 COM_j + \beta_5 LANDLOCK_j + (v_{jt} - u_{jt}) \quad (1)$$

In Equation 1, X_{jt} is the real value of textile and garment (TG) exports from Vietnam to EU countries (j) at time t; Y_{jt} and y_{jt} are GDP and GDP per capita of country j at time t; $DISTANCE_j$ is the geographical distance between Vietnam and country j; COM_j is a dummy variable which takes a value of 1 if both countries were communist countries and 0 otherwise; $LANDLOCK_j$ is a dummy variable which takes a value 1 if the importer is a landlocked country and 0 otherwise. These independent variables are commonly used variables in gravity models. v_{jt} is the standard two-sided stochastic error term, and u_{jt} is the one-sided error term, which indicates export inefficiency. The lower the value of u_{jt}, the higher the efficiency level.

GDP and GDP per capita are measures of economic size and income level, respectively. The geographical distance between Vietnam and trading partners and the dummy variable for landlocked countries reflect transportation costs. COM represents cultural and historical ties that are expected to reduce costs and promote trade.

Researchers have mixed opinions about how to model the inefficiency term u_{jt} to estimate the impacts of potential factors influencing efficiency. While some economists assume that u_{jt} depends only on "behind the border" factors (Kalirajan & Singh, 2008; Nguyen, 2020), others believe that both "behind the border" and "beyond the border" factors impact efficiency (Armstrong, 2015; Nguyen & Wu, 2020). This paper follows the later approach because both exporters and importers should eliminate their trade resistance if maximum export is to be achieved. In addition, the policy of exporters or importers can be affected by the policy of their partner countries. For example, a country can receive financial and non-financial assistance from its richer trading partners to improve the quality of its infrastructure. More developed countries also support their less developed partners to improve their institutional quality and technological capabilities so that they can increase trade. However, the influence can be different from one trade partner to another. Therefore, "behind the border" and "beyond the border" values should be weighted averages with the share of each country in two countries' total GDP as weights (Nguyen & Wu, 2020).

In this paper, the trade efficiency of Vietnam's TG exports to EU countries is modelled as follows:

$$u_{jt} = \delta_0 + \delta_1 INST_{jt} + \delta_2 INFRA_{jt} + \delta_3 GM_{jt} + \delta_4 TECH_{jt} + \delta_5 ER_t + w_{jt} \quad (2)$$

In Equation 2, $INST_{jt}$ is the weighted average of the strength of institutions in Vietnam and country j at time t; $INFRA_{jt}$ is the weighted average of the quality of infrastructure in Vietnam and country j at time t; GM_{jt} is the weighted average of the efficiency level of the goods market in Vietnam and country j at time t; $TECH_{jt}$ is the weighted average of the state of technological adaptation and readiness in Vietnam and country j at time t; ER_t is the ratio of the real effective exchange rate of country j at time t to the real effective exchange rate of Vietnam at time t; and w_{jt} is the standard statistical error.

In stochastic frontier analysis literature, Equations 1 and 2 are often estimated separately in two steps. However, Wang and Schmidt (2002) and Greene (2005) showed that there could be substantial bias if a two-step procedure is applied. In this paper, Equations 1 and 2 are estimated together in one step, following Battese and Coelli (1995), which is implemented in STATA by the sfpanel command (Belotti, Daidone, Ilardi, & Atella, 2013).

3.2. Data Description

The data for TG exports were extracted from the UN Comtrade, a database for trade provided by the United Nations Statistics Division (UNSD), for 28 EU countries over the 2007–2019 period. Export values are measured in US dollars and are converted to real values with the US GDP deflator collected from the World Bank (data.worldbank.org). Real GDP and real GDP per capita in constant 2010 US dollars were collected from the World Bank. Geographical distance was obtained from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). Dummy variables for communism and landlocked countries were taken from the EU's website and CEPII. The data for the "behind the border" and "beyond the border" factors, including institutional strengths, quality of infrastructure, goods market efficiency, and technological readiness, were retrieved from the Global Competitiveness Reports, which are issued annually by the World Economic Forum (WEF). This is the most complete data source for these variables for the period from 2007–2019. Because these indicators were scored on a different scale in 2019 compared to previous years due to some methodological changes, all values are normalized to the same scale[1] with a higher score indicating better performance. The CPI-based real effective exchange rate of Vietnam with 171 trading partners over the 2007–2019 period was collected from Bruegel.org, which provides the fullest dataset for Vietnam and 28 EU members. The descriptive statistics of the variables used in this study are presented in Table 1. This study follows Pham, Dao, & Doan (2014) and considers all missing values as zero trade. Because the log of zero is undefined, zero export values are replaced with 1 when taking the natural logarithm in order to avoid missing data and to keep the maximum number of observations.

