

Determinants efficiency of Vietnam's footwear export: A stochastic gravity analysis

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ABSTRACT

This study was conducted to estimate the determinants as well as the efficiency of Vietnam's footwear export to 50 trading partners by applying stochastic frontier gravity approach for the period 2001-2018. We found that Vietnam's footwear export is positively affected by income measured by gross domestic product (GDP), border and landlock situation. The income elasticity of footwear export of Vietnam was about 1.2%. We also showed that the export efficiency of Vietnam's footwear was not very high with the average ranges from 50.8% to 63.1%. The 10 most efficient countries were Cambodia, Panama, Slovakia, Belgium, Myanmar, Hongkong, Korea, Chile, the US and the Netherlands. We also found that 10 countries with the largest export potential were the US, China, Germany, Japan, Belgium, the UK, Netherlands, Korea, France, Canada. Regarding the determinants of export efficiency, the study provides evidence that trade freedom, financial freedom and importers' population density positively contributed to efficiency. Our findings also support further integration of Vietnam since membership to many FTA enhances Vietnam's footwear export efficiency. These FTAs include AFTA, Vietnam-Chile FTA, ASEAN-India FTA, ASEAN-Korean FTA, ASEAN-Japan FTA, ASEAN-China FTA, ASEAN-Australia-New Zealand FTA. Finally, the study recommends a relevant market policy for Vietnam's footwear export in the coming years. We have provided 4 types of markets with different levels of priorities that Vietnam's footwear exporters should focus on. The top footwear market priority should be countries with high potential yet low efficiency such as China, Russia, Brazil, Thailand, Sweden, Singapore and Australia.

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1. Introduction

Footwear is one of the key export sectors Vietnam has comparative advantage for. During the past 15 years, footwear has been in top five commodities that have the highest export value. According to the statistics of International Trade Center, since 2014, this sector export value has ranked the 2nd, after electrical machinery and equipment. In 2018, the export value of footwear sector was about 16.8 billion USD, accounting for 6.9% of Vietnam total export. In the period from 2001 to 2018, the average growth was 15%. With regards to world footwear export, Vietnam is always one of the top three countries having the highest footwear export value. Especially, from 2015 to 2018, Vietnam became the 2nd footwear exporting country in the world with the average export value of 14.49 billion USD/year. More importantly, the proportion of Vietnam footwear export had an upward trend, from 5.26% in 2008 to 11.5% in 2018. Vietnam's footwear has exported to almost all countries in the world. The biggest partner of Vietnam is the United State of America which accounts for 34.7% of total Vietnamese footwear export, followed by China that accounts for 9.4%. However, can we define trade potential of Vietnam? Is there large room to promote Vietnam's footwear export or not? If yes, what should be the priority markets of Vietnam's footwear exports? Therefore, identifying the potential value, trade efficiency (TE) as well as analyzing TE's determinants that affect to Vietnam's trade efficiency of footwear sector is very important. Studying on trade potential in generally as well as export potential in particularly has attracted many researchers (e.g.

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Drysdale (2000), Kalirajan (2007), Kumar (2009), Drysdale *et al.* (2012), Deluna (2013), Kumar and Prabhakar (2017), Linh (2019), ...) Nevertheless, there is not any study on trade potential of Vietnamese footwear. This paper fills exactly in this gap in the literature. By using the stochastic gravity model, the paper aims to estimate trade efficiency and export potential for each partner in top 50 biggest importers of Vietnam's footwear (total value export to these countries account for more than 99% of total export value of Vietnamese footwear).

The paper is organized as follows. Part 2 provides theoretical basis of stochastic gravity trade model. Literature review and econometrics model are presented in part 3. Part 4 describes data. Part 5 justifies estimation methods. Part 6 discusses the estimation results. Conclusions are in part 7.

2. Theoretical basis of stochastic gravity trade model

The stochastic gravity model is the combination of gravity model and stochastic frontier production function model.

2.1 Gravity model

The gravity model is based on Newton's law of universal gravitation in physics. In 1962, Jan Tinbergen, Dutch economist, firstly applied this model into economics to estimate bilateral trade flows between two countries. He states that the volume of trade among two countries has positive relationship with their masses and negative one with their geographical distance. The model is represented as follows:

$$X_{ij} = A \cdot \frac{GDP_i^\alpha \cdot GDP_j^\beta}{Distance_{ij}^\gamma} \quad (1)$$

Following Tinbergen, Linneman (1966) first extended gravity model by adding other independent variables, such as population and complementary. Many researchers also studied and applied this model into economics and the gravity model was extended, bilateral trade was not affected only by GDP or geographical distance. It depends on many factors which represents for economic mass of exporter and importers, as well as trade costs:

$$X_{ij} = \alpha \cdot \frac{Y_i^\alpha \cdot Y_j^\beta}{t_{ij}} \quad (2)$$

where X_{ij} is the total export from country i to country j ; α is the gravitational constant; Y_i and Y_j are economic mass of country i and j ; t_{ij} is the trade cost between two countries (such as distance, adjacency and so on). To have linear relationship between variables, taking natural logarithm of above function and adding the error term ε_{ij} is necessary. α , β , and γ are elasticity of the exporter's economic mass, importer's economic mass and trade cost respectively. Their value can take different value from 1. These coefficient shows that if these factors' values change one percentage, how many percentages the bilateral trade between them changes:

$$\ln(X_{ij}) = \ln A + \alpha \cdot \ln(Y_i) + \beta \cdot \ln(Y_j) - \gamma \cdot \ln(t_{ij}) + \varepsilon_{ij} \quad (3)$$

Although being applied in many empirical researches and recognized for its success to test trade theories, gravity model had been criticized because of its weak theoretical foundations. In 1979, Anderson developed a theoretical foundation for gravity model which brought gravity model into mainstream economics. He found that the gravity equation can be derived from the expenditure systems where goods were differentiated by country of origin. After that, in 1985, Bergstrand used incomes to make a generalized gravity equation. He found that prices items were considered endogenous in gravity model and has significantly impact on trade flows but in his model, prices came from underlying utility and production functions. In 1987, the gravity was derived from an imperfect competition model by Helpman and in 1995, it also was derived from the Heckscher-Ohlin model.

