Market Size, Cannibalization and Policy Competition for a Multiproduct Multinational Firm

Qi Duan*, Jie Ma** and Yang Yue***

(Peking University)

July 21, 2011

Abstract
This paper studies policy competition for a foreign-owned multiproduct monopolist firm producing two products that are horizontally differentiated between two countries of different size. We show that the equilibrium outcome of FDI competition is determined by the interaction between the market size effect and the cannibalization effect, and countries’ subsidy policies. Welfare effects of competition for FDI are derived; in particular, we show that the competing countries may Pareto strictly gain from or Pareto strictly lose from FDI competition.

Key Words: Foreign direct investment (FDI); Policy competition; Market size; Cannibalization; Welfare

JEL Classification: F12; F23; H25; H73; L12

* Department of Applied Economics, Guanghua School of Management, Peking University, Beijing 100871, China.

** Corresponding author. Department of Applied Economics, Guanghua School of Management, Peking University, Beijing 100871, China; E-mail: jiema@gsm.pku.edu.cn; Phone: +86 (0) 10 62757876; Fax: +86 (0) 10 62751463.

*** Department of Applied Economics, Guanghua School of Management, Peking University, Beijing 100871, China.
1. Introduction

Foreign direct investment (FDI) has joined international trade as a primary driving force of globalization and it grows much faster than either trade or income in recent decades.1 As key players in globalized economies, multinational firms typically produce a vast range of consumer goods. For instance, Volkswagen Group, via its Volkswagen Group China division, has 14 subsidiaries in China, with Shanghai Automotive Industry Corporation (SAIC), and First Automobile Works (FAW) being the two major Chinese partner companies. Volkswagen Group China enjoys sales of about 1.9m cars in the Chinese market in 2010 and is the largest foreign carmaker. The products of SAIC include VW brands: Tiguan LWB, Touran, Passat New Lingyu, Lavida, Polo (hatchback and notchback), Cross Polo, Santana B2 and Santana Vista; and Škoda brands: Octavia, Fabia and Superb. The products of FAW consist of VW brands: Jetta A2, New Bora, Golf, Sagitar, Magotan and Volkswagen CC; and Audi brands: A6L, A4L and Q5.2 On the other hand, during the past twenty years, policy competition for attracting FDI has become commonplace.3 For instance, Changchun and Shanghai fiercely competed for the location of Toyota’s ninth joint venture plant in China in 2009. Shanghai won the plant and it will produce economy family cars, possibly Aygo and iQ, for China and Thailand from 2012.4

Regions or countries have an economic incentive to attract foreign investors since possible benefits of FDI include job creation, technological spillover and import substitution effects. In addition, when a region or country succeeds in attracting FDI in one sector, it can

1 See Barba Navaretti and Venables et al. (2004), Chapter 1.
2 See http://en.wikipedia.org/wiki/Volkswagen_Group_China. Both SAIC and FAW are stated-owned enterprises. The head office for SAIC is in Shanghai, while that for the FAW is in Changchun, the capital city of Jilin Province, China.
4 Although Changchun lost the plant, as a state-owned enterprise FAW exerted high pressure on Toyota. As a result, Toyota decided to expand the capacity of Fengyue plant, its joint venture plant with FAW in Changchun. Fengyue will be opened up in 2013 and its product lines will include Reiz, Prius, etc.
help encourage other manufacturing industries to follow and unleash a flow of new investments to that region or country. Thus, the beneficial effects of FDI will be reinforced. At the same time, there are also a number of reasons why multinational firms wish to launch new overseas plants. The investments may be driven by the market seeking motive. The access to cheap inputs and resources, such as labor, both unskilled and skilled, land, raw materials and parts and components for assembling into final goods is also relevant. When evaluating possible investment locations, multinational firms may also have a logistical concern. The outcome of FDI competition is determined by the interaction between these factors.

In this paper, we study policy competition for a foreign-owned multiproduct monopolist firm producing two products that are horizontally differentiated between two countries of different size. We ask the following questions. On the positive side, (i) under what condition will a country win part or all of production of the multinational firm? (ii) how is the equilibrium subsidy for attracting FDI determined? On the normative side, (i) is allocative efficiency achieved? (ii) what is the distribution effect of competition for FDI? (iii) compared to the case when countries do not provide any financial incentive to attract FDI, whether does FDI competition Pareto improve or Pareto deteriorate national welfare of the competing countries?

We show that whether a country will win part or all of production of the multinational firm is determined by the interaction between the market size effect, the cannibalization effect and import substitution effects. The first two effects determine the multinational firm’s investment premium of a particular location of production; while import substitution effects determine two countries willingness to pay to attract part or all of production of the multinational firm. We also characterize the condition under which the winning country will

---


6 Note that we may reinterpret the two horizontally differentiated goods as two product lines, which consist of one good respectively. In addition, “countries” can be easily reinterpreted as “regions”/“jurisdictions” in our paper.
subsidize/tax the multinational firm. On the welfare effects of FDI competition, we first show that allocative efficiency is achieved when countries engage in competition to attract the multinational firm. After analyzing its distribution effect, we show that the competing countries may Pareto strictly gain from or Pareto strictly lose from competition for FDI.

Our analysis has important implications for international investment policy. There is a policy debate about the possible effects of “bidding war for firms” on the competing countries. The advocates of FDI competition argue that tax competition is better than tax harmonization since the latter is a governmental tax and spending cartel, which is as objectionable as a private cartel. On the other hand, the opponents argue that competition for FDI results in a pure waste of resources of the competing countries. In addition, it may weaken public finances and distort the location of investment. Our analysis suggests that FDI competition may strictly Pareto improve national welfare of the competing countries when they compete for multiproduct multinational firms and at the same time the cannibalization effects are sufficiently great. If this is the case, there is no need for calling for tax harmonization. On the other hand, competition for FDI will strictly do harm to the competing countries when they do not differ that much in size and the cannibalization effects are sufficiently small. As a result, Multinational firms will receive a transfer from host countries. This calls for international cooperation to contain excesses of policy competition for FDI.