Table 1. Descriptive statistics.

Variables	Obs.	Mean	Std. Dev.	Min.	Max.
lnX	364	16.508	2.822	0.000	20.548
lnYi	364	26.102	1.566	22.844	29.003
lnyi	364	10.229	0.633	8.776	11.626
lnDISTANCE	364	9.033	0.092	8.874	9.264
COM	364	0.357	0.480	0	1
LANDLOCK	364	0.179	0.384	0	1
INST	364	0.557	0.107	0.396	0.787
INFRA	364	0.628	0.151	0.278	0.924
GM	364	0.584	0.054	0.493	0.715
TECH	364	0.602	0.127	0.374	0.866
ER	364	0.781	0.129	0.530	1.025

An issue of using data from the Global Competitiveness Report is the correlation among four trade facilitation variables (INST, INFR, GM and TECH). Table 2 shows high and positive correlation coefficients among the four variables in Equation 2. Therefore, each variable will be used separately to avoid multicollinearity problems.

Table 2. Correlation coefficients of trade facilitation variables.

Variable	INST	INFR	GM	TECH
INST	1			
INFR	0.7324	1		
GM	0.9135	0.652	1	
TECH	0.7965	0.8521	0.7482	1

Source: All coefficients are significant at 1%.

[1] Values are normalized by the formula: $x' = \left({(x - x_{min})}/{(x_{max} - x_{min})} \right)$, where x' is the normalized value, x is the reported values for each country, and x_{min}, x_{max} are the minimum and maximum values. The converted data are scored in the range of 0–1.

4. EMPIRICAL RESULTS

The estimation results with four trade facilitation variables are shown in Table 3 below. The γ parameters of the four models are high[2], confirming that the stochastic frontier gravity model is a suitable choice to explain Vietnam's TG exports to the EU (Battese & Coelli, 1995). The estimated results show that coefficients of lnY_i and lny_i are positive and highly significant. This should not be surprising because bigger and richer countries should buy more from Vietnam. The geographical distance between Vietnam and its trading partners reflects transportation costs and risks; therefore, longer distances will reduce export activities. However, the estimation results show that the coefficients of lnDIS are either not significant or only significant at 10%. This might be due to the fact that EU countries are not far from each other and so distance becomes insignificant when other key factors have been considered.

Table 3. Estimation results.

Variable	Model 1	Model 2	Model 3	Model 4
Frontier model				
lnY_i	1.00*** (0 .17)	0.98*** (0.17)	0.98*** (0.18)	0.97*** (0.17)
lny_i	0.89** (0.35)	0.95*** (0.35)	0.86** (0.35)	0.90*** (0.34)
lnDIS	5.38* (3.05)	4.92 (3.11)	5.38* (2.99)	5.14* (2.94)
COM	1.18** (0.6)	1.20** (0.58)	1.12* (0.63)	1.12* (0.59)
LANDLOCK	-0.337 (0.35)	-0.38 (0.33)	-0.35 (0.37)	-0.36 (0.33)
cons	-66.68*** (24.38)	-62.71** (24.43)	-65.72*** (23.96)	-63.84*** (23.49)
Inefficiency model				
INST	-301.24 * (181.28)			
INFR		-438.59*** (141.18)		
GM			-560.09*** (155.70)	
TECH				-589.09*** (146.74)
ER	105.35 (135.26)	-56.6 (140.15)	78.14 (86.59)	21.59 (149.72)
cons	-37.78 (151.26)	140.63 (151.88)	173.91 (125.99)	120.98 (157.37)
sigma_u	11.62** (5.00)	13.41*** (3.21)	10.04*** (2.64)	14.97*** (3.03)
sigma_v	0.44*** (0.15)	0.45*** (0.74)	0.41** (0.16)	0.43*** (0.16)
Gamma (γ)	0.99	0.99	0.99	0.99
Number of obs.	364	364	364	364
Log pseudo likelihood	-528.19	-518.06	-523.42	-520.01
Wald chi2	393.83	332.9	366.86	360.82

Note: Robust standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Numbers are rounded to two decimal places.

