The Optimal Entry Mode of the Multinational Firm under Network Externalities: Foreign Direct Investment and Tariff

Jue-Shyan Wang
Department of Public Finance
National Chengchi University
64, Tz-nan Road, Sec. 2, Wenshan, Taipei 11623
Taiwan

Ya-Shan Tang
Department of Public Finance
National Chengchi University
64, Tz-nan Road, Sec. 2, Wenshan, Taipei 11623
Taiwan

Abstract

In the generation of frequent interaction internationally and booming internet, the commodity with network externalities in international trade has been spotted all the time. In this paper, we analyze how the multinational firms producing goods with network externalities choose the optimal entry mode between foreign direct investment and exporting. We found out that the technical advantages are the key factors for multinational firms to choose the entry modes.

Keywords: Network Externality, Direct Investment, Tariff

JEL Classification: F13, D85

1. Introduction

Under the revolution of the modern network economic system, some products are not only limited to the traditional economic law to consumers' value, but also depend on the number of the people using the same goods. We call that network externality. Network externality was proposed by Rohlfs (1974), and laid foundation by Katz and Shapiro (1985).With international trade and globalization, world trade has become more and more open. As a rational and multinational firm, it will choose the most profitable entry mode to get into the international market. For example, exporting, direct investment, commons, joint venture, etc. Each mode has its pros and cons. The firms usually take the best way to enter the market of the other countries. We will analyze the model by the entry modes of exporting and direct investment in this article. In reality, we do have some cases. For example, Microsoft has branches in 60 countries and areas over the world by direct investment. In addition, the global mobile phone companies, such as Nokia and Sony Ericsson, they both sell mobile phones through agents into Taiwan. The above instances show indirectly that how the firms producing goods under network externality choose the most profitable way to get into other foreign markets.

There are so many papers talking about international trade. We put emphasis on the firms' choice between exporting and direct investment, so we focus on this part of the papers talking about international trade. Rowthorn (1992) discussed if an oligopoly firm sells goods to the rival countries or just sell in the native country. Rowthorn assumed the two countries are well-matched in economy. Firms produce homogeneous goods and have the property of increasing return to scale. What would a firm adopt exporting or direct investment when it decides to sell to rival countries? It turns out that there are two important factors to affect firms' decisions, size of market and degree of tariff barrier. Campa et al. (1998) investigate how strategic interaction of firms affects industrial structure. And foreign firms would choose exporting or direct investment as an entry mode. He concluded that under highly-intensive industries, firms would increase import and reduce direct investment due to high tariff. Qiu and Tao (1999) discussed about how Local Content Requirement (LCR) influence the entry of heterogeneous multinational firms.

When the LCR is the same, firms without efficiency or vertical integration may adopt direct investment. Rob and Vettas (2003) studied that how firms get into foreign market under uncertainty demand growth. They found out that in the situation of demand uncertainty and non-reversible, interior solution would happen, namely for multinational firms, both exporting and direct investment could be the possible choices under some specific circumstances. Eicher and Kang (2003) use Hotelling model to analyze the best entry decision for multinational firms. They pointed out that fixed cost of direct investment, tariff, and transportation cost would be the important factors affecting multinational firms' decisions. They also explain why big countries may attract acquisitions, medium-sized countries are mainly through trade even if the tariff is very high, and small countries attract direct investment or no entry.[1]

Although there are so many articles talking about network externality and international trade, they rarely add the goods with network externality to model, and discuss the result of the trade policy. Matutes and Regibeau (1996) discuss the firms which produce goods with network externality export to the third country by quantity competition, and the government optimal decision of export. Gandal and Shy (2001) thought if the government has identification for foreign standards under network externality and transition cot. Government usually chooses to identify. And they assume standardization unions can exist between various countries, and that differs from the traditional trade measure.

In the above-mentioned literature, no matter with network externality for firms' entry mode or not, most of them put emphasis on how cost advantage affects firms' action. Due to the never-ending changing and improvement technology, cost is not the most important thing for firms which produce network externality goods. Hence, we should focus on what this kind of goods with network externality and universality bring to us, and what advantages firms bring to consumers because of the technical advantages. How would these affect the firm's entry mode. We consult Wang Zhi-Xian(2005), modified Hotelling model as a base to discuss how a multinational firms choose the most beneficial way to foreign market. This paper also consults Katz and Shapiro (1985), which assumed two firms have the same network externality coefficient, but consumers have different utilities at first for the two goods. Meanwhile, we refer Matutes and Regibeau (1996) that how to multinational firms choose entry mode when products are non-compatible. And for simplicity, we use single-period model to focus on the multinational firms decisions under network externality. At the end, we analyze by assuming network externality has smaller impact than the preference of goods, and know that the technical advantages are the key factors affecting decisions of firms.