Related Literature

This paper is among the first papers studying policy competition for multiproduct multinational firms and relates to several strands of literature. There have been interesting contributions which consider two asymmetric countries competing for a profit-maximizing single product multinational firm from the rest of the world, and have trade costs and

---

7 Based on recent empirical evidence that has highlighted how the export patterns of multiproduct firms dominate world trade flows, and how they respond to different economic conditions across export markets by varying the number of products they export, Mayer et al. (2011) study the effects of export market conditions on the relative export sales of products: they refer to this as the firm’s product mix choice. Also see references they cite.
imperfect competition as the basic building blocks for the partial equilibrium analysis. Haufler and Wooton (1999) consider the case where two countries differ in size. In Barros and Cabral (2000), besides difference in size, a new asymmetry is introduced into the analysis, i.e., the small country suffers from problems of unemployment, while the large country does not. Bjorvatn and Eckel (2006) consider the situation where two countries not only differ in size, but also differ in market structure, i.e., there is a domestic firm located in the large country, which produces the same good as the foreign firm does, while this is not the case in the small country. Fumagalli (2003) examines the case where two countries of different levels of technology compete for the location of a foreign-owned firm. Raff (2004) extends the above two-country framework to consider how free-trade agreements and customs unions affect the location of FDI and social welfare, taking into account that governments may adjust taxes and external tariffs to compete for FDI. Haufler and Wooton (2006) also extend the two-country framework to analyze the effects of a regionally coordinated profit tax or location subsidy in a model with three active countries, one of which is not part of the union, and a globally mobile firm.

Behrens and Picard (2008), and Bucovetsky and Haufler (2008) study bidding war for firms in the context of the endogenous presence of horizontal multinational firms. Behrens and Picard (2008) develop a two-country model of subsidy competition in which utilitarian governments non-cooperatively bid for firms by taxing/subsidizing setup costs in order to maximize their residents’ consumption surplus and profit claims. Firms choose both the number and the location of the plants they operate, and the equilibrium market structure is affected by governments’ subsidy policies. Bucovetsky and Haufler (2008) present a model where firms endogenously choose a national or a multinational form, in response to the tax

8 She assumes that the market size is equal in both countries, and hence does not consider the market size effect in the paper.

9 In these papers, national firms refer to the firms producing goods only in the domestic countries, while multinational firms refer to the firms producing goods both in the domestic country and in the foreign country. They are single product firms irrespective of their organizational form.
advantage accord to a multinational status. Governments are able to commit to long-term tax
discrimination policies before firms’ decisions are made and before statutory capital tax rates
are chosen non-cooperatively.10

Our paper differs from the above contributions mainly in that we consider policy
competition for a multiproduct rather than a single product multinational firm; and study FDI
location choice, the equilibrium subsidy policy and welfare.11

This paper is also related to the literature of tax competition for mobile capital in
traditional public finance, such as Bucovetsky (1991), Wilson (1991), Kanbur and Keen
(1993), and Trandel (1994).12 In a perfectly competitive environment, it introduces
asymmetries between countries and studies the interaction of different tax instruments.
However, since profit-maximizing firm is different from mobile capital, thus, as Fumagalli
(2003) notes, this approach is more appropriate when dealing with competition for portfolio
investments rather than for FDI.

The remainder of the paper proceeds as follows. Section 2 sets out the model. Follows
equilibrium and welfare analysis. Next, we compare our results with those established in
previous contributions on policy competition for FDI. The final section concludes. Some
proofs are contained in the Appendix.

10 Amerighi and Peralta (2010) consider the situation where a firm serving two unequally-sized jurisdictions must
choose the location of its first production plant, and decide whether to open a second plant to serve the other
market through local sales rather than exports. As an exporter, it pays taxes only to the region where it locates its
production plant. A double-plant multi-regional firm pays taxes in both regions; however, it may shift taxable
profits across two regions at a cost. Note that the firm they consider is a single product firm.

11 Haaparanta (1996) uses a common agency approach to studying competition for FDI between two countries
with unequal wage rate. Both countries face problems of unemployment and will gain from FDI from increased
employment (reduced unemployment). He treats FDI as being perfectly divisible and considers the impact of
policy competition on how the foreign firm allocates its capital between the competing countries. This
differentiates his paper from our paper and other previous contributions cited.

2. Model

A region consists of two countries of different size. The number of households in Country B is $N^B$, while it is $N^S$ in country S, with $N^S < N^B$. Representativ households of the two countries share the same utility function:

$$u'(q_1', q_2', z') = q_1' + q_2' - \frac{1}{2} \left[ b \cdot (q_1')^2 + 2q_1'q_2' + b \cdot (q_2')^2 \right] + z'$$

where $q_1'$ and $q_2'$ are consumptions of two differentiated products, and $z'$ is the consumption of a numeraire good; $b > 1$ measures the degree of product differentiation, $i \in \{B, S\}$. In each country, each household provides one unit of labor and receives a wage. Assume that wage rates across two countries are equal and the common wage rate is denoted by $w$. Households wage income may be subject to a lump-sum tax. (If it is negative, it is a lump-sum subsidy.) Hence, representative households total expenditure cannot exceed its wage income minus/plus taxes/subsidies.

The inverse demands of country $i$’s representative household are given by

$$p_1^i = 1 - bq_1' - q_2', \quad p_2^i = 1 - bq_2' - q_1'$$

while the direct demands are given by

$$q_1' = \left( b - 1 - bp_1^i + p_2^i \right) / (b^2 - 1), \quad q_2' = \left( b - 1 - bp_2^i + p_1^i \right) / (b^2 - 1)$$

where $p_1^i$ and $p_2^i$ denote the prices of the two differentiated products in country i. Country B’s aggregate demands for products 1 and 2 are:

$$Q_1^B = N^B \cdot \left( b - 1 - bp_1^B + p_2^B \right) / (b^2 - 1), \quad Q_2^B = N^B \cdot \left( b - 1 - bp_2^B + p_1^B \right) / (b^2 - 1)$$

while those of country S are:

$$Q_1^S = N^S \cdot \left( b - 1 - bp_1^S + p_2^S \right) / (b^2 - 1), \quad Q_2^S = N^S \cdot \left( b - 1 - bp_2^S + p_1^S \right) / (b^2 - 1)$$

A multinational firm from the rest of the world intends to make an investment in the region in order to service the regional demand. This may be due to that transportation costs

