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Impact of removing industrial tariffs under the European–Vietnam free trade agreement

A computable general equilibrium approach

Le Trung Ngoc Phat
Faculty of Economic and Business Administration, An Giang University, Long Xuyen, Vietnam, and
Nguyen Kim Hanh
Faculty of Economics, Can Tho University, Can Tho, Vietnam

Abstract

Purpose – The purpose of this paper is to employ the computable general equilibrium (CGE) approach to examine how the European–Vietnam Free Trade Agreement (EVFTA) impacts on the Vietnamese economy in the case of the removal of industrial tariffs.

Design/methodology/approach – The authors construct a social accounting matrix based on the latest data of the Vietnam input-output Table for the year 2012 and then apply the CGE model to simulate the economic scenarios when the tariff rate of the industrial sector reduces to 0 percent.

Findings – The first simulation results demonstrate that the elimination of tariffs in the industrial sector will lead to a 9.13 percent increase in household consumption, together with an increase in the factors of production of the agricultural, industrial and service sectors by 9.61, 9.74 and 8.21 percent, respectively. The EVFTA also causes a deficit in the trade balance because the value of imports increases by 12.54 percent, while exports' value slightly increases by 2.71 percent. Furthermore, there has been a drop of 2.29 percent in the total government income; nevertheless, social welfare witnesses a gain of 9.13 percent. The second scenario simulation draws crucial attention to policymakers that a small fluctuation in the production tax rate will cause a significant change in the economy.

Practical implications – The reduction of tariff in the industrial sector will increase the social welfare and strengthen the whole economy regarding the growth of household consumption, factors of production and trade value. On the unfavorable side, the EVFTA causes a national budget deficit and puts pressure on domestic production. This paper is a valuable reference for governments and policymakers when they decide to reduce tariffs or adjust production taxes once Vietnam integrates into the world economy.

Originality/value – This study differs from previous research works by utilizing a static CGE model to investigate the impact of removing the industrial tariff on the economy under EVFTA.

Keywords CGE model, Social accounting matrix, IO table, Tariff reduction

Paper type Research paper

1. Introduction

Vietnam has been integrating into the world economy and many bilateral and multilateral free trade agreements (FTA) have been signed making a big impact on the Vietnamese economy. Especially, the European–Vietnam free trade agreement (EVFTA), for which

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negotiations started in June 2012, hopefully will be presented to the European Commission and European Parliament for signing and ratification in 2019 (EUROCHAM, 2018).

The General Statistics Office of Vietnam reports that the European Union (EU) market constituted 21 percent of Vietnam's total exports value and 7 percent of Vietnam's total imports value in 2018. Hence, the EVFTA will obviously bring a variety of tremendous benefits for both Vietnam and the EU. Specifically, this agreement will eliminate virtually all tariffs on goods between Vietnam and the EU. Thus, products made in Vietnam such as textiles, footwear and wooden products have widely appeared in all EU countries. Moreover, the EVFTA will certainly create precious chances for extending business, investments and increasing the labor force as well as boosting commercial and economic growth in Vietnam and the EU.

Nevertheless, as most of the EU members are high- or upper-middle-income countries, while Vietnam is a low-income country, the economic health imbalance might cause tremendous challenges for Vietnam as long as the tariffs of most commodities from EU countries are substantially reduce to a 0 percent level. Thus, this will cause fierce competition between domestic products and foreign products and uncompetitive firms might suffer from going bankrupt, or suffer external shocks (Doanh and Heo, 2009).

In fact, in the import structure of Vietnam, the EU's commodities from the industrial sector accounted for 97 percent of the total import value of Vietnam (General Statistics Office of Vietnam, 2018). Hence, this paper investigates the effect of tariff reductions in the industrial sector on the Vietnamese economy under the EVFTA by employing the computable general equilibrium (CGE) approach. The remainder of this study is structured as follows. The next section summarizes the literature, which involves CGE models and explores the impact of tariff elimination on the economy. Section 3 shows the theoretical framework of CGE modeling. And Section 4 describes data and the research methodology. Then, Section 5 explores the empirical results of this study. The final section provides the conclusion and policy implications.

2. Literature review and theoretical framework

Numerous studies and policy reports have highlighted the inevitable trend of removing or decreasing tariffs in FTAs once countries have committed their partners to promote global and regional trade liberalization (Ahmed and O'Donoghue, 2010; Cirera *et al.*, 2014). Fukase and Martin (2016) pointed out that an FTA brings additional welfare benefits to both countries and create a positive impact on both economies when they studied the case of the India–US FTA. Phan and Jeong (2016) found that the Vietnam–Korea FTA increased aggregate welfare and decreased the level of unemployment for both countries in the long run as a result of improving allocation resources. Dung (2009) and Minh *et al.* (2018) concluded that joining a FTA causes a positive impact on Vietnam's economic growth through promoting gross domestic product (GDP) growth, increasing import-export value, and promoting the diversification and restructuring of the import-export market.