The framework of the paper is as follows: Section 1 is an introduction, section 2 is the basic model, section 3 is about the equilibrium of two firms under price competition, section 4 is about the best entry mode for transnational firms under network externality, and section 5 is the conclusion.

2. The Basic Model

Assume there is a foreign firm A (called firm A) producing goods with network externality. Firm A wants to enter the domestic market, and it can choose paying tariff or direct investment to entry the domestic market. At the same time, we assume a domestic firm B having a price competition with firm A, and firm A has a better technique. This section, we will take the Hotelling model reformed by Wang et al. (2005) as the basic model.

Assume firm A and firm B produce the same type of goods, but incompatible. Meanwhile, in the market consumers' preference index lie between $[0,1]$ as an uniform distribution. Firm A and B's product property lie on the extremes of the index; i.e. 0 and 1. We take d a disutility between the product property and consumers' preference, and $d>0$. When d is bigger, the preference to the goods of consumers is stronger. The preference index of consumers for two firms lie at both ends of the index, so there only be consumers with exact preference index 0 or 1. They can totally satisfy their preference by buying two firms' products, and the rest of the consumers get lower utility because there are no products in accordance with their preference. The farther the product departs from consumers' preference, the less utility consumers get. We use the additive network effect from Katz and Shapiro (1985), and then know that consumers get expected utility by buying the product of firm

[1] The comparison between exporting and direct investment, we can see some papers, Dixit (1984), Ethier (1986), Horstmann and Markusen (1992), Smith (1987), Motta (1992), Motta et al. (1997), Belderbos and Sleuwaegen(1998), and Stähler(2006), etc.

A or firm B as following:

$$U(x,S)=\begin{cases} R+v_A-p_A+rx-dl, & \text{if } S=A \\ R+v_B-p_B+r(1-x)-d(1-l), & \text{if } S=B \end{cases} \quad (1)$$

R is the highest price that consumer willing to pay for product S. For simplicity, we assume R is enough to buy at least one unit product of firm A or firm B, and each consumer would buy one unit at most. At the same time, each consumer in the market would certainly buy one of the products. v_A and v_B are the technical skill level of firm A and firm B separately, and $v_A>0$, $v_B>0$, $v_A\geq v_B$. That means the technical skill level of firm A isn't lower than firm B. So v_A-v_B is the technical skill level difference that product A exceeds product B. Similar to general model that contains goods with network externality, we assume the higher technical skill level of firm is, the higher quality they can raise. And consumers have better utility by purchasing the products. Therefore the will of buying products is strengthened. Besides, p_A and p_B are the price of firm A and firm B. x is the size of the network of firm A's product. We can take x as the market share of firm A, and thus the market share of firm B is $1-x$.[2] r is the intensity of network effect per unit, and $0\leq r<d$. When r is bigger that means the network externality effect is stronger. Under the same network size and product quality, when r is bigger represents consumers get more utility.

Because the market isn't always in equilibrium, there must be a dynamic adjustment for the market to get the long run equilibrium.[3] v_A and v_B are constant, and lie on the two extreme side of line. According to the property of consumers, given a timing τ, it must exist a marginal consumer $x(\tau)$ who separates two market segmentation, $[0,x(\tau)]$ and $(x(\tau),1]$. $[0,x(\tau)]$ is the market range of firm A, and $(x(\tau),1]$ is for firm B. Assume the difference of utility for marginal consumer buying the two products is $\varphi(x(\tau))$, given a timing τ. That is:

$$\begin{aligned}\varphi(x(\tau)) &\equiv U(x(\tau),A)-U(x(\tau),B) \\ &=(v_A-v_B)-(p_A-p_B)+(r-d)(2x(\tau)-1), x(\tau)\in[0,1]\end{aligned}$$

