FDI with Reverse Imports
and Hollowing Out

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Abstract

This paper develops a model of FDI with reverse imports examining the
impact of FDI on the home economy through the "hollowing out" effect on
the domestic employment. A foreign wage threshold exists. If the foreign
wage is lower than the threshold, the home firm chooses FDI. The threshold
depends on a FDI fixed cost and a demand parameter. A welfare analysis
shows that another foreign wage threshold exists. If the foreign wage is lower
than the threshold, FDI makes the welfare of the home country higher. This
paper derives the conditions about which threshold is higher and that as an
application, FDI cannot be deterred if the home firm prefers it.

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1   Introduction

The "hollowing out" of the Japanese economy, especially in the manufacturing industries, has been widely discussed. Many people are concerned for the future of the Japanese economy, as they believe that its strength stems from its manufacturing sector. As a reason for the hollowing out of the Japanese economy, the rising Chinese economy is often noted. Many Japanese manufacturing firms have moved their production facilities to China partially or completely and import their products reversely to Japan, which, many argue, has resulted in the loss of employment in Japan's manufacturing sector. Why have many Japanese firms undertaken FDI in China? Three factors are often pointed out; (1) low labor costs, (2) China's rapidly growing or potentially huge market, and (3) advantages to firms entering the Chinese market first such as establishing brand image and taking a large market share.

Various factors are discussed as causes of outward FDI such as heterogeneity in productivity among domestic firms (Helpman et al. 2003, 2004), networks to sell products to buyers from the same country (Greaney 2003), expectation of demand growth in the FDI host country (Rob and Vettas 2003), and marginal-cost differences between the home and the FDI host countries associated with a cost of FDI (Horstmann and Markusen 1992, Yomogida 2004). Among these factors, the cost factor seems to be most important when considering the hollowing out of the Japanese economy.

The purpose of this paper is to analyze a lower wage in the FDI host country as a cause of FDI with reverse imports from the FDI host country theoretically. This paper develops a model based on Horstmann and Markusen (1992). The home country has two sectors, a competitive numeraire sector and a monopoly sector. The monopoly firm chooses its plant location in the home country or in the foreign country, i.e. FDI, not both. With the home production, the home firm employs a home consumer and pays a wage higher than that in the foreign country. With FDI, the home firm must expend a fixed cost but it can save the labor costs. The home consumer, however, is not employed and thus her labor income is only from the numeraire sector, which this paper refers as "hollowing out." This paper discusses the decision of the home firm, determination of the wage paid by the home firm, and the welfare consequence with explicit consideration for the hollowing out effect.

The most important contribution of this work is to develop a theoretical framework to evaluate the effects of an outward FDI on the domestic welfare with detailed consideration for the domestic labor market, including the possible hollowing out effect. Previous literature such as Horstmann and Markusen (1992) and Yomogida (2004) also discusses the effect of FDI on welfare. However, in their studies, the wages in the both countries are exogenous. In this paper, the wage paid by the monopoly firm is endogenous. Therefore this paper analyzes the determination of the home wage and the wage differential between the home and the foreign coun-

tries by a general equilibrium framework with the two sectors of the labor market. Moreover, this paper deals with a conflict of interests between the home firm and the consumer. That is, the wage determination affects the plant location and vice versa.[1]

This paper shows that a foreign wage threshold exists. If the foreign wage is lower than the threshold, the home firm chooses to undertake FDI rather than to locate its plant in the home country. The threshold depends on two parameters, a fixed cost peculiar to FDI and a demand parameter. As well as the profits of the home firm, another foreign wage threshold exists for the welfare. If the foreign wage is lower than the threshold, FDI makes the welfare of the home country higher, even with the hollowing out effect. The threshold for welfare could be either higher or lower than that for the profits of the home firm. This result implies that in the case when the welfare threshold is higher than the profit one, and the actual foreign wage is between the two thresholds, any policy by the home government to reduce the FDI fixed cost may improve the welfare. Moreover, this paper shows conditions about which threshold is higher, and that as an application, the consumer cannot deter FDI if the home firm prefers it.

