Restrictions on foreign investments and the relocation of firms*

Quan Dong, [a] Juan Carlos Bárcena-Ruiz [b,*], María Begoña Garzón [b]

[a] *South China Normal University, School of Economics and Management, Higher Education Mega Center, Guangzhou 510006, P. R. China.*
[b] *Departamento de Fundamentos del Análisis Económico I, Universidad del País Vasco UPV/EHU. Avenida Lehendakari Aguirre 83; 48015 Bilbao, Spain.*

ABSTRACT

The literature on the relocation of firms is unable to explain why the Chinese government restricts foreign investment in particular industries but permits it in others. This paper analyzes this issue, focusing on the decision of the government on the percentage of shares in relocated firms that can be foreign-owned. We show that by choosing this percentage the Chinese government may restrict the number of firms that relocates to China or encourage firms to relocate there. The government's decision on this percentage depends on the entry cost, the number of firms that relocate and the weight of the consumer surplus in the objective function of the government. We also find that for some parameter values the government subsidizes the relocation of firms which increases the weighted welfare of all the countries involved.

JEL classification: *L33, Q28, F15.*
Keywords: Relocation; Foreign Investment; Institutional restrictions; Duopoly.

* Financial support from Ministerio de Ciencia y Tecnología and FEDER (ECO2009-07939, ECO2012-32299) and Departamento de Educación, Universidades e Investigación del Gobierno Vasco (IT-223-07) is gratefully acknowledged.

* Corresponding author at: Departamento de Fundamentos del Análisis Económico I, Facultad de Ciencias Económicas y Empresariales, Universidad del País Vasco. Avenida Lehendakari Aguirre, 83; 48015 Bilbao, Spain. Phone: 34 + 94 601 38 29. Fax: 34 + 94 601 38 91.
E-mail addresses: dongquan@scnu.edu.cn (Quan Dong), juancarlos.barcena@ehu.es (Juan Carlos Bárcena-Ruiz), mariabegona.garzon@ehu.es (María Begoña Garzón).

1. Introduction

In this paper we analyze the factors that explain why the Chinese government restricts foreign investment in some industries. Foreign investment in China is subject to the Foreign Investment Industrial Guidance Catalogue which classifies it under four categories:[1] encouraged, restricted, prohibited and permitted. The "encouraged" category covers industrial sectors in which foreign investment is eligible for benefits such as greater flexibility of foreign ownership and lower levels of taxes and governmental review. The "restricted" category covers industries in which foreign investment is subject to ceilings on the share of ownership that can be foreign-owned; thus, foreign investment is more likely to be limited to joint ventures instead of wholly foreign-owned firms. Industrial sectors listed under the "prohibited" category are barred from foreign investment. In those industrial sectors not expressly listed under the "prohibited" category foreign investment is permitted.

The three structures most often used for investing in China (see The Economist Intelligence Unit, 2011) are wholly-foreign-owned firms (WFOs), equity joint ventures (EJV), and co-operative joint ventures (CJV). The rise in popularity of WFOs is largely due to the relaxing of foreign-investment restrictions after China's 2001 accession to the World Trade Organization, which resulted in the dismantling of some barriers to foreign investment in the retail, trading, wholesale, and other sectors. EJVs are typically used for long-term projects: this structure is preferred when firms want to enter industries in which the government restricts foreign investment. Finally, CJVs are mainly adopted by investors for shorter-term projects or build-operate-transfer investments. Typically, the foreign investor provides funding and technology and the Chinese partner provides land, labor, natural resources, and power and water facilities.[2]

---

[1] The first catalogue was published in 1995 and a new one took effect on 30 January 2012. See http://www.wilmerhale.com/publications/whPubsDetail.aspx?publication=10011.

[2] Apart from the aforementioned structures, foreign investors may also enter the Chinese market by acquiring an existing firm. These acquisitions are limited by government regulations.

The issue analyzed in this paper is the relocation of firms to China. Since it affects market structure in advanced countries, this is a current issue given the liberalization now ongoing in world trade. The literature studying the location decisions of firms has mainly analyzed the different factors that influence such decisions, e.g. reducing wage costs, entering foreign markets, establishing cooperation agreements between firms, R&D investments and public-ownership of firms (see Mucchielli and Saucier, 1997; Feenstra, 1999; Petit and Sanna-Randaccio, 2000; Norbäck, 2001; Blomstöm and Kokko, 2003; Fumagalli, 2003; Bárcena-Ruiz and Garzón, 2003, 2009).

One important factor that affects the location of firms in China that has not been considered by the said literature is the stake in the relocated firms that the Chinese government allows to be foreign-owned. Therefore, although the papers cited above analyze firms' relocation decisions they are not able to explain why the Chinese government restricts foreign investment in some industries but permits it in others. In order to fill this gap in the relevant literature we study firms' relocation decisions when the Chinese government chooses what share of relocated firms can be foreign-owned.[3]

In order to analyze the restrictions imposed by the Chinese government on foreign investment in particular industries, we assume that the government decides what percentage of the stake of the entrant firm may be foreign-owned. Thus, if the firm is wholly foreign-owned it is categorized as a WFO, while if part of its stake is owned by domestic investors it is categorized as an EJV or CJV. Apart from the stake in relocated firms that the Chinese government allows to be foreign-owned, there are other relevant factors that affect firms' decisions on whether to set up factories in China. One of them is that wages are low in relation to Western countries, which enables foreign firms to

[3] A related issue is the privatization by the government of public firms that may be partially sold to foreign investors. In this regard, Chen et al. (2009) analyze the optimal ratio for foreign participation in domestic state-owned banks. Similarly, Wang and Chen (2011) analyze the impact of foreign penetration when the government chooses the degree of privatization of the public firm. Sun et al. (2006) analyze a similar issue but consider that the government cares about employment. Finally, Matsumura et al. (2009) discuss the relationship between the welfare effects of privatization and the degree of foreign direct investment in the private sector.

reduce production costs.[4] Another is the cost of setting up a firm in China. The final factor is the different weights that the Chinese government attaches to consumers and producers in its objective function.[5]

We show in the paper that decisions by foreign firms on whether to relocate or not depend on the reduction in wage costs, the fixed entry cost and the percentage of shares that they will own in the new firm. When a firm relocates it reduces production costs and gains market share, which increases its revenues (positive effect). However, relocating the firm means paying a fixed entry cost and giving up a percentage of the shares in the firm (negative effect). Therefore, if the percentage of the shares owned by foreign investors is great enough the two firms relocate since the positive effect dominates the negative one in both cases. If that percentage is low enough neither firm relocates since the negative effect dominates in both cases. Finally, for intermediate values of the percentage only one firm relocates since the positive effect outweighs the negative one in only one of the firms.