2.2 Stochastic gravity model

Gravity model estimates the mean impact of trade's determinants. According to Drysdale and Garnaut (1892), trade barriers can be divided into two groups: subjective resistances and objective resistances. Objective resistance includes transport and other trade costs, but the minority of them can be controlled in gravity model while the remaining is not. Subjective resistances which derived from imperfect information or internal constraints are not controlled for at all in gravity model. Therefore, stochastic frontier approach was applied to gravity model to deal these issues. Stochastic frontier approach was developed by Aigner, Lovell and Schmidt (1977) and Meeusen and van Den Broeck (1977) and was first applied in production sectors. In production area, there are two distinct impacts on production process that are economically distinguishable and disturbances (Aigner *et al.*, 1977). Therefore, the error term composes of two types: a non-negative term or the inefficiency components and random disturbance which represents for unobservable resistances. Based on this approach, the economists built stochastic frontier production function to estimate technical efficiency of firms. Kalirajan (2007) applied stochastic frontier approach into gravity model for export. The stochastic frontier gravity equation can be written as follows:

$$\ln Y_{ij,t} = \beta_0 + f(\ln X_{ij,t}, t, \beta) + (v_{it} - u_{it}), \quad (4)$$

where $Y_{ij,t}$ is the export from country i to country j at the time t ; $X_{ij,t}$ is the export determinants of country i and country j at the time t ; β is the estimated parameters from model; v_{it} is the pure random error term, which is double-sided error term and assumed to follows normal distribution $N(0, \sigma_v^2)$. v_{it} takes value from 0 to 1, representing unobserved variables which impact on export flows from country i to country j ; u_{it} represents the single sided error term, takes value between 0 and 1 and it is assumed to follow half-normal distribution with mean μ and variance σ_u^2 or exponential distribution (Drysdale, 2000; Urata, 2002).

2.3 Trade Potential and Technical Efficiency

Efficiency (technical efficiency) is known as a concept in production. The first definition of technical efficiency was given by Koopmans (1951). He said that the production was considered as efficiency if it achieved maximum output with a given input. Technical efficiency in production is the ratio between actual output and potential output which is the maximum output can reach at frontier. Similar to the definition in production, when a firm is producing at the frontier, it has achieved economic efficiency (Kalirajan and Shand, 1999). When a country achieves its trade potential, the country is trading at the most efficient manner. Export potential is therefore defined as the export achieved when there is at least resistance to trade given the current trade, transport and institutional practices (Drysdale, 2000; Kalirajan, 2000). The ratio between the potential and the actual is export efficiency (trade efficiency). The value of export efficiency ranges from 0 to 1. When export efficiency is close to 1, it means that the actual export is near potential export. Higher export efficiency is, lower the gap between the actual and the potential is:

$$\text{Export efficiency}_{ij,t} = \frac{\text{actual export}_{ij,t}}{\text{potential export}_{ij,t}} = \frac{\text{Exp}(\ln Y_{ij,t} \setminus U_{ij,t}, X_{ij,t})}{\text{Exp}(\ln Y_{ij,t} \setminus U_{ij,t}=0, X_{ij,t})} = e^{-u_{ij,t}} \quad (5)$$

3. Literature review

3.1 Literature review on stochastic gravity model

Brühlhart and Kelly (1999) researched on trade potential of Ireland with Central and Eastern European countries by using gravity model. They found that the estimated ratio between export potential and actual was 1.13 which means that Ireland was “under-trading” with most of the partners. Similarly, import efficiency of Ireland was 0.65 which was lower than the export’s. In 2000, Drysdale *et al.* used stochastic frontier approach to estimate China’s trade efficiency from 1991 to 1995. The result showed that trade efficiency of China in this period was significant low. The average export efficiency was 0.28 while the average import efficiency was 0.27 for this country. Armstrong *et al.* (2008) also researched on trade potential and efficiency Asia countries, but instead of focusing on particular country. They estimated export efficiency of group countries for three periods 1993-1995; 1996-1998 and 2002-2004. ASEAN was the association which has the highest export efficiency with 55% to 70%. Export efficiency of East Asia was from 53% to 66% while this figure of APEC and South Asia was 49% - 64% and 27% - 50% respectively. In 2009, Miankhel *et al.* calculated potential exports and export efficiency of Australia, another Asia country, with 65 key trading partners from 2006 to 2008. The mean of the Australia’s export efficiency was about 97.6%, its TE with Macao was the lowest with 2.47%. Ravishankar and Stack (2013) filled in the gap in the Brühlhart and Kelly estimated efficiency score of 17 western European countries to 10 new members from 1994 to 2007. The estimated result stated that the efficiency of these countries arranged from 0.2 to 0.91. Efficiency score between Hungary and Island (0.2) was the lowest while efficiency between Iceland and Lithuania was the highest score (0.91). For African countries, in 2016, Tamini *et al.* studied on trade performance and potential of North African countries from 2001 to 2012 by using stochastic frontier gravity model. According to this research, among north African countries, Tunisia and Morocco had the highest import efficiency, while Egypt had relatively low and instable import efficiency. In terms of particular economic sector, Atif *et al.* (2019) focused on Pakistan’s chemical products’s exports from 1995 to 2015 with 60 its trading partners. Stochastic frontier gravity model was used in this study and the result stated that average export performance of Pakistan was less than 30% of its potential. The efficiency export to Afghanistan was the highest with 74.6% while, to some other countries such as Norway, Denmark or New Zealand was less than 2%. In Vietnam, there are limited researches on trade potential as well as trade efficiency. Hai and Thang (2017) employed a stochastic gravity model to estimate trade efficiency of Vietnam with its trading partners from 1995 to 2015. The empirical results suggested that export efficiency was better than import and they had the upward trend from 1995 to 2015. In 2015, actual export to Singapore and Cambodia achieved 91.36% and 91.3% of export potential, while this index of Greece was the lowest with 3.29% of the potential. In terms of import, Singapore also was the partner whose efficiency was highest with 91.51%, while Greece still was the partners whose import efficiency was lowest with 1.78%. By 2015, Vietnam’s average trade efficiency with EU was 21.21% and 19.8% for export and import respectively. Export efficiency with ASEAN+3 was 41.32% which was lower than expected. Bao *et al.* (2018) used stochastic frontier gravity model to estimate the bilateral trade efficiency of Vietnam and main trade partners from 2000 to 2015. According to this research, export efficiency of Vietnam in this period ranged from 54% to 61% while this figure for import efficiency was between 32% to 45%. In terms of particular sector, in 2016, by using gravity model with panel data and the method using speed of convergence, Trung and Thu calculated the gap between actual trade and trade potential of climate smart product of Vietnam and its 45 partners from 2002 to 2013. The result indicated that Vietnam did not achieve trade potential with 19 out of 45 partners. In another way, Vietnam still had opportunity to improve trade with these countries like China, the USA or Japan. The study contributed to the empirical

