

Footloose multinational and the effects of domestic cost efficiency

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Abstract: We show that cost efficiency in the domestic industry may reduce domestic welfare if it changes foreign firm's production strategy from foreign investment to export. We find that domestic cost efficiency is welfare reducing only if the domestic market size is sufficiently small and the domestic firm's cost of production is higher compared to the foreign firm's cost of production under foreign investment.

Key Words: Domestic welfare, Domestic innovation, Export, FDI

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Footloose multinational and the impact of cost efficiency in the domestic industry

1 Introduction

This paper shows the effects of cost efficiency in domestic industry under foreign competition. We show that domestic cost efficiency may be detrimental for the domestic economy when it changes the foreign firm's production strategy from foreign direct investment (FDI) to export. Domestic cost efficiency is welfare reducing only if the domestic market size is sufficiently small and the cost of production of the domestic firm is higher compared to the foreign firm's cost of production under FDI.

Empirical evidences show that multinationals account for a significant portion of international trade. For example, using the data from 1999, Caves et al. (2002) has demonstrated that over 60% of multinational trade can be traced to a small set of developed countries and that 70% of their FDI is hosted by industrial countries. However, multinationals often face the important choice of export vs. FDI, which has generated enormous amount of empirical and theoretical literature.¹ So, in this era of globalization, we believe that when looking at the impact of cost efficiency in the domestic industry, it is important to consider how it affects the interest of the foreign firms and their production decisions.

We show that if the foreign firms are footloose, cost efficiency in the domestic industry reduces the foreign firm's incentive for FDI and encourages it to do export. So, even if there is efficiency gain in the domestic industry, foreign firms may prefer to choose a production strategy, which reduces their cost efficiency. The latter effect

may dominate the former if the cost reduction in the domestic market changes the foreign firm's production strategy from FDI to export and the domestic cost reduction is not very large. We also show that domestic cost reduction reduces domestic welfare only if the domestic market is sufficiently small and the foreign firm's cost of production under FDI is lower compared to the cost of production of the domestic firm.

Though previous works on international trade have shown that cost efficiency in the foreign firm may reduce domestic welfare (see, e.g., Brander, 1981, Markusen, 1981, Cordella, 1993 and Collie, 1996), it follows from those analyses that domestic cost efficiency always increases domestic welfare. This paper contradicts this view and shows that if domestic cost efficiency makes the foreign firms relatively cost inefficient by affecting their production strategy then domestic cost efficiency may reduce domestic welfare. Hence, we show that there is rationale for discouraging certain amount of domestic innovation when it shifts the foreign firm's mode of operation from FDI to exports.²

Our results can also be related to the literature on knowledge spillover and patent protection.³ It is well documented in the literature that knowledge spillover from foreign technology benefits the domestic firms since it reduces the cost of production of the domestic firms. We show that knowledge spillover may induce the foreign firm to do export and domestic welfare may fall. So, if the amount of knowledge spillover is not sufficiently large and the foreign firms are footloose, it

¹ For recent surveys on foreign direct investment, one may refer to Pack and Saggi (1997) and Saggi (2002).

² It is shown in the literature that when innovation is costly, higher amount of innovation may reduce social welfare (see, e.g., Tandon 1984). Note that our argument does not depend on the cost of domestic innovation but depends on the effect of domestic cost efficiency on the production decision of the foreign firm.

³ Mazzoleni and Nelson (1998) give an overview on the benefits and costs of patent protection.

may be better for the domestic country to adopt a patent policy that protects the technological knowledge of the foreign firms and prevents technology spillover.

Remainder of the paper is organized as follows. Section 2 provides the basic model and shows the impact of domestic cost efficiency on foreign firm's production strategy and domestic welfare. Section 3 shows the importance of domestic market size and the relationship between domestic and foreign costs of production. Section 4 concludes.

2 The model and results

Assume that there is a firm, called firm 1, who wants to enter a country, called domestic country. Firm 1 has two options: (i) either it exports its product to the domestic country or (ii) it serves the domestic country through FDI. Assume that in case of export, firm 1 incurs a constant marginal cost of production c_x but in case of FDI, its constant marginal cost of production is $c_f < c_x$. Further, assume that firm 1 needs to incur a fixed cost F , if it decides to do FDI. We assume away any other costs associated with either export or FDI.