The rest of this article is arranged as follows. Section two develops a model. Section three discusses two cases of the wage paid by the home firm. The first

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[1]As a study discussing the effect of globalization on the domestic economy based on the political economy literature, see Gaston and Nelson (2004).

case is the home wage to maximize the income of the consumer, i.e. the sum of her labor income and the profits of the home firm, and the second case is that to maximize the labor income. Section four discusses the general case where the home wage is greater than or equal to the wage in the numeraire sector. The conditions about which foreign wage threshold is higher are derived. Section five concludes this paper.

2 Model

Our model is based on Horstmann and Markusen (1992), who analyze endogenous plant location in a two-firm, two-market model. Suppose that a monopoly firm, which this paper refers as the home firm, exists in a country called home country. The home firm makes a two-step decision. First, it chooses the location of its production plant. The home firm has two options; (1) a plant in the home country, and (2) a plant in another country called foreign country, i.e. FDI.[2] Then the home firm produces its products in its plant and sell them in the home market. In the case of FDI, the home firm imports its products from its foreign plant. This paper refers this as "reverse imports."

This paper assumes the following cost structure. If the home firm locates its plant in the home country, it does not need to pay any fixed cost. Although in reality some fixed cost might exist even with the home production, the difference in

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[2]This article does not consider a possibility that the home firm has plants both in the home and in the foreign countries. See Rob and Vettas (2003) about such a possibility.

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fixed costs between the home and the foreign production matters, as shown later. Thus, for simplicity this paper assumes a zero fixed cost for the home production. On the other hand, if the home firm decides to locate its plant in the foreign country, the fixed cost is G.

Since FDI requires the fixed cost, the home firm needs benefits from FDI to compensate for the extra expense. In this paper, it is a constant marginal cost of production. This paper assumes that after building a plant, labor is the only production factor, and that the unit labor cost in the foreign country is lower than that in any industry in the home country. w_f denotes the wages in the foreign country, assumed to be exogenous in the model.

In the home country, besides the industry that the home firm rules, another industry, the numeraire sector, exists. The role of the numeraire sector is explained below.

To make the general equilibrium setting, first the demand side of the model is discussed. X denotes the quantity sold by the home firm. The home country has one representative consumer, and her utility maximization problem is as follows:

$$\max U = aX - \frac{1}{2}X^2 + Z \tag{1}$$

$$\text{s.t. } I = I_L + \pi = PX + Z$$

I is income for the consumer. I_L denotes the labor income. π denotes the profits of the home firm. P is the price of the product of the home firm. Z denotes the

numeraire. This paper assumes that the numeraire industry is perfectly competitive and that the price of the numeraire and the wage paid in this industry is one. Therefore, $w_f < 1$ is assumed. Solving the above maximization problem yields an inverse demand function $P = a - X$.

The next component of the model is the home firm's decision. i.e. the supply side of the home market. The home firm chooses its plant location to maximize its profits, for given levels of the home and the foreign wages. When the home firm chooses FDI, its profits, $\pi(FDI)$, are

$$\pi(FDI) = (a - X - w_f)X - G.$$

This paper assumes a zero unit-shipping cost for simplicity.[3] Also, this paper assumes that both in the home and in the foreign countries, the home firm's production function is $X = l$ where l denotes the quantity of labor hired. From the profit function, the optimal quantity for the home firm is $\frac{a-w_f}{2}$. Substituting the optimal X into the profit function yields $\pi(FDI) = \left(\frac{a-w_f}{2}\right)^2 - G$.