measurement of trade potential, but this did not estimate the detailed trade potential as well as trade efficiency of Vietnam and its partners. This only addressed the question is that whether Vietnam reached trade potential with its partners. In 2019, Linh *et al.* researched on export potential of Vietnam's agricultural sector to the European Union. They used stochastic frontier analysis and data from 2006 to 2016 to estimate efficiency of agricultural export for each country in the EU. Through this study, in 2016, Belgium's export efficiency was the highest with 0.73. Netherlands and Austria followed with 0.71, while Croatia was the country having the smallest. In generally, during that period, and the potential for Vietnam's agricultural export to enter deeply into the EU market is still very high. So, most of the previous literature focused on estimating trade potential and efficiency in generally instead of focusing on particularly. Besides that, those results represented that the actual trade was significantly lower than the potential, especially Asian countries.

3.2 Literature review on determinants of trade efficiency

In 2000, Drysdale *et al.* estimated the impact of two types variables on trade efficiency of China as well as some other countries. The first group is policies adopted by the governments and the second is regional agreement between governments. In the first group, he used trade tax rate and economic freedom of importer and exporter variables. While economic freedom had positive impact on TE, trade tax rate of the importer and exporter also effected negatively on TE. In the second group, ANDEAN (Andean Community) had the most positive impact on TE. In the 2nd group, member's trade efficiency, while NAFTA (North American Free Trade Agreement) had the worst impact on member's trade efficiency. In the case of China in particular, TE of this country when trading with APEC members would be higher than when trading with the other countries. Besides, economic freedom of the exporter and importer improved TE, but exporter's tariff decreased TE. For Indonesia's TE, Irhami (2015) also focused on the impact of tariff but instead of tariff rate as Drysdale (2000), he used taxes' revenue as a percentage of the sum of export and imports. Nevertheless, being similar as Drysdale, Irhami used two types variables included the government's policy and free trade agreements. Representing for the government's policy, a composite index based on 10 criteria: fiscal burden of government, trade policy, banking and finance, wages and prices, monetary policy, government intervention in economy, property rights, regulation and informal market activity was used and it had a positive relationship with trade efficiency. Two other independent variables: ASEAN and APEC were expected that membership in regional organizations helped improve trade efficiency. In Vietnam particularly, Hai and Thang (2017) estimated determinants of Vietnam's export efficiency and import efficiency. The estimated results showed that while the ASEAN membership and economic freedom contributed positively to Vietnam's export efficiency, while TR_{it} , the weighted tariff levied by some country on Vietnam's goods and real efficiency exchange rate reduced Vietnam's export efficiency. In terms of import efficiency, the results stated that real efficiency exchange rate of partners' domestic currency, being member ASEAN and economic freedom of Vietnam rose Vietnam's import efficiency, while weighted tariff levied by the country and Vietnam to importers decreased import efficiency. Apart from some researches who directly focused on trade efficiency's determinants, there were some others concerning about the inefficiency or trade potential, which related to trade efficiency. Following Drysdale (2000), Deluna (2013) studied on inefficiency effect model. The empirical result showed that being member of APEC decreased technical inefficiency while, membership to ASEAN or WTO were insignificant as landlocked dummy variable. Monetary freedom had positively relationship with technical inefficiency while freedom from corruption and business freedom significantly decreased this index. Other variables like fiscal freedom, labor freedom, trade freedom, financial freedom and investment freedom were not statistically significant. In 2017, Kumar and Prabhakar mentioned determinants of trade inefficiency of India. However, he not only used free trade agreement variables, but also estimated the impact of exporter and importer regulatory quality. He found that joining FTAs negatively effects on trade inefficiency which implied that FTAs increased export efficiency and import efficiency. Regulatory quality of the importers also enhanced trade efficiency between countries.

This paper fills in the gap in the literature of stochastic gravity model for Vietnam aiming at estimating trade efficiency and the potential trade between Vietnam and its top 50 importers, and analyzing determinants of Vietnam's footwear trade efficiency.

4. Econometrics model

4.1 Stochastic gravity trade model

In this study, we adopt stochastic gravity model to estimate export efficiency of Vietnamese footwear and calculate export potential. The original model is as follows:

$$\ln Y_{ij,t} = \beta_0 + f(\ln X_{ij,t}, t, \beta) + (v_{it} - u_{it}), \quad (6)$$

where $Y_{ij,t}$ is actual Vietnamese footwear export, but $X_{ij,t}$ is a captures factors which are determinants of export. As mentioned above, there are three main groups of factors impact on export from Vietnam to other countries: factors having effect on demand of importer, export supply and trade costs. Based on the structural gravity model, we build the following model to estimate Vietnamese footwear export efficiency to its top 50 partners:

$$\ln EX_{ij,t} = \beta_0 + \beta_1 \ln GDP_{j,t} + \beta_2 \ln PP_{j,t} + \beta_3 \ln OER_{ij,t} + \beta_4 \ln DIST_{ij} + \beta_5 \text{Landlocked}_j + \beta_6 \text{Border}_{ij} + \varepsilon_{ij,t} \quad (7)$$

where Ln is natural logarithm; i and j indicate country: i is Vietnam and j is Vietnam's partner, t represents for year t ; $EX_{ij,t}$ is export value of Vietnamese footwear to country j in year t , measured in thousands of US Dollars; The data of this variable has been get from International trade center. $GDP_{j,t}$ is gross domestic product of country j in year t , measured in billion US Dollars, and data are in constant 2010 US Dollars; the data has been get from World bank; $PP_{j,t}$ is population of country j in year t , measured in hundred thousands of people and the data has been get from World bank too; $OER_{ij,t}$ is official exchange rate between Vietnam Dong and country j 's domestic currency in year t , measured as 1 country j 's currency = X Vietnam Dong, the data has been collected from Organization for Economic Cooperation and Development; $DIST_{ij}$ is geographical distance between Vietnam and country j , measured in km, the data has been gathered from Center for prospective studies and international information (CEPII); Landlocked_j is landlocked status dummy variable, which equals 1 if the country j is landlocked without no coast and zero otherwise, the information about this variable is found at Center for prospective studies and international information (CEPII); Border_{ij} is dummy variable, which equals 1 if Vietnam and country j have common border and zero otherwise, The author's check by geographic map for this the information; $\varepsilon_{ij,t}$ is error terms.