Given $x(\tau)$ is constant, if $\varphi(x(\tau))>0$, and then marginal consumer will choose product A at τ. When consumers' preference index, l, is less than or equals to $x(\tau)$, they suffer lower preference difference under the same network benefit and price. So they must choose A. While l is more than $x(\tau)$, this kind of consumers will buy B. Hence market of product A will expand to let x move to the right side until $\varphi(x)=0$. Otherwise, x will move to the left side until $\varphi(x)=0$ if $\varphi(x(\tau))<0$. We express this adjustment progress as $\dot{x}$. Let $\dot{x}$ represents differentiating the marginal consumers' location with respect to time:

$$\begin{aligned}\dot{x} &= k\varphi(x) \\ &= k\left[(v_A-v_B)-(p_A-p_B)+(r-d)(2x-1)\right], \quad 0<k<\infty\end{aligned} \quad (2)$$

Let $\dot{x}=0$ we can get steady-state equilibrium is:

$$\bar{x}=\frac{(v_A-v_B)-(p_A-p_B)+(d-r)}{2(d-r)} \quad (3)$$

if $r<d$, that means the above equation has a steady-state equilibrium, $\bar{x}$. When $\bar{x}$ is an interior solution, it implies two firms will stay in the long run steady-state equilibrium.

[2] We assume consumers have perfect foresight; i.e. consumers can predict the market share of firms in steady-state.

[3] Traditional Hotelling model equilibrium comes from Nash equilibrium. It is still Nash equilibrium solution in this part with dynamic adjustment. However, the area of solutions is confined; i.e. the equilibrium solution is the Nash refinement with dynamic adjustment.

If $r > d$, the steady-state equilibrium isn't stable. $\bar{x}$ is just the critical mass of firm A's market. And the equilibrium vale, x, would depend on the difference between the market starting point x_0 and $\bar{x}$. When the difference is bigger, x would approach to 0. In a contrary direction, x would approach to 1 when the difference is smaller. It means when market is in steady-state equilibrium, there must be only one monopoly in the market ; If $r = d$, $\dot{x}$ and x are non-relative constants, and $\bar{x}$ is undefined. At this time, the market is similar to Bertrand price competition. We analyze the following situations by assuming $r < d$.

After descripting the adjustment of the Market, we continue to explain firms' decision-making. From the former mentioned, the two firms are constant to the two extreme sides of the preference index line. Consequently, firms just have to decide price at the same time, and they can get the long run equilibrium x^* through $\dot{x}$. When $r > d$, we have to take the market starting point, x_0 into consideration as making decision of long run equilibrium, x^*. So we assume we don't know x_0 when setting price, but assuming x_0 is an uniform distribution, $x_0 \in [0,1]$. And we concern for which way would firms choose, exporting or direct investment, so we will set profit function of both way separately for firm A. Assume v_A and v_B are technical level of firm A and firm B, v_A and v_B are exogenously given. And their producing costs per unit are both zero. When firm A chooses exporting as an entry mode, it's profit function in equilibrium is:

$$\pi_A^{t*} = \int_0^1 \left(p_A^* - t \right) x^* \left(p_A^*, p_B^*, x_0 \right) dx_0 \tag{4}$$

t is unit tax. When firm A chooses direct investment as an entry mode to foreign country, the profit function in equilibrium is:

$$\pi_A^{F*} = \int_0^1 p_A^* x^* \left(p_A^*, p_B^*, x_0 \right) dx_0 - F \tag{5}$$

F is the fixed cost of direct investment, and firm B's profit function is:

$$\pi_B^* = \int_0^1 p_B^* \left(1 - x^* \left(p_A^*, p_B^*, x_0 \right) \right) dx_0 \tag{6}$$

No matter which entry way firm A chooses, firm B's general profit function is eq. (6).

3. Equilibrium Under Price Competition

After defining the profit function of firm A and B, we will investigate two entry modes to know is it possible to achieve equilibrium price and social standardization under competition at x_0. Besides, we probe into firm A's entry restriction.

3.1 When foreign firm chooses exporting

4. If $0 \le \bar{x} \le 1$, and then $\bar{x} = [(v_A - v_B) - (p_A - p_B) + (d - r)] / [2(d - r)]$, which is the only long run equilibrium as market is segmented; i.e. $x^*(x_0) = \bar{x}$ And x^* doesn't change with x_0. We take $\bar{x}$ into two firms' profit function, given p_A and p_B . So two firms' expected profit via exporting are separately:

$$\pi_A^{te} = \frac{(p_A - t)}{2(d - r)} (v_A - v_B - p_A + p_B + d - r) \tag{7}$$

$$\pi_B^{te} = \frac{p_B}{2(d - r)} (-v_A + v_B + p_A - p_B + d - r) \tag{8}$$

Differentiate the above-mentioned maximization profit condition with respect to their own price and find simultaneous solution.[4] We can get the equilibrium price