All coefficients of COM are positive and significant at 5% or 10%. This means that historical links between Vietnam and former communist countries in the EU can help promote the export of Vietnam's TG goods to these countries. The landlocked status has an insignificant impact, perhaps because the EU's internal trade and infrastructure are developed such that landlocked countries do not have problems accessing international trade.

[2] Detailed test statistics and other estimation results can be provided upon request.

Table 3 reports that the coefficient of INST is negative and significant at the 10% level, which means there is evidence to suggest that institutional quality negatively affects the export inefficiency of Vietnam's TG to the EU. This result is consistent with that of Doanh, Truong, and Heo (2022), and it suggests that a higher institutional quality of Vietnam and its EU partners can improve Vietnam's TG export efficiency. Table 3 also reports a significant and negative effect of infrastructure quality on the inefficiency of Vietnam's TG exports to EU countries. In other words, a better infrastructure system of Vietnam and its EU partners can increase Vietnam's TG export efficiency. Similarly, we can see from Table 3 that the efficiency of the goods market also has a negative and significant impact on the inefficiency of Vietnam's TG exports to EU countries. This implies that more efficient goods markets in both Vietnam and its EU partners can boost Vietnam's TG export efficiency. Normally, an efficient goods market also indicates a high level of trade openness, more competition and higher efficiency (Schwab, 2017).

Technological readiness is also a key factor affecting the export (in)efficiency of Vietnam's TG to EU countries since its coefficient is negative and highly significant. The availability of advanced information and communication technologies (ICTs) in trade activities helps speed up information exchange between importers and exporters and minimize transaction costs (Schwab, 2017). As a result, export efficiency will be enhanced.

To have a better understanding of Vietnam's TG export efficiency vis-à-vis the EU countries, the inefficiency scores for each EU partner and each year are estimated. Over the 2007–2019 period, Vietnam's TG export efficiency score ranged from 0.125 to 0.785, with the average score varying from 0.4754 to 0.4919. This means that Vietnam has not achieved its TG export potential with many EU countries. However, the estimated efficiency scores for Vietnamese TG exports are higher than those reported by previous studies (Doan & Xing, 2018; Nguyen & Doan, 2017) on the efficiency of Vietnam's export of all goods. Nguyen and Doan (2017) reported that the mean export efficiency of Vietnam was low, at only approximately 0.2121 in 2015, while Doan and Xing (2018) found that from 1995 to 2013, Vietnam realized about one-third of its export potential to the EU. However, our result is similar to that of Trung et al. (2018), who pointed out that the mean trade efficiency of Vietnam was 0.463 during the 2007–2015 period. The difference in estimated scores may come from differences in exported products and time periods. Furthermore, these studies a used two-step estimation, which may be biased. The results of this paper are close to the research of Nguyen and Wu (2020), who found that the export efficiency of Vietnam was 0.48, and the export efficiency of Vietnam's textile, leather, and footwear as a sector was about 0.414 in the 1996–2014 period.

Regarding the dynamics of efficiency, this study shows that there is an upward trend in the efficiency of Vietnam's TG exports to EU countries. The average TG export efficiency increased from about 0.37 in 2007 to about 0.54 in 2019. This result is consistent with what was reported by Nguyen and Wu (2020) but different from the results of Nguyen (2020), who showed that the aggregate export efficiency of Vietnam decreased after joining the WTO. Again, differences may arise from data sources and estimation methods.