We also show that the higher the entry cost is the lower the profit obtained by a relocated firm will be and, as a consequence, foreign investors must receive a greater percentage of the shares in the new firm for them to find it profitable to relocate. This means that the government could subsidize the fixed entry cost to reduce the percentage of shares in firms owned by foreign investors.

In order to determine what percentage of shares in new firms the Chinese government allows to be foreign-owned it has to be noted that its weighted welfare

---

4 For example, the European textile sector is closing factories in Europe to relocate to countries with lower wages due to the full liberalization of the textile trade that took place in 2005 [El País, 29/9/2004].

5 Empirical evidence shows that the weight attached to consumer surplus in the objective function of the government influences restrictions on foreign investment. For example, in the 2011 version of the Foreign Investment Industrial Guidance Catalogue the weight of services (especially those that the Chinese government emphasizes as for the people's well being) in the "encouraged" category is increased. Furthermore, foreign-invested medical institutions and financial leasing companies are shifted from the "restricted" to the "permitted" category. This might indicate that entry is more likely to be encouraged in industries where the consumer surplus has a greater weight than the producer surplus.

decreases with this percentage. This means that the Chinese government chooses the lowest percentage such that at least one firm relocates.[6] When the entry cost is high enough foreign investors find it unprofitable to relocate both firms. Thus, by setting the right percentage the government can ensure that one firm relocates. For the remaining values of the entry cost the government has to decide whether the two firms relocate or just one does so. If the entry cost takes an intermediate value and the weight of the consumer surplus in weighted welfare is low enough, the government wants just one firm to relocate and this can be assured by choosing the same percentage as in the above case. It must be noted that in this case although the government may get both firms to relocate it prefers just one firm to do so. This means that governments may be interested in restricting the entry of foreign firms even when such firms want to relocate. However, for the remaining values of parameters the government wants both firms to relocate. In this case the government has to choose a higher percentage than in the previous cases.

When both the entry cost and the weight attached to consumer surplus in weighted welfare are great enough, the Chinese government wants both firms to relocate but only gets one firm to do so. In this case, the government gives full ownership of the firms to foreign investors to get them both to relocate. However, although the relocated firms are wholly foreign-owned it is too expensive for them both to relocate. We show that in this case the government finds it profitable to provide a subsidy such that the two firms relocate. This could be done, for example, by subsidizing the cost of setting up firms or by providing tax holidays. We also find that the Chinese subsidy increases the weighted welfare of the rest of the world if the latter attaches sufficient weight to the consumer surplus in its weighted welfare. This result helps to explain partially why China is allowing wholly foreign-owned firms in some sectors.

[6] In the paper when neither firm relocates both consumer and producer surpluses in the relevant industry are zero in China. As a result, the Chinese government finds it profitable for at least one firm to relocate since weighted welfare thus increases.

The rest of the paper is organized as follows. Section 2 presents the model. Section 3 presents the main results. Section 4 analyzes whether the government wants to subsidize firms to get them to relocate and, finally, conclusions are drawn in Section 5.

2. The model

We consider two firms, denoted by 1 and 2, that produce a homogeneous good. Initially these firms are located in country *A* and sell their products to the consumers of that country. These firms have access to a new market located in another country, denoted by *B*. However, under institutional restrictions set by the government of country *B*, to sell in country *B* firms need to make their products in that country. Thus, firms can set up new plants in country *B*, closing plants in country *A* and supplying markets *A* and *B* from there.[7] In that case, firms relocate from country *A* to country *B*. We assume that the two markets are separate and there are no other trade costs between countries.

Inverse demand functions in countries *A* and *B*, respectively, are given by:

$$p_i = a - q_{i1} - q_{i2},\ i=A,\ B, \tag{1}$$

where q_{i1} (q_{i2}) denotes the output sold in country i by firm 1 (2); and p_i is the price of the product in country i.[8]

Labor is the only factor used in the production process in both countries. To simplify the analysis we assume that the workers in both countries have the same productivity. If firm i is located in country A it hires L_{Ai} workers with a uniform wage rate w_{Ai}. All

[7] We consider that when a firm relocates it closes the plant in country *A* and sets up a new one in country *B*. Thus, we exclude the possibility of the firm maintaining its plant in country *A* since the new plant, due to institutional restrictions, has to export part of its production. In fact, around 70% of China's exports are made by foreign multinationals operating in China, whose exporting behavior is different from that of China's domestic firms (Lu et al., 2010).

[8] It can be shown that the main results of the paper hold if the markets are of different sizes.

workers in country A are unionized and there is an independent union at each firm. To determine wages we consider a variant of the "right-to-manage" model of Nickell and Andrews (1983), where wages are bargained between unions and firms, and employment is then set unilaterally by the firm. Unions and firms are both risk neutral, and firm i aims to maximize its profit while the union at firm i maximizes its wage bill: $U_{Ai}(w_{Ai}, L_{Ai}) = w_{Ai} L_{Ai}$, i=1, 2. The solution concept considered is the two-person Nash bargain solution (see Binmore *et al.*, 1986).[9]

We assume that country B has lower wage costs than country A since its workers are not unionized. In order to simplify the analysis, and with no loss of generality, we assume that the wage paid in country B is normalized to zero. If firm i relocates to country B it hires L_{Bi} workers. Independently of the country in which the firm is located, both firms have the same technology and exhibit constant returns to scale. Specifically, we assume that $L_{Ai} = q_{Ai}$ if firm i is located in country A and $L_{Bi} = q_{Ai} + q_{Bi}$ if firm i is located in country B, i=1, 2.