---

Note that we may normalize the market size of the small country to be 1, and hence interpret the market size of the big country as the relative market size of the two countries. See later discussion.
associated with exporting the differentiated goods to the region are prohibitively high, so that in order to supply the regional market the multinational firm needs to go for FDI.\textsuperscript{14} Denote the multinational firm’s FDI location choice by a vector: $\omega = (i, j)$, $i, j \in \{B, S\}$, where the first component means that the multinational firm locates the production of $q_1$ in country $i$; while the second component means that it locates the production of $q_2$ in country $j$. (As noted in the Introduction, two differentiated goods can be reinterpreted as two product lines. We use product line and good/product interchangeably in the following analysis.) Therefore, the multinational firm has four possible location choices:

$$\omega \in \Omega \equiv \{(B, B), (B, S), (S, B), (S, S)\}$$

In order to produce any one of the differentiated products, the multinational firm first needs to establish a production line. After paying the fixed set-up cost, it uses one unit of labor to produce one unit of the differentiated product. We also assume that the fixed cost of setting up any product line is $F > 0$ irrespective of its location.\textsuperscript{15} Two markets are segmented and as a result when the multinational locating the production of good $k$ in one country and selling it in another country, it needs to pay a transportation cost per unit, $\tau > 0$. Hence, the generalized marginal cost for the multinational firm to sell good $k$ in country $i$ is given by $c_i^k(\omega)$, and

$$c_i^1(i, j) = w, \quad c_i^1(i, j) = w + \tau; \quad c_i^2(i, j) = w, \quad c_i^2(i, j) = w + \tau.$$
Here, \(-i/j = S\), if \(i/j = B\); \(-i/j = B\), if \(i/j = S\). We suppose \(w + \tau < 1\). This guarantees that the multinational firm is able to service both countries’ demand irrespective of its location choice.

The two countries and the multinational firm play a two-stage game of complete information. In the first stage, two countries simultaneously announce lump-sum subsidies \(s^i(\omega), \omega \in \Omega\), to the multinational firm (conditional on it locating part or all of production in their territories).\(^{16}\) Since the budget of a government must be balanced, the subsidy paid to the multinational firm is financed by a poll tax.\(^{17}\) In the second stage, the multinational firm makes its location choice and then services the regional demand.

The multinational firm receives its profits plus/minus subsidies/taxes. The two countries receive national welfare, \(W^i = N^i \cdot u^i\), minus/plus subsidies/taxes.

Before going further, note that both countries may benefit from FDI and have an economic incentive to attract FDI simply because of import substitution effects in our model. This is true when \(b \geq 2\). In order to simplify analysis, we consider the case where \(b = 2\).\(^{18}\) In addition, since the two differentiated products enter into the representative households’ utility function in a symmetric way, and the technologies for producing the two differentiated products are the same, FDI location choices \(\omega = (B, S)\) and \(\omega = (S, B)\) are equivalent. Hence, we consider three possible location choices: \(\omega = (S, S)\), \(\omega = (B, S)\) and \(\omega = (B, B)\) in the following analysis. Next, we solve the model from backward.

---

\(^{16}\) It is a lump-sum tax if \(s^i(\omega)\) is strictly negative.

\(^{17}\) When a country collects taxes from the multinational firm, it redistributes the revenues among its households as a poll subsidy.

\(^{18}\) We can show that the results obtained in the paper carry over to the case where \(b > 2\).
3. Equilibrium Analysis

We first consider the benchmark case where two countries do not engage in FDI competition, i.e., \( s^i(\omega) = 0, \quad \forall i \in \{B, S\}, \quad \forall \omega \in \Omega \). We simply determine what the profit-maximizing FDI location choice is. When the multinational firm chooses a location to supply the regional demand, it receives:

\[
\pi(\omega) = \sum_{i \in \{B, S\}, k \in [1, 2]} \left[ p_k^i(\omega) - c_k^i(\omega) \right] \cdot N^i \cdot q_k^i(\omega) - 2F
\]

where \( p_k^i(\omega) \) and \( q_k^i(\omega) \) denote good \( k \)'s price and sales in country \( i \). The equilibrium price, sales and profits will be:

\[
p_k^i(\omega) = \frac{1 + c_k^i(\omega)}{2}
\]

\[
q_k^i(\omega) = \frac{2[1 - c_k^i(\omega) - [1 - c_k^i(\omega)]]}{6}
\]

\[
\pi^*(\omega) = \sum_{i \in \{B, S\}, k \in [1, 2]} N^i \cdot \frac{[1 - c_k^i(\omega)]^2}{2} - \frac{2[1 - c_k^i(\omega)]^2}{6} - 2F
\]

In particular,

\[
\pi^*(B, S) = \pi^*(S, B) = \left(N^B + N^S\right) \cdot \left[\frac{1-w}{2} \cdot \frac{2(1-w) - (1-w-r)}{6} + \frac{1-w-r}{2} \cdot \frac{2(1-w-r) - (1-w)}{6}\right] - 2F
\]

\[
\pi^*(B, B) = 2N^B \cdot \frac{(1-w)^2}{12} + 2N^S \cdot \frac{(1-w-r)^2}{12} - 2F
\]

\[
\pi^*(S, S) = 2N^B \cdot \frac{(1-w-r)^2}{12} + 2N^S \cdot \frac{(1-w)^2}{12} - 2F
\]

Since it is straightforward to show \( \pi^*(B, B) > \pi^*(S, S) \), i.e., the multinational firm will not locate production of both goods in the small country, we need to compare the profits receiving when it choosing \( \omega = (B, B) \) with those receiving when it choosing \( \omega = (B, S) \).

In other words, the multinational firm’s decision problem is that given one good, say good 1, is produced in the big country, whether should the other good, say good 2, be produced in the big country or in the small country? Define

\[
\Delta \pi = \pi^*(B, B) - \pi^*(S, B) = N^B \cdot \frac{1-w-r}{6} \tau - N^S \cdot \frac{1-w}{6} \tau
\]
$\Delta \pi$ is the multinational firm’s investment premium when it locating the production of both goods in the big country. Obviously, it will choose $\omega = (B, B)$ to service the regional demand if and only if the investment premium is nonnegative.$^{19}$

**Proposition 1** $\Delta \pi \geq 0$ if and only if

$$\frac{N^B}{N^S} \geq \frac{1-w}{1-w-\tau}$$

**Proof.** Condition (7) implies the Proposition immediately. ■

The forces that drive the investment premium are market size effect and cannibalization effect. On the one hand, other things being equal, the multinational firm prefers producing both goods in the big country to producing them in the small country since shipping goods from one country to another country incurs transportation costs. Call this the market size effect. On the other hand, when both goods are produced in the big country, they cannibalize each other sales both in the big country and in the small country. All else being equal, the multinational firm should allocate the production of the two goods in different countries in order to alleviate the cannibalization effect.$^{20}$ The multinational firm’s equilibrium location choice is determined by these two effects together. Consider the market size effect and the cannibalization effect of the multinational firm shifting the production of good 2 from the small country to the big country.