5. CONCLUSION

This paper estimates the efficiency of Vietnam's textile and garment exports to 28 EU countries and identifies its determinants from 2007 to 2019 by applying the stochastic frontier gravity model and the one-step estimation method developed by Battese and Coelli (1995).

The results demonstrate that Vietnam's TG exports to EU countries have an increasing efficiency level over the 2007–2019 period, but there is still room for improvement.

Our paper confirms that the mean efficiency of Vietnam's TG exports to EU countries is significantly and positively affected by the strength of institutions, the quality of infrastructure, the level of efficiency in the goods market, and the state of technological adaptation and readiness. However, the real effective exchange rate did not have an effect on Vietnam's TG export efficiency.

The empirical results show that Vietnam has achieved on average only a half of its TG export potential to EU countries. Therefore, Vietnam should make more effort to remove export barriers and find more buyers in EU countries, especially Portugal, Lithuania, and Malta. Vietnam should improve the quality of institutions, the quality of infrastructure, the level of efficiency in the goods market, and the level of technological adaptation and readiness if it is to take full advantage brought about by the EVFTA in the coming years. Vietnam should work with EU trading partners in this effort, especially under the EVFTA framework.

Funding: This study received no specific financial support.
Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: Both authors contributed equally to the conception and design of the study.

REFERENCES

Abbas, S., & Waheed, A. (2019). Pakistan's global trade potential: A gravity model approach. *Global Business Review, 20*(6), 1361–1371.Available at: https://doi.org/10.1177/0972150919848936.

Ahsan, M. R., & Chu, S. N. (2014). The potential and constraints of the exports of environmental goods (EGs): The case of Bangladesh. ASARC Working Paper No. 2014/05. Crawford School of Public Policy, the National University of Australia. Canberra.

Aigner, D., Lovell, C. A. K., & Schmidt, P. (1977). Formulation and estimation of stochastic frontier production function models. *Journal of Econometrics, 6*(1), 21–37.Available at: https://doi.org/10.1016/0304-4076(77)90052-5.

Anderson, J. E., & Van Wincoop, E. (2003). Gravity with gravitas: A solution to the border puzzle. *American Economic Review, 93*(1), 170–192.Available at: https://doi.org/10.1257/000282803321455214.

Armstrong, S. P. (2015). East and South Asia: Managing difficult bilateral relations and regional integration globally. *Asian Economic Journal, 29*(4), 303–324.Available at: https://doi.org/10.1111/asej.12076.

Batra, A. (2006). India's global trade potential: The gravity model approach. *Global Economic Review, 35*(3), 327-361.Available at: https://doi.org/10.1080/12265080600888090.

Battese, G. E., & Coelli, T. J. (1995). A model for technical inefficiency effects in a stochastic frontier production function for panel data. *Empirical Economics, 20*(2), 325-332.Available at: https://doi.org/10.1007/BF01205442.

Belotti, F., Daidone, S., Ilardi, G., & Atella, V. (2013). Stochastic frontier analysis using Stata. *The Stata Journal, 13*(4), 719-758.Available at: https://doi.org/10.1177/1536867x1301300404.

Deardorff, A. V. (2011). Determinants of bilateral trade: Does gravity work in a neoclassical world? *In Comparative Advantage, Growth, and the Gains from Trade and Globalization: A Festschrift in Honor of Alan v Deardorff,* 267-293.

Doan, T. N., & Xing, Y. (2018). Trade efficiency, free trade agreements and rules of origin. *Journal of Asian Economics, 55*, 33–41.Available at: https://doi.org/10.1016/j.asieco.2017.12.007.

Doanh, N. K., Truong, L. T., & Heo, Y. (2022). Impact of institutional and cultural distances on ASEAN's trade efficiency. *Journal of Economic Studies, 49*(1), 77-94.

Drysdale, P., Huang, Y., & Kalirajan, K. (2000). *China's trade efficiency: Measurement and determinants' APEC and liberalisation of the Chinese economy.* Canberra: Asia Pacific Press.

Eaton, J., & Kortum, S. (2002). Technology, geography, and trade. *Econometrica, 70*(5), 1741-1779.