When a firm relocates from country A to country B, we assume that there is a fixed entry cost $F = fa^2$, where $f < f_I = 2/9$.[10] In that case, the legislation of country B forces the relocated firm to set up a joint venture with domestic investors (investors from country B). Government B decides on the percentage of the shares in the new firm that may be owned by foreign investors (investors from country A). Accordingly, we assume that α and $(1-\alpha)$ are the percentages of the shares in each new plant owned by foreign and domestic investors, respectively. This institutional restriction (the percentage α) is the same for all firms that relocate.

If firm i does not set up a plant in country B it only sells its products in country A and its profit, which corresponds only to investors from country A, is given by:

---

9 It can be shown that the main results of the paper hold if firms and unions have different bargaining powers.

10 We assume, without loss of generality, that the fixed cost is $F=fa^2$; this assumption permits us to simplify the exposition of the results. Assumption $f<f_I$ assures that the firms obtain no losses in any case.

$$\pi_i = (a - q_{Ai} - q_{Aj} - w_{Ai})\, q_{Ai},\ i \neq j;\ i, j = 1, 2. \tag{2}$$

If firm i relocates to country B it sells its product in both markets and thus its profit is given by:

$$\pi_i = (a - q_{Ai} - q_{Aj})\, q_{Ai} + (a - q_{Bi} - q_{Bj})\, q_{Bi} - fa^2,\ i \neq j;\ i, j = 1, 2, \tag{3}$$

where $q_{Bj}=0$ if firm j is not located in country B. α percent of the above profits corresponds to investors from country A and $(1-\alpha)$ percent corresponds to investors from country B.

We consider that both governments care about weighted welfare, where β_i is the weight that the government of country i attaches to the domestic consumer surplus, CS_i, and $(1 - \beta_i)$ is the weight that this government attaches to the domestic producer surplus, PS_i, and to the rents obtained by domestic workers, U_i. Specifically, we assume the following weighted welfare function:

$$W_i = \beta_i\, CS_i + (1 - \beta_i)(PS_i + U_i),\ i=A, B;\ 0<\beta_i<1 \tag{4}$$

where $CS_i = (q_{i1} + q_{i2})^2/2$, $i=A, B$; $U_A = U_{A1} + U_{A2}$, and $U_B = 0$.[11] The producer surplus in each country comprises the percentage of firms' profits that goes to investors from that country. Thus, if neither firm relocates: $PS_A=\pi_1+\pi_2$ and $PS_B=0$, where π_i (i=1, 2) is given by (2); if both firms relocate: $PS_A = \alpha(\pi_1+\pi_2)$ and $PS_B = (1-\alpha)(\pi_1+\pi_2)$, where π_i (i=1, 2) is given by (3); and finally if only firm i relocates $PS_A = \alpha\pi_i+\pi_j$ and $PS_B = (1-\alpha)\pi_i$, where π_i is given by (3) with $q_{Bj}=0$ and π_j is given by (2).

11 This is usual in the relevant literature. Union rents are included as that part of the producer surplus which is absorbed by the unions. See, for example, Brander and Spencer (1988), Mezzetti and Dinopoulos (1991), Bughin and Vanini (1995) and Naylor (1998).

The objective of this paper is to study the factors that explain the institutional restrictions set by country *B* on foreign firms that want to set up production plants in that country. To that end we propose a four stage game with the following timing. In the first stage, government *B* decides the percentage of the shares in the new firms that may be owned by foreign investors, α. In the second stage firms decide simultaneously whether or not relocate to country *B*. In the third stage, unions simultaneously and independently negotiate over wages with the firms located in country *A*; there are no wage negotiations in country *B*. Finally, in the fourth stage, given wages, firms simultaneously choose their output and employment levels. We solve the game by backward induction from the last stage of the game to obtain a subgame perfect Nash Equilibrium.

3. Results

Given that there are two firms that can relocate or not, there are four subgames to be analyzed. By symmetry, they are reduced to three: neither firm relocates (denoted by *NN*), only one firm relocates (*RN* and *NR* denote the firm that relocates and the one that does not, respectively), and both firms relocate (denoted by *RR*). Next, we solve the fourth and third stages of the game when neither firm relocates.

3.1. Neither firm relocates

In this case both firms are located in country *A* and sell their products there. In the fourth stage, firm *i* chooses the value of q_{Ai} that maximizes its profit given by (2), i=1, 2. From the first order conditions of these maximization problems output and employment levels are obtained as a function of wage rates:

$$q_{Ai}(w_{Ai},\ w_{Aj}) = L_{Ai}(w_{Ai},\ w_{Aj}) = \frac{a-2w_{Ai}+w_{Aj}}{3},\ i \neq j;\ i, j = 1, 2. \qquad (5)$$

In the third stage, given (5), the union at firm *i* negotiates the wage, w_{Ai}, with the owners of the firm. The disagreement payoff level of firms and unions is zero, since

each firm bargains with a separate and independent union. Accordingly, the solution to the bargaining problem between firm *i* and its union is:

$$w_{Ai}(w_{Aj}) = \underset{w_{Ai}}{arg\ max}\ [\pi_i(w_{Ai}, w_{Aj})]\ [w_{Ai}\, L_{Ai}(w_{Ai}, w_{Aj})],\ i \neq j;\ i, j = 1, 2. \tag{6}$$

Solving the first order conditions for (6) gives the following result.

Lemma 1. *When neither firm relocates, in equilibrium the profit obtained by each firm and the weighted welfare obtained by country B are:*

$\pi^{NN} = \frac{4a^2}{49}$, $W_B^{NN} = 0$.[12]

3.2. Only one firm relocates

We now assume that only firm *i* relocates to country *B*; thus, $q_{Bj} = 0$. Therefore, firm *i* produces its output in country *B* but sells it in both countries while firm *j* produces and sells its product only in country *A*. In the third stage of the game the firms simultaneously choose the output levels that maximize their profits. The profit of firm *i* is given by (3) for $q_{Bj} = 0$ and the profit of firm *j* is given by (2). From the first order conditions of these maximization problems it is obtained that the output and employment levels as a function of wage rates are given by:

$$q_{Aj}(w_{Aj}) = L_{Aj}(w_{Aj}) = \frac{a-2w_{Aj}}{3},\ q_{Ai}(w_{Aj}) = \frac{a+w_{Aj}}{3},\ q_{Bi} = \frac{a}{2},$$
$$L_{Bi}(w_{Aj}) = \frac{a+w_{Aj}}{3} + \frac{a}{2},\ q_{Bj} = 0,\ i \neq j;\ i, j = 1, 2.$$

In the third stage, the union at firm *j* bargains the wage, w_{Aj}, with the owners of the firm. As assumed above, disagreement payoffs are normalized to zero. The solution to the bargaining problem between firm *j* and its union is:

$$w_{Aj} = \underset{w_{Aj}}{\arg\max}\ [\pi_j(w_{Aj})]\ [w_{Aj}L_{Aj}(w_{Aj})], j = 1, 2. \tag{7}$$

[12] The remaining expressions are relegated to Appendix 1.