[4] Now $\pi_{A,p_A p_A} = \pi_{B,p_B p_B} = 1/(r-d)$, $\pi_{A,p_A p_B} = \pi_{B,p_B p_A} = (-1)/[2(r-d)]$,

are:

$$\left(p_A^{t^*}, p_B^{t^*}\right) = \begin{cases} \left((v_A - v_B) - (d - r), 0\right), & \text{if } \dfrac{v_A - v_B - t}{d - r} \geq 3 \\ \left(\dfrac{1}{3}(v_A - v_B + 2t) + (d - r), -\dfrac{1}{3}(v_A - v_B - t) + (d - r)\right), & \text{if } 3 > \dfrac{v_A - v_B - t}{d - r} \geq 0 \end{cases} \tag{9}$$

5. Substitute $\left(p_A^{t^*}, p_B^{t^*}\right)$ into $\bar{x}$ separately, and we can get firm A's market share under exporting equilibrium as follows:

$$x^{t^*} = \begin{cases} 1, & \text{if} \quad 3 \leq \dfrac{v_A - v_B - t}{d - r} \\ \dfrac{1}{2} + \dfrac{v_A - v_B - t}{6(d - r)}, & \text{if} \quad 3 > \dfrac{v_A - v_B - t}{d - r} \geq 0 \end{cases} \tag{10}$$

So when we solve the interior solution, two firms' expected profit are:

$$\left(\pi_A^{t^*}, \pi_B^{t^*}\right) = \left(\frac{\left(-v_A + v_B + 3r + t - 3d\right)^2}{18(d - r)}, \frac{\left(-v_A + v_B - 3r + t + 3d\right)^2}{18(d - r)}\right) \tag{11}$$

6. At last, let $\pi_A^{t^*} = 0$, and we can know the condition for firm A withdrawing from domestic market is:[5]

$$v_A - v_B < 3(r - d) + t \tag{12}$$

According to the above circumstances, we can base on the difference of $v_A - v_B$, and discuss the three competitive situations for two firms when firm A chooses exporting :

1. When $v_A - v_B \geq 3(d - r) + t$, firm B's equilibrium price and market share are both 0. Consumers would all buy products of firm A, and firm A will take all the market. And the equilibrium price is $p_A^{t^*} = (v_A - v_B) - (d - r)$.
2. When $v_A - v_B \in \left[3(r - d) + t, 3(d - r) + t\right)$, the two firms would be in the market at the same time in equilibrium, and firm A's market is $x^{t^*} = (1/2) + [(v_A - v_B - t)]/[6(d - r)]$, firm B's is $1 - x^{t^*}$. Two firms' equilibrium price are:
$$\left(p_A^{t^*}, p_B^{t^*}\right) = \left(\frac{1}{3}(v_A - v_B) + (d - r), -\frac{1}{3}(v_A - v_B) + (d - r)\right)$$
And now the firms' profit function in equilibrium is eq. (11).
3. When $v_A - v_B \in \left[0, 3(r - d) + t\right)$, firm A would withdraw from domestic market, and firm B will take all the market.

$\pi_{A,p_Ap_A}\pi_{B,p_Bp_B} - \pi_{A,p_Ap_B}\pi_{B,p_Bp_A} = 3/[4(r - d)^2] > 0$ is the S.O.C. of profit maximization. In the following article, how to solve S.O.C. of interior solutions is the same way.

[5] Let $[(-v_A + v_B + 3r + t - 3d)^2]/[18(d - r)] = 0$, we can obtain $v_A - v_B = 3(r - d) + t$. So we take $v_A - v_B = 3(r - d) + t$ as a condition.

The above three situations are differ from the two firms technical level. When v_A is bigger than v_B enough, it isn't beneficial for firm B to enter the market. So firm A take all the market. On the contrary, when v_B is bigger than v_A, it isn't beneficial for firm A. So firm B takes all the market. Besides, $0 \le r < d$, which means the preference intensity of consumers is bigger than network effect. Consequently, if two firms have similar technique, firm A and firm B will exist in the market and have profit more than zero.