Greene, W. (2005). Reconsidering heterogeneity in panel data estimators of the stochastic frontier model. *Journal of Econometrics, 126*(2), 269-303.Available at: https://doi.org/10.1016/j.jeconom.2004.05.003.

Huang, C. J., & Liu, J.-T. (1994). Estimation of a non-neutral stochastic frontier production function. *Journal of Productivity Analysis, 5*(2), 171-180.Available at: https://doi.org/10.1007/bf01073853.

Kalirajan, K. (1981). An econometric analysis of yield variability in paddy production. *Canadian Journal of Agricultural Economics, 29*(3), 283-294.Available at: https://doi.org/10.1111/j.1744-7976.1981.tb02083.x.

Kalirajan, K., & Singh, K. (2008). A comparative analysis of China's and India's recent export performances. *Asian Economic Papers, 7*(1), 1–28.Available at: https://doi.org/10.1162/asep.2008.7.1.1.

Kim, D.-H., & Lin, S.-C. (2009). Trade and growth at different stages of economic development. *Journal of Development Studies, 45*(8), 1211-1224.Available at: https://doi.org/10.1080/00220380902862937.

Meeusen, W., & van Den Broeck, J. (1977). Efficiency estimation from Cobb-Douglas production functions with composed error. *International Economic Review, 18*(2), 435-444.

MOIT. (2019). *Vietnam export import 2019 report*. Ha Noi: Industry and Trade Publisher.

Nguyen, H. T. H., & Doan, T. N. (2017). The ASEAN free trade agreement and Vietnam's trade efficiency. *Asian Social Science, 13*(4), 192–200.Available at: https://doi.org/10.5539/ass.v13n4p192.

Nguyen, D. D. (2020). Determinants of Vietnam's rice and coffee exports: Using stochastic frontier gravity model. *Journal of Asian Business and Economic Studies, 29*(1), 19–34.Available at: https://doi.org/10.1108/jabes-05-2020-0054.

Nguyen, S. T., & Wu, Y. (2020). Governance and export performance in Vietnam. *Journal of Southeast Asian Economies, 37*(1), 1–25.

Pham, V. N., Dao, N. T., & Doan, Q. H. (2014). Analyzing the determinants of services trade flow between vietnam and european union: Gravity model approach (Vol. 5). In MPRA Paper No. 63982.

Pitt, M. M., & Lee, L.-F. (1981). The measurement and sources of technical inefficiency in the Indonesian weaving industry. *Journal of Development Economics, 9*(1), 43-64.Available at: https://doi.org/10.1016/0304-3878(81)90004-3.

Ravishankar, G., & Stack, M. M. (2014). The gravity model and trade efficiency: A stochastic frontier analysis of eastern european countries' potential trade. *World Economy, 37*(5), 690–704.Available at: https://doi.org/10.1111/twec.12144.

Rigobon, R., & Rodrik, D. (2005). Rule of law, democracy, openness, and income: Estimating the interrelationships1. *Economics of Transition, 13*(3), 533-564.Available at: https://doi.org/10.1111/j.1468-0351.2005.00226.x.

Roperto, J. D., & Edgardo, C. (2014). *Philippine export efficiency and potential: An application of stochastic frontier gravity model*. MPRA Paper, No. 53603.

Schwab, K. (2017). *The global competitiveness report 2017-2018*. Geneva: World Economic Forum.

Tinbergen, J. (1962). *Shaping the world economy: Suggestions for an international economic policy*. New York: Periodicals Service Co.

Trinh, N. (2020). Seizing investment opportunities in Vietnam's garment and textile sector: Vietnam Briefing. Retrieved from: https://www.vietnam-briefing.com/news/seizing-investment-opportunities-vietnams-textile-garment-industry.html/.

Trung, N. X., Hung, N. D., & Hien, N. T. (2018). Exploiting the trade potential from integration: analysing the impact of free trade agreements between ASEAN and India and China. *China Report, 54*(4), 442-466.Available at: https://doi.org/10.1177/0009445518795999.

Wang, H.-J., & Schmidt, P. (2002). One-step and two-step estimation of the effects of exogenous variables on technical efficiency levels. *Journal of Productivity Analysis, 18*(2), 129-144.