4.2 Determinants of trade efficiency

After having export efficiency from trade equation model, we continue on employing another regression to identify the impact of determinants on trade efficiency. In this research, we choose three indexes representing for open market that are investment freedom, financial freedom and trade freedom. Besides that, dummy variables which represent for all regional trade agreement Vietnam participates in are used. The regression function is written as:

$$TE_{ij,t} = \delta_0 + \delta_1 (INV_{i,t} \cdot INV_{j,t}) + \delta_2 (FIN_{i,t} \cdot FIN_{j,t}) + \delta_3 (TRADE_{i,t} \cdot TRADE_{j,t}) + \delta_4 PPDE_j + \delta_5 FTA_j + w_{ij,t} \quad (8)$$

where i and j indicate country: i is Vietnam and j is Vietnam's partner, t represents for year t ; $TE_{ij,t}$ is trade efficiency of Vietnamese footwear export to country j in year t ; $INV_{i,t}$ and $INV_{j,t}$ are investment freedom index of country i and j in year t . This index was developed by The Heritage Foundation and determines how free the flow of investment capital is. The flow of investment capital in this case is defined as the moving resources into and out of specific activities, both internally and across the country's borders. The index evaluates a variety of restrictions which are usually imposed on investment. The investment freedom score ranges from 0 to 100. The higher the score is, the freer the investment is; $FIN_{i,t}$ and $FIN_{j,t}$ are financial freedom index of country i and j in year t . This index measures banking efficiency and independence of government control and interference in the financial sector. The index score lies between 0 and 100. The value is closer 100, which indicates that country j has a higher financial freedom; $TRADE_{i,t}$ and $TRADE_{j,t}$ are trade freedom index of country i and j in year t . Trade freedom is a composite measure of tariff and non-tariff barriers which affect trade of commodities and services. Trade freedom score is calculated based on two components: the trade-weighted average tariff rate and non-tariff barriers. This index's function is as follows:

$$\text{Trade freedom}_i = (((\text{tariff}_{\max} - \text{tariff}_i) / (\text{tariff}_{\max} - \text{tariff}_{\min})) \times 100 - \text{NTB}_i,$$

where tariff max and tariff min represent the upper and lower limit of tariff rates (%). Tariff i represents for the weighted average tariff rate (%) in country j . NTB is non-tariff barriers and have 5 penalty levels (20,15,10,5 and 0) corresponding to NTBs applied. When NTB penalty equals zero, which means there is not any non-tariff barrier used to limit international trade;

$PPDE_j$ is the population density of country j , measured by hundred thousand people per km^2 ; The author's calculation are from date of World Bank and Center for prospective studies and international information (CEPII)

FTA_{ij} is a dummy variable and includes FTAs which Vietnam has been participated as well as has been prepared to join which includes:

$APEC_j$ represents Asia-Pacific Economic Cooperation; =1 if after a counterpart participates in APEC; and 0 otherwise;

$EVFTA_j$ states EU-Vietnam free trade agreement; =1 if a counterpart is member of EVFTA; =0 otherwise;

$AFTA_j$ denotes ASEAN free trade area; =1 after a counterpart officially becomes member of AFTA; and 0 otherwise;

$RCEP_j$ is the Regional Comprehensive Economic Partnership; =1 if a counterpart is member of RCEP; and 0 otherwise;

$CPTPP_j$ states the Comprehensive and Progressive Agreement for Trans-Pacific Partnership, which is =1 if a counterpart is member of CPTPP and 0, otherwise;

$$WTO_j = \begin{cases} 1 & \text{Counterpart is a member of WTO} \\ 0 & \text{Otherwise} \end{cases}$$

$$AIFTA_j \text{ as ASEAN - India Free Trade Agreement} = \begin{cases} 1 & \text{Counterpart is a member of AIFTA} \\ 0 & \text{Otherwise} \end{cases}$$

$$AKFTA_j \text{ as ASEAN - Korea Free Trade Agreement} = \begin{cases} 1 & \text{Counterpart is a member of AKFTA} \\ 0 & \text{Otherwise} \end{cases}$$

$$\begin{aligned}
\text{AHFTA}_j \text{ as ASEAN - Hong Kong Free Trade Agreement} &= \begin{cases} 1 & \text{Counterpart is a member of AHFTA} \\ 0 & \text{Otherwise} \end{cases} \\
\text{AJFTA}_j \text{ as ASEAN - Japan Free Trade Agreement} &= \begin{cases} 1 & \text{Counterpart is a member of AJFTA} \\ 0 & \text{Otherwise} \end{cases} \\
\text{ACFTA}_j \text{ as ASEAN - China Free Trade Agreement} &= \begin{cases} 1 & \text{Counterpart is a member of ACFTA} \\ 0 & \text{Otherwise} \end{cases} \\
\text{AANZFRTA}_j \text{ as ASEAN - Australia/New Zealand Free Trade Agreement} &= \begin{cases} 1 & \text{Counterpart is a member of AANZFRTA} \\ 0 & \text{Otherwise} \end{cases} \\
\text{VCFTA}_j \text{ as Vietnam - Chile Free Trade Agreement} &= \begin{cases} 1 & \text{Counterpart is a member of VCFTA} \\ 0 & \text{Otherwise} \end{cases} \\
\text{VKFTA}_j \text{ as Vietnam - Japan Free Trade Agreement} &= \begin{cases} 1 & \text{Counterpart is a member of VKFTA} \\ 0 & \text{Otherwise} \end{cases} \\
\text{VNEAEU}_j: \text{ Vietnam - Eurasian Economic Union Free trade agreement} &= \begin{cases} 1 & \text{Counterpart is a member of EAEU FTA} \\ 0 & \text{Otherwise} \end{cases} \\
\text{VJFTA}_j: \text{ Vietnam-Japan Free Trade Agreement} &= \begin{cases} 1 & \text{Counterpart is a member of VJFTA} \\ 0 & \text{Otherwise} \end{cases} \\
\text{VNEFTA}_j: \text{ Vietnam-Member of the Free Trade Agreement} &= \begin{cases} 1 & \text{Counterpart is a member of VNEFTA} \\ 0 & \text{Otherwise} \end{cases} \\
\text{VNISAREL}_j: \text{ Vietnam-Israel Member of the Free Trade Agreement} &= \begin{cases} 1 & \text{Counterpart is a member of Vietnam-Israel} \\ 0 & \text{Otherwise} \end{cases}
\end{aligned}$$

and $w_{ij,t}$ is the error term.