Assume that there is a domestic firm, called firm 2, with a constant marginal cost of production c and competes with firm 1. We will examine all possible situations, i.e., where c can be either less than c_f or greater than c_x or lies between c_f and c_x . We assume that these firms produce homogeneous products and compete like Cournot duopolists in the domestic country

Inverse market demand function in the domestic country is

$$P = a - q, \tag{1}$$

where the notations have usual meanings.

2.1 Choice of FDI and exports

If firm 1 does FDI, it maximizes $(a - q_1 - q_2 - c_f)q_1 - F$, where q_1 and q_2 are the outputs of firm 1 and firm 2 respectively. It is easy to check that the net profit of firm 1 under FDI is

$$\pi_f^{FDI} = \frac{(a - 2c_f + c)^2}{9} - F. \quad (2)$$

If firm 1 does export, it maximizes $(a - q_1 - q_2 - c_x)q_1$ and its net profit is

$$\pi_f^{ex} = \frac{(a - 2c_x + c)^2}{9}. \quad (3)$$

We make the following assumptions for our analyses.

$$\mathbf{A1.} \quad \frac{(a - c_f)^2}{4} - F > \frac{(a - c_x)^2}{4}.$$

That is, firm 1's maximum profit (i.e., monopoly profit) under FDI is greater than its maximum profit under export. This assumption ensures that firm 1 must have incentive for FDI for high values of c . It also ensures that if firm 1 does FDI for a particular cost of firm 2, (i.e., for a given c), it should do FDI for any higher value of c .

$$\mathbf{A2.} \quad \frac{(a - 2c_f)^2}{9} - F < \frac{(a - 2c_x)^2}{9}.$$

Suppose firm 2's marginal cost of production is zero and it receives positive duopoly profit under both FDI and exports. Assumption 2 implies that if firm 2 is extremely efficient (having zero marginal cost), it is optimal for firm 1 to export rather than doing FDI. Without assumption A2, firm 1 always does FDI and never does export to the domestic country.

For simplicity, we restrict the parameter ranges such that firms 1 and 2 always produce positive outputs, i.e., we assume:

A3. $a - 2c_x + c > 0$, and $a - 2c + c_f > 0$.

This assumption helps us to simplify our analysis by ignoring the possibility of corner solution in output choice.

Given the assumptions A1 and A2 which describe two polar situations, it is easy to see that since the payoff functions are continuous with respect to c , there exists a critical value of $c = \bar{c}$ such that for $c \geq \bar{c}$, firm 1 does FDI and for $c < \bar{c}$, firm 1 does export. These payoff functions can be presented in the following diagram.

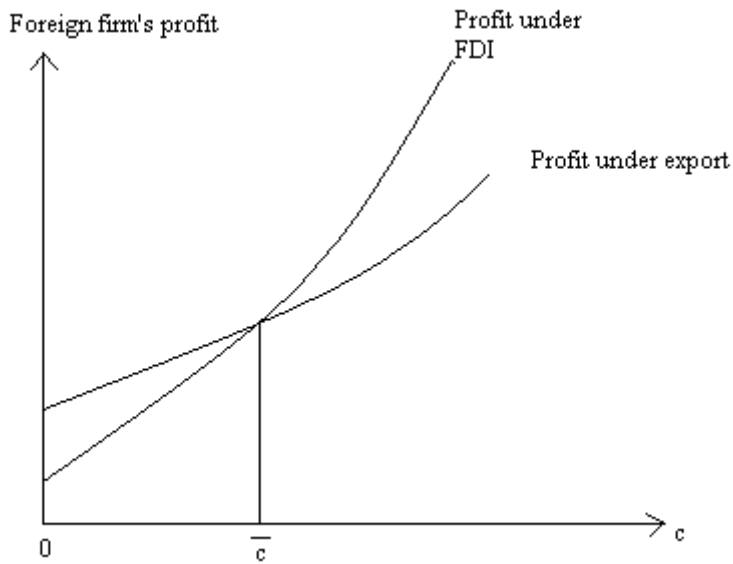


Figure 1: Relationship between firm 1's profit and c .