Before doing this, the multinational firm’s profits receiving from good 1 are:

$$\pi_1 (B, S) = N^B \cdot \frac{1-w}{2} \cdot \frac{2(1-w)-(1-w-\tau)}{6} + N^S \cdot \frac{1-w-\tau}{2} \cdot \frac{2(1-w-\tau)-(1-w)}{6}$$

When the production of good 2 has been shifted to the big country, the multinational firm’s profits receiving from good 1 are:

$^{19}$ We prescribe that when the investment premium is zero, the multinational firm chooses to locate the production of both goods in the big country.

$^{20}$ See Baldwin and Ottaviano (2001).
\[ \pi_1(B, B) = N^B \cdot \frac{(1-w)^2}{12} + N^S \cdot \frac{(1-w-z)^2}{12} \]

Obviously, the above profit change is due to cannibalization effect only, call it \( CE_1 \)

\[ CE_1 = -N^B \cdot \frac{1-w}{12} \tau + N^S \cdot \frac{1-w-z}{12} \tau < 0 \]

When the production of good 2 is shifted to the big country, the multinational firm’s profits receiving from good 2 are driven by both the market size effect and the cannibalization effect. Before moving the production of good 2 to the big country, the profits it receives from good 2 are:

\[ \pi_2(B, S) = N^B \cdot \frac{1-w-z}{2} \frac{2(1-w-z)-(1-w)}{6} + N^S \cdot \frac{1-w}{2} \frac{2(1-w)-(1-w-z)}{6} \]

After shifting production, it receives from good 2:

\[ \pi_2(B, B) = N^B \cdot \frac{(1-w)^2}{12} + N^S \cdot \frac{(1-w-z)^2}{12} \]

We divide the profit change into the market size effect and the cannibalization effect. In order to get the market size effect, we first control the cannibalization effect. Note that the magnitude of the cannibalization effect is affected by the generalized marginal costs of supplying products 1 and 2. Assume that after moving the production of good 2 to the big country, the low-cost good 2 faces a high-cost good 1 in the big country; while the high-cost good 2 faces a low-cost good 1 in the small country. Now, the profits the multinational firm receives from good 2 are:

\[ \tilde{\pi}_2(B, B) = N^B \cdot \frac{1-w}{2} \frac{2(1-w)-(1-w-z)}{6} + N^S \cdot \frac{1-w-z}{2} \frac{2(1-w-z)-(1-w)}{6} \]

With the help of this experiment, we get the market size effect:

\[ ME_2 = \tilde{\pi}_2(B, B) - \pi_2(B, S) = \left( N^B - N^S \right) \frac{(1-w)^2-(1-w-z)^2}{6} > 0 \]

21 Before shifting production, the low-cost good 2 faces the high-cost good 1 in the small country, while the high-cost good 2 faces the low-cost good 1 in the big country. What we have done in the text keeps the generalized marginal costs of the two products in each market still being different and in this sense, we have controlled the cannibalization effect.

22 We may control the market size effect and get the cannibalization effect at the first place.
and the cannibalization effect is given by:

$$ CE_2 = \pi_2(B, B) - \tilde{\pi}_2(B, B) = -N^B \cdot \frac{1-w}{12} \tau + N^S \cdot \frac{1-w-\tau}{12} \tau < 0 $$

In summary, the market size effect of the multinational firm shifting the production of good 2 from the small country to the big country, calling it $ ME$ , is given by

$$ ME = ME_2 = \left( N^B - N^S \right) \left( \frac{(1-w)^2 - (1-w-\tau)^2}{6} \right) > 0, $$

while the cannibalization effect is given by

$$ CE_1 + CE_2 = -N^B \cdot \frac{1-w}{6} \tau + N^S \cdot \frac{1-w-\tau}{6} \tau < 0 $$

For convenience, we use the absolute value of $ CE_1 + CE_2 $ to denote the cannibalization effect, calling it $ CE $. It turns out when the condition (8) holds, the market size effect dominates the cannibalization effect, and the multinational firm locates the production of both goods in the big country. Otherwise, it locates the production of different goods in different countries.

Next, we turn to discuss the welfare implications of the multinational’s FDI location choice and want to know whether its choice achieves allocative efficiency. Allocative efficiency requires that the multinational firm’s FDI location choice should maximize its profits and two competing countries’ national welfare. From previous discussion, two countries’ national welfare corresponding to each of the multinational firm’s location choices is easily calculated:

$$ W^B (B, B) = N^B \cdot \frac{(1-w)^2}{12} + N^B \cdot w $$  \hspace{1cm} (9.1)

$$ W^B (B, S) = N^B \cdot \frac{2(1-w)^2 + 2(1-w-\tau)^2 - 2(1-w)(1-w-\tau)}{24} + N^B \cdot w $$  \hspace{1cm} (9.2)

$$ W^S (S, S) = N^S \cdot \frac{(1-w-\tau)^2}{12} + N^S \cdot w $$  \hspace{1cm} (9.3)

$$ W^S (B, S) = N^S \cdot \frac{2(1-w)^2 + 2(1-w-\tau)^2 - 2(1-w)(1-w-\tau)}{24} + N^S \cdot w $$  \hspace{1cm} (10.1)

$$ W^S (B, B) = N^S \cdot \frac{(1-w)^2}{12} + N^S \cdot w $$  \hspace{1cm} (10.2)
\[ W^S (B, B) = N^S \cdot \frac{(1-w-\tau)^2}{12} + N^S \cdot w \]  

It is easy to show:

\[ W^B (B, B) > W^B (B, S) > W^B (S, S) \]

and

\[ W^S (S, S) > W^S (B, S) > W^S (B, B) \]

We define

\[ \Delta^B \equiv W^B (B, B) - W^B (B, S) = N^S \cdot \frac{(1-w)+(1-w-\tau)-\tau}{12} \tau \]  

\[ \Delta^S \equiv W^S (B, S) - W^S (B, B) = N^S \cdot \frac{(1-w)+(1-w)+\tau}{12} \tau \]  

\( \Delta^B \) measures the net benefits of the big country by hosting the production of both goods rather than one good, while \( \Delta^S \) measures the net benefits of the small country by hosting the production of one good rather than importing both goods from the big country.  