Nevertheless, it is still a controversial issue whether a country should sign an FTA, especially after the failure of the Doha negotiation rounds, due to taking into consideration what benefits and losses that country virtually achieves (Cho, 2010). Minh *et al.* (2018) predicted that joining an FTA will not only cause Vietnam exports to face many non-tariff barriers (e.g. technical barriers, rules of origin) which will become more complex and sophisticated, but will also cause a large competitive pressure for domestic production. Meanwhile, Nguyen and Cao (2016) demonstrated that not all FTAs contribute to increasing the amount of foreign direct investment (FDI) inflow in Vietnam.

To explore the influences of tariff reduction on the economy, various studies have recently employed the CGE model, which is very effective in studying the impact of climate change, tax policy or tax reform on the economy. There are papers that utilized the static CGE model (Dasgupta and Mukhopadhyay, 2017; Ganguly and Das, 2017; Jean *et al.*, 2014; Khorana and Narayanan, 2017; Shaikh, 2009; Todsadee *et al.*, 2012); meanwhile, others

employed a dynamic CGE model to measure the impacts of the FTAs (Itakura and Lee, 2012; Thu and Lee, 2015).

Ahmed and O'Donoghue (2010) utilized Pakistan's social accounting matrix (SAM) data for the year 2002 and developed a CGE model to evaluate the effect of slashing tariff rates on the macroeconomic and welfare indicators of Pakistan. They concluded that tariff reduction not only increases the welfare level but also raises the export value, household consumption and gross fixed capital formation. Similarly, Khorana and Narayanan (2017), Shaikh (2009) and Winchester (2009) employed a CGE model to evaluate the impact of reducing tariffs on the economies of India, Pakistan and New Zealand in sequence. They revealed that tariff reduction will benefit social welfare and strengthen GDP growth, the labor force and factors of production (e.g. capital and labor).

Ganguly and Das (2017) employed a CGE modeling approach and constructed an SAM to estimate the impact of FDI and trade liberalization in India. Their article demonstrated that any change in trade policy will not only change the export-import volumes of different sectors, but also change the level of GDP, the exchange rate and government income. Recently, Erero and Bonga-Bonga (2018) conducted a research to evaluate the impact of tariff reduction on the economy of the Congo by using a CGE model. Their paper found that the output and employment of the formal sector increase when the tariff decreases because this tariff reduction policy pushes import competition and that requires local manufacturers to survive import competition by seeking to import input-saving technologies and production practices.

Instead of employing a static CGE model, Thu and Lee (2015) employed a dynamic CGE model to study the effect of trade reform on economic welfare. They considered the impact of goods and services under trade liberalization, which included reducing tariffs and introducing reforms in other trade-related areas. One of their findings was that the elimination of tariffs has a strong positive impact on total output, on exports and on imports. Nevertheless, welfare gains were much lower than output expansion.

Albeit applying difference approaches from analysis methods, most of these studies reveal similar results about the importance of tariff reduction and elimination on economic development and welfare. In this paper, the authors have an *ex-post* evaluation of the impact of the EVFTA on some critical factors of the Vietnamese economy such as household consumption, factors of production, trade balance and government budget under the scenario that the tariff barrier of the industrial sector is removed, through constructing an SAM based on the latest Vietnam input-output table for the year 2012 and then utilizing static CGE modeling.

3. Theoretical framework

General equilibrium (GE) modeling is derived from the marginal utility theory. Gossen (1854), Jevons (1871) and Walras (1874) laid the foundation of GE theory, which is an extremely helpful and valuable tool in the explanation of exchange economies. In an economy, the interaction between demand and supply of all markets will result in a GE which implies that in the GE model we consider explicitly interrelationships between all different markets and different sectors of the economy (Dinwiddy and Teal, 1988). Meanwhile, in partial equilibrium modeling, we consider only a specific market instead of all markets.

The next stage of GE theory is the development of production into a static framework including static CGE, which is considered as an extension of the input-output table that Leontief (1986) successfully developed. Nowadays, CGE models are widely used in analyzing the impacts of economic shocks whose effect may be transmitted through multiple markets (Lofgren *et al.*, 2002; Wing, 2004). In contrast to dynamic CGE models which attempt to capture economic cycle fluctuation and thus have stronger impacts in the short term, static CGE models aim to capture economic cycle fluctuations in the long term, provided that there is a policy change.

Theoretically, CGE models are simulations that combine the GE structure with realistic economic data to solve numerically for the levels of supply, demand and price that support

equilibrium across a specified set of markets (Wing, 2004). In this paper, the economic impact of the EVFTA is evaluated by comparing the level of the economy before (baseline) and after (simulation result) the EVFTA goes into force as illustrate in Figure 1.