The value of \bar{c} can easily be calculated from (2) and (3) as

$$\bar{c} = \frac{9F}{4(c_x - c_f)} - a + c_f + c_x.$$

Firm 1 has the incentive to do FDI than export provided

$$c > \bar{c} = \frac{9F}{4(c_x - c_f)} - a + c_f + c_x$$

or

$$F < \frac{4(c_x - c_f)(a - c_f - c_x + c)}{9}. \quad (4)$$

Therefore, if condition (4) is satisfied, firm 1 does FDI but otherwise it exports to the domestic country.

We also find that c_f and c_x can have any relationship with \bar{c} , i.e.,

$$\bar{c} \begin{matrix} \geq \\ < \end{matrix} c_x \quad \text{and} \quad \bar{c} \begin{matrix} \geq \\ < \end{matrix} c_f. \quad (5)$$

2.2 Domestic welfare under FDI and export

Now, we consider welfare of the domestic country, which is summation of consumer surplus and profit of firm 2.

Note that if firm 1 does FDI then firm 2's profit is $\frac{(a - 2c + c_f)^2}{9}$ and if firm 1 does export then firm 2's profit is $\frac{(a - 2c + c_x)^2}{9}$. Thus, depending on the production strategy of firm 1 (i.e., export or FDI), firm 2's profit with respect to its cost can be portrayed as below.

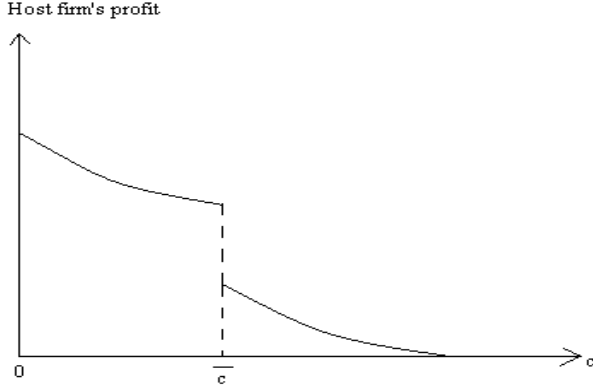


Figure 2: Relationship between firm 2's profit and c .

If firm 1 does FDI, profit of firm 2 and consumer surplus are respectively

$\frac{(a - 2c + c_f)^2}{9}$ and $\frac{(2a - c - c_f)^2}{18}$. Therefore, domestic welfare under FDI is

$$W^{FDI} = \frac{(a - 2c + c_f)^2}{9} + \frac{(2a - c - c_f)^2}{18}. \quad (6)$$

On the other hand, if firm 1 does export, profit of firm 2 and consumer surplus are

respectively $\frac{(a - 2c + c_x)^2}{9}$ and $\frac{(2a - c - c_x)^2}{18}$. So, domestic welfare under export is

$$W^{ex} = \frac{(a - 2c + c_x)^2}{9} + \frac{(2a - c - c_x)^2}{18}. \quad (7)$$

It is clear from (6) and (7) that if firm 1 always does either FDI or export, domestic welfare increases as the constant marginal cost of production of firm 2 (i.e., c), falls.⁴

This implies that if the cost efficiency in firm 2 does not affect the production decision of firm 1, domestic welfare always increases.

⁴ Note that, irrespective of FDI or export by firm 1, firm 2's profit always increases as its cost of production reduces, which may be due to R&D. Hence, if the cost of doing R&D is not very large, firm 2 has always the incentive for doing innovation.

Now, we consider domestic welfare when the cost efficiency in firm 2 affects the production decision of firm 1. From (6) and (7) and after rearranging we find that domestic welfare is higher under FDI provided

$$c > c^* = \frac{c_x + c_f}{2}, \quad (8)$$

where

$$c_f < c^* = \frac{c_x + c_f}{2} < c_x. \quad (9)$$

The welfare comparisons can be portrayed diagrammatically as follows:

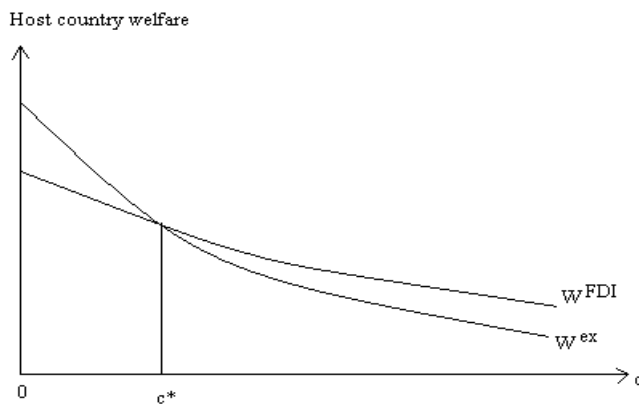


Figure 3: Relationship between domestic welfare and c .

