FDI with Reverse Imports and Hollowing Out

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Abstract

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. This paper shows that for the home firm, a home-wage threshold exists. Next the consumer’s decision with the profit threshold and the equilibrium are discussed. Two cases arise. For the each case, a foreign wage threshold for the consumer and the equilibrium home wage are derived. A welfare analysis shows that the foreign wage threshold for the welfare is higher than that for the profits. This result implies a possibility for the home government to improve the welfare.

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1 Introduction

The “hollowing out” of the Japanese economy, especially in the manufacturing industries, has been widely discussed. As a reason for the hollowing out, 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 taking a large market share and establishing brand image.

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, Xing and Zhao 2003, Yomogida 2004). Among these factors, the cost factor seems to be most important when considering the hollowing out of the Japanese economy.

1 Analyzing Japanese firms’ FDI in China with reverse imports theoretically, Xing and Zhao (2003) discuss the effect of Yen-Yuan exchange rate besides the cost difference.
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. 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 paper 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 also discusses the effect of FDI on welfare. However, to my knowledge, the wages in the both countries are given to all economic agents. In this paper, the wage paid by the monopoly firm is determined through strategic interaction between the monopoly firm and the consumer, possible employee of the monopoly firm. This paper analyzes the determination of the home wage and the wage differential between the home and the foreign countries by a general equi-
librium framework with the two sectors of the labor market. Moreover, as noted above, this paper deals with a conflict of interests between the home firm and the consumer. The wage determination affects the plant location and vice versa.\(^2\)

This paper shows that for the monopoly firm, a home-wage threshold exists. If the home wage is higher than the threshold, the home firm chooses to undertake FDI rather than to locate its plant in the home country. Next the consumer’s decision with the profit threshold and the equilibrium are discussed. Depending on the optimal level of the home wage for the consumer is lower or higher than the profit threshold, two cases arise. For the each case, a foreign wage threshold for the consumer and the equilibrium home wage are derived. The consumer determines the home wage based on the two factors, the consumer surplus and the labor income. Thus, in some cases, the consumer prefers FDI even with a loss of her labor income, i.e. the hollowing out. A welfare analysis shows that the foreign wage threshold for the welfare is higher than that for the profits. This result implies that in the case when 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.

The rest of this article is arranged as follows. Section two develops a model. Section three discusses the equilibrium home wage and the associated plant location. Section four is the welfare analysis. Section five concludes this paper.

\(^2\)As a study discussing the effect of globalization on the domestic economy based on the political economy literature, see Gaston and Nelson (2004).
2 Model

This paper develops a model based on Horstmann and Markusen (1992), who analyze endogenous plant location in a two-firm, two-market model. Suppose that a monopoly firm called 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 either in the home country or in another country called foreign country, i.e. FDI. Then the home firm produces its products and sells 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 section describes the model by the following order; (1) differences in production costs between the home production and FDI, (2) consumer’s utility maximization problem, (3) profits of the home firm with or without FDI, and (4) labor income earned by the consumer with or without FDI.

2.1 Production Costs

This paper assumes the following cost structure. If the home firm locates its plant in the home country, it does not pay any fixed cost. Although in reality some fixed cost might exist even with the home production, the difference in fixed costs between the home and the foreign production matters. Thus, for simplicity this paper assumes a zero fixed cost for the home production. On the other hand, if

3 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.
the home firm decides to locate its plant in the foreign country, it must pay a fixed cost of FDI, denoted by $G$.

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 wage in the foreign country, assumed to be exogenous in the model.

### 2.2 Demand

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:

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

subject to

$$I_L = PX + Z.$$

$I_L$ denotes the labor income. $P$ 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 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 in case when she is employed.

(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 utility of the consumer are determined.

This three-period game is solved by backward induction.

This paper assumes a monopsony in the labor market of the home country, except for the numeraire sector. Although other schemes of the wage determination such as a negotiation between the labor union and the management exist, the setting in this paper makes the results simple and clear. Moreover, the distribution of the monopoly rent between the home firm and the consumer is an important aspect of the model and is clearly described in this setting.

### 2.3 Profits of the Home Firm

The home firm’s decision, i.e. the supply side of the home market is now considered. 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, \( \pi_F \), are

\[
\pi_F = (a - X - w_f)X - G.
\]
This paper assumes a zero unit-shipping cost for simplicity.\textsuperscript{4} 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 first order condition, the optimal quantity for the home firm is $\frac{a-w_f}{2}$. Substituting the optimal $X$ into the profit function yields $\pi_F = \left(\frac{a-w_f}{2}\right)^2 - G$.