On the other hand, when the home firm chooses the home production, its profits, $\pi(NoFDI)$, are

$$\pi(NoFDI) = (a - X - w_d)X,$$

where w_d is the wage paid by the home firm. How w_d is determined through the interaction between the home firm and the consumer is one of the most impor-

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[3]One may assume that the exogenous foreign wage is net of the unit shipping cost and trade barriers such as tariff.

tant issues addressed in this paper. Note that the home production saves the FDI fixed cost G. From the profit function, the optimal quantity for the home firm is $\frac{a-w_d}{2}$. This is also the labor demand function of the home firm in case of the home production. Substituting the optimal X into the profit function yields $\pi(NoFDI) = \left(\frac{a-w_d}{2}\right)^2$.

The last component of the model is the labor market in the home country. When the home firm decides the home production, the home consumer allocates its labor endowment either to the home firm or to the numeraire sector. That is, $L = L_d + L_z$ where L is the labor endowment, L_d and L_z are units of labor employed by the home firm and in the numeraire sector respectively. Then the labor income for the consumer is

$$
\begin{aligned}
I_L &= w_d L_d + w_z L_z \\
&= w_d L_d + L - L_d = (w_d - 1)L_d + L. \quad (2)
\end{aligned}
$$

Note that the home consumer works for the home firm only when $w_d \geq 1$, i.e. the wage is higher than or equal to that in the numeraire sector.

If the home firm decides FDI, on the other hand, it does not hire the consumer. Then the labor income for the home consumer is from only the numeraire sector, and is equal to L. This paper refers such a change in the labor income for the consumer according to the plant allocation of the home firm as "hollowing out." This hollowing out effect gets larger as w_d increases.

The timing of the decision by the consumer and the home firm is listed below.

(Stage 1) The consumer determines the wage paid by the home firm.

(Stage 2) The home firm decides its plant location.

(Stage 3) The consumer supplies her labor and makes consumption. The home firm produces and sells its product. The profits of the home firm and the welfare or the utility of the consumer are determined.

In the next section, two special cases of the home wage are examined.

3 Home Wage, Plant Location, and Welfare

In this section, the two cases of different levels of wages paid by the home firm, w_d, are discussed; (1) w_d maximizing the income for the consumer, i.e. the sum of the labor income and the profits of the home firm, and (2) w_d maximizing the labor income for the consumer in case of the home production.

3.1 Home Wage Maximizing the Income

Suppose that the home firm chooses the home production. From equation (2), the income for the consumer is

$$
\begin{aligned}
I &= (w_d - 1)\frac{a - w_d}{2} + \left(\frac{a - w_d}{2}\right)^2 + L \\
&= -\frac{1}{2}(w_d - 1)^2 + \frac{1}{4}(a - 1)^2 + L.
\end{aligned}
\tag{3}
$$

The maximized income is $\frac{1}{4}(a-1)^2 + L$ at $w_d = 1$. [4]

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[4] $a > 1$ is assumed.

The next thing to be considered is the firm's decision on its plant location. If the following equation holds, FDI and home production are indifferent for the home firm.

$$\pi(FDI) = \pi(No\ FDI).$$

Substituting the profits in the each case to the each side of the above equation yields

$$\frac{1}{4}(a - w_f)^2 - G = \frac{1}{4}(a - 1)^2. \tag{4}$$

From equation (4), a threshold of the foreign wage w_f, denoted by w_f^*, is derived.

$$w_f^* = a - \sqrt{(a - 1)^2 + 4G}. \tag{5}$$

If the foreign wage is higher than w_f^*, the home firm chooses the home production. If the foreign wage is lower than w_f^*, the home firm chooses FDI.