Solving the first order condition for (7) the following result is obtained.

Lemma 2. *When only one firm relocates, in equilibrium the profit obtained by each firm and the weighted welfare obtained by country B are:*

$$\pi^{NR} = \frac{a^2}{16},\ \pi^{RN} = \frac{a^2(25-64f)}{64},\ W_B^{NR} = \frac{a^2\left((25-64f)(1-\alpha)\left(1-\beta_B\right)+8\beta_B\right)}{64}.$$ [13]

Given that the firm that relocates has lower costs than the firm that does not, it produces more, hires more workers and thus, if the entry cost is not considered (f=0), the firm that relocates obtains greater profits than its rival.

Next we analyze the case in which both firms relocate.

3.3 Both firms relocate

In this case both firms relocate to country *B*. In the fourth stage of the game firm *i* chooses the value of q_{Ai} and q_{Bi} that maximizes its profit given by (3), i=1, 2. There is no wage negotiation. From the first order conditions of these maximization problems the following result is obtained.

Lemma 3. *When both firms relocate, in equilibrium the profit obtained by each firm and the weighted welfare obtained by country B are:*

$$\pi^{RR} = \frac{a^2(2-9f)}{9},\ W_B^{RR} = \frac{2a^2\left((2-9f)(1-\alpha)(1-\beta_B)+\beta_B\right)}{9}.$$ [14]

Once the fourth and third stages of the game have been analyzed in all subgames, the second and first stages of the game must then be solved.

3.4. Relocation decisions

[13] The remaining expressions are relegated to Appendix 2.

[14] The remaining expressions are relegated to Appendix 3.

Next we solve the second stage of the game, i.e. we study whether firms want to relocate to a country where wage costs are lower. From Lemmas 1 to 3, the following result is obtained. We denote by α_I the value of α such that $\alpha\pi^{RR} = \pi^{NR}$ and by α_{II} the value of α such that $\alpha\pi^{RN} = \pi^{NN}$,[15] where $\alpha_I = \frac{9}{16(2-9f)}$, $\alpha_{II} = \frac{256}{49(25-64f)}$, and $\alpha_{II}<\alpha_I$. Moreover, $\alpha_I > 1$ if and only if $f > f_{II} = 23/144$, $f_{II} < f_I$, and $\alpha_{II} < 1$.

Proposition 1. *Both firms relocate if $\alpha \geq \alpha_I$. Neither firm relocates if $\alpha < \alpha_{II}$. Finally, there are two equilibria if $\alpha_I > \alpha \geq \alpha_{II}$: in each of them only one firm relocates.*

Proof. See Appendix 4.

The result shown in Proposition 1 is illustrated in Figure 1. This result does not depend on parameter β_i since the decision of each firm is not affected by that parameter.

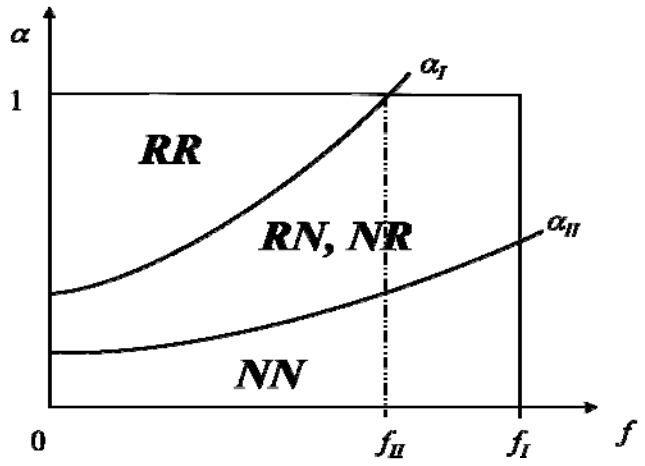

Figure 1. Illustration of Proposition 1.

When a firm relocates it reduces production costs and gains market share which increases it incomes (positive effect of relocating the firm). However, relocating the firm

15 Note that investors from country *A* own only α percent of the shares in the firm when it is located in country *B*, while they have full ownership of the firm when it is located in country *A*.

implies paying a fixed entry cost and giving up 1-α percent of the ownership of the new firm, which is owned by investors from country *B* (negative effect of relocating the firm). Therefore, if parameter α is great enough both firms relocate since the positive effect dominates the negative one in both firms. If parameter α is low enough neither firm relocates since the negative effect dominates in both firms. Finally, for intermediate values of parameter α only one firm relocates. In this case, the positive effect outweighs the negative one only in one of the firms. Therefore, if one firm relocates, the other firm finds it unprofitable to follow suit.

It should be noted that if the entry cost is great enough ($f > f_{II}$), investors from country *A* do not find it profitable to relocate both firms. In this case the cost of entry is so great that it outweighs the positive effect of relocating the firm, even if they retained full ownership of the relocated firm (α_I=1). Greater profit is thus obtained by keeping at least one firm in country *A*.

Moreover, it is easy to see that α_i increases with the fixed entry cost ($\frac{\partial \alpha_i}{\partial f} > 0$, *i*=*I*, *II*). This is because the greater the fixed entry cost is, the less the profit is obtained by a relocated firm; as a consequence, foreign investors must receive a greater percentage of the shares of the new firm to find it profitable to relocate the firm. It can also be shown that $\alpha_I - \alpha_{II}$ increases with *f* since α_I increases faster than α_{II} with this parameter. This is because when both firms relocate market competition is greater and thus the profit of the firms is lower than if just one firm relocates.