Proposition 1 summarizes the above discussion about firm 1's production strategy and domestic welfare.

Proposition 1: (i) Firm 1 does FDI (export) provided $c \geq (<) \bar{c}$.

(ii) Domestic welfare is higher under FDI (export) provided $c \geq (<) c^*$.

The above proposition shows that there are two different critical values determining the optimal decision of firm 1 and higher domestic welfare. We also find that $\bar{c} > c^*$ if and only if

$$a \begin{cases} \leq \\ > \end{cases} \frac{(c_x + c_f)^3}{2} + \frac{9F}{4(c_x - c_f)}. \quad (10)$$

Straightforward calculation shows that both inequalities in (10) are possible depending on parameter values. So, domestic welfare depends on c as well as on c_f and c_x .

In the following analysis we consider two separate possibilities: (1) $\bar{c} < c^*$ and (2) $\bar{c} > c^*$.⁵

2.2.1 Case1: $\bar{c} < c^*$

First consider the situation where $\bar{c} < c^*$. Proposition 1 shows that firm 1 does FDI for all c above \bar{c} and it does export for all c below \bar{c} . Hence, corresponding domestic welfare can be achieved from figure 4 as given below. Given firm 1's behavior, domestic welfare is shown as the bold curve for different values of firm 2's marginal cost of production c . It is clear from Figure 4 that domestic welfare always increases as firm 2's cost of production reduces.

⁵ The other possibility of $\bar{c} = c^*$ is easy to understand from our analysis.

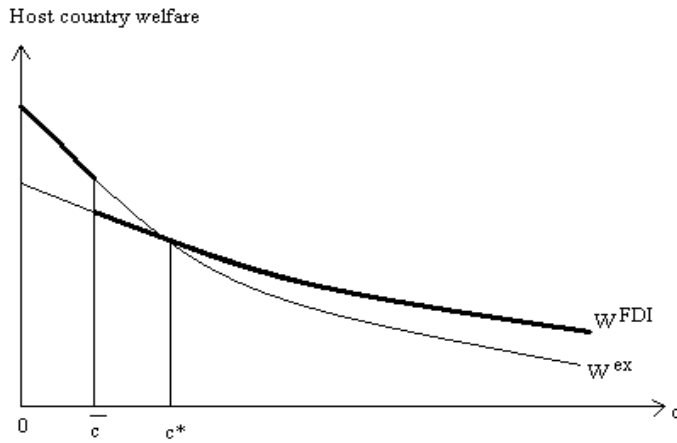


Figure 4: Domestic welfare (under FDI and export) when $\bar{c} < c^*$.

Thus:

Lemma 1. *Suppose $\bar{c} < c^*$. Domestic welfare always increases with lower cost of production of the domestic firm.*

2.2.2 Case 2: $\bar{c} > c^*$

Now consider the situation where $\bar{c} > c^*$. Depending on the production strategy of firm 1, domestic welfare would be the bold curve presented in the figure below.

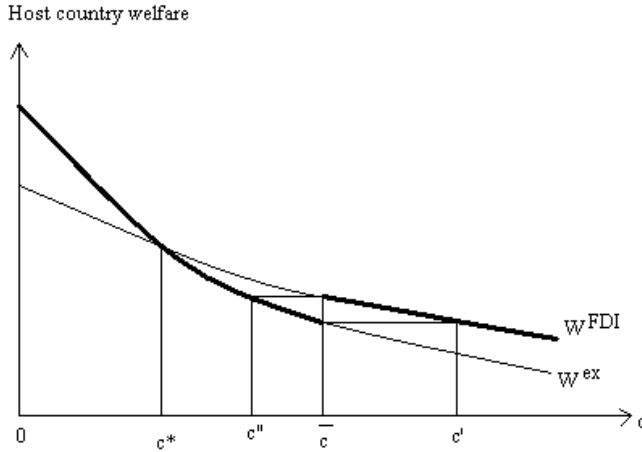


Figure 5: Domestic welfare (under FDI and export) when $\bar{c} > c^*$.