To compare the welfare of the home country under the two different strategies of the home firm, the measure of the welfare has to be specified. By substituting the budget constraint into the utility function U of equation (1) to erase Z, and by substituting the equilibrium outputs into U, the equilibrium value of the home consumer's utility denoted by W is derived. This paper uses W as the measure of the welfare. When the home firm undertakes FDI, the welfare of the home country is

$$W(FDI) = \frac{3}{8}(a - w_f)^2 - G + L. \tag{6}$$

In a similar way, when the home firm locates its plant in the home country, the

welfare is

$$W(NoFDI : w_d = 1) = \frac{3}{8}(a - 1)^2 + L. \tag{7}$$

As well as the profits of the home firm, the ranges of the foreign wage w_f where

FDI or the home production are desirable are derived. If the following equation

holds, FDI and the home production are indifferent in terms of the welfare.

$$W(FDI) = W(NoFDI : w_d = 1).$$

From equations (6) and (7), the above equation is changed to

$$\frac{3}{8}(a - w_f)^2 - G + L = \frac{3}{8}(a - 1)^2 + L. \tag{8}$$

From equation (8), a threshold of w_f, denoted by w_f^{**}, is derived.

$$w_f^{**} = a - \sqrt{(a - 1)^2 + \frac{8}{3}G}. \tag{9}$$

If the foreign wage is higher than w_f^{**}, the home production is desirable for the

home country in terms of the welfare. If the foreign wage is lower than w_f^{**}, FDI

is desirable.

In the case of $w_d = 1$, w_f^{**}, the threshold of the foreign wage for the welfare, is

higher than w_f^*, the threshold for the profits of the home firm. Thus, if $w_f^* < w_f <$

w_f^{**}, the home firm prefers the home production while FDI makes the welfare higher.

In such a case, a policy by the home government decreasing FDI fixed cost G may

increase the both thresholds, changing the above inequality to $w_f < w_f^* < w_f^{**}$,

inducing the home firm to FDI, and improving the welfare of the home country.

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One example of such policies is to liberalize FDI to the foreign country more by a negotiation with the foreign government. Subsidies for FDI might violate the WTO rule.

The following statement summarizes the result in this subsection.

Result 1 : *Suppose that the home wage is determined to maximize the sum of the labor income and the profits. Then the foreign wage threshold for the welfare is higher than that for the profits.*

3.2 Home Wage Maximizing the Labor Income

In this subsection, the case when the consumer chooses w_d to maximize her labor income is discussed. This case may be more realistic than the first case. Labor unions usually negotiate with employers about their wages. From equation (2), the labor income for the consumer is

$$
\begin{aligned}
I_L &= (w_d - 1)\frac{a - w_d}{2} + L \\
&= -\frac{1}{2}\left(w_d - \frac{1+a}{2}\right)^2 + \frac{1}{8}(a-1)^2 + L.
\end{aligned}
\tag{10}
$$

The maximized labor income is $\frac{1}{8}(a-1)^2 + L$ at $w_d = \frac{1+a}{2}$. Note that in this case $w_d > 1$, the home wage in the first case. The reason for this inequality is that the consumer takes into account the negative impact of wage on the profits of the home firm more in the first case. For a given level of production, a higher wage results in lower profits, which implies lower income for the consumer in the first case.

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By the same way as in the first case, the thresholds of the foreign wage in terms of the profits or the welfare are derived. First, the profit threshold is

$$w_f^* = a - \sqrt{\frac{1}{4}(a-1)^2 + 4G}. \tag{11}$$

This profit threshold is higher than that in the first case; $w_d = 1$. As mentioned above, the home wage is increased from the first case. When w_d is increased, FDI attracts the home firm more due to a relatively lower foreign wage, and thus w_f^* is also increased.

Next, the welfare threshold is

$$w_f^{**} = a - \sqrt{\frac{7}{12}(a-1)^2 + \frac{8}{3}G}. \tag{12}$$

The welfare threshold is also higher than that in the first case, because of a higher home wage.

One might ask if which threshold is higher. Like the first case, the welfare threshold is higher than the profit one if the following inequality holds.

$$G > \left(\frac{a-1}{2}\right)^2.$$

That is, the FDI fixed cost is relatively high.[5] However, the above inequality does not always hold. Therefore, the second case has another possibility, i.e. $w_f^* > w_f^{**}$, depending on which of two parameters, FDI fixed cost, G, and demand parameter, a, is relatively larger.