First, the authors generate a pre-policy baseline, which accurately reflects the current level of the economic structure described in the Vietnamese social accounting matrix (VSAM), by fitting the model equations and the behavioral parameters to the actual data of the VSAM. The baseline (benchmark result) assumes that the economy starts from an equilibrium position that is described as equality in the demand and supply side from each economic factor.

Then, with the effect of the EVFTA, the economy will converge to the new equilibrium point at which the demand and supply side of each of the economic factors will also be equal. That means, once tariffs are adjusted to 0 percent, the CGE model derives a solution by finding a new set of prices and allocation of goods and factors such that the economy is in equilibrium again. The new equilibrium solution (simulation result) will reveal the changes in household consumption, the factors of production, government income, foreign trade and savings. Additionally, a net effect on social welfare will also be computed.

4. Data and research methodology

4.1 Data

To investigate the impact of the EVFTA, this paper employs the conventional static CGE model, which is considered as the extension of the input-output table that Wasilly Leontief successfully developed in 1986. Theoretically, before employing a CGE model, the authors construct the VSAM (see Table I) based on the data of the Vietnam input-output table for the year 2012 (General Statistics Office of Vietnam, 2015; CIEM-WIDER, 2016), which includes 164 sectors that are classified into three primary sectors (agriculture, industry and services) regarding the classification of The Ministry of Planning and Investment of Vietnam (2007).

4.2 Research methodology

4.2.1 Model. Ballard *et al.* (2009), Hosoe *et al.* (2015) and Shoven and Whalley (1992) presented a CGE framework to evaluate the impact of tax policy. Thanks to their contribution, this paper conducts the conventional static CGE model to estimate the impact of removing tariffs from the industrial sector of the Vietnamese economy. Theoretically, the CGE model is constructed based on some crucial assumptions that are established on the basis of following behaviors:

With $i, j = 1, 2, 3$(denote Agriculture, Industry, and Service sector, respectively).

Consumer behavior. Assume that household consumers are homogeneous and maximize their utility by consuming commodities from three sectors under the Cobb–Douglass function:

$$U = \prod_{i=1}^{3} X_i^{\alpha_i}.$$

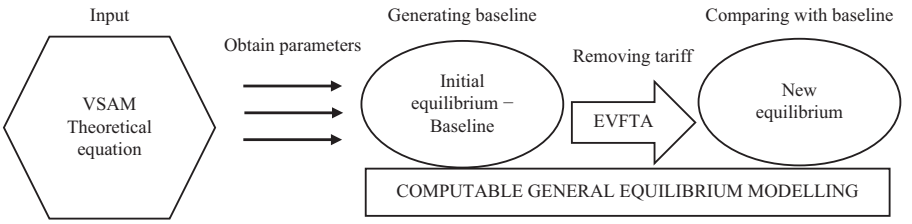

Figure 1.
Framework of CGE modeling

Table I.
Social accounting matrix of Vietnam for the year 2012 (unit: million VND)

	Agriculture (1–27)	Industrial (28–111)	Services (112–164)	Capital	Labor (140)	Production tax	Tariff	Final household consumption	Final government consumption	Final investment consumption	Foreign sector	Total
Agriculture (1–27)	243,011,267	686,701,498	22,704,183					288,206,438	0	44,787,447	153,117,889	1,438,528,722
Industrial (28–111)	435,923,283	3,106,039,566	503,716,125					861,603,359	0	814,969,356	2,065,597,292	7,787,848,981
Services (112–164)	69,606,568	406,599,358	415,406,850					864,164,486	192,337,960	22,098,570	377,946,880	2,348,160,672
Capital	141,780,714	477,382,694	372,249,722									991,413,130
Labor	320,360,857	832,396,247	745,262,907									1,898,020,011
Production tax[a]	20,359,000	152,568,000	135,132,000									308,059,000
Tariff	5,845,000	64,038,000	162,000									70,045,000
Final household consumption				991,413,130	1,898,020,011							2,889,433,141
Final government consumption						308,059,000	70,045,000	389,554,960				767,658,960
Final investment consumption								485,903,898	575,321,000		−179,369,525	881,855,373
Foreign sector	201,642,033	2,062,123,618	153,526,885									2,417,292,536
Total	1,438,528,722	7,787,848,981	2,348,160,672	991,413,130	1,898,020,011	308,059,000	70,045,000	2,889,433,141	767,658,960	881,855,373	2,417,292,536	

Note: [a]Production tax include sale tax and activity tax
Source: Data from input-output table of Vietnam for the year 2012

Budget constraint of consumer:

$$\sum_i p_i^Q X_i = Y - T^y - S^y = (1-\pi^y)\left(r\overline{K} + w\overline{L}\right) - S^y.$$

Income of consumer:

$$Y = r + w\ \overline{L},$$

α_i is parameter obtained by VSAM through the function:

$$\alpha_i = \frac{X_i p_i^Q}{(1-\pi^y)\left(r\overline{K} + w\overline{L}\right) - S^y},$$

where X_i, p_i are consumption and price of good i; S^y is household saving, T^y is income tax r, w denote rental cost and wage rate, $\overline{K}$ and $\overline{L}$ represents endowments of capital and labor, respectively.