Figure 5 shows that welfare function has a jump at point \bar{c} due to firm 1's change in production strategy from export to FDI. We define a point c' such that domestic welfare is same 'under FDI at c' ' and 'under export at \bar{c} '.

Now, consider the effect of firm 2's cost reduction from c^0 to c^r . First, note that if c^0, c^r are on either side of the critical value \bar{c} , domestic welfare always increases as firm 2's cost reduces. In this situation, firm 1's mode of operation (either export or FDI) remains the same under c^0 to c^r .

But, if c^0 and c^r belong to two different sides of \bar{c} , the effect on welfare depends both on the initial cost of firm 2 and the size of cost reduction. If c^0 is greater than c' and c^r is less than \bar{c} , domestic welfare always increases with domestic cost efficiency. Now consider the possibility that $c^0 \in (\bar{c}, c')$. If c^r is sufficiently close to \bar{c} , *domestic welfare reduces with domestic cost efficiency*. On the other hand, if domestic firm becomes sufficiently cost efficient, i.e., c^r is less than c'' in Figure 4, domestic welfare increases with domestic cost efficiency.

So, there is a range of c^r for which domestic welfare reduces with domestic cost efficiency. For $c^0 \in (\bar{c}, c')$, define $\gamma(c^0) < \bar{c}$ such that domestic welfare is the same under export at $\gamma(c^0)$ and under FDI at c^0 . If $c^0 \in (\bar{c}, c')$ and firm 2's cost reduces to c^r such that $c^r \in (\gamma(c^0), \bar{c})$, domestic welfare reduces with domestic cost efficiency. But, domestic welfare increases with domestic cost efficiency if $c^r < \gamma(c^0)$.

Following lemma summarizes the above discussion.

Lemma 2: *Suppose the cost of production of firm 2 reduces from c^0 to c^r .*

(a) If firm 1 does either FDI or export under both c^0 and c^r , domestic welfare increases with lower domestic cost.

(b) If firm 1 does FDI when $c = c^0$ but export when $c = c^r$, i.e., $c^0 > \bar{c} > c^r$, then following scenario would emerge:

(i) If $c^0 \in (\bar{c}, c')$, domestic welfare reduces with lower domestic cost if and only if $c^r \in (\gamma(c^0), \bar{c})$.

(ii) Domestic welfare increases for all other possible combinations of c^0 and c^r .

The above result shows an interesting phenomenon that if the cost reduction of the domestic firm (or domestic innovation) affects plant location choice of the foreign firm, it may reduce domestic welfare. This is in sharp contrast to the conventional wisdom suggesting domestic welfare increases with lower cost of production of the domestic firm.

The reason for our result stems from the fact that there is a change in foreign firm's production strategy from FDI to export due to domestic cost efficiency. Note

that firm 1's marginal cost of production under export is higher than its marginal cost of production under FDI. Given the expression of consumer surplus under FDI and export, it is clear that if $c^0 + c_f < c^r + c_x$, cost reduction in the domestic firm reduces consumer surplus. However, domestic profit increases due to its own cost efficiency and also for foreign firm's cost inefficiency. If the domestic cost reduction is not very large (Lemma 2(b(i))), the higher profit of the domestic firm is not sufficient to compensate the loss of consumer surplus. But, if the domestic cost reduction is sufficiently large, either the effect of higher domestic profit outweighs the loss of domestic consumer surplus (if $c^0 + c_f < c^r + c_x$) or the consumer surplus increases with domestic cost efficiency (i.e., $c^0 + c_f > c^r + c_x$).

3 Market size, domestic and foreign costs of production

We have so far shown the possibility of lower domestic welfare due to cost reduction in the domestic firm. Now, we will discuss the implications of market size⁶ and the domestic and foreign costs of production on our results.

3.1 Market size

The importance of market size is relatively easy to identify and can be seen from condition (10). It is clear from (10) that, given the cost of production of firm 1, if the market size, i.e., a , is sufficiently large so that the left hand side of (10) is greater than the right side of (10), then $\bar{c} < c^*$.⁷ So, it is evident from Lemma 1 that if the domestic market is sufficiently large, domestic cost reduction always increases

⁶ We use the intercept term of the demand function as a proxy for market size.

