THE INTERNATIONAL JOURNAL OF HUMANITIES & SOCIAL STUDIES

Applying Hub - Spoke Model to Analyze Welfare Efficacy in Global FTA Network and Some Recommendations for Vietnam

Oanh Vu Thi
Lecturers, Thai Nguyen University of Economics and Business Administration,
Thai Nguyen Province, Vietnam
Tram Tran Thi Thu
Lecturers, Thai Nguyen University of Economics and Business Administration,
Thai Nguyen Province, Vietnam

Abstract
Based on the model of general equilibrium in monopolistic competition, the main purpose of the research paper is to analyze welfares of nations with discrepant positions, benefits of FTA as well as determinants in accordance with Hub - Spoke system and its extended structure. Results show that: (1) Country H and Country S are disproportionate in efficacy with the former earning more benefits than the latter; (2) the welfare distribution of Hub - Spoke system and spoke connective structure both exhibit extensive complexity, subject to combined effects of product substitution, commercial complementarity, extent of bilateral trading relation, profitability of scale, etc; (3) thanks to the extension of Hub-spoke system to global free trade, it is possible for country S to increase its trade volume and welfare, and by contrast, for country H to decrease its trade volume and welfare. Based on those arguments, the paper proposes some policy implications for Vietnam in its FTA partner selection and implementation of FTA strategies.

Keywords: General equilibrium model, hub and spoke structure, welfare effect

1. Introduction

The Hub and Spoke model has been applied in logistics and transportation, particularly in airline transportation. After the 2008 international financial crisis, the new trade protectionism rose and the multilateral trade liberalization faced more and more obstacles. Therefore, the trend of FTAs was activated again. Overlapping FTAs created hub and spoke systems. In a hub and spoke system, the hub country (H-country) is the big country and other countries in the system (S-country) are small countries. The H-country and each spoke country sign a FTA; however, there is no FTA between spoke countries. A FTA-hub country gains preferential access to markets of all spoke countries but spoke countries still imply MFN (Most Favored Nation) tariff on spoke country partner's goods. The scope and mechanism of these tariff barriers are different from each other; therefore, it makes the so called "spaghetti bowl" phenomenon of global system (Bhagwati [1]). The development of the FTA global network proves that the formation, developing trend and functional mechanism of a hub and spoke system have an important influence on welfare of member countries or non-member countries as well as on changes of global economies.
Many regions or countries not only developed countries (United States, Australia, Japan, EU...) but also developing countries (Mexico, Chile...) actively become the first movers in signing and executing a FTA. Vietnam is a developing country with a remarkable growth rate in terms of trade, so Vietnam stays in the same trend. This research is designed in the scope of general equilibrium theory to explore welfare allocation of a nation joining a FTA and its determinants. At the same time, it finds out how Vietnam could become a major node in the global FTA network, as well as dominate in a favorable position in the global economy.

2. Methodology

Research of hub and spoke models in FTA has been published recently in some scholars' works. Based on the different multi-nations models, scholars including Goyal and Joshi [2], Furusawa and Konishi [3], Mukunoki and Tachi [4], Deltas [5] analyzed the motivation of FTA formation. Furthermore, these scholars examined whether a nation had a motivation to deteriorate the current FTA network. Baldwin [6] emphasized that the hub and spoke structure had an important impact on business operating environment of members. Based on the Cournot competition model, DongYan [7] concluded that the hub and spoke model brought about smaller general welfare of country members than the huge FTA formation did. Hejian and Sun Yu-Hong [8], DengWei [9], analyzed the geographical location effect of the hub and spoke model and the FTA network. Moreover these scholars also analyzed intrinsic reasons generated by a FTA. The current research has given deep recognition

and a rigid base for further investigations regarding a FTA. However, research about the hub and spoke model in the viewpoint of micro economies is still limited. Furthermore, the premises such as constant returns to scale, perfect competition, the FTA exogenous variable etc., limited the explaining ability of the model. In this research, the study aims to make up a multi-nation model in the scope of monopoly, and then examine the change in welfare of the hub country, spoke country and non-member countries. While analyzing the developing circumstances of Vietnam and potential FTA partners, the purpose of the authors is to recommend the appropriate ways to select Vietnam's FTA partners at present, as well as the suitable policies to make Vietnam become the hub country in the global FTA network.