Production behavior. Theoretically, the production behavior follows as per the structure (Figure 2): each sector uses its labor and capital to make composite goods, and then utilizes its composite goods and some intermediate goods from other sectors to produce domestic goods. Then the domestic goods are decomposed into exported and finally domestic goods. Finally, final domestic and import goods are consumed by the customer, government and investment company, and are used as intermediate goods for another sector:

- Step 1: the production of composite goods.

Producers in each sector produce their own composite goods and maximize their profit:

$$\pi_{i=} p_i^Y Y_i - rK_i - wL_i.$$

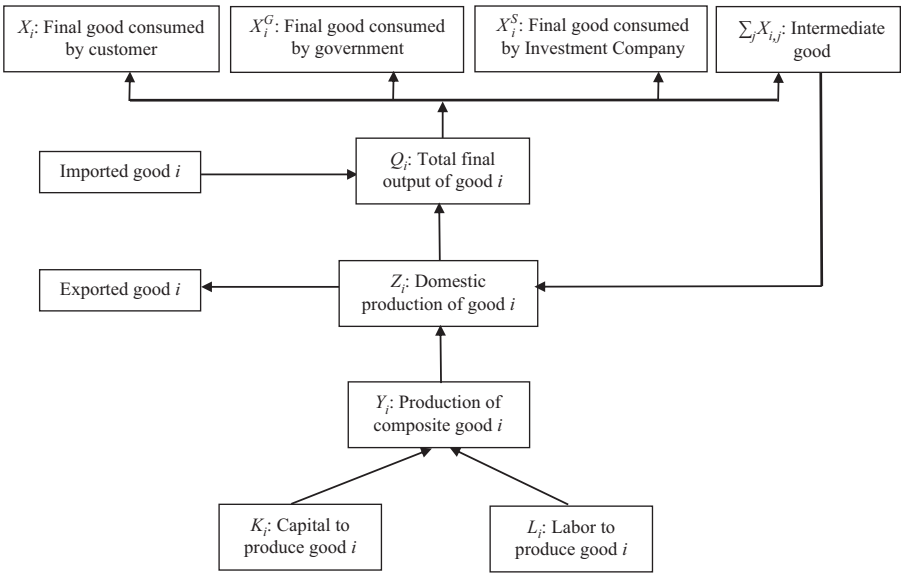

Figure 2.
Tree structure of production decision

Production technology:

$$Y_i(K_i, L_i) = K_i^{\beta_{K,i}} L_i^{\beta_{L,i}} \left(\text{assume that } \beta_{K,i} + \beta_{L,i} = 1\right).$$

Profit maximization behavior yields demand functions for capital and labor such that:

$$K_i = \frac{\beta_{K,i}}{r} p_i^Y Y_i,\ L_i = \frac{\beta_{L,i}}{w} p_i^Y Y_i,$$

where rK_i, wL_i denote the amount of capital and labor using in product i, p_i^Y, Y_i are price and number of goods which each sector needs to produce its final goods and $\beta_{K,i}$, $\beta_{L,i}$ are parameter obtain by VSAM.

- Step 2: the production of domestic goods.

Domestic goods producers (Z_i) use intermediate goods from other sectors for their production and their own composite goods. The profit maximization behavior is given by:

$$\text{Max}_{Z_i, K_i, L_i} : \pi_i = p_i^z Z_i - \left(p_i^Y Y_i + \sum\nolimits_j p_j^X X_{i,j}\right),$$

s.t.:

$$Z_i = \min\left(\frac{X_{i,j}}{ax_{i,j}}, \frac{Y_i}{ay_i}\right).$$

Under zero-profit condition, we have:

$$p_i^z = p_i^Y a_y + \sum_j p_j^X ax_{i,j},$$

where ay_i is a parameter obtained by the VSAM through function:

$$ay_i = \frac{Y_i}{Z_i},$$

where Z_i is domestic goods produced by firm i, $X_{i,j}$ is the final consumption of goods j used by firm i, $ax_{i,j}$ denotes the amount of intermediate goods j used for producing one unit of i, ay_i denotes the amount of composite goods for producing one unit of domestic goods.

- Step 3: decomposition of domestic goods into exported goods and final domestic goods.