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[5]Note that the right hand side of the inequality is equal to the profits when the home production occurs with $w_d = 1$.

Comparing the two cases, it is clear that the order of the two thresholds may change as the wage paid by the home firm gets higher. In the next section, the general case is discussed to examine the level of the home wage at that a change of the order of the two thresholds occurs.

The following statements summarize the results in this subsection.

Result 2 : *Suppose that the home wage is determined to maximize the labor income. Then the home wage is higher than that to maximize the total income for the consumer.*

Result 3 : *Suppose that the home wage is determined to maximize the labor income. Then the order of the two foreign wage thresholds is ambiguous.*

4   The General Case

In this section, conditions about which foreign wage threshold is higher for any home wage $w \geq 1$ are derived. Then, the conditions are applied to discuss a possibility for the consumer to deter FDI by controlling for the home wage.

4.1   Conditions for the Two Thresholds

When the wage paid by the home firm is $w \geq 1$, the two thresholds of the foreign wage are as follows.

$$\text{Profits: } w_f^* = a - \sqrt{(a-w)^2 + 4G} \tag{13}$$

$$\text{Welfare: } w_f^{**} = a - \sqrt{a^2 - \frac{1}{3}\{(2w+4)a + w^2 - 4w\} + \frac{8}{3}G} \tag{14}$$

Suppose that the two thresholds are equal. Then, from equations (13) and (14), the following quadratic equation with respect to w is derived.

$$f(w) = w^2 - (a+1)w + (a+G) = 0.$$

Whether the above equation has one or two real roots depends on which of the following two values, $(\frac{a-1}{2})^2$ and G, is larger. In the second subsection of the last section, how these two values affect the foreign-wage thresholds is briefly discussed.

According to the number of real roots for the quadratic equation $f(w) = 0$, the following three cases exist.

1. $(\frac{a-1}{2})^2 < G$

In this case, $f(w)$ is greater than zero for all w, i.e. the quadratic equation $f(w) = 0$ has no real root. This implies that for all w, $w_f^* < w_f^{**}$.

2. $(\frac{a-1}{2})^2 = G$

In this case, the quadratic equation $f(w) = 0$ has one real root, $w = \frac{1+a}{2}$. This implies that for all w other than $\frac{1+a}{2}$, $w_f^* < w_f^{**}$. When $w = \frac{1+a}{2}$, on the other hand, $w_f^* = w_f^{**}$.

3. $(\frac{1+a}{2})^2 > G$

In this case, the quadratic equation $f(w) = 0$ has two real roots, $w_1 = \frac{a+1-\sqrt{(a-1)^2-4G}}{2}$ and $w_2 = \frac{a+1+\sqrt{(a-1)^2-4G}}{2}$. Whether w is higher or lower than each of the root makes three possibilities.

$$\begin{cases} w_f^* < w_f^{**} & if \quad w_1 > w. \\ w_f^* \geq w_f^{**} & if \quad w_2 \geq w \geq w_1. \\ w_f^* < w_f^{**} & if \quad w > w_2. \end{cases}$$

To interpret the above conditions, two conflicting interests for the consumer are important. For the consumer, a higher home wage is better IF the quantity produced by the home firm and the price of the product are unchanged. On the other hand, a higher wage has a negative impact on the profits of the home firm and thus hurts the consumer too, because her income consists of her labor income and profits. For the home firm, a lower wage is always better.

The first case occurs when the FDI fixed cost is relatively high. Other things being equal, an increase in the fixed cost raises the relative attractiveness of the home production for both the home firm and the home consumer. However, when FDI is chosen, the consumer may enjoy foreign produced goods. That is why the welfare threshold of the foreign wage is higher in this case. The second case is rare and thus not considered.