3.5. Restrictions on foreign investments

Next we solve the first stage of the game. In this stage government *B* decides the percentage of the shares in the relocated firms that may be foreign-owned. Given that relocation of firms increase weighted welfare in country *B*, government *B* chooses the value of α such that at least one firm relocates. Denote by $f_{III} = \frac{295+2449\beta_B}{28224(1-\beta_B)}$ the value of *f* such that $W_B^{RR}(\alpha = \alpha_I)$=$W_B^{NR}(\alpha = \alpha_{II})$; i.e. f_{III} is the value of parameter *f* such that

weighted welfare in country B, when both firms relocate and government B sets $\alpha = \alpha_I$, is the same as when just one firm relocates and government B sets $\alpha = \alpha_{II}$. Moreover, $f_{III} = f_{II}$ for $\beta_B = 4213/6975 \approx 0.6055$.

Proposition 2. *When $f \leq \min\{f_{II}, f_{III}\}$, government B sets $\alpha=\alpha_I$ and both firms relocate. When $f > \min\{f_{II}, f_{III}\}$, government B sets $\alpha=\alpha_{II}$ and just one firm relocates.*

Proof. See Appendix 5.

The result shown in Proposition 2 is illustrated in Figure 2. Both W_B^{RR} and W_B^{NR} decrease with α (see Appendix 5) since the greater the percentage of the shares that is foreign-owned, the lower the producer surplus of country B (note that the consumer surplus does not depend on α). Thus, government B chooses the lowest value of α that ensures relocation. That is, it chooses $\alpha=\alpha_I$ or $\alpha=\alpha_{II}$ if it wants both firms to relocate or just one, respectively. It remains to be analyzed whether government B wants both firms to relocate or just one.

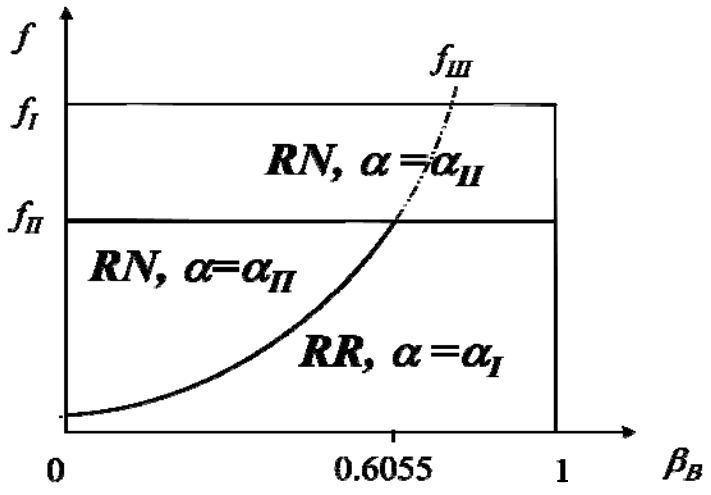

Figure 2. Illustration of Proposition 2.

As shown in Proposition 1, when $f>f_{II}$ foreign investors find it unprofitable to relocate both firms. This result does not depend on parameter β_B since firms care only

about profits. Thus, by setting $\alpha=\alpha_{II}$ government B can ensure that just one firm relocates.

When $f \leq f_{II}$ government B has to decide whether it is profitable, from a weighted welfare point of view, for both firms to relocate or just one. To analyze this case we first compare the consumer and producer surpluses obtained in both cases. Competition in the product market is greater when the two firms relocate, implying a greater consumer surplus in country B in this case. However, the comparison of producer surpluses depends on both α and f.[16] When $f < 0.0104$ the producer surplus in country B is greater when both firms relocate than when just one firm does since the difference between α_I and α_{II} is low. When $0.0104 \leq f \leq f_{II}$ the difference between α_I and α_{II} increases and thus the producer surplus is lower when both firms relocate.

When $f \leq f_{II}$ there are two cases. The first one is when $f \leq min\{f_{II}, f_{III}\}$. In this case, if $f < 0.0104$ both the consumer surplus and the producer surplus are greater when both firms relocate, whereas if $0.0104 \leq f \leq min\{f_{II}, f_{III}\}$ the greater consumer surplus outweighs the lower producer surplus when both firms relocate. As a result, in both cases government B chooses $\alpha=\alpha_I$ and both firms relocate. The second case is when $f_{II} \geq f > f_{III}$. In this case, f is great enough and government B wants just one firm to relocate which is assured by choosing $\alpha=\alpha_{II}$. As the difference between α_I and α_{II} is high and the weight of the consumer surplus in weighted welfare is low enough ($\beta_B < 0.6055$), the greater producer surplus outweighs the lower consumer surplus when just one firm relocates.

It should be noted that when $f_{II} \geq f > f_{III}$ although government B can get both firms to relocate by choosing $\alpha=\alpha_I$, it prefers only one firm to do so. Therefore, in this case government B restricts the relocation of one of the firms.

[16] Note that PS_B^{RR} is evaluated for $\alpha=\alpha_I$ and PS_B^{NR} for $\alpha=\alpha_{II}$.

Proposition 2 shows that for given parameter values just one firm relocates. We next analyze whether government *B* finds it profitable for some of those parameter values to provide subsidies to get both firms to relocate.

4. Subsidies to get firms to relocate

Proposition 2 shows that when $f_{II} \geq f > f_{III}$, government *B* wants just one firm to relocate; therefore, in that case, it never provides subsidies to get both firms to relocate. We next analyze whether government *B* provides subsidies when $f > f_{II}$. In this case, government *B* needs to choose $\alpha_I = 1$ to get both firms to relocate.[17] However, even if relocated firms are wholly foreign-owned it is too expensive for them both to relocate. We analyze whether in that case it is profitable for government *B* to subsidize the firms to get them to relocate.

The maximum subsidy that government *B* is able to pay to get both firms to relocate is: $W_B^{RR}(\alpha = 1) - W_B^{NR}(\alpha = \alpha_{II})$. The two firms share the subsidy equally. Denote by $f_S = \frac{5(59+2293\beta_B)}{28224(1+\beta_B)}$ the value of f such that $\pi^{NR} - \pi^{RR} = (W_B^{RR}(\alpha = 1) - W_B^{NR}(\alpha = \alpha_{II}))/2$. Thus, f_S is the maximum subsidy such that each firm is indifferent between relocating or not, given that its rival relocates.[18]

Proposition 3. *When $f_S \geq f > f_{II}$, government B sets α =*1 *and provides a subsidy such that both firms relocate. This subsidy increases the weighted welfare of country B, and increases the weighted welfare of country A when β_A >*0.6518. *For $f > max\{f_{II}, f_S\}$ government B does not provide subsidies.*

Proof. See Appendix 6.