In our data set, each variable has 900 observations in total with 50 observations per year. We checked correlation among variables used in the two models. All correlation coefficients among quantitative variables are below 0.9; therefore, there is not big concern about high multicollinearity among variables. For the stochastic gravity trade model, in order to use the model to estimate export efficiency, it must be that there is existence of inefficiency and types of u_i 's distribution that effects the estimation result. The authors checked whether the variance of u_i is equal to zero or not. If it is equal to zero, there is not an inefficiency factor. Contrarily, if the variance is over zero, the existence of inefficiency factor is proved. The result of the hypothesis test for technical efficiency shows that there is an existence of inefficiency and u_i can follow exponential distribution as well as half-normal. Regarding trade efficiency model, to choose the suitable model to estimate significance of TE's determinants among pooled ordinary least squares, fixed effects or random effects model, we have run Breusch-Pagan Lagrange multiplier test and Hausman test. In the Lagrange test, the null hypothesis is that the omitted variable is not significant (variances across entities is zero). In Hausman test, the null hypothesis is that there is no correlation between omitted variable and independent variables. The result of Lagrange and Hausman tests state that random effect model is more suitable in in both equations of export efficiency.

5. The results

5.1 Estimation result of stochastic gravity trade model

Result in estimated stochastic gravity model with u_i following half-normal distribution and exponential distribution is shown in Table 2. In general, these results are similar. In both of two models, GDP, distance and common border have positive impacts on export, while population and landlocked dummy variable have negative effects. The coefficients of each independent variable are similar among two models, such as the coefficient of GDP is 1.208 from the model with u_i follows half-normal distribution and 1.189 from the model with u_i follows exponential distribution; Distance's coefficient is 0.145 from the model with u_i follows half-normal distribution and 0.130 from the model with u_i follows exponential distribution. The income of the importer represented by GDP has positive impact on export at a statistical significance level of 1%, while population of the country of destination has negative impact. The latter reveals that market size measured by population is large, but the market segment for Vietnamese goods is not well served yet. Therefore, Vietnam's exporters have to focus on improving quality and increasing variety to meet demand of the right market segment for Vietnams products of large markets. We also have evidence that for Vietnam's footwear export, geographic *distance* has positive relationship with export. The reasons could be because the transportation among countries becomes more and more conventional and cheaper as well as countries have promoted trade facilitation; therefore, geographical distance is no longer the important trade resistance as in the past. In fact, the important markets of Vietnam's footwear export that have lots of advantages for Vietnam in terms of market size, market access via trade agreements are mostly faraway from Vietnam.

The latter possibly hints that the lower transaction cost dominates the geographical distance in this gravity model of Vietnam footwear export. The *Border* variable has the strongest positive impact on export. Its coefficient is 1.492 - 1.440, which indicates that export value of Vietnamese footwear to countries having a common border with Vietnam is high as about 1.5 times as otherwise. Therefore, Vietnam can promote export to some countries which have common border with Vietnam such as China, Cambodia or Thailand. Contrarily, landlocked status variable has negatively significant which means that Vietnamese footwear export to countries without coast is lower than the others. In convention in ocean transportation leads to higher freight, so, it may be a reason which prevents Vietnam reaching higher value export. The official exchange rate between Vietnam Dong and partners' domestic currency does not impact on export same as some previous researches which states devaluation of domestic currently is not a good method to promote export. Instead of devaluating currency, improving quality and images of commodities is encouraged to be obtained by the government and enterprise.

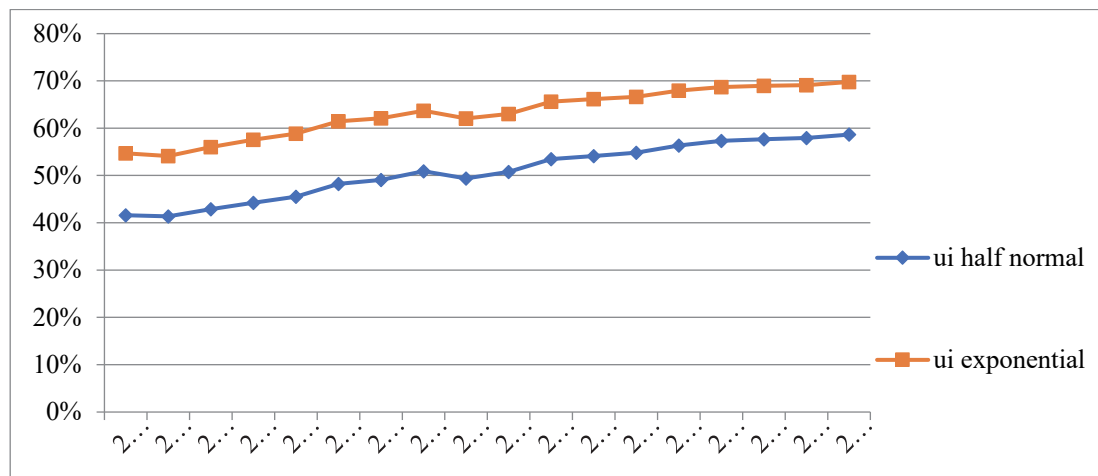
Table 1Estimated result of stochastic gravity trade model¹

	u_i follows half-normal distribution	u_i follows exponential distribution
lnGDP	1.208***	1.189***
lnDIST	0.145**	0.130**
lnPP	-0.472***	-0.455***
lnOER	0.022	0.026
Landlocked	-0.306**	-0.309**
Border	1.492***	1.440***
Constant	4.895***	4.757***
Log likelihood value	-1558.702	-1557.149
Wald chi2	726.13	788.30
P-value	0.000	0.000
Prob>Chibar2(LR test of $\sigma_u = 0$)	0.100	0.016
Number of observations	900	900

Source: The authors' calculation

5.2 Estimated technical efficiency

Based on the estimates of the *stochastic gravity trade model*, the estimated technical efficiency is calculated for both half-normal distribution and exponential distribution of u_i . In generally, export efficiency of footwear has an upward trend from 2001 to 2018. According to the model with u_i follows half-normal distribution, Vietnamese footwear's average export efficiency is from 41.4% to 58.7%, while this figure in the remaining ranges from 54.17% to 69.81%. The mean of export efficiency for this period ranges from 50.8% to 63.1% (Fig. 1).