The third case occurs when the FDI fixed cost is relatively low. This implies that FDI is attractive for the home firm. FDI may be attractive even for the consumer if a certain level of income is guaranteed. When $w_1 > w$, the threshold of the profits becomes low because of the low home wage. A lower home wage makes the home production less attractive for the consumer, which makes the threshold of the welfare higher. Thus $w_f^* < w_f^{**}$ due to these factors. When $w > w_2$, the opposite things happen. A higher home wage makes FDI more likely. This does not necessarily make the consumer unhappy. She may enjoy consuming cheaper foreign produced goods. Therefore $w_f^* < w_f^{**}$ still holds at another extreme. When

$w_2 > w > w_1$, all of the above factors, especially for the consumer side, get things complicated. One possible reason for the change of order is the hollowing out effect for the consumer.

If the hollowing out effect is bad for consumer, why does she deter FDI? To answer this question, the conditions developed here and summarized in the following proposition are used.

Proposition 1 : *Suppose that the home wage is set at any value between one and a. Then the two foreign wage thresholds are ordered as follows.*

1. If $(\frac{a-1}{2})^2 < G$, $w_f^* < w_f^{**}$ for all w.

2. If $(\frac{a-1}{2})^2 = G$ and if $w = \frac{1+a}{2}$, $w_f^* = w_f^{**}$. $w_f^* < w_f^{**}$ holds for any other w in this case.

3. If $(\frac{1+a}{2})^2 > G$, the following cases are possible.

$$\begin{cases} w_f^* < w_f^{**} & if \quad w_1 > w \ or \ if \ w > w_2. \\ w_f^* \geq w_f^{**} & if \quad w_2 \geq w \geq w_1. \end{cases}$$

4.2   Application: Can the Consumer Deter FDI?

Suppose that the home production gives a higher welfare than FDI does. Then, it is natural to ask if the consumer or the home government can prevent the home firm from performing FDI. Such a possibility occurs when the welfare with the home production is higher than that with FDI while the profits with FDI is higher than those with the home production. Using the two thresholds of the foreign wage, this situation is described by the following two inequalities; $w_f > w_f^{**}$ and

$w_f < w_f^*$. That is, the threshold for the profits is higher than that for the welfare. From Proposition 1, this case occurs if $\left(\frac{a-1}{2}\right)^2 > G$ holds.

If the above inequality holds, which level of the home wage w maximizes the welfare? The welfare with the home production and with $w_d = w$ is

$$-\frac{1}{8}(w-2)^2 - \frac{wa}{4} + \frac{3}{8}\left(a - \frac{2}{3}\right)^2 \frac{1}{3} + L.$$

The welfare is maximized at $w = 2 - a$. Thus, if the consumer sets the home wage at this level, she seems to be able to deter FDI successfully.

However, because $a > 1$, $w < 1$. If this is the case, the consumer gets better off when employed in the numeraire sector. Thus, the consumer cannot deter FDI if the foreign country is the best plant location for the home firm.

5   Conclusions

This article addresses the decision of plant location by a home firm and its impact on the home economy, especially through the "hollowing out" effect on the domestic employment. It is shown that there are foreign wage thresholds. At these thresholds, the optimal plant locations in terms of either the profits of the home firm or the welfare of the home country change, and that the difference in the two thresholds suggest that in some cases the home government enact policies enhancing FDI. The conditions about which foreign wage threshold is higher are derived. Using the conditions, it is shown that the home consumer cannot deter FDI if the home firm prefers it.

This paper does not discuss the details of the role of home government. However, Cowling and Tomlinson (2000) argue that the bargaining power of Japanese multinational companies against both the Japanese government and labor unions increased in the 1990s. Therefore, the role of the home government and its relative power over the home firm or the consumer are interesting issues to be addressed. Another possible extension is to introduce the foreign government in the model. For instance, the foreign government may subsidize the labor costs to attract FDI by the home firm. Head, Ries, and Swenson (1999) show that some states in the U.S. have succeeded in receiving FDI of Japanese manufacturing firms by their labor-cost subsidies. In sum, the roles of the home and the foreign governments are valuable future research agenda.

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