On the other hand, when the home firm chooses the home production, its profits, $\pi_{NF}$, are

$$\pi_{NF} = (a - X - w)X,$$

where $w$ is the wage paid by the home firm. Note that the home production saves the FDI fixed cost $G$. From the first order condition, the optimal quantity for the home firm is $\frac{a-w}{2}$. 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 $\pi_{NF} = \left(\frac{a-w}{2}\right)^2$.

2.4 Labor Income for the Consumer

Next the wage paid by the home firm in case of the home production, which is determined by the home consumer in period one, is considered. When the home firm decides the home production, the home consumer allocates her 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

\textsuperscript{4}One may assume that the exogenous foreign wage is net of the unit shipping cost and trade barriers such as tariff, or adjusted by the exchange rate.
home firm and in the numeraire sector respectively. Then the labor income for the consumer in case of the home production is

\[ I_L = wL_d + w_z L_z \]

\[ = wL_d + (L - L_d) = (w - 1)X_{NF} + L, \quad (2) \]

where \( w_z \) is the wage in the numeraire sector and is assumed to be one. Assume that the home consumer works for the home firm only when \( w \geq 1 \), 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 location of the home firm as “hollowing out.”

In the next section, how the equilibrium home wage and the plant location are determined is discussed.

3 Home Wage and Plant Location

In this section, first how the level of the home wage affects the plant location is discussed. Then, how the level of the home wage is determined is considered. One important thing is that the consumer must consider the home firm’s decision on its plant location when she determines the home wage, because the home firm may affect the consumer by two channels; the labor income and the consumer surplus.
3.1 Home firm’s decision

The difference in profits with and without FDI is

\[ \pi_F - \pi_{NF} = \left\{ \left( \frac{a - w_f}{2} \right)^2 - \left( \frac{a - w}{2} \right)^2 \right\} - G. \]

The first term is positive because \( w_f < w \). Thus whether the profits with FDI is higher than those with the home production depends on whether the first term, wage saving factor, is larger than the second term, the FDI fixed cost. If \( \pi_F = \pi_{NF} \), the home and the foreign production are indifferent for the home firm:

Solving \( \pi_F = \pi_{NF} \) for the home wage \( w \) yields the threshold of the home wage for its plant location.

\[ w^* = a - \sqrt{(a - w_f)^2 - 4G}. \] (3)

If the home wage is higher than \( w^* \), the home firm chooses FDI. If the home wage is lower than \( w^* \), the home firm chooses the home production. It is easily shown that the effects of \( w_f \) and \( G \) on \( w^* \) are positive while the effect of \( a \) is negative. An increase in either \( w_f \) or \( G \) makes FDI more costly and thus allows higher \( w \) for the home production. On the other hand, an increase in \( a \), demand parameter, increases the profits with FDI more than those with home production.

The following proposition summarizes the results.

**Proposition 1** About the plant location of the home firm, a threshold of the home wage \( w^* \) exists. If the home wage is higher than \( w^* \), the home firm chooses FDI. If the home wage is lower than \( w^* \), the home firm chooses the home production.
the effects of the foreign wage and the FDI fixed cost on the threshold are positive
while the effect of the demand parameter is negative.

3.2 Consumer’s decision and Equilibrium

The consumer determines the level of the home wage, taking $w^*$ derived in the last
subsection into account. Substituting the equilibrium output in the utility function
(1) and also erasing $Z$ yields the consumer’s utility with the home production.

$$U_{NF} = \frac{1}{2}X_{NF}^2 + (w - 1)X_{NF} + L$$

$$= \frac{1}{8}(a - w)^2 + \frac{1}{2}(w - 1)(a - w) + L. \quad (4)$$

In the right hand side of the first line, the first term is a consumer surplus. The
sum of the second and the third terms is the labor income.

The effect of the home wage on the utility is

$$\frac{\partial U_{NF}}{\partial w} = -\frac{1}{4}(-3w + a + 2). \quad (5)$$

Thus, the effect is greater (less) than zero if $w$ is lower (higher) than $\frac{a + 2}{3}$, which
is the optimal level of $w$ for the consumer. Assume $a > 1$ so that $\frac{a + 2}{3} > 1 = w_z$, 
which is the wage paid in the numeraire sector.

The consumer’s utility with FDI is

$$U_F = \frac{1}{2}X_F^2 + L. \quad (6)$$

By comparing $U_F$ and $U_{NF}$ with $w$ chosen optimally, the best plant location for the
consumer is determined. The difference in the utility with the home production
and with FDI is

\[ U_{NF} - U_F = \frac{1}{2}(X_{NF}^2 - X_F^2) + (w - 1)X_{NF}. \] (7)

The first term is the difference in the consumer surplus, which is negative because of the larger production with FDI. The second term is the extra labor income with the home production, which is positive. Whether the utility with the home production is higher than that with FDI depends on whether the hollowing-out effect dominates the consumer-surplus effect. The following two cases are examined.