**Proposition 2** When countries do not engage in competition for FDI, allocative efficiency is achieved.

**Proof.** When \( \frac{N^B}{N^S} \geq \frac{1-w}{1-w-\tau} \), the multinational firm chooses to produce both products in the big country. First of all, it is easy to see

\[
\left[ W^B (B, B) + W^S (B, B) + \pi^* (B, B) \right] - \left[ W^B (B, S) + W^S (B, S) + \pi^* (B, S) \right] = \Delta^B - \Delta^S + \Delta\pi \geq 0
\]

In addition, it is also straightforward to show

\[
\left[ W^B (B, B) + W^S (B, B) + \pi^* (B, B) \right] - \left[ W^B (S, S) + W^S (S, S) + \pi^* (S, S) \right] > 0
\]

Hence, allocative efficiency is achieved when the multinational firm chooses to locate the production of both goods in the big country. When \( \frac{N^B}{N^S} < \frac{1-w}{1-w-\tau} \), the multinational firm

---

23 This implies that both countries have an economic incentive to compete for FDI due to the import substitution effects.
chooses to produce one product in one country. Using similar arguments, we can establish that allocative efficiency is achieved.

![Figure 1](image)

**Figure 1**

We use Figure 1 to briefly summarize discussion of the above subsection. The horizontal axis measures the unit transportation cost, while the vertical axis measures the relative market size. The upward sloping curve represents the case where \( \frac{N^B}{N^G} = \frac{1-w}{1-w-\tau} \), and it divides the plane into two regions. When parameter configurations fall into region I, the multinational firm chooses to produce both products in the big country, while when parameter configurations fall into region II, it locates the production of different goods in different countries. In any case, allocative efficiency is achieved.

**Policy competition for FDI**

Let us turn to discuss policy competition for FDI. In the last stage of the game, after observing two countries’ lump-sum subsidy policies, the multinational firm simply makes its location choice to maximize its profits plus subsidies.\(^{24}\) In the first stage, two countries play a

\(^{24}\) Its equilibrium price-quantity decision is not affected by two countries’ lump-sum subsidy policies, and it is the same as that in the benchmark case.
Nash subsidy game. Instead of deriving two countries’ best responses, then characterizing Nash equilibria, we use a simple and intuitive way to approach the solution.\textsuperscript{25} As the first step, note that the small country is not able to attract the multinational to locate the production of both goods in its territory in an equilibrium outcome.

**Lemma 3** When two countries engage in FDI competition, FDI location choice, $\omega = (S, S)$, cannot emerge in an equilibrium outcome.

**Proof.** See Appendix. $\blacksquare$

The small country’s net gains when the multinational firm changing its location choice from $\omega = (B, B)$ to $\omega = (S, S)$ are strictly dominated by those of the big country when the multinational firm changing its location choice from $\omega = (S, S)$ to $\omega = (B, B)$. Compared to the location, $\omega = (B, B)$, the multinational firm’s investment premium when choosing location, $\omega = (S, S)$, is strictly negative. Hence, the small country cannot win two product lines in an equilibrium outcome.

According to Lemma 3, the analysis is much simplified. Since the possible FDI location that will emerge in an equilibrium outcome is $\omega = (B, B)$ or $\omega = (B, S)$, it seems that two countries compete for one product line only. Note that the small country’s subsidy payment conditional on the multinational firm choosing $\omega = (B, S)$ should not exceed its net gains,

$$s^S(B, S) \leq \Delta^S$$

The similar argument applies to the big country and

$$s^B(B, B) - s^B(B, S) \leq \Delta^B$$

The RHS of the above expression represents the big country’s valuation for the additional product line, while LHS represents the extra payment should be made in order to attract it.

\textsuperscript{25} The full characterization of Nash equilibria of the first stage of the game is available upon request.
Based on the above arguments, we have the following result on the equilibrium location of FDI.

**Proposition 4** The big country will attract both product lines if and only if

\[(ME - CE) + (\Delta^b - \Delta^S) \geq 0\]  

(12)

Otherwise, two countries attract one product line respectively.

Moreover, it is straightforward to show \((ME - CE) + (\Delta^b - \Delta^S) \geq 0\) if and only if condition (8) holds.\(^{26}\) Next, we turn to discuss two countries’ equilibrium payments to the multinational firm.

**Proposition 5** (1) In the case where the big country attracts both product lines, its equilibrium payment to the multinational firm is:

\[s^{B*}(B, B) = (3N^S - 2N^B) \left(\frac{1 - w + (1 - w - r)}{12}\right) \tau\]  

(13)

(2) In the case where two countries attract one product line respectively, the big country’s equilibrium payment is:

\[s^{B*}(B, S) = (3N^S - 2N^B) \left(\frac{(1 - w) + (1 - w - r)}{24}\right) \tau - \left(2N^B + 3N^S\right) \frac{r}{24} \tau\]  

(14.1)

while that of the small country is:

\[s^{S*}(B, S) = (3N^B - 2N^S) \left(\frac{(1 - w) + (1 - w - r)}{24}\right) \tau - \left(3N^B + 2N^S\right) \frac{r}{24} \tau\]  

(14.2)

**Proof.** See Appendix. ■

\(^{26}\) This is because we consider a monopoly model with linear demand functions and the monopolist firm’s generalized marginal production costs are constants, so that the monopolist firm’s profits receiving from the sale of one product in one country and the country’s consumption surplus deriving from the product are proportionate. Considering other forms of demand may make us have more case to analyze; however, the basic driving forces that we address are still there and our results cannot be changed qualitatively.
In the first case, the big country will choose a payment as low as possible such that the small country is not able to attract one product line or two product lines to its territory. In the second case, note that two countries’ subsidy polices must prevent both the small country and the big country from attracting both product lines to their territories. Based on this argument, we can pin down two countries’ equilibrium payments.27

When the big country wins two product lines, note that when \( \frac{N^B}{N^S} < \frac{3}{2} \), its equilibrium payment is negative and it collects a lump-sum tax from the multinational firm. When \( \frac{N^B}{N^S} > \frac{3}{2} \), its equilibrium payment is positive and it pays a lump-sum subsidy to the multinational firm. It is easy to establish that other things being equal its equilibrium payment to the multinational firm increases with the small country’s size, while decreases with its own size. When it collects taxes from the multinational firm, the tax revenues increase with the per unit transportation cost; while in case where it pays a subsidy to the multinational firm, the subsidy increases with the per unit transportation cost.