**Fig. 1. Average export efficiency of Vietnamese footwear**

Source: The authors' calculation

This result obviously shows there is a significantly positive trade gap between predicted potential export and actual export. So, there is large room for Vietnamese footwear to promote export and enhance export activities to reach to the potential. Turning to country level, countries achieving highest technical efficiency in 2018 in descending order include Cambodia, Panama, Slovakia, Belgium, Myanmar, Hongkong, Korea, the US, the Netherlands, Chile, the Philippines, Indonesia, Mexico, South Africa, Argentina, Peru; while countries experiencing lowest technical efficiency in 2018 in ascending order include Ireland, Norway,

*, **, *** means that the coefficient is statistically significant at 10%, 5%, 1% level of significance respectively¹

Ecuador, Switzerland, Turkey, Denmark, Austria, Finland, Poland, Sweden, Israel, Greece, Columbia, New Zealand. Top five biggest importers of Vietnam are the US, the UK, Belgium, Germany and China. From 2014 to 2018, export efficiency of Vietnam’s footwear export to these countries are over 60%. We have evidence supporting the optimist figure that while technical efficiency of Vietnam’s export toward the UK remains stable, these figures for the other four other countries’ are rather increasing. China’s export efficiency increases dramatically by about 37%. However, except Belgium, the other countries have not yet been experiencing very high level of technical efficiency yet suggesting that there’s still rooms for improving Vietnam’s footwear export toward these important markets. Interesting experience of having good strategy to export footwear to increase technical efficiency can be withdrawn from the case of two small countries: Slovenia and Slovakia. These countries experience huge improvement in technical efficiency over the period 2001-2018: technical efficiency of Slovenia increases by about 50% while that of Slovakia rises up by about 35%. In contrast, Austria, Demark, Ecuador and Ireland are among countries whose export efficiency has a downward trend. Especially, export efficiency of Vietnam’s footwear export to Ecuador declines dramatically by about 20% Vietnam’s footwear exporters need to find out reasons why this decline is possible. Learning successful lessons from exporting to Slovenia and Slovakia can be a very good pathway to solve the problem.

5.3 Potential exports

Based on estimated export efficiency, the authors calculate Vietnam’s footwear potential export to its partners. It should be reminded that potential exports depend upon technical inefficiency as well as other export determinants of the country including market size (GDP), border, landlock. Country having the largest potential for Vietnam’s footwear export is the United States with about 8.3 billion USD in 2018, while in reality, Vietnam exported only more 5.8 billion USD to this country. The average potential export value to the U.S. in the period from 2001 to 2018 is 1.41 billion USD. So top countries in export potential in 2018 in descending order are the US, China, Germany, Japan, Belgium, the UK, Netherlands, Korea, France, Canada, Spain, Australia, etc. In contrast, countries with low export potential in 2018 in ascending order are Ecuador, Ukraine, Slovenia, Uruguay, Ireland, Colombia, Greece, Finland, Switzerland, Austria, Denmark, etc.

6. Recommendations on relevant market policy for Vietnam’s footwear export

Based on the estimates of export efficiency and export potential of Vietnam, we analyze export markets policy in the following matrix with four types (or groups) of countries:

- i. Group 1 includes countries with high export potential but Vietnam still experiences low efficiency. Vietnam’s exporters should pay the most attention to this group to effectively develop this sector.
- ii. Group 2 countries are selected from high potential, high efficiency countries: among them, we carefully choose the ones with high export potential, and efficiency is still not very high yet. This set of countries deserves to be paid enough attention to by Vietnam’s exporters.
- iii. Group 3 includes countries with low export potential but Vietnam still has not reached high level of efficiency yet. Focusing on this group to realize all potential is an adequate strategy.
- iv. Group 4 comprises of countries with low potential and high efficiency. There is not much room for Vietnam’s exporter to do with this group of countries, so they should not be the priority in export market strategy of Vietnam.

Summary of recommendation on market policy and main countries belonging to each group are indicated in the following matrix:

		Export Efficiency (EE)	
		High	Low
Export Potential (EP)	High	Group 2: Belgium, US, Germany, Japan, UK; Netherlands, Korea, France, Canada, Spain, Italy	Group 1: China, Russia, Brazil, Thailand, Sweden, Singapore, Australia
	Low	Group 4: The Philippines, Peru, Cambodia, Panama, South Africa, Myanmar, Slovakia	Group 3: Ecuador, Ireland, Norway, Switzerland, Denmark, Turkey, Austria, Finland, Poland, Colombia, Greece.

6.1 The estimation result of export efficiency model

As specified, in this study, we have used random effect model. We need to test for autocorrelation in panel data for models. There is auto correlation in two panel data. Therefore, the result of Generalized Least Square approach is used to analyze and discuss in this study (Table 2). $FINF_{i,t}$ and $FINF_{j,t}$ are financial freedom index of country i and j in year t . This index measures banking efficiency and independence of government control and interference in the financial sector. The index score lies between 0 and 100. The value is closer 100, which indicates that country j has a higher financial freedom; In the first group of trade efficiency’s determinants, the policies adopted by the governments, trade freedom and financial freedom have positive impacts in both models, while investment freedom is not statistically significant in random effect and GLS model, but in fixed effect model with u_i follows haft-normal distribution, investment freedom has negative impact on efficiency export.