General-equilibrium approach to the multinational model

Suppose that there are n countries; including 1, 2, ..., n (n≥3). The country i implies tax rate tij >0 on imported goods and service from the country j. In agriculture and manufacturing industries, there are two factors of production: labor and capital. Total labor of the country i is Li: one unit of labor has one unit of capital. There are premises: agriculture is a perfect competitive market; a constant return to scale is applied to produce standardized products; there is no transportation cost of agricultural products between areas. Agricultural products can be traded freely; thus the national trade balance could be balanced. The manufacturing industry uses capital resources to produce a big number of non-standardized products in a monopoly market.

The utility of customers in country i is showed in the form of a linear and quadratic equation as:

$$U_i = a \int_0^n q_i(x)\,dx - \frac{\beta-\gamma}{2}\int_0^n [q_i(x)]^2 dx - \frac{\gamma}{2}\left[\int_0^n q_i(x)dx\right]^2 + q_0 \quad (1)$$

Where:
$q_i(x)$ = the demand of customers in country i regarding finished industrial products. $(x\in[0,n])$;
q_0 = the consumption of agricultural products;
α = consumers' different priority of different industrial products; α > 0
β> γ> 0 means that consumers tend to consume more and more types of products. Regarding a given β, γ variable represents the alternative elasticity between any two types of finished products.
Equation that shows the limitation of customers' budget is expressed as:

$$\int_0^n p_i(x)q_i(x)\,dx + q_0 = y + \overline{q_0} \quad (2)$$

Where:
y = the income of a typical customer, including his salary, benefits of capital investment and his reallocated income;
$p_i(x)$ = the price of industrial finished products x in the i domain. Agricultural products are considered as a unit with the price of one. Particularly, the agricultural products are seen as constant.
Applying the dynamic programming, Nash demand of country j's customers of products manufactured in country i is showed as:

$$q_{ij} = a - (b - cn)p_{ij} + cP_j \quad (3)$$

Where:
a = the magnitude of demand of industrial products
b = the elasticity of price
c = the replacement ratio among types of goods
a, b and c values have impacts on importing cost and exporting profit of country i with respect to country j. These three factors decide whether tax amendment after signing FTA can increase the welfare.
pij = the consumer price level in country j of the product manufactured by country i
Pj = the price index in country j
The inverse demand function of manufacturing product market is expected as:

$$p_{ij} = \frac{2[a + (b + cn)t_{ij}] + c\sum_{k}^{k\neq i} n_k(t_{kj} - t_{ij})}{2(2b + cn)} \quad (4)$$

In other countries, the demand function and benefit can be expressed as the same. Changes in tax tij are the main reasons influencing the change of domestic price. Therefore, it causes the fluctuation of components forming the welfare function. These changes in tax tij depend on the difference of influencing mechanism; therefore changes are showed in various ways. The equilibrium tax rate of country i is expressed as:

$$t_i = \sum_{k}^{k\neq i} n_k(t_{kj} - t_{ij}) \quad (5)$$

Based on the profit – maximizing goal of company, salary and capital rate are represented as:

$$\omega_j(\lambda) = \frac{2L(bm + cL)}{m^2}\left[\sum_i \theta_i\left(\frac{1}{2}\frac{2a + \sum_j t_{ij}\frac{L_j}{m}}{2b + c\frac{L}{m}}\right)^2\right]$$

$$r_i = \frac{L(b + cn)}{2F(2b + cn)^2}\sum_j \theta_j\left[2(a - bt_{ij}) + cn\left(\sum_k^{k \neq i}\lambda_k(t_{kj} - t_{ij})\right)\right]^2 \quad (6)$$

We can get the utmost value when the economy is balanced based on wage – maximizing goal of workers as well as profit – maximizing goal of the company. We put the salary of workers in country i and the capital rate (6) into the equilibrium price equation (4). The expected consumer surplus of workers in country j Sj(λ)(λ) is expressed as:

$$S_j(\lambda) = \frac{a^2L}{2bm} - \frac{aL}{m}\left(\sum_i \lambda_i p_{ij}\right) + \frac{(bm + cL)L}{2m^2}\left(\sum_i \lambda_i p_{ij}^2\right) - \frac{cL^2}{2m^2}\left(\sum_i \lambda_i p_{ij}\right)^2 \quad (7)$$