[17] In this case $\alpha_I > 1$ since $f > f_{II}$.

[18] Note that as $\alpha\pi^{RN} > \pi^{NN}$ when $\alpha = 1$ each firm always finds it profitable to relocate given that its rival does not relocate.

The result shown in Proposition 3 is illustrated in Figure 3. This proposition shows that when $f_S \geq f > f_{II}$ government B provides subsidies such that both firms relocate. In this case, relocated firms are wholly owned by investors from country A. However, as the consumer surplus has a great weight in the weighted welfare of country B ($\beta_B \geq$ 0.6055) and the entry cost is not high enough ($f \leq f_S$) weighted welfare in country B is greater when both firms relocate than when just one does.

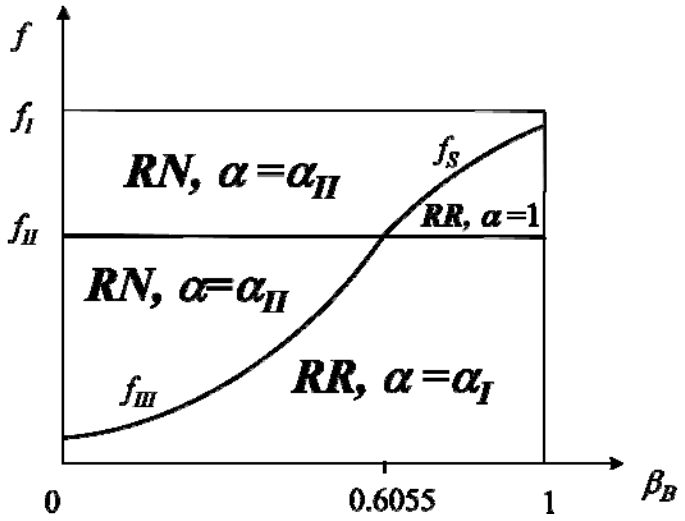

Figure 3. Illustration of Proposition 3.

Moreover, this proposition states that the subsidy increases the weighted welfare of country A when the weight attached to the consumer surplus of this country, β_A, is great enough (β_A >0.6518). This is because the subsidy increases both the profit received by investors from country A and the consumer surplus of that country; however it reduces the rents of domestic workers. If β_A is great enough, the effect of consumer and producer surpluses on weighted welfare dominates and, as a result, the weighted welfare of country A increases. If β_A is low enough, the opposite result is obtained. Therefore, the subsidy may increase the welfare of the whole world, not only the welfare of the country that implements it. This is the case, for example, when both governments attach a great enough weight to their consumers.

Proposition 3 also shows when $f > max\{f_{II}, f_S\}$, government *B* does not provide subsidies. This may be for one of two reasons: either weighted welfare in country *B* is greater when just one firm relocates or the maximum subsidy that government *B* can pay is not great enough to change firms' location decisions (see Appendix 6).

5. Conclusions

An important factor that affects the relocation of firms to China, and that has not been considered to date by the literature analyzing this issue, is the stake in the relocated firms that the Chinese government allows to be foreign-owned. As a result, the literature is not able to explain why the Chinese government restricts foreign investment in some industries but permits it in others. Thus, this paper analyzes firms' relocation decisions when the Chinese government chooses the percentage of shares in the relocated firms that can be foreign-owned. We also consider other relevant factors that affect firms' relocation decisions: the fact that wages are lower in China than in the rest of the Western countries, the entry cost of setting up a firm in China, and the different weights that governments may attach to consumers and producers in their objective functions.

We find that the government may encourage or restrict relocation by choosing the percentage of shares in firms that may be foreign-owned. In fact, if the entry cost takes an intermediate value and the weight of the consumer surplus is low enough, the government prefers just one firm to relocate even though it may be able to get both to do so. As a result, it restricts relocation by choosing the right percentage. However, if the entry cost is low enough the government wants both firms to relocate. To achieve this, the government has to choose a greater percentage than in the previous case.

When both the entry cost and the weight attached to consumer surplus in weighted welfare are great enough, the government wants both firms to relocate but only gets one to do so. In this case, even if the government gives full ownership of the firms to foreign investors it is too expensive for both firms to relocate. We find that, in this case, the government provides a subsidy such that both firms relocate. This subsidy increases

the weighted welfare of all countries if the weight attached to consumer surplus is high enough.

One possible extension of the paper is to consider that when a firm, initially located in one country relocates to another to set up a joint venture with investors from that country it does not close its domestic plant. This assumption implies additional strategic effects. This issue goes beyond the objective of this paper and we leave it for future research.

Appendix 1. Neither firm relocates.

In equilibrium, the wage paid by each firm, the output and employment level of each firm, the utility of the workers of country *A*, the consumer and producer surplus in country *A* and weighted welfare in that country are given by:

$$w^{NN} = \frac{a}{7},\ q^{NN} = L^{NN} = \frac{2a}{7},\ U_A^{NN} = \frac{4a^2}{49},\ CS_A^{NN} = PS_A^{NN} = \frac{8a^2}{49},\ W_A^{NN} = \frac{20a^2}{49}.$$

Appendix 2. Only firm *i* relocates.

In equilibrium, the wage paid by the firm that does not relocate, the output and employment level of the firm that does not relocate, the output sold in each country by the firm that relocates and its employment level, the utility of the workers of country *A*, the consumer and producer surplus in both countries and the weighted welfare in country *A* are given by:

$$w^{NR} = \frac{a}{8},\ q^{NR} = L^{NR} = \frac{a}{4},\ q_A^{RN} = \frac{3a}{8},\ q_B^{RN} = \frac{a}{2},\ L^{RN} = \frac{a}{2},\ U_A^{NR} = \frac{a^2}{32},$$

$$CS_A^{NR} = \frac{25a^2}{128},\ CS_B^{NR} = \frac{a^2}{8},\ PS_A^{NR} = \frac{a^2(4+(25-64f)\alpha)}{64},$$

$$PS_B^{NR} = \frac{a^2(25-64f)(1-\alpha)}{64},\ W_A^{NR} = \frac{a^2(2\alpha(25-64f)(1-\beta_A)+12+13\beta_A)}{128}.$$

Appendix 3. Both firms relocate.