3.2.1 Optimal Wage is Lower than Profit Threshold: \( w^* > \frac{a+2}{3} \)

In this case, the wage level maximizing the utility with home production is lower than the profit threshold for the home firm. That is, even if the consumer sets the level of the home wage at \( \frac{a+2}{3} \), the home firm chooses the home production.

However, whether the utility is higher with the home production than with FDI is another problem. From equation (4), the utility with home production at \( w = \frac{a+2}{3} \) is

\[ U_{NF} \left( w = \frac{a + 2}{3} \right) = \frac{3}{2} \left( \frac{a - 1}{3} \right)^2 + L. \]

By equating \( U_{NF} \left( w = \frac{a+2}{3} \right) \) with \( U_F \), the following threshold of \( w_f \) is derived.

\[ w_f^*(Case 1) = a \left( 1 - \frac{2\sqrt{3}}{3} \right) + \frac{2\sqrt{3}}{3}. \] (8)

This threshold is positive when \( a \) is relatively small and may be negative. If \( w_f \) is lower than this threshold, the consumer prefers FDI, even with no employment by
the home firm. In this case, the positive effect of the consumer surplus dominates the negative effect of the hollowing out. If $w_f$ is higher than this threshold, the consumer prefers the home production. If only the hollowing-out effect is considered, FDI seems to be bad for the consumer. However, a lower $w_f$ implies a larger consumer surplus with FDI. Therefore the consumer compares the effect of the hollowing out with that of the consumer surplus, as equation (7) describes.

The following proposition summarizes the results.

**Proposition 2** Suppose $w^* > \frac{a+2}{3}$. Then, a threshold of the foreign wage for the consumer, $w^*_f$(Case 1), exists. If the foreign wage is lower than the threshold, the consumer prefers FDI, and thus sets the home wage at a level higher than $w^*$ to induce FDI. If the foreign wage is higher than the threshold, on the other hand, the consumer prefers the home production and $\frac{a+2}{3}$ is the equilibrium home wage.

### 3.2.2 Optimal Wage is Higher than Profit Threshold: $w^* < \frac{a+2}{3}$

In this case, if the consumer sets the home wage at $\frac{a+2}{3}$, the home firm chooses FDI. The maximum level of the home wage that the consumer may set to induce the home production is $w^* = a - \sqrt{(a - w_f)^2 - 4G}$. From equation (5), the home consumer attains the highest utility with $w = w^*$ in case of the home production. Substituting $w^*$ into equation (4) yields

$$U_{NF}(w = w^*) = -\frac{3}{8}((a - w_f)^2 - 4G) + \frac{1}{2}(a - 1)\sqrt{(a - w_f)^2 - 4G} + L.$$
Note that in the second case the utility depends on the foreign wage $w_f$ because it depends on $w^*$, the profit threshold of the home wage for the home firm. The effect of the foreign wage on the utility is

$$
\frac{\partial U_{NF}(w = w^*)}{\partial w_f} = (a - w_f) \left\{ \frac{3}{4} - \frac{a - 1}{2\sqrt{(a - w_f)^2 - 4G}} \right\}. 
$$

(9)

It is easily shown that $\frac{3}{4} - \frac{a - 1}{2\sqrt{(a - w_f)^2 - 4G}} > 0$ if $w^* < \frac{a + 2}{3}$. Thus, the effect is positive. When the foreign wage increases, the profit threshold of the home wage for the home firm also increases. This implies that the consumer may set a higher level of the home wage, and that from equation (5), it increases the utility.

By the same way as in the first case, a threshold of the foreign wage for the utility is derived.

$$
w_f^*(\text{Case 2}) = a - \sqrt{\frac{6G + (a - 1)^2 + \sqrt{(a - 1)^4 - 4(a - 1)^2G}}{2}}.
$$

(10)

If $w_f$ is lower than this threshold, the consumer prefers FDI, as well as in the first case. In this case, the consumer may induce FDI by setting $w$ higher than $w^*$. If $w_f$ is higher than this threshold, the consumer prefers the home production, and sets the home wage at $w^*$.

The following proposition summarizes the results.

**Proposition 3** Suppose $w^* < \frac{a + 2}{3}$. Then, a threshold of the foreign wage for the consumer, $w_f^*(\text{Case 2})$, exists. If the foreign wage is lower than the threshold, the consumer prefers FDI, and thus sets the home wage at a level higher than $w^*$ to induce FDI. If the foreign wage is higher than the threshold, on the other hand,
the consumer prefers the home production and \( w^* = a - \sqrt{(a - w_f)^2 - 4G} \) is the equilibrium home wage.