6.1 When foreign firm chooses direct investment

As the example of tariff, we can know that $\bar{x} = (v_A - v_B) - (p_A - p_B) + (d - r)/[2(d - r)]$ is the only long run equilibrium when market is segmented. Substitute $\bar{x}$ into profit function of firm A and firm B separately, given p_A and p_B. Then two firms' expected profit of direct investment are separately:

$$\pi_A^{Fe} = \frac{p_A(v_A - v_B - p_A + p_B + d - r)}{2(d - r)} - F \tag{13}$$

$$\pi_B^{Fe} = \frac{p_B(-v_A + v_B + p_A - p_B + d - r)}{2(d - r)} \tag{14}$$

Differentiate the above-mentioned maximization profit condition with respect to their own price and find simultaneous solution. We can get the equilibrium price are:

$$(p_A^{F*}, p_B^{F*}) = \begin{cases} ((v_A - v_B) - (d - r), 0), & \text{if } \frac{v_A - v_B}{d - r} \ge 3 \\ \left(\frac{1}{3}(v_A - v_B) + (d - r), -\frac{1}{3}(v_A - v_B) + (d - r)\right), & \text{if } 3 > \frac{v_A - v_B}{d - r} \ge 0 \end{cases} \tag{15}$$

Substitute (p_A^{F*}, p_B^{F*}) into $\bar{x}$ separately, and we can get firm A's market share under direct investment as follows:

$$x^{F*} = \begin{cases} 1, & \text{if } 3 \le \frac{v_A - v_B}{d - r} \\ \frac{1}{2} + \frac{v_A - v_B}{6(d - r)}, & \text{if } 3 > \frac{v_A - v_B}{d - r} \ge 0 \end{cases} \tag{16}$$

So when we solve the interior solution, two firms' expected profit are:

$$(\pi_A^{F*}, \pi_B^{F*}) = \left(\frac{[(v_A - v_B) + 3(d - r)]^2}{18(d - r)} - F, \frac{[-(v_A - v_B) + 3(d - r)]^2}{18(d - r)} \right) \tag{17}$$

At last, let $\pi_A^{F*} = 0$,and we can know the condition for firm A would withdraw from domestic market is: [6]

$$v_A - v_B < 3\left(r - d + \sqrt{2F(d - r)}\right) \tag{18}$$

[6] Let $[(v_A - v_B) + 3(d - r)]^2 / [18(d - r)] = 0$, we obtain $v_A - v_B = 3\left(r - d - \sqrt{2F(d - r)}\right)$ and $v_A - v_B = 3\left(r - d + \sqrt{2F(d - r)}\right)$. Because of $d > r$, so we take $v_A - v_B = 3\left(r - d + \sqrt{2F(d - r)}\right)$ as a condition.

According to the above circumstances, we can base on the difference of $v_A - v_B$, and discuss the three competitive situations for two firms when firm A chooses direct investment, and we assume $(v_A - v_B) - (d - r) > F$ and given $F < 2(d - r)$.[7]

1. When $v_A - v_B \geq 3(d - r)$, firm B's equilibrium price and market share are both 0. Firm A will take all the market. And the equilibrium price is $p_A^{F*} = (v_A - v_B) - (d - r)$.
2. When $v_A - v_B \in \left[3\left(r - d + \sqrt{2F(d - r)}\right), 3(d - r)\right)$, two firms would be in the market at the same time. Firm A's market share is $x^{F*} = (1/2) + [(v_A - v_B)]/[6(d - r)]$, and firm B's market share is $1 - x^{F*}$. We can get the equilibrium price are
$$\left(p_A^{F*}, p_B^{F*}\right) = \left(\frac{1}{3}(v_A - v_B) + (d - r), -\frac{1}{3}(v_A - v_B) + (d - r)\right)$$
3. When $v_A - v_B \in \left[0, 3\left(r - d + \sqrt{2F(d - r)}\right)\right)$, firm A would withdraw from domestic market, and firm B will take all the market.

The reasons that lead to different result are the same with the example of exporting, so we skip this part.

7. The Optimal Entry Mode of Market

Last section, we compare two different modes, exporting and direct investment. We obtain the restrictions for two entry modes. In this section, we will compare the two restrictions difference of profit and discuss how firms choose the best entry mode under network externality.