When two countries attract one product line respectively, first consider the equilibrium payment of the big country. Note that it is positive when \( \frac{N^B}{N^S} < \frac{1}{2} \frac{1-w-r}{1-w} \); while it is negative when \( \frac{N^B}{N^S} > \frac{1}{2} \frac{1-w-r}{1-w} \). It is easy to show that again other things being equal the big country’s equilibrium payment to the multinational firm increases with the small country’s size, while decreases with its own size. Again, when it collects taxes from the multinational firm, the tax revenues increase with the per unit transportation cost; while in case where it pays a subsidy to the multinational firm, the subsidy increases with the per unit transportation cost.

Next, consider the equilibrium payment of the small country. When \( \frac{N^S}{N^B} < \frac{2}{3} \frac{1-w}{1-w-r} \), it is negative; while when \( \frac{N^S}{N^B} > \frac{2}{3} \frac{1-w}{1-w-r} \), it is positive. It is straightforward to show that other things being equal the small country’s equilibrium payment to the multinational firm increases with the big country’s size, while decreases with its own size. When it collects taxes

\[ \text{Note that the equilibrium subsidy payments are affected by the absolute measure rather than the relative measure of the two countries’ size. Also see Footnote 16.} \]
from the multinational firm, the tax revenues increase with the per unit transportation cost; while in case where it pays a subsidy to the multinational firm, the subsidy increases with the per unit transportation cost.

4. Welfare Analysis

In this section, we consider the welfare implications of FDI competition and want to ask the following questions. First, is allocative efficiency achieved? Second, what are the distribution effects of FDI competition for the competing countries as a whole? Third, compared to the benchmark case, does FDI competition Pareto improve/deteriorate national welfare of the competing countries as a whole? The first question is answered in Proposition 6.

**Proposition 6** When countries engage in FDI competition, allocative efficiency is achieved.

**Proof.** Note that the equilibrium payments made by countries to the multinational firm are lump-sum transfer payments. Hence, similar arguments to those used in the proof of Proposition 2 establish the result stated in the proposition. ■

That FDI competition will achieve allocative efficiency is a well known result obtained in the contributions considering policy competition for a single product firm.\(^{28}\) We show that this result carries over to the case when countries compete for multiproduct multinational firms. Next, we turn to the distribution effect of FDI competition.

**Proposition 7** Consider the case when \( \frac{\nu^B}{\nu^S} \geq \frac{1-w}{1-w^f}, \) i.e., the multinational firm produces both products in the big country. Compared to the benchmark case, (1) the small country’s national welfare is unchanged; (2) while the big country benefits from FDI competition if and only if \( N^B/N^S > 3/2 \); when \( N^B/N^S < 3/2 \), it loses from it.

\(^{28}\) For instance, see Bjorvatn and Eckel (2006).
**Proof.** Part (1) is established by the fact that regardless of whether countries engage in FDI competition, the multinational firm chooses to produce both goods in the big country when \( \frac{N^B}{N^S} \geq \frac{1-w}{1-w-\tau} \). Part (2). In the case considered, the big country wins two product lines and when \( N^B/N^S > 3/2 \), it collects a lump-sum tax from the multinational firm, hence, its national welfare is strictly higher than that in the benchmark case. When \( N^B/N^S < 3/2 \), it pays a lump-sum subsidy to the multinational firm, hence, its national welfare is strictly lower than that in the benchmark case. ■

**Proposition 8** Consider the case where \( \frac{N^S}{N^B} < \frac{1-w}{1-w-\tau} \), i.e., the multinational firm chooses to produce different goods in different countries. Compared to the benchmark case, (1) national welfare of the small country will be improved by FDI competition if and only if \( \frac{N^S}{N^B} < \frac{1}{3} \frac{1-w}{1-w-\tau} \); when \( \frac{N^S}{N^B} > \frac{1}{3} \frac{1-w}{1-w-\tau} \), it loses from it. (2) national welfare of the big country will be improved by FDI competition if and only if \( \frac{N^B}{N^S} > \frac{3}{2} \frac{1-w-\tau}{1-w} \); when \( \frac{N^B}{N^S} < \frac{3}{2} \frac{1-w-\tau}{1-w} \), its national welfare will be deteriorated.

**Proof.** First of all note that regardless of whether countries engage in FDI competition, the multinational firm chooses to produce one good in one country. Hence, compared to the benchmark case, a country’s national welfare is improved when it collects a lump-sum tax from the multinational firm; while its national welfare is deteriorated when it pays a lump-sum tax to the multinational firm. For the small country, its equilibrium payment is negative/positive when \( \frac{N^S}{N^B} < / > \frac{1}{3} \frac{1-w}{1-w-\tau} \); while that of the big country is negative/positive when \( \frac{N^B}{N^S} > / < \frac{1}{3} \frac{1-w-\tau}{1-w} \). ■

An interesting result implied by Proposition 7 and Proposition 8 is regarding when competing countries as a whole strictly gain or lose from FDI competition.
Corollary 9 When $\frac{N^B}{N^S} < \frac{1-w}{1-w-\tau}$, i.e., the multinational firm chooses to produce different goods in different countries, FDI competition Pareto strictly improve national welfare of the two competing countries, if and only if $\frac{1}{3} \frac{1-w-\tau}{1-w} < \frac{N^B}{N^S} < \frac{1}{2} \frac{1-w-\tau}{1-w}$; it will Pareto strictly deteriorate national welfare of them if and only if $\frac{2}{3} \frac{1-w-\tau}{1-w} < \frac{N^B}{N^S} < \frac{1}{2} \frac{1-w-\tau}{1-w}$.