The decomposition of Z_i, which has just been produced at the above step, is assumed to follow the Cobb–Douglass technology. Each firm is assumed to maximize the following profit:

$$\text{Max}_{Z_i, E_i, D_i} : \pi_i = \left(p_i^e E_i + p_i^d D_i\right) - \left(1 + \pi_i^p\right) p_i^Z Z_i,$$

s.t.:

$$Z_i = E_i^{\kappa_i^e} D_i^{\kappa_i^d} \left(\kappa_i^e + \kappa_i^d = 1\right).$$

The profit maximization behavior yields the following optimal decomposition equations:

$$E_i = \left(\frac{\kappa_i^e \left(1 + \pi_i^p\right) p_i^z}{p_i^e}\right) Z_i,\ D_i = \left(\frac{\kappa_i^d \left(1 + \pi_i^p\right) p_i^z}{p_i^d}\right) Z_i,$$

where E_i, D_i are the amounts of decomposed goods into the exported and final domestic goods, p_i^e, p_i^d are the prices when the goods are sold abroad, and sold domestically, π_i^p is a tax rate imposed on the production of Z_i, κ_i^e, κ_i^d are parameters obtain by VSAM.

- Step 4: the production of the final goods.

The final consumption goods Q_i are assumed to be produced by using the final domestic goods and the imported goods M_i. The production technology at this final stage also follows the Cobb–Douglass function:

$$\mathrm{Max}_{Q_i,M_i,D_i} : \pi_i = p_i^Q Q_i - \left(1+\pi_i^m\right) p_i^m M_i - p_i^d D_i,$$

s.t.:

$$Q_i = M_i^{\gamma_i^m} D_i^{\gamma_i^d} \left(\gamma_i^m + \gamma_i^d = 1\right).$$

Demand functions are given by:

$$M_i = \frac{\gamma^m p_i^Q Q_i}{\left(1+\pi_i^m\right) p_i^m},\ D_i = \frac{\gamma^d p_i^Q Q_i}{p_i^d},$$

where D_i, M_i are the final domestic goods and import of goods i, p_i^m, $p_i^d$are the price of M_i and the price of D_i, π_i^m is the tariff rate on goods i, γ_i^m, $\gamma_i^d$are the parameters obtain by VSAM.

Government behavior. The government maximizes its revenue by imposing income tax on the consumer, production tax on producers and tariffs on imported goods:

$$T^y = \pi^y Y = \pi^y \left(r\overline{K} + w\overline{L}\right),$$

$$T^p = \sum_i \pi_i^y p_i^Z Z_i,$$

$$T^m = \sum_i \pi_i^m p_i^m M_i,$$

s.t.:

$$\sum_i p_i^Q X_i^g + S^g = T^y + T^p + T^m.$$

θ_i is parameter obtained by the VSAM through function:

$$\theta_i = \frac{p_i^Q X_i^g}{\sum_i p_i^Q X_i^g},$$

where X_i^g, S^g are the government consumption of goods i, and government saving, π^y, π_i^y, π_i^m denote the income tax rate, production tax rate and import tax rate.

Foreign trade. The world prices of import goods and export goods are assumed to be exogenously given, S^f denotes the foreign saving, and the foreign trade balance is given by:

$$\sum_i p_i^e E_i + S^f = \sum_i p_i^m M_i\ .$$

Saving behavior. In the conventional static CGE model, in order to consistently close the model, we introduce an investment company, which invests a certain amount of money

in the final production industries. The total amount of money the investment company can use is given by:

$$S^f + S^g + S^y.$$

The budget constraint of the investment company:

$$\sum_i p_i^Q X_i^s = S^f + S^g + S^y.$$

ζ_i is a parameter obtained by SAM data by function:

$$\zeta_i = \frac{p_i^Q X_i^S}{S^f + S^g + S^y},$$

where $p_i^Q X_i^S$ are the investment demand in goods i, S^f, S^g, S^y are foreign saving, government saving and private saving.

- Market clearing condition.

The final goods and services consumption is equal to the total of domestic goods and services and import goods and services:

$$Q_i = X_i + X_i^g + X_i^s + \sum_j X_{i,j}.$$

The amount of capital in households equals the total capital required in all firms:

$$\overline{K} = \sum_i K_i.$$

The amount of labor in households equals the total labor required in all firms:

$$\overline{L} = \sum_i L_i.$$

Through the CGE model and data from the VSAM, an initial economy (benchmark result) will be generated to reflect the actual level of the economy described in the VSAM. Then, with new tariff rates of the industrial sector (0 percent), the CGE model will find a new equilibrium point which reveals the changing of the economic situation under the impact of the EVFTA.

4.2.2 Benchmark calibration. The parameters (see Table II) from the CGE model are endogenous variables and are calculated from the data of the VSAM. Those parameters are realistic and reliable for the benchmark calibration process.

Before simulating tax policy, one of the critical tasks is to achieve a trustworthy benchmark model that reflects the actual level of the economy. In this paper, the CGE model has been successfully calibrated and the results from the benchmark model are pretty close to the real economy described in the VSAM (see Table III). That means the benchmark model is established accurately, thus it can be applied in the simulation stage, which aims to measure the impacts of the industrial sector's tariff elimination on the Vietnamese economy under the EVFTA.