The welfare function of country i, v_i (λ) is determined as:

$$v_i(\lambda) = S_j(\lambda) + \sum_{k=1}^{n}(\pi_{ik} + t_{ik}q_{ik})$$

$$= \frac{a^2L}{2bm} - \frac{aL}{m}\left(\sum_i \lambda_i p_{ij}\right) + \frac{(bm + cL)L}{2m^2}\left(\sum_i \lambda_i p_{ij}^2\right) - \frac{cL^2}{2m^2}\left(\sum_i \lambda_i p_{ij}\right)^2$$

$$+ \sum_{i=1}^{n}\left\{\frac{2L(bm + cL)}{m}\left[\sum_i \theta_i\left(\frac{1}{2}\frac{2a + \sum_j t_{ij}\frac{L_j}{m}}{2b + c\frac{L}{m}}\right)^2\right]\right\} + \sum_{k=1}^{n}t_{ik}q_{ik} \quad (8)$$

This function comprises the consumer surplus, the total profit of producers and tax revenue of that country.
We have the total world welfare expressed as:

$$V = \sum_{i=1}^{n}v_i(\lambda) \quad (9)$$

3.1. Analyzing Welfare of H-S Single-Axis System

Utmost values of major economic variables in the general equilibrium theory are numerically emulated. Examination of the welfare status of hub, spoke and non-member countries is based on different micro-economic viewpoints including customer's utility, producer's profit and income allocation. Firstly, we analyze the basic H-S single-axis system.

Suppose that there is one hub country (country H) and g-1 (1≤ g ≤ n −1) spoke countries Sk (k = 1, 2,..., g-1). The rest are non-member countries (country N). Country H can freely export their goods to country S's market. Among S countries, between country S and country N and between country N and any other country, there is no FTA. Thus, country H has to deal with g tax-exempt objects. Among FTAs, country members can define the tax rates by themselves. It could be expressed as:

$$t_{ij} = \begin{cases} 0, when\ i = j, or\ j\ signs\ FTA \\ t,\ other\ cases \end{cases} \quad (10)$$

After answering the system of equations (10), we get the welfare function of country H, country Sk and country N respectively: v_H (λ),v_(S_(k)),v_N (λ) and changes in terms of welfare before and after signing a FTA. Based on the calculating Results, we can compare welfare status of different countries in particular cases.

1st proposition: The H-S model improves the welfare status of country H and country S. And the more distinctive goods in country H and country S are, the higher their welfare status get. Moreover, country H gains more profits than country S.

Criteria to compare the economic welfare in this model contain consumer surplus, producer surplus and tax income. After the H-S network is formed, the welfare status of country H is improved. The welfare status of country Sk after creating H-S model is bigger than before signing the FTA. In a more complex point of view, when country H penetrates into a given market, it could become a bigger attracting-FDI area. Therefore, it becomes the center of economic activities and causes negative effects on Sk country's economy.

The impacting mechanism of rate of substitution in goods is more complex and relates to many factors such as initial tax rate, industrialization level, magnitude of market, etc. However, when we analyze two extreme cases including perfect non-substitution and perfect substitution, we investigate that the smaller the replacement ability of products is, the bigger the trade surplus of country H and country S tend to be after signing a FTA. Thus, the welfare status will be improved.

2nd proposition: The larger the market share of S country's products is, the more the consumer surplus and welfare of country H increases. The tighter bilateral trade relationship between country H and S makes the FTA's benefit increase. The reason could be "the 3rd country effect". It means that a FTA formed between country H and S changes the resources of imported products. Moreover, when non-member countries (3rd countries) become FTA partners, they can benefit a larger market share and lower tariff barriers. Thus, the consumer surplus of buyers and welfare status in country H will rise. This could explain why when H country finds a potential FTA partner, it always considers major exporting countries and its important trade partners as valuable candidates.