First, when $v_A - v_B$ is bigger than $3(d - r) + t$, firm A will take all the market in both entry mode. The profit of exporting mode is $(v_A - v_B) - (d - r) - t$, and direct investment is $(v_A - v_B) - (d - r) - F$. So if $t > F$, then firm A would choose direct investment as an entry mode. On the contrary, if $t < F$, then firm A would choose exporting. And $t = F$, there's no difference between two modes. While when $v_A - v_B \in \left[3(d - r), 3(d - r) + t\right]$, we have interior solution and no monopoly. Profit is $[-v_A + v_B + 3(r - d) + t]^2/[18(d - r)]$. But direct investment mode is still the same with monopoly. Hence we have a subtraction between two kinds of profit and let it be zero. We can know that when $F > (v_A - v_B) + (r - d) + [-v_A + v_B + 3(r - d) + t]^2/[18(r - d)]$, firm A will choose exporting. But when $F < (v_A - v_B) + (r - d) + [-v_A + v_B + 3(r - d) + t]^2/[18(r - d)]$, firm A will choose direct investment. And there is no difference between two mode when $F = (v_A - v_B) + (r - d) + [-v_A + v_B + 3(r - d) + t]^2/[18(r - d)]$.

Second, when $t < 3\sqrt{2F(d - r)}$,[8] $v_A - v_B \in \left[3\left(r - d + \sqrt{2F(d - r)}\right), 3(d - r)\right]$.

---

[7] Substitute $F + (d - r) = (v_A - v_B)$ into $\pi_A^{F*} > 0$. We can get $F < 2(d - r)$ or $F > 8(d - r)$. However, as $\pi_A^{F*} > 0$, $F > 8(d - r)$ doesn't conform with $3(d - r) > 3\left(r - d + \sqrt{2F(d - r)}\right)$. But $F < 2(d - r)$ does. So we choose $F < 2(d - r)$.

[8] When $t > 3\sqrt{2F(d - r)}$ or $t = 3\sqrt{2F(d - r)}$. They are similar, so we skip the similar part.

Firm A will has interior solution no matter which mode it chooses, and previously we got the profit of exporting mode and direct investment mode are $[-v_A + v_B + 3(r-d) + t]^2 / [18(d-r)]$ and $\left[(v_A - v_B) + 3(d-r)\right]^2 / [18(d-r)] - F$.

We have a subtraction between two kinds of profit and let it be zero. And know that when $F > t\left[2(v_A - v_B) + 6(d-r) - t\right]/[18(d-r)]$, firm A will choose exporting as the optimum. When $F < t\left[2(v_A - v_B) + 6(d-r) - t\right]/[18(d-r)]$, direct investment is the best strategy. And there's no difference between two modes for firm A if $F = t\left[2(v_A - v_B) + 6(d-r) - t\right]/[18(d-r)]$.

Last, when $v_A - v_B \in \left[3(r-d) + t, 3\left(r - d + \sqrt{2F(d-r)}\right)\right]$, firm will choose exporting as the optimal entry mode. And when $v_A - v_B$ is less than $3(r-d) + t$, firm A will withdraw from the market. To conclude all above-mentioned, we summarize firm A's decision modes into table 1 by different regions of $v_A - v_B$.[9]

Table 1. Firm A's technical advantage and decision making in different regions of $v_A - v_B$, under $t < 3\sqrt{2F(d-r)}$.

$v_A - v_B$	Comparison of the threshold	Firm s decision making	Market state
$v_A - v_B \geq 3(d-r) + t$ (high degree of advantage)	$t > F$	Direct investment	Firm A is a monopoly
	$t = F$	Either way	
	$t < F$	Exporting	
$\left[3(d-r), 3(d-r) + t\right]$ (Firms' technique have medium degree of advantage)	$F > X_1$	Exporting	Both two firms in the market
	$F = X_1$	Either way	Firm A is a monopoly or two firms in the market
	$F < X_1$	Direct investment	Firm A is a monopoly
$\left[3\left(r - d + \sqrt{2F(d-r)}\right), 3(d-r)\right]$ (low degree of advantage)	$F > X_2$	Export	Both two firms in the market
	$F = X_2$	Either way	
	$F < X_2$	Direct investment	
$\left[3(r-d) + t, 3\left(r - d + \sqrt{2F(d-r)}\right)\right]$ (low degree of advantage)		Exporting	Both two firms in the market
$v_A - v_B \leq 3(r-d) + t$ (extremely low degree of advantage)		Withdraw from the market	Firm B is a monopoly

1. $X_1 \equiv (v_A - v_B) + (r-d) + [-v_A + v_B + 3(r-d) + t]^2 / [18(r-d)]$

[9] We standardize the whole national market as one unit. So when the market is monopoly by foreign firm, t is equivalent to the total tariff that the domestic government can receive. The following table is the comparison between t and F; i.e. the comparison between tariff and establishing a factory by direct investment for a foreign firm.