Table 2
The result of determinants of export efficiency model

Variables	GLS	
	<i>u_i follows half-normal distribution</i>	<i>u_i follows exponential distribution</i>
PPDE	0.00006**	0.00006**
INVF _{it} . INVF _{it}	-0.00001	- 0.000004
FINF _{it} . FINF _{it}	0.00003***	0.00003***
TRADE _{it} . TRADE _{it}	0.00001***	0.000005***
APEC	0.016	0.024
EVFTA	-0.013	-0.006
AFTA	0.052**	0.038*
RCEP	-0.063***	-0.060***
CPTPP	-0.003	0.004
WTO	0.010	0.002
VNCHILE	0.063*	0.043
VKFTA	0.053	0.042
VNEAEU	0.030	0.025
VJFTA	0.024	0.021
VNEFTA	-0.141***	-0.113***
VNISAREL	- 0.060*	-0.038
AIFTA	0.089**	0.088**
AKFTA	0.150***	0.143***
AHFTA	- 0.096***	-0.094***
AJFTA	0.039***	0.034***
ACFTA	0.035**	0.036***
AANZFFTA	0.031***	0.024**
NAFTA	0.001	-0.004
Constant	0.432***	0.561***
R-square overall	38.57%	35.56%

Source: The authors' calculation

Trade freedom is the variable which has a positive relationship with export efficiency with a level of significance at 1% in all models. It indicates that there's still room for trade policies to influence trade efficiency: reducing tariff and non-tariff barriers in origin country as well as destination country improves export efficiency. Lowering trade barriers in Vietnam helps ensure the input of footwear production while export volumes of the final products depends on trade barriers of the importer. Another important factor contributing to trade efficiency is financial freedom. In case of exporter, if the firms access financial sources conveniently and effectively, they can ensure input for production as well as extend production scale and develop business. In case of importer, financial freedom means that the importer can access credit or payment faster, which create advantages for purchasing and connect with foreign partners. Investment freedom however is not significant in explaining export efficiency. This finding does not support investment channel as a way to improve export efficiency of Vietnam's footwear export. It is interesting that although population is not a meaningful determinant to export, result is different when taking into account country area and to explain export efficiency. It is in fact found that market size measured by population density of importer has a positive impact on export efficiency in GLS model. If we want to increase export efficiency, targeting countries with high population density is an appropriate decision. In the second group of trade efficiency's determinants, there are three types of impact directions. Table 3 presents detail the result of export efficiency of some country groups before and after coming into force, for FTAs which have not signed or have not come into force before 2019, the authors use 2007, when Vietnam officially become member of WTO is the milestone. The first group of impact's direction includes APEC, EVFTA, CPTPP, WTO, VKFTA, VNEAEU, VJFTA and NAFTA that do not have statistically significant impact on export efficiency in both of three models. But, the members of these FTAs are main partners of Vietnamese footwear. The reason is that some of area appeared before 2001 like APEC(1989); NAFTA (1983) or WTO (1995) or some FTAs have not come into force such as CPTPP, EEVFTA or like VNEAEU came into force in 2016, therefore, their impact is not clear for the period 2001-2018. In case of VJFTA and AKFTA, there is a agreement between ASEAN and Japan, ASEAN and Korea, may be the enterprise chose applied the goodwill of multilateral agreement, instead of bilateral agreement, so, the impact of two agreement is not as strong as area agreements. AFTA, AIFTA, AKFTA, ACFTA, AJFTA and AANZFFTA are dummy variables in the second ones which having positive relationship with export efficiency. AFTA, free trade area among ASEAN countries which is one of the most important markets of Vietnamese footwear in particularly as well as Vietnam economy in generally. From 2001 to 2018, export efficiency and export potential to this area increased significantly. Especially, the potential value in 2001 was 39.4 million USD while in 2018 was 764.4 million USD. In determinants of export efficiency model, AKFTA is the variable having the highest coefficient in GLS model (0.14-0.15). Before AKFTA came into force, the average technical efficiency of this group is 43.7%-56.3%, but after 2007, this figure is 55.6%-66.4%. More importantly,

Vietnamese export potential to AKFTA countries is also rapidly increased after this Free Trade Area was established. Before 2007, average export potential to AKFTA was 85.4 - 110.4 million USD and after 2007, its figure was 648.4 – 758.5 million USD. The gap for Vietnamese footwear to promote exporting to this area is about 250 million USD.

Table 3
Export efficiency and export potential of some country groups

	u_i follows half-normal distribution				u_i follows exponential distribution			
	Before the validity		After the validity		Before the validity		After the validity	
	Export efficiency	Export potential	Export efficiency	Export potential	Export efficiency	Export potential	Export efficiency	Export potential
ACFTA	39.9%	94.0	52.7%	1 214.5	52.0%	69.0	64.2%	1 052.1
AJFTA	43.6%	270.0	54.7%	1 180.4	56.3%	203.1	66.3%	981.7
VJFTA	42.5%	213.2	55.2%	829.7	57.1%	159.4	67.5%	686.5
AANZFTA	44.0%	174.0	56.0%	770.0	56.8%	133.0	67.1%	640.6
AKFTA	43.7%	110.4	55.6%	758.5	56.3%	85.4	66.4%	648.4
VKFTA	53.8%	158.0	65.8%	669.9	66.3%	132.7	75.0%	588.7
AIFTA	43.5%	94.1	55.7%	537.3	55.6%	73.5	67.0%	453.7
VNCHILE	55.7%	54.1	65.3%	192.5	67.8%	45.4	74.6%	168.4
VNEAEU	47.4%	81.4	56.7%	193.8	61.0%	64.6	68.7%	160.0
WTO ²	43.92%	4 675.8	53.98%	14 795.0	56.85%	3 747.1	65.81%	12 499.3
APEC	44.0%	1 598.9	56.0%	8 442.4	57.6%	1 231.5	67.8%	7 122.1
NAFTA	47.6%	1 060.6	58.5%	5 223.7	61.3%	826.8	69.9%	4 463.8
EVFTA	46.2%	2 160.2	53.5%	4 355.2	59.3%	1 762.0	65.6%	3 695.2
RCEP	41.2%	448.3	53.8%	2 834.7	54.2%	333.2	65.5%	2 331.4
AHFTA	45.5%	93.0	55.6%	571.4	57.6%	84.3	66.2%	488.6
CPTPP	43.9%	434.6	54.5%	1 623.7	58.0%	326.1	66.9%	1 333.4
AFTA	43.2%	62.7	54.8%	374.7	55.6%	48.4	65.6%	315.8
VNEFTA	40.5%	93.9	44.0%	135.7	54.2%	71.9	58.1%	104.6
VNISAREL	41.2%	14.6	48.8%	44.3	55.6%	10.8	62.4%	35.1