3.2. Analyzing the Welfare of Hub and Spoke Network

After forming the H-S system, the welfare of non-member countries, which have a close trade relationship with H and S countries, can be reduced. Thus, non-member countries will have more motivation to join the FTA network to change this unfavorable situation. The rise of g causes changes in 〚Δv〛_H (λ), 〚Δv〛_Sk (λ), 〚Δv〛_N (λ) as below:

3rd proposition: The welfare of hub country increases when the number of spoke countries increases (the direct proportion). However, the welfare of country S and non-member countries go down when the number of spoke countries goes up (the inverse proportion). S countries gain more benefit from joining a FTA early than countries joining any FTA late.

Importantly, it is not always the best case for the hub country if more and more countries join the network and become S countries. The number of S countries can decrease symmetric gains. When the number of spoke countries reaches an utmost value, the producing capacity of companies in country H is in a statured position. Attaining more chances to enter new markets cannot boost the economic growth as much as previously. In other words, the hub and spoke system only develops in a particular boundary. After the critical value inside that boundary gains of being a spoke country are less than before joining the H-S system. Hence, no country wants to participate in this H-S system. At that time the development of the H-S system approaches the utmost position.

4th proposition: If spoke countries establish a topology, it will increase the welfare of the spoke country and decrease the welfare of the hub country. Simultaneously, the welfare of non-member countries will be decreased and total welfare of the world will be increased.

The previous propositions say that after forming the hub and spoke system, the number of new spoke countries rises and the benefit of current spoke countries is cut down. The reason is that current spoke countries have to share their gains with new spoke country members. In this case, the best choice for current spoke country members is to sign new FTAs with new members. It will make a new topology compared to the former hub and spoke system. When any current spoke country makes a new topology with the other one, the Hub effect of the hub and spoke model has an inverse proportion with the growth of free trade liberalization between spoke countries. Changes in the welfare of non-member countries relate to the increasing returns, the initial tax rate, and the elasticity of substitution.... When those changes reach the utmost value, non-member countries will have motivation to become a new spoke country.

3.3. Analyzing the Welfare of Multilateral and Multi-Axis Trade

Allocating benefits of a hub and spoke system is unbalanced. The hub country stays in a dominant position. It gives the hub country more motivation to strengthen its position, as well as encourages the spoke country to set up becoming a hub country as its priority. After signing a FTA, a country can put other related or non-member countries under a lot of pressure to join a FTA in order to avoid being left out of the international market. Moreover, there are more and more spoke countries signing FTA. This creates a new hub and spoke system among one current spoke country and many new spoke countries. At that time, the current spoke country becomes a new hub country. The similar mechanism happens, so in the hub and spoke system there are more spoke countries in different developing status. In this new hub and spoke system, several hub countries connect with many spoke countries. As a result, the initial hub and spoke system transforms to the multi-axis hub and spoke system. Each axis has a different amount of spoke countries so that we cannot estimate exactly the welfare allocation. If we simply assume that each axis has the same amount of spoke countries; after the initial spoke country becomes the new hub country, trade deflection can increase the turnover between initial trade partners.

5th proposition: If a Multinational Free Trade Area is created, the welfare of the initial hub country will be decreased while that of the initial spoke country will be increased.

The transformation from a hub and spoke system to a regional FTA can damage the benefit of hub country. Therefore, a current hub country does not have much motivation to seek a regional free trade agreement easily. However, that

transformation brings about some benefits. After uniting broken markets, the market size of companies is enlarged and member countries accomplish the specialization. Then, there is an optimal resource allocation. Simultaneously, new products as well as traditional products with competitive advantages will be improved remarkably. The production cost will be reduced as well. Thus, economies of scale will be achieved. The increasing trade volume between hub and spoke countries makes the productivity rise and creates the technology spillover. In like manner, the hub country will have motivation to join regional trade agreement.