In equilibrium, the output sold in each country by each firm, the employment level of each firm, the consumer and producer surplus in each country and the weighted welfare in country *A* are given by:

$$q^{RR} = \frac{a}{3},\ L^{RR} = \frac{2a}{3},\ CS^{RR} = \frac{2a^2}{9},\ PS_A^{RR} = \frac{2\alpha a^2(2-9f)}{9},$$

$PS_B^{RR} = \frac{2(1-\alpha)a^2(2-9f)}{9}$, $W_A^{RR} = \frac{2a^2(\alpha(2-9f)(1-\beta_A)+\beta_A)}{9}$.

Appendix 4. Proof of Proposition 1.

As $f<f_I$, the following can be shown:

i) $\alpha\pi^{RR} - \pi^{NR} = \frac{a^2(16(2-9f)\alpha-9)}{144} > 0$ if and only if $\alpha > \alpha_I = \frac{9}{16(2-9f)}$, where $\alpha_I < 1$ if and only if $f < f_{II} = \frac{23}{144}$, $f_{II} < f_I$;

ii) $\alpha\pi^{RN} - \pi^{NN} = \frac{a^2(49(25-64f)\alpha-256)}{3136} > 0$ if and only if $\alpha > \alpha_{II} = \frac{256}{49(25-64f)}$, $\alpha_{II} < 1$;

iii) $\alpha_I - \alpha_{II} = \frac{8640f+2833}{784(25-64f)(2-9f)} > 0$;

iv) $\frac{\partial \alpha_I}{\partial f} = \frac{81}{16(2-9f)^2} > 0$, $\frac{\partial \alpha_{II}}{\partial f} = \frac{16384}{49(25-64f)^2} > 0$,

$\frac{\partial(\alpha_I - \alpha_{II})}{\partial f} = \frac{(551+576f)(2599-8640f)}{784(2-9f)^2(25-64f)^2} > 0$ since $f > f_I$.

From the above computations it is easy to prove Proposition 1.

Appendix 5. Proof of Proposition 2.

As $f<f_I$, W_B^{RR} and W_B^{NR} are positive and thus greater than W_B^{NN}. It remains to be analyzed whether, in equilibrium, W_B^{RR} is greater than W_B^{NR} or not. As $f<f_I$, then: $\frac{\partial W_B^{RR}}{\partial \alpha} = -\frac{2a^2(2-9f)(1-\beta_B)}{9} < 0$ and $\frac{\partial W_B^{NR}}{\partial \alpha} = -\frac{a^2(25-64f)(1-\beta_B)}{64} < 0$. Therefore, government *B* chooses the lower value of α in both cases: it chooses $\alpha=\alpha_I$ when both firms relocate and $\alpha=\alpha_{II}$ when only one firm relocates. When $\alpha=\alpha_I$ we obtain that $W_B^{RR}(\alpha = \alpha_I) = \frac{a^2(23-144f(1-\beta_B)-7\beta_B)}{72}$. When $\alpha=\alpha_{II}$ we obtain that $W_B^{NR}(\alpha = \alpha_{II}) = \frac{a^2(969-3136f(1-\beta_B)-577\beta_B)}{3136}$. It can also be shown that $W_B^{RR}(\alpha = \alpha_I) - W_B^{NR}(\alpha = \alpha_{II}) = \frac{a^2(295-28224f(1-\beta_B)+2449\beta_B)}{28224} > 0$ if and only if $f<f_{III} = \frac{295+2449\beta_B}{28224(1-\beta_B)}$. It should be noted that $\frac{\partial f_{III}}{\partial \beta_B} > 0$ and $f_{III} = 0.0104$ when $\beta_B=0$.

When $\alpha=\alpha_I$ we obtain that $CS_B^{RR} = \frac{2a^2}{9}$ and $PS_B^{RR} = \frac{a^2(23-144f)}{72}$; when $\alpha=\alpha_{II}$ we obtain that $CS_B^{NR} = \frac{a^2}{8}$ and $PS_B^{NR} = \frac{a^2(969-3136f)}{3136}$. It is easy to see that $CS_B^{RR}>CS_B^{NR}$ $\forall f$, and that $PS_B^{RR}<PS_B^{NR}$ if and only if $f > \frac{295}{28224} \approx 0.0104$.

Appendix 6. Proof of Proposition 3.

When $f > f_{II}$, government B chooses $\alpha=1$ to get both firms to relocate. However, the two firms find it unprofitable to relocate since $\pi^{RR} - \pi^{NR} = -\frac{a^2(144f-23)}{144} < 0$. Therefore, firms have to receive a subsidy to find relocation profitable.

Next we compute the maximum subsidy that government B can pay. If both firms relocate and government B chooses $\alpha=1$, weighted welfare is $W_B^{RR}(\alpha = 1) = \frac{2a^2\beta_B}{9}$. If government B chooses $\alpha=\alpha_{II}$ just one firm relocates and weighted welfare is: $W_B^{NR}(\alpha = \alpha_{II}) = \frac{a^2(969-3136f(1-\beta_B)-577\beta_B)}{3136}$. Therefore, the maximum subsidy that government B can pay is $S = W_B^{RR}(\alpha = 1) - W_B^{NR}(\alpha = \alpha_{II}) = \frac{a^2(28224f(1-\beta_B)+11465\beta_B-8721)}{28224}$, where $S>0$ if $f > \frac{8721-11465\beta_B}{28224(1-\beta_B)} = f_W$. It is easy to see that $f_{II} \geq f_W$ if $\beta_B \geq 0.6055$ (see Figure 4). Therefore, when $f_W \geq f > f_{II}$ government B is unable to provide subsidies (since $S \leq 0$). When $f > \max\{f_{II}, f_W\}$, government B finds it profitable to subsidize the firms to get them to relocate (since $S>0$).