Figure 2

We briefly summarize our discussion on policy competition for FDI with the help of Figure 2. The horizontal axis measures the unit transportation cost; while the vertical axis measures the relative market size. Curve F1 represents the case where $\frac{N^B}{N^S} = \frac{1-w}{1-w-\tau}$. When parameter configurations are on the left side of it, falling into region I, the big country wins both product lines. The horizontal line segment F2 represents the case where $\frac{N^B}{N^S} = \frac{1}{3}$ and it
splits region I into two parts. Region I.1 represents the case where the big country taxes the multinational firm, hence FDI competition weakly Pareto improves national welfare of the competing countries. When parameter configurations fall into region I.2, the big country pays a subsidy to the multinational firm and competition for FDI weakly Pareto deteriorates national welfare of the competing countries. Region II represents the case where two countries attract one product line respectively. Here, the downward sloping line segment F3 represents the case when $\frac{N^a}{N^p} = \frac{3}{2} \frac{1-w-z}{1-w}$; while curve F4 represents the case where $\frac{N^a}{N^p} = \frac{2}{3} \frac{1-w-z}{1-w}$. They together split Region II into three parts. When parameter configurations fall into region II.1, since two countries pay a subsidy to the multinational firm respectively, FDI competition strictly Pareto deteriorates national welfare of the competing countries. In region II.2, the big country taxes while the small country subsidizes the multinational firm. Hence, compared to the benchmark case, the big country’s national welfare is improved; while that of the small country is deteriorated. Region II.3 represents the case where both the small country and the big country are able to tax FDI, hence competition for FDI strictly Pareto improve national welfare of the competing countries.

5. Discussion

As we have seen in the previous analysis, introducing multiproduct multinational firms into the analysis of FDI competition affects the FDI location choice, investment policy and welfare in interesting ways. Our paper both contributes and complements the literature of policy competition for FDI in a number of respects.

When countries do not provide any financial inventive to attract FDI, which country is the attractive location for FDI? Our paper shows that when allocating its production among the competing countries, the multiproduct multinational firm faces a trade-off between the market size effect and the cannibalization effect. If the former dominates the latter, the multinational firm chooses to produce both goods in the relatively large country. If this is not the case, it allocates the production of different goods in different countries. Consider papers
studying policy competition for single product multinational firms. In Bjorvatn and Eckel (2006), the attractive location for FDI is determined by the interaction between the market size effect and the competition effect. When the former dominates the latter, the foreign firm will invest in the large country, and vice versa. While absent policy competition for FDI, both Haufler and Wooton (1999) and Barros and Cabral (2000) show that the foreign firm will establish a plant in the large country due to market size effect. In Fumagalli (2003), the foreign firm will definitely invest in the technically advanced country.

In case when countries engage in FDI competition, we show that the relatively large country has a chance to attract at least one product line, while the relatively small country may attract at most one product line. When considering tax competition for a single product firm, Barros and Cabral (2000), Bjorvatn and Eckel (2006) and Fumagalli (2003) show that both countries has a chance to win the firm; while in Haufler and Wooton (1999), the small country will never win FDI competition since the two competing countries only differ in market size.\footnote{Some papers show that FDI competition increases the attractiveness of the small country (Barros and Cabral (2000) and Bjorvatn and Eckel (2006)), or the less technologically advanced country (Fumagalli (2003)) as location for the investment since its valuation of FDI is higher than that of the other country. As a result, policy competition may change the FDI location choice in these papers.}

Let us turn to discuss welfare issues. Barros and Cabral (2000), Fumagalli (2003) and Bjorvatn and Eckel (2006) show that allocative efficiency is achieved when countries compete for FDI, i.e., from an aggregate perspective, policy competition leads to an efficient outcome. Though Haufler and Wooton (1999) do not explore the welfare implications of FDI competition, their analysis imply this result as well. We show that this result carries over to the case where countries compete for a multiproduct multinational firm.

Moreover, an interesting result that we obtain is that policy competition for FDI may Pareto \textit{strictly} improve or Pareto \textit{strictly} deteriorate national welfare of the competing countries. When considering policy competition for a single product firm, Bjorvatn and Eckel (2006) obtain the result that tax competition for FDI may Pareto \textit{weakly} improve the welfare
of the competing countries.\textsuperscript{30} That happens in the case where one of the competing countries does not benefit from the entry of the multinational firm; hence, its valuation of FDI is strictly\textit{negative}. This increases the bargaining power of the other country and may lead to taxation of FDI rather than subsidies. Our result is derived in the situation where both countries have an economic incentive to attract FDI. Behrens and Picard (2008) show that compared to a world in which multinational firms are disregarded, the presence of multinational firms relaxes the problem of tax competition, hence alleviating the race to the bottom. However, similar result cannot be obtained when countries compete for multiproduct multinational firms since compared to the case where countries compete for a single product firm, they may strictly lose from FDI competition.\textsuperscript{31}

6. Concluding Remarks

We have studied policy competition for a foreign-owned multiproduct monopolist firm between two countries of different size. We show that the equilibrium outcome of FDI competition is determined by the interaction between the market size effect and the cannibalization effect, and countries’ subsidy policies. Welfare effects of competition for FDI are derived; in particular, we show that the competing countries may Pareto strictly gain from or Pareto strictly lose from competition for FDI.

Our model naturally has some limitations. We capture the idea that countries benefit from FDI due to import substitution effects. In addition, the situation that we focus on is relevant for market seeking FDI. We do not consider other possible beneficial effects of FDI, such as job creation and technological spillovers; and do not take inputs or resources seeking FDI into account. However, to the best of our knowledge, our paper is among the first

\textsuperscript{30} Though Haufler and Wooton (1999) do not consider welfare implications of FDI competition, their analysis implies a similar result to that of Bjørvatn and Eckel (2006), while the driving force is different.

\textsuperscript{31} Note that Behrens and Picard (2008) do not consider the case where two countries differ in size. Bucovetsky and Haufler (2008) use a traditional public finance model to study capital tax competition when firms can endogenously choose their organizational form, which is different from our approach.
contributions introducing multiproduct multinational firms into policy competition for FDI models. We want to further explore other implications of this interesting idea in our future research.