3.4. FTA-Joining Strategies for Vietnam

Up to December of 2016, Vietnam have already signed and accomplished 10 FTAs, finished negotiations for 2 FTAs, and continued negotiating 4 different FTAs. Among 10 FTAs signed and accomplished, there are 6 FTAs Vietnam joining on behalf of ASEAN member (AFTA, FTA between ASEAN and China, South-Korea, India, Japan, Australia and New Zealand) and 4 FTAs Vietnam joining on behalf of an individual partner (Chile, Japan, South-Korea and Asia-Europe Economic Union). Two FTAs whose negotiations have been finished are Europe-Vietnam FTA and Trans-Pacific Partnership. Four FTAs which have been negotiating are Regional Comprehensive Economic Partnership (RCEP), ASEAN – Hong Kong FTA, Vietnam-Israel and European Free Trade Association (EFTA) and ASEAN – Canada agreement. As a result, the FTA network in the world is basically formed. However, if Vietnam wants to carry out the FTA successfully, Vietnam needs to analyze the current FTA network thoughtfully. Moreover, it has to find out exactly the overlap among different networks and the country's position in the world. Thanks to these ways, Vietnam can gain advantages.

South – Korea now is the only country signing FTA with two big economies simultaneously including EU and America (EU – South Korea FTA comes into effect since 1st July 2011 and America – South Korea FTA comes into effect on 1st January 2012). The analysis shows that in the FTA network where EU and America are hub countries Vietnam is the non-member country.

In the FTA network where Chile is the hub country Vietnam is the spoke country. Chile has signed FTA with 37 countries and regions including 3 countries in North America, 10 countries in Latin America, 7 countries in European Free Trade Association, Japan and South Korea. Therefore, Chile has become a major country in the FTA network in the world and a remarkable hub country in the hub and spoke network. After signing FTA with Chile, Vietnam can connect to spoke countries in South America and other countries in the global FTA network.

In the FTA network in East Asia, the position of ASEAN and Singapore as the hub country is more and more important while Vietnam is a spoke country. East Asian countries have formed 28 FTAs/EPAs so far; Japan signed the bilateral FTA with Singapore, Thailand, Malaysia and Philippines; South Korea signed the bilateral FTA with Singapore and ASEAN, China signed the FTA with ASEAN and Singapore.

Vietnam has not signed any FTA with Middle East and Africa. In general, in the regional FTA network, Vietnam is the late comer; therefore, Vietnam has to deal with the increasing complexity of the hub and spoke system as well as the more complicated welfare reallocation.

Based on the results of researched model, we can figure out factors influencing benefits of a FTA. These factors are the market of products, substitution rate among different products, the trade complementarity and the growth of economies of scale. Therefore, this research uses five criteria, including import and export complementarity index, trade comparative index, export intensity and import intensity, to analyze the potential FTA partners of Vietnam. The statistics show that Mexico, Russia and South Africa are major partners to have discussion with. Particularly Mexico which is the developing country signing most FTAs takes the role of a hub country in the regional FTA network. According to results of this research, Vietnam has been the non-member country in this FTA network; therefore the best choice for Vietnam is to sign a FTA with Mexico. Then Vietnam can take part in this FTA network and corporate with other spoke countries to gain more benefits. Moreover, the free trade region between Russia and East Asia has not been created yet. If Vietnam signs a FTA with Russia, Vietnam will get more advantages.

4. Conclusions and Recommendations

This research is accomplished in order to give several major conclusions as below:

In the hub and spoke system, the hub country gains more welfare than other countries. Furthermore, the more and more countries join this network, the bigger and bigger the welfare gets. However, the welfare of spoke country is smaller than the one of hub country. And it decreases while the number of spoke countries increases. The perfect choice for spoke countries is to advance multilateral free trade. In this case, the welfare of the initial hub country drops while the welfare of spoke country grows up sharply and finally gets bigger than the one of the initial hub country. The secondary choice is to create a FTA between one spoke country with other spoke countries and non-member countries. Accordingly the spoke country becomes the center of a new hub and spoke system. The last choice is that the spoke country forms a FTA with another spoke country. Then a topology with the initial hub and spoke system is formed. When there is no FTA signed, the welfare gets the least value. If non-member countries confront different ways of trade liberalization, their welfare is not similar. The country's welfare is the least when this country is left out of the network. In the hub and spoke system, the best choice is to sign a FTA with the hub country. If the country's products have a relatively big market share in other countries and a small elasticity of substitution, the bilateral FTA can improve the utility of domestic customers as well as the country's welfare.