2. $X_2 \equiv t\left[2\left(v_A - v_B\right) + 6\left(d - r\right) - t\right]/[18(d - r)]$

8. Conclusion

There are more and more interactions among international trades, and transnational firms have to know the best way to enter the foreign countries. It's been the most important issue for everyone. In the generation of thriving Internet, the appearance of network-externality products makes this issue more complicated. In this article, we take network externality into consideration, which differs from the point of view of Eicher and Kang (2003). Eicher and Kang thought that the size of market, fixed cost of direct investment, tariff, and transportation cost are the key factors to affect transnational firms' decision making. However, we don't put the market size into consideration. At the same time, we found out that technical skill level is the key point to influence transnational firms' decision of entry mode.

At the end, we didn't assume that direct investment to the domestic can increase employment due to simplification. Nevertheless, it's possible to increase employment for local people because foreign firms have direct investment to the domestic country. So there some incentives for government to adopt high tariff and induce the foreign firms to take the direct investment way due to increasing employment is beneficial. Besides, there are more entry modes for transnational firms to choose. For example, commons or integration, etc. But we focused on that how would transnational firms choose between exporting and direct investment under network effect. We believe that we will get more specific and interesting result if we add more entry modes into consideration.

References

Belderbos, R. and L. Sleuwaegen (1998), "Tariff Jumping FDI and Export Substitution: Japanese Electronic Firms in Europe," International Journal of Industrial Organization, 16, 601-638.

Campa, J., S. Donnenfeld and S. Weber (1998), "Market Structure and Foreign Direct Investment," Review of International Economics, 6(3), 361-380.

Dixit, A. (1984), "International Trade Policy for Oligopolistic Industries," Economic Journal, 94, 1-16.

Eicher, T. and J. W. Kang (2003), **"**Trade, Foreign Direct Investment or Acquisition: Optimal Entry Modes for Multinationals," Journal of Development Economics, 77, 207-228.

Ethier, W. J. (1986), "The Multinational Firm," Quarterly Journal of Economics, 80, 805-833.

Gandal, N. and O. Shy (2001), "Standardization Policy and International Trade," Journal of International Economics, 53, 363–383.

Horstmann, I. and J. R. Markusen (1992), "Endogenous Market Structures in International Trade," Journal of International Economics, 10, 361-368.

Katz, M. L. and C. Shapiro (1985), "Network Externalities, Competition, and Compatibility," American Economic Review, 75, 424-440.

Katz, M. L. and C. Shapiro (1986), "Technology Adoption in the Presence of Network Externalities," Journal of Political Economy, 94, 822-841.

Matutes, C. and P. Regibeau (1996), "A Selective Review of the Economics of Standardization, Entry Deterrence, Technological Progress and International Competition," European Journal of Political Economy, 12, 183–209.

Motta, M. (1992), "Multinational Firms and the Tariff-Jumping Argument," European Economic Review, 36, 1557-1571.

Motta, M., J. F. Thisse and A. Cabrales (1997), "On the Persistence of Leadership and Leapfrogging in International Trade," International Economic Review, 38, 809-824.

Qiu, L. D. and Z. Tao (1999), "Export, Foreign Direct Investment, and Local Content Requirement," Journal of Development Economics, 66, 101-125.

Rob, R. and N. Vettas (2003), "Foreign Direct Investment and Exports with Growing Demand," Review of Economic Studies, 69, 1-20.

Rohlfs, J. (1974), "A Theory of Interdependent Demand for a Communications Service," Bell Journal of Economics, 5, 16-37.

Rowthorn, R. E. (1992), "Intra-industry Trade and Investment under Oligopoly: The Role of Market Size," Economic Journal, 412, 402-414.

Smith, A. (1987), "Strategic Investment, Multinational Corporations and Trade Policy," European Economic Review, 31, 89-96.

Stähler, F. (2006), "Market Entry and Foreign Direct Investment," International Journal of Industrial Organization, 24, 335-347.

Wang, J. S., C. W. Huang and K. P. Chen (2005), "Price and Quality Competition for Open Source Software," Taiwan Economic Review, 33, 115-147. (in Chinese)