Source: The authors' calculation

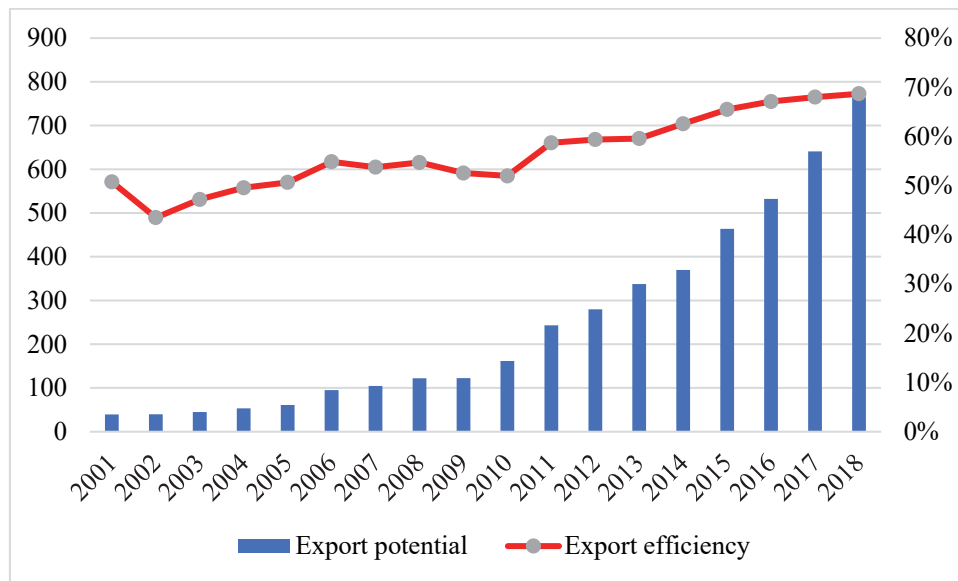


Fig. 2. Export efficiency and export potential of AFTA

Source: The authors' calculation

² In the paper's sample, there is Russia which is member of WTO in 2012, Cambodia became member of WTO in 2004 and Ukraine is WTO member on 2008, therefore, to calculate easily, the authors do not calculate technical efficiency and trade potential of three mentioned countries.

The coefficient of AIFTA is approximately 0.09. It indicates that joining AIFTA helps Vietnam promote exporting to country members of AIFTA. Similar to AKFTA member countries, before AIFTA came into force in 2010, the average export efficiency of these countries is 43.5%-55.66%, however, after 2010, the figure was from 55.7% to 56.3%. From 2010 to 2018, average export potential of Vietnamese footwear to this area was 453.7-537.3 million USD, was 6 times more than the potential in the period from 2001 to 2009. The Free Trade Area among ASEAN and some other partners such as Japan, China and Australia & New Zealand also contributed to promote Vietnamese footwear export to these markets. When AJFTA came into force, export efficiency increased from 43.6%-56.3% to 54.7% to 66.3%. Besides that, export potential rose from above 200 million USD to about 1 billion USD. Japan is one of the most important partners of Vietnamese footwear. Not calculated other countries in AJFTA, from 2009 to 2018, the average potential of Japan market is about 645.6 million USD to 783 million USD. Therefore, there is opportunity for Vietnamese footwear to get used with Japan market. Likely AJFTA, ACFTA and AANZFTA have positive relationship with export efficiency. After coming into force, these free trade areas helped Vietnamese footwear. The average efficiency of Vietnamese footwear when exporting to ACFTA and AANZFTA members before these came into force were 39.9%-52% and 44%-56.8% respectively, but then, the free trade areas pushed export efficiency to 52.7%-64.2% and 56%-67.1% respectively. More importantly, the potential for ACFTA and AANZFTA markets for Vietnamese footwear still is high, the average potential for these areas are about 1.1 billion USD for ACFTA market and above 700 million USD for AANZFTA market. Therefore, encouraging to export to these markets plays an important role in improving ability of Vietnamese footwear. The remaining type of impact directions is negative impacts that includes four FTAs are AHFTA, VNISAREL, RCEP and VNEFTA. Having negative coefficients suggests that being member of these FTAs deteriorates Vietnam's export efficiency. Nevertheless, all of three free trade agreements/areas between has not been signed or came into force later than 2018. Therefore, in this case, the coefficients present for the gap of export efficiency among members and non-members.

7. Conclusion

Vietnam is the third largest footwear manufacturing country in Asia after China, India, and places fourth in the world. This study attempts to estimate trade efficiency and export potential of Vietnam's footwear to 50 counterparts by using stochastic frontier gravity approach. Some important conclusions can be withdrawn as follows.

First, we have found that Vietnam's footwear export is significantly positively affected by income measured by GDP, border and landlock situation. The income elasticity of footwear export was about 1.2%.

Second, the study shows that export efficiency of Vietnam's footwear is not very high. In 2018, the average export efficiency of Vietnam ranges from 50.8% to 63.1%. The 10 most efficient countries were Cambodia, Panama, Slovakia, Belgium, Myanmar, Hongkong, Korea, the US, the Netherlands, Chile. 10 Countries with the largest export potential were the US, China, Germany, Japan, Belgium, the UK; Netherlands, Korea, France, Canada. Third, on the determinants of export efficiency, the paper shows that trade freedom, financial freedom and importers' population density positively contributed to improve efficiency. Furthermore, we indicated that FTA enhancing efficiency include AFTA, Vietnam-Chile FTA, ASEAN-India FTA, ASEAN-Korean FTA, ASEAN-Japan FTA, ASEAN-China FTA, ASEAN-Australia-New Zealand FTA, while FTA deteriorating efficiency includes RCEP, Vietnam-EU FTA, Vietnam-Israel FTA, ASEAN-Hongkong FTA. It is easily seen that most of the efficiency enhancing FTAs are well standing agreements while efficiency deteriorating FTA are not-signed-yet (by 2018) FTA (except the AHFTA). Last but very important finding of the paper is a recommendation of relevant market policy for Vietnam's footwear export in the coming years. We have provided 4 types of markets with different level of attention that Vietnam's footwear exporters should pay attention to. The top priority should be group 1 countries with high potential yet low efficiency such as China, Russia, Brazil, Thailand, Sweden, Singapore, Australia. The other giant markets that Vietnam has already reached relatively high efficiency however rooms for improvement are still large should be of the second top priority including countries such as US, Germany, Japan, UK, Netherlands, Korea, France, Canada, Spain. An adequate level of attention should also be paid to group 3 countries including those having only low potential but efficiency is low, leaving good rooms for improvement such as Ecuador, Switzerland, Denmark, Austria, Finland, Greece, Columbia.

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