4.2.3 Scenario simulation. According to the roadmap of tariff reduction, when the EVFTA enters into force, 65 percent of the tariff flow will be reduced to a 0 percent level

Parameter	Agriculture (1–27)	Industrial (28–111)	Services (112–164)
ALFA (α)	0.1431033357440	0.4278124930750	0.4290841711810
BETA K (βK)	0.3067906522520	0.3644757745420	0.3331056064510
BETA L (βL)	0.6932093477480	0.6355242254580	0.6668943935490
TETA (θ)	0.0000000000000	0.0000000000000	1.0000000000000
AY	0.3817198141170	0.2377474247150	0.5426557754360
GSAI (ζ)	0.0507878080295	0.9241541988870	0.0250592075696
GAMMAM $\left(\gamma_i^m\right)$	0.1614169008640	0.3715603111420	0.0780061969031
GAMMAD $\left(\gamma_i^d\right)$	0.8385830991360	0.6284396888580	0.9219938030970
KAPPAE $\left(\kappa_i^e\right)$	0.1243807503580	0.3648377523460	0.1722268120460
KAPPAD $\left(\kappa_i^d\right)$	0.8756192496420	0.6351622476540	0.8277731879540

Source: Result from the CGE model performed by FORTRAN program

Table II.
Parameter value

Factor	Sector	Actual	Benchmark	Factor	Actual	Benchmark
Household consumption	Agriculture	288,206,438	288,206,438	Household saving	485,902,827	485,902,827
	Industry	861,603,359	861,603,359	Government saving	575,321,000	575,321,000
	Services	864,164,486	864,164,486	Foreign saving	−179,369,525	−179,369,525
Capital	Agriculture	141,780,714	141,780,714	Income tax	389,556,031	389,556,031
	Industry	477,382,694	477,382,694	Production tax	308,059,000	308,059,000
	Services	372,249,722	372,249,722	Tariff	70,045,000	70,045,000
Labor	Agriculture	320,360,857	320,360,857			
	Industry	832,396,247	832,396,247			
	Services	745,262,907	745,262,907			
Export	Agriculture	153,117,889	153,117,889			
	Industry	2,065,597,292	2,065,597,292			
	Services	377,946,880	377,946,880			
Import	Agriculture	201,642,033	201,642,033			
	Industry	2,062,123,618	2,062,123,618			
	Services	153,526,885	153,526,885			
Domestic production	Agriculture	1,210,682,689	1,210,682,689			
	Industry	5,509,119,363	5,509,119,363			
	Services	2,059,339,787	2,059,339,787			
Total output of final product	Agriculture	1,285,410,833	1,285,410,833			
	Industry	5,722,251,689	5,722,251,689			
	Services	1,970,213,792	1,970,213,792			

Source: Result from the CGE model performed by FORTRAN program

Table III.
Benchmark result (unit: million VND)

immediately; 99 percent of the tariff flow will be completely liberalized in 2028, and the rest of the tariff flow will be applied at a 0 percent level with the application of tariff quotas (Vietnam Chamber of Commercial and Industry, 2016). Accordingly, the EVFTA will create a positive impact on bilateral trade between Vietnam and the EU. It will also offer many opportunities and challenges for Vietnamese enterprises (Duong, 2016).

In the first scenario, the industrial tariff is used as an exogenous variable while other various endogenous variables will be clarified when the industrial tariff is adjusted in the simulation procedures. Specifically, the authors will adjust the tariff rate of the industrial sector to 0 percent in order to evaluate the impacts of the EVFTA on the economy. An elimination of this tariff will lead to significant changes in other sectors in the VSAM such as household consumption, the factors of production, trade value, government income and social welfare.

In the second scenario, the authors simulate both the tariff and production tax rates of the industrial sector through maintaining the tariff rate at 0 percent while adjusting the

production tax rate, which includes activity tax and sales tax (VAT), by increasing them by 10 and 20 percent and decreasing them at the same proportion. The second scenario just aims to show some possible production tax policies that can be applied to adjust the impact of the EVFTA.

In addition, to evaluate the impact of tax policy on social welfare, this paper uses the equivalent variation, which is appropriate to measure how much people are satisfied with an ongoing project. Equivalent variation is computed by the difference between income before a policy change and the minimum expenditure to guarantee the utility level before the policy change with prices obtained before the policy change (Hosoe *et al.*, 2015):

$$\mathrm{EV} = e\left(p^{Q}_{i,\mathrm{before}}, U_{\mathrm{after}}\right) - e\left(p^{Q}_{i,\mathrm{before}}, U_{\mathrm{befor}}\right),$$

where U_{after} and U_{before} denote the utility level which is obtained after and before the policy change and $p^{Q}_{i,\mathrm{before}}$ denotes the price level obtained before the policy change.