The area of Vietnam is not large but it situates in a very favorable location with many neighbor countries. It refers that the regional integration strategy of Vietnam cannot be as similar as the strategy of North America Free Trade Area (NAFTA) or European Union (EU). Apparently, through signing bilateral or multilateral FTAs Vietnam can accomplish the regional integration strategy.

According to the above conclusions, the authors have some recommendations:

Firstly, Vietnam's FTA partners mainly are neighbor countries in the region; therefore, it should continue finding suitable partners in this region. Through related agreements, Vietnam should enhance the bilateral trade relationship with countries in the region, which already signed FTA with Vietnam. Besides, Vietnam should enlarge its FTA/RTA by merging with other FTAs or increasing the number of members. Furthermore, the future strategy for Vietnam is to concentrate on integrations that are formed among developing or developed countries as well as regions. And Vietnam has to be more active in the current FTA network. Hence, Vietnam can accumulate more benefits from FTAs, economize budget for new discussions and create more effects. Vietnam needs to choose the right moment to sign the bilateral FTA such as EU and NAFTA on behalf of a unilateral partner. This strategy helps Vietnam access a bigger free market and a non-frontier market. Also it results to a lower cost and more regional advantages to attract investment. Then domestic companies can improve their standards as well as optimize their production lines.

Secondly, besides multilateral FTA, Vietnam can sign bilateral FTAs with hub countries in its neighborhood. Aside from EU, Mexico is the country signing most FTAs in the world. In the network where Mexico is the hub country, Vietnam is the non-member country. Therefore, Vietnam should consider Mexico as a very important partner, then recommends and discusses the bilateral FTA with Mexico. By this way, Vietnam can share benefits and minimize negative effects of FTA.

Thirdly, African countries have not created a successful FTA network yet. Based on the long-lasting relationship between Vietnam and African countries, Vietnam should consider South Africa as the starting point to sign the bilateral FTA. This activity can stimulate the formation of FTA network and the hub and spoke network in which Vietnam is the center. In the viewpoint of international resources allocation, Vietnam should select oil resources and rare mineral resources, then accomplish FTA discussions with these countries. Vietnam should be aware of economical and political benefits that Vietnam can attain from FTA.

Overall, each country in the world has its own strategy with regard to the international trade. Vietnam should pay attention to the development of signing FTAs in the world. Regarding each FTA, which has been signed or will be signed, Vietnam must analyze its direct and indirect effects on Vietnam's position in the FTA network and on Vietnam's economy. Vietnam also needs to examine strategies, advance advantages and remove disadvantages in order to be in an active situation. Furthermore, Vietnam can benefit its advantages in FTA discussions including variety natural resources, the huge market with more than 90.5 million people, which stands at the 14th in the world and the 3rd in South East Asia

5. References

i.   Bhagwati, J. (1995). Us trade policy: successes and failures. Department of Economics Columbia University.
ii. Goyal S. & Joshi S. (2000) "Bilateralism and free trade", Econometric Institute Research Papers, 47, 749–778.
iii. Furusawa T., Konishi H. (2004), "A welfare decomposition in quasi-linear economies", Economics Letters, 85(1), 29-34.
iv. Mukunoki H., & Tachi K. (2006), "Multilateralism and hub-and-spoke bilateralism". Review of International Economics, 14(4), 658-674.
v.   Deltas G., Desmet K., & Facchini, G. (2012). Hub-and-spoke free trade areas: theory and evidence from Israel. Canadian Journal of Economics, 45(3), 942–977.
vi. Baldwin R. E. (2008), "The spoke trap: hub-and-spoke bilateralism in East Asia", China Asia & the New World Economy, pp. 51-87.
vii. DongYan (2006). "New methods of regional economic integration – Theoretical and Empirical Analysis of Hub and Spoke Bilateralism. Economics and Finance Research, 32(9), 4-18.
viii. HeJian, SunYuHong (2008). "Impacts of global FTA network development on countries in different locations". Chinese social science review, 5, 57-66.
ix. DengWei (2008). "Regional production effectiveness of FTA in the hub and spoke structure: Capital Movement Theory". Global Economic Research, 2, 42-48.