Next we have to check whether the maximum subsidy assures that both firms relocate. The two firms share the maximum subsidy so, given the symmetry of the model, the maximum subsidy that each firm can obtain, is $S/2 = \frac{a^2(28224f(1-\beta_B)+11465\beta_B-8721)}{56448}$. Firms relocate if $(\pi^{RR}+S/2) - \pi^{RN} > 0$; by substituting we obtain that $(\pi^{RR} + S/2) - \pi^{NR} = \frac{a^2(295-28224f+11465\beta_B-28224f\beta_B)}{56448}$, which is positive if $f < f_S = \frac{5(59+2293\beta_B)}{28224(1+\beta_B)}$. It is easy to see that $f_S \geq f_{II}$ if $\beta_B \geq 0.6055$. It can also

be shown that when $f_S \geq f > f_{II}$, the subsidy is positive; so in this case both firms relocate. When $f > \max\{f_S, f_W\}$, even if government B provides a positive subsidy it is not great enough for firms to relocate, i.e. $(\pi^{RR} + S/2) - \pi^{NR} < 0$.

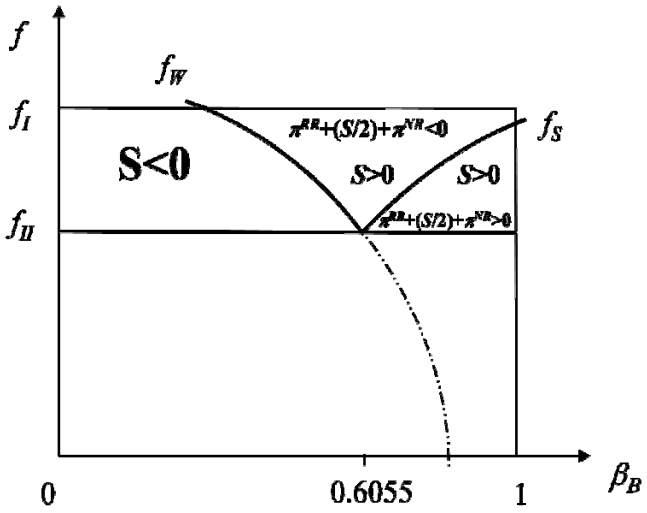

Figure 4. Subsidies and relocation.

The subsidy given to each of the two firms is $\pi^{NR} - \pi^{RR} = a^2\left(f - \frac{23}{144}\right)$. So in case of a subsidy to both firms, the weighted welfare of country A, that includes that subsidy, is $W_A^{RR}(\alpha = 1) = \frac{a^2(9 + 7\beta_A)}{72}$. If there is no subsidy only one firm relocates and thus the weighted welfare obtained by country A is $W_A^{RN}(\alpha = \alpha_{II}) = \frac{25a^2(44 + 5\beta_A)}{6272}$. Then $W_A^{RR}(\alpha = 1) - W_A^{RN}(\alpha = \alpha_{II}) = \frac{a^2(-2844 + 4363\beta_A)}{56448}$ which is positive if $\beta_A > \frac{2844}{4363} \approx 0.6518$.

References

Bárcena-Ruiz, J.C., & Garzón, M.B. (2003). Strategic environmental standard, wage incomes and the location of polluting firms. *Environmental and Resource Economics*, 24, 121-139.

Bárcena-Ruiz, J.C., & Garzón, M.B. (2009). Relocation and public ownership of firms. *Journal of the Japanese and International Economies*, 23, 71-85.

Binmore, K., Rubinstein A., & Wolinsky, A. (1986). The Nash bargaining solution in economic modeling. *RAND Journal of Economics*, 17, 176-188.

Blomström, M., & Kokko, A. (2003). The economics of foreign direct investment incentives. *NBER Working Paper*, Nº 9489.

Brander, J.A., & Spencer, B.J. (1988). Unionized oligopoly and international trade policy. *Journal of International Economics,* 24, 217-234.

Bughin, J., & Vannini, S. (1995). Strategic direct investment under unionized oligopoly. *International Journal of Industrial Organization*, 13, 127-145.

Chen, C-H, Mai, C-C., Liu, Y-L., & Mai, S-Y. (2009). Privatization and optimal share release in the Chinese banking industry. *Economic Modelling*, 26, 1161-1171.

Feenstra, R. (1999). Facts and fallacies about foreign direct investment. In Feldstein, H., (ed.). *International Capital Flows*. National Bureau of Economic Research Conference Report Series, University of Chicago Press, 331-350.

Fumagalli, C. (2003). On the welfare effects of competition for foreign direct investments. *European Economic Review*, 47, 963-983.

Lu, J., Lu, Y., & Tao, Z. (2010). Exporting behavior of foreign affiliates: Theory and evidence. *Journal of International Economics*, 81, 197-205.

Matsumura, T., Matsushima, N., & Ishibashi, I. (2009). Privatization and entries of foreign enterprises in a differentiated industry. *Journal of Economics*, 98, 203-219.

Mezzetti, C., & Dinopoulos, E. (1991). Domestic unionization and import competition. *Journal of International Economics*, 31, 79-100.

Mucchielli, J-L., & Saucier, P. (1997). European industrial relocations in low-wage countries: policy and theory debates. In Bucley, P.J., and Mucchielli, J-L., (Eds.). *Multinational firms and international relocation*, Edward Elgar: Cheltenham, UK, 5-33.

Naylor, R. (1998). International trade and economic integration when labour markets are generally unionised. *European Economic Review*, 42, 1251-1267.

Nickell, S., & Andrews, M. (1983). Union real wages and employment in Britain 1951-1979. *Oxford Economic Papers*, 35, 183-206.

Norbäck, P.J. (2001). Multinational firms, technology and location. *Journal of International Economics*, 54, 449- 469.

Petit, M.L., & Sanna-Randaccio, F. (2000). Endogenous R&D and foreign direct investment in international oligopolies. *International Journal of Industrial Organization*, 18, 339-367.

Sun, Q., Li, J., & Zhang, A. (2006). SOE reform under oligopolistic market structure: the optimal choices of State shares. *Frontiers of Economics in China*, 1, 39-47.

The Economist Intelligence Unit, (2011). Organising an investment in China Prepare for opportunity. A practical guide from The Economist Intelligence Unit. *The Economist.* Available at http://www.eiu.com.

Wang, L.F., & Chen, T-L. (2011). Mixed oligopoly, optimal privatization, and foreign penetration. *Economic Modelling*, 26, 1465-1470.