5. Result analysis

5.1 Impacts of the EVFTA on the economy

5.1.1 Variation in household consumption. Given the first scenario (see Table IV), the reduction in tariffs in the industrial sector leads to the import of more industrial products. In order to survive, domestic industrial producers have to reduce product prices, thus, the consumption in the industrial sector obviously increases (9.13 percent). On the other hand, industrial products are also the intermediate inputs of other sectors; therefore, the reduction of tariffs causes a positive effect on intermediate consumption in some sectors (Ahmed and O'Donoghue, 2010). This paper shows that the EVFTA causes household consumption in each sector to definitely rise as well (9.13 percent). These results are consistent with the research of Mohamed (2016), which points out that the elimination of industrial tariffs increases the household consumption in three main sectors.

5.1.2 Variation in factors of production. Coinciding with the study of Cirera *et al.* (2014), which shows the positive impact of tariff reduction on employment, this study also demonstrates that tariff elimination in the industrial sector not only increases the production factors of industry (by 9.74 percent) but also increases the factors of production for both agriculture (by 9.61 percent) and the service sector (by 8.21 percent) (see Table V).

Table IV. The effect of industrial tariff elimination on household consumption (unit: million VND)

Sector	Benchmark	Simulation	Deviation	Percentage change
Agriculture	288,206,438	314,510,722	26,304,284	9.13
Industry	861,603,359	940,240,948	78,637,589	9.13
Service	864,164,486	943,035,826	78,871,340	9.13
Total	2,013,974,283	2,197,787,495	183,813,212	9.13

Source: Result from the CGE model performed by FORTRAN program

Table V. The effect of industrial tariff elimination on factors of production (unit: million VND)

Sector	Benchmark	Simulation	Deviation	Percentage change
Agriculture	462,141,571	506,541,044	44,399,473	9.61
Industry	1,309,778,941	1,437,329,193	127,550,252	9.74
Service	1,117,512,629	1,209,278,280	91,765,651	8.21
Total	2,889,433,141	3,153,148,518	263,715,377	9.13

Source: Result from the CGE model performed by FORTRAN program

This can be explained as follows: the elimination of tariffs in the industrial sector is an opportunity for manufacturers to import modern machines, material and equipment from Europe in order to improve their producing capacity; hence, their businesses will grow faster and lead them to hire more employees to expand their business.

5.1.3 Variation in export and import values. Table VI illustrates how the export values will be as long as industrial tariffs reduce. It is important to recognize that export values from all three sectors increase slightly but negligibly. Exports from services are estimated with the highest increase (4.46 percent), agriculture is second (3.67 percent) while exports from the industrial sector increase at the lowest proportion (2.32 percent). This phenomenon can be explained: when the EVFTA goes into force, Vietnam will import a huge amount of modern industrial products from the EU to improve production capability in all sectors. As a result, output will increase and that will lead to pushing up the export value. Ahmed and O'Donoghue (2010) also agree that a decline in tariffs will allow domestic manufacturers to improve their capability to produce with a lower cost that will make the country's exports more attractive.

In terms of imports, the tariff elimination will boost imports more and lead to a deficit in the trade balance. As described in Table VII, the impacts of eliminating tariffs on the industrial sector on import values are stronger than on export values. Specifically, the import values of the agricultural, industrial and service sectors rise by 9.61, 13.15 and 8.21 percent, respectively.

From the results above, it is definitely determined that the trade balance in Vietnam will be in deficit due to zero industrial tariffs. More and more industrial products from EU countries will penetrate into the Vietnamese market, posing a variety of fierce competition for domestic firms but creating a great opportunity so that Vietnamese firms are able to improve the business environment, enhance product quality and diversify the types of products.

5.1.4 Effect on government income and social welfare. Once the tariff rates of the industrial sector decrease to 0 percent, the income of government from tariffs accordingly reduces by 90.6 percent, while the revenue from income tax and production tax increases by 9.13 and 3.34 percent, respectively, due to the rise of household consumption, and the factors

Sector	Benchmark	Simulation	Deviation	Percentage change
Agriculture	153,117,889	158,733,195	5,615,306	3.67
Industry	2,065,597,292	2,113,421,171	47,823,879	2.32
Service	377,946,880	394,788,463	16,841,583	4.46
Total	2,596,662,061	2,666,942,828	70,280,767	2.71

Source: Result from the CGE model performed by FORTRAN program

Table VI. The effect of industrial tariff elimination on export value (unit: million VND)

Sector	Benchmark	Simulation	Deviation	Percentage change
Agriculture	201,642,033	221,014,452	19,372,419	9.61
Industry	2,062,123,618	2,333,213,695	271,090,077	13.15
Service	153,526,885	166,133,896	12,607,011	8.21
Total	2,417,292,536	2,720,362,044	303,069,508	12.54

Source: Result from the CGE model performed by FORTRAN program

Table VII. The effect of industrial tariff elimination on import value (unit: million VND)

of production. Our results (Table VIII) show that government revenue decreases with lower tariff revenue earnings, and that coincides with the study of Ganguly and Das (2017).