Appendix

Proof of Lemma 3

We prove Lemma 3 by contradiction. Suppose that the multinational firm chooses to produce both goods in the small country in an equilibrium outcome, and the small country’s subsidy payment to the multinational is $s^S(S,S)$. According to Expressions (9.3) and (10.1), the small country’s gross national welfare is:

$$W^S(S,S) = N^S \cdot \frac{(1-w)^2}{12} + N^S \cdot w;$$

the big country’s gross national welfare is:

$$W^B(S,S) = N^B \cdot \frac{(1-w)^2}{12} + N^B \cdot w.$$

According to Expression (6.3), the multinational firm’s profits are:

$$\pi^*(S,S) = 2N^B \cdot \frac{(1-w)^2}{12} + 2N^S \cdot \frac{(1-w)^2}{12} - 2F.$$

From the previous discussion, we know that if the multinational firm produces both goods in the big country, the small country achieves gross national welfare:

$$W^S(B,B) = N^S \cdot \frac{(1-w)^2}{12} + N^S \cdot w;$$

while that of the big country is:

$$W^B(B,B) = N^B \cdot \frac{(1-w)^2}{12} + N^B \cdot w.$$

According to Expression (6.2), the multinational firm’s profits are:

$$\pi^*(B,B) = 2N^B \cdot \frac{(1-w)^2}{12} + 2N^S \cdot \frac{(1-w)^2}{12} - 2F.$$
Hence, the subsidy offered by the small country to the multinational firm conditional on it producing both goods in its territory will not be bigger than its net gains from the change of FDI location, i.e., from $\omega = (B,B)$ to $\omega = (S,S)$,

$$s^{S*}(S,S) \leq W^S(S,S) - W^S(B,B) = N^S \cdot \frac{(1-w)^2-(1-w-r)^2}{12}.$$  

However, note that the big country is able to choose a subsidy payment, which satisfies

$$s^{B*}(B,B) \leq W^B(B,B) - W^B(S,S) = N^B \cdot \frac{(1-w)^2-(1-w-r)^2}{12}$$

such that

$$\pi^*(B,B) + s^{B*}(B,B) \geq \pi^*(S,S) + N^S \cdot \frac{(1-w)^2-(1-w-r)^2}{12}$$  \hspace{1cm} (A1)

and attracts both product lines. In an equilibrium outcome, the equality holds in the above inequality, and the big country’s minimal payment can be solved

$$s^{B*}(B,B) = \left(3N^S - 2N^B\right) \frac{(1-w)^2-(1-w-r)^2}{12} = \left(3N^S - 2N^B\right) \frac{(1-w)+(1-w-r)}{12} r.$$  

Hence, that the small country attracts both product lines cannot emerge in an equilibrium outcome. ■

Proof of Proposition 5

Part (1). From the proof of Lemma 3, we know that

$$s^{B*}(B,B) = \left(3N^S - 2N^B\right) \frac{(1-w)^2-(1-w-r)^2}{12} = \left(3N^S - 2N^B\right) \frac{(1-w)+(1-w-r)}{12} r$$

is the minimal subsidy offered by the big country, which can successfully prevent the small country from attracting both product lines to its territory. Here, we also need to check whether the small country is able to increase $s^S(B,S)$, with $s^S(B,S) \leq \Delta^S$, such that to attract one product line. The big country may choose $s^{B*}(B,S)$ to prevent the small country from doing this, which satisfies

$$(ME - CE) + \left(s^{B*}(B,B) - s^{B*}(B,S)\right) \geq \Delta^S$$
with \( s^{B*}(B,B) - s^{S*}(B,S) \leq \Delta^B \). This \( s^{B*}(B,S) \) exists since in the case we consider, the following inequality

\[
(ME - CE) + \Delta^B \geq \Delta^S
\]

always holds.

Part (2). First of all, two countries' subsidy policies must satisfy

\[
\pi^*(S,S) + s^{S*}(S,S) \leq \pi^*(B,S) + s^{S*}(B,S) + s^{B*}(B,S)
\]

i.e.

\[
s^{S*}(S,S) - s^{S*}(B,S) - s^{S*}(B,S) \leq \pi^*(B,S) - \pi^*(S,S) = \left( N^S - N^S \right) \left( \frac{1-\omega}{2} \right) \tau + \left( N^S + N^S \right) \frac{\tau}{2} \tau \quad (A2)
\]

in order to prevent the small country from attracting both product lines. Here, the big country's subsidy payment should not exceed its net gains from the change of FDI location, i.e., from \( \omega = (B,S) \) to \( \omega = (S,S) \),

\[
s^{B*}(B,S) \leq W^B(B,S) - W^B(S,S) = N^B \cdot \left( \frac{(1-\omega)(1-\omega+\tau)}{24} \right) \tau.
\]

Similarly, the small country's subsidy payments must satisfy

\[
s^{S*}(S,S) - s^{S*}(B,S) \leq W^S(S,S) - W^S(B,S) = N^S \cdot \left( \frac{(1-\omega)(1-\omega+\tau)}{24} \right) \tau, \quad (A3)
\]

its net subsidy payment should not exceed its net gains. Conditions (A2) and (A3) together imply

\[
s^{S*}(B,S) \geq \left( 3N^S - 2N^S \right) \frac{(1-\omega)(1-\omega+\tau)}{24} \tau - N^S \frac{\tau}{2} \tau = \left( 3N^S - 2N^S \right) \frac{(1-\omega)(1-\omega+\tau)}{24} \tau - \left( 2N^S + 3N^S \right) \frac{\tau}{2} \tau
\]

In an equilibrium outcome, the equality holds in the above inequality, giving the minimal \( s^{B*}(B,S) \) that preventing the small country from attracting both product lines.

Next, two countries' subsidy policies must satisfy

\[
(ME - CE) + s^{B*}(B,B) \leq s^{B*}(B,S) + s^{S*}(B,S) \quad (A4)
\]

in order to prevent the big country from attracting both product lines. Similar to the above arguments, here
\[ s^S(B,S) \leq W^S(B,S) - W^S(B,B) = \Delta^S \]

and

\[ s^B(B,B) - s^B(B,S) \leq \Delta^B \quad (A5) \]

Conditions (A4) and (A5) together imply

\[ s^S(B,S) \geq \left( 3N^B - 2N^S \right) \frac{(1-w)+(1-w-r)}{24} \tau \left( 3N^B + 2N^S \right) \frac{\tau}{24} \tau . \]

In an equilibrium outcome, the equality holds in the above inequality, giving the minimal \( s^S(B,S) \) that preventing the big country from attracting both product lines. This \( s^S(B,S) \) exists since in the case we consider, the following inequality

\[ (ME - CE) + \Delta^B < \Delta^S \]

always holds. ■

Reference