4 Welfare Analysis

In the last section, the consumer’s utility and the home firm’s profits are evaluated separately. However, it is natural for the home government to attempt to maximize the (weighted) sum of the utility and the profits as a measure of the welfare, i.e.

\[
W_i = U_i + \pi_i. \quad i = NF, F.
\]

The welfare with home production or with FDI are as follows.

\[
W_{NF} = \frac{3}{2} X_{NF}^2 + \{(w - 1)X_{NF} + L\}. \tag{11}
\]

\[
W_F = \left( \frac{3}{2} X_F^2 - G \right) + L. \tag{12}
\]

In the right hand side of the each welfare measure, the first term is the sum of the consumer and the producer surpluses, and the second term is the labor income for the consumer.

From the first order condition, \( W_{NF} \) is maximized when \( w = 2 - a \). Because \( a > 1, \ 2 - a < 1 \). Since \( w \geq 1 \) is assumed, \( w = 2 - a \) is not possible. Because \( \frac{\partial W_{NF}}{\partial w} = -a - w + 2 < 0 \), \( W_{NF} \) is maximized at \( w = 1 \), and is equal to \( \frac{3}{2} \left( \frac{a-1}{2} \right)^2 + L \).

The difference in the welfare with the home production and with FDI is

\[
W_{NF} - W_F = \left\{ \frac{3}{2} (X_{NF}^2 - X_F^2) + G \right\} + (w - 1)X_{NF}. \tag{13}
\]
The first term is the difference in the sum of the consumer and the producer surpluses, which may be positive or negative. The second term is the extra labor income with the home production, which is positive. Therefore, whether the welfare with the home production is higher than that with FDI depends on whether the second term, the hollowing-out effect, dominates the first term. By equating \( W_{NF}(w = 1) \) with \( W_F = \frac{3}{2} \left( \frac{a-w_f}{2} \right)^2 - G + L \), the threshold of the foreign wage about the welfare is derived:

\[
w_f^{**}(\text{welfare}) = a - \sqrt{(a-1)^2 + \frac{8}{3}G}. \quad (14)
\]

If the foreign wage is higher than this threshold, the home government prefers the home production. If the foreign wage is lower than this threshold, the home government prefers FDI.

However, the home firm does not always follow the home government’s will, because its objective function is its profits, not the welfare. By the same way as the welfare threshold, the profit threshold of the foreign wage when \( w = 1 \) is derived:

\[
w_f^{**}(\text{profit}) = a - \sqrt{(a-1)^2 + 4G}. \quad (15)
\]

It is obvious that \( w_f^{**}(\text{profit}) < w_f^{**}(\text{welfare}) \). If the foreign wage is higher or lower than the two thresholds, the home government and the home firm have the same preference. For the former, both prefers the home production, and for the latter, both prefers FDI. However, what if \( w_f^{**}(\text{profit}) < w_f < w_f^{**}(\text{welfare}) \) ? In
this case, the home government prefers FDI while the home firm prefers the home production. One possibility for the home government to improve this situation is to induce FDI by the home firm through policies reducing the FDI fixed cost $G$ such as a negotiation with the foreign government for FDI liberalization.

This seems odd from the reality. Does the home government facilitate FDI resulting in the hollowing out? First of all, in this case, the hollowing out problem does not exist because $w = 1$. Second, in the measure of the welfare, the weight on the consumer surplus is the same as that on the producer surplus. If the weight on the producer surplus increases and if the weight on the consumer surplus decreases, according to political importance of the home firm, the result might change. Also, $w_f^{**}(profit) < w_f^{**}(welfare)$ always holds. If $w_f^{**}(welfare) < w_f < w_f^{**}(profit)$, the home government wants the home firm to stay in the home country. However, such a case never occurs.

The following proposition summarizes the results.

**Proposition 4** Suppose that the home government attempts to maximize the sum of the consumer and the producer surpluses. In case of the home production, the optimal home wage is one, equal to the wage in the numeraire sector. About the foreign wage, there are two thresholds with $w = 1$. One is for the welfare and the other is for the profits, and the former is greater than the latter. When the foreign wage is between the two thresholds, the home government may improve welfare by lowering the FDI fixed cost.
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. This paper shows that for the home firm, a home-wage threshold exists. Next the consumer’s decision with the profit threshold and the equilibrium are discussed. Two cases arise. For the each case, a foreign-wage threshold for the consumer and the equilibrium home wage are derived. A welfare analysis shows that the foreign-wage threshold for the welfare is higher than that for the profits. This result implies a possibility for the home government to improve the welfare.

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 interaction with 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 and coordination between the two governments are possible future research agenda.
References