In this study, the positive EV index reflects the positive prospect of the economy when Vietnam joins the EVFTA. Specifically, the removing of tariffs on the industrial sector raises social utility by 9.13 percent (see Table VIII). This result is similar to the study of Doanh and Heo (2009) and illustrates that the reduction of tariffs will increase social welfare when Vietnam joins the World Trade Organization.

5.2 Result of the second scenario

When the government tends to increase the production tax rate to compensate for the loss from tariffs, the more they increase, the more other factors such as household consumption, trade value, domestic production and social welfare will be lost. Table IX shows that a small change in the production tax rate causes an enormous change in the economy. This result is also emphasized in the research of Truc (2016).

Especially, when the production tax rate decreases by 10 and 20 percent, government income decreases by only 2.72 and 3.1 percent, while social welfare significantly increases by 11.57 and 14.13 percent, respectively. Those interesting results reveal that the fluctuation of government income is smaller than social welfare when the production tax rate changes. In other words, if the government sacrifices their revenue, the positive effects on the economy are much greater than its deficit.

6. Conclusion and discussion

To highlight the role of trade liberalization in promoting sustainable economic growth and strengthening the relationship between Vietnam and the EU, this paper has indicated that when the EVFTA comes into force, it will make a considerable impact on the Vietnamese economy. By constructing the VSAM based on the latest Vietnam input-output table for the year 2012 and utilizing CGE modeling, this paper simulates the economic scenario when the tariff rate of the industrial sector reduces to 0 percent.

Table VIII.
The effect of industrial tariff elimination on government income and social welfare (unit: million VND)

	Benchmark	Simulation	Deviation	Percentage change
Income tax	389,556,031	425,110,380	35,554,349	9.13
Production tax	308,059,000	318,359,547	10,300,547	3.34
Tariff	70,045,000	6,581,851	−63,463,149	−90.60
Government Income	767,660,031	750,051,778	−17,608,253	−2.29
Utility	737,564,507	804,881,206	67,316,699	9.13
EV		168,451,055		

Source: Result from the CGE model performed by FORTRAN program

Table IX.
The impact of adjusting production tax on the economy when tariff rate is 0 percent (unit: %)

		Production tax change (tariff rate = 0%)				
Category	Actual data (million VND)	−20%	−10%	0%	+10%	+20%
Total household consumption	2,013,974,283	14.13	11.57	9.13	6.80	4.57
Total factors of production	2,889,433,141	14.13	11.57	9.13	6.80	−2.53
Export	2,596,662,061	3.76	3.21	2.71	2.23	1.78
Import	2,417,292,536	17.47	14.94	12.54	10.24	8.05
Government income	767,660,031	−3.10	−2.72	−2.29	−1.81	−1.29
Utility	737,564,507	14.13	11.57	9.13	6.80	4.57

Source: Result from the CGE model performed by FORTRAN program

In conclusion, the reduction of the tariff will not only increase the social welfare but also strengthen the whole economy regarding the growth of household consumption, factors of production and trade value. In fact, when the tariff rate of the industrial sector is 0 percent, consumers are the benefitted the most because the price becomes more competitive and reasonable with the presence of import products, while manufacturers have plenty of opportunities to accost modern technology in order to improve their productivity and consume quality intermediate goods at a reasonable price. Interestingly, this paper also demonstrates that the sacrifices of government will certainly bring more significant benefits to the economy.

On the unfavorable side, the EVFTA causes a national budget deficit and puts pressure on domestic production, which will suffer from the tariff reduction because of the severe competition from imported products. As long as manufacturers do not effectively improve in allocating their resources in order to be more competitive in the market, they will be eliminated.

Last but not least, the results of this paper are not only a valuable reference for governments and policymakers from other countries when they decide to reduce tariffs or adjust production taxes once integrated into the world economy, but also emphasize the benefits of trade liberalization, tariff elimination and domestic tax reforms. Nonetheless, the impacts of trade liberalization on the economy by reducing tariffs also rely on the contexts of each nation, such as their economic foundation, per capita income, consumer demand and firms' competitive capacity.

Since this study just focuses on investigating the impacts of removing tariffs in the industrial sector, it does not reflect all possible impacts of the EVFTA on Vietnam's economy. Future study should investigate the impact of reducing tariffs in other sectors to fully understand the effect of the EVFTA on Vietnam's economy. Furthermore, although the static CGE is a powerful technique to analyze the impact of specific policy changes, it omits the time dimension in policy analysis, and is unable to incorporate dynamic behaviors to use in forecasting (Iqbal and Siddiqui, 2001). Also, the static CGE model is able to incorporate changes in only one exogenous factor instead of changes in all exogenous factors, which mobilize over some period of actual time.

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Corresponding author
Le Trung Ngoc Phat can be contacted at: ltnphat@agu.edu.vn