⁷ Note that the expression (10) is independent of c .

domestic welfare. So, domestic cost reduction can reduce domestic welfare *only if* the domestic market size is small. Ceteris paribus, as the size of the domestic market increases, it increases the likelihood of higher domestic welfare due to domestic cost reduction.

Thus:

Proposition 2: *Given the foreign costs of production under export and or FDI, domestic welfare reduces with domestic cost efficiency only if the domestic market is not sufficiently large and the cost reduction in the domestic firm is moderate.*

This result implies that an economy with sufficiently small domestic market may have the incentive to discourage domestic innovation.

3.2 Domestic and foreign costs of production

Next we will see the relationship between c , c_x and c_f that is necessary to reduce domestic welfare with domestic cost efficiency, for a given market size.

3.2.1 Case (i): $c < c_f < c_x$

Let us first consider the situation where firm 2 (domestic firm) is more efficient irrespective of the mode of production of firm 1, i.e., $c < c_f < c_x$. This may happen when firm 1 is a new entrant in the market and needs to incur switching cost (see, Klemperer, 1988). Alternatively, if there is a network cost involved in serving the foreign market, as in Greaney (2003), firm 1 may be cost inefficient compared to the domestic firm even under FDI.

Proposition 3: *For a given value of a , domestic cost reduction always increases domestic welfare if $c < c_f < c_x$.*

Proof: Note that when $c < c_f < c_x$, we have the situation where $c < c^*$, for a given value of a . So, it is clear from by Lemmas 1 and 2 that cost reduction in the domestic firm always reduce domestic welfare irrespective of whether $\bar{c} \begin{matrix} > \\ < \end{matrix} c^*$. Q.E.D.

The above result suggests that when the domestic firm is more cost efficient compared to the foreign firm irrespective of foreign mode of production, domestic cost reduction always increases domestic welfare *even if it changes the production strategy of the foreign firm.*

3.2.2 Case (ii): $c_f < c$

Now, consider that firm 2's initial cost is greater than firm 1's cost under FDI. So, there may be two situations (i) $c_f < c < c_x$, (ii) $c_f < c_x < c$. That is firm 1's cost under export may be greater or less than firm 2's initial cost. Thus, We consider the situation where switching cost or network cost of firm 1 is not sufficiently large but due to its superior production technology, its cost of production under FDI is lower compared to the cost of firm 2. However, if firm 1 does export, transportation cost along with network cost and switching cost may make firm 2 either more or less cost efficient compared to firm 1.

Proposition 4: *Suppose, $c_f < c$. Domestic welfare falls with domestic cost efficiency only if ' $\bar{c} > c^*$ and the Lemma 2(b(i)) holds'.*

Proof: We have shown in section 2 that domestic cost reduction reduces domestic welfare only if $\bar{c} > c^*$ and the cost reduction satisfies the condition of Lemma 2(b(i)). These two conditions can be satisfied simultaneously when $c_f < c$. Q.E.D.

The above result shows that domestic cost reduction can reduce domestic welfare when the foreign firm is more cost efficient compared to domestic firm, at least under FDI. While considering trade between developed and developing countries, the common wisdom suggests that foreign firms are generally more cost efficient compared to the domestic firms. Hence, our results suggest that there are situations where the developing countries may have the incentive to discourage domestic cost reduction when they are opening up their economies to attract foreign firms.

4 Conclusion

We show that domestic cost efficiency may reduce domestic welfare in the presence of foreign competition. In case of international oligopoly where the foreign firm may decide over FDI and export, domestic cost efficiency may induce the foreign firm to shift its production from FDI to export. So, while cost reduction in the domestic firm increases domestic production efficiency, it may make the foreign firm relatively cost inefficient. The latter effect may dominate the former only if the domestic market is sufficiently small, the foreign cost of production under FDI is lower than the domestic

cost of production and the domestic cost reduction is not very large. However, if the domestic cost reduction is either very large or it is very small such that it does not affect the mode of operation of the foreign firm then domestic cost reduction always increases domestic welfare. So, domestic cost reduction may reduce welfare when the cost reduction is moderate.

Thus, we show that often an economy may be better off by preventing moderate innovations since it may induce the foreign firm to take a relatively cost inefficient production strategy. So, one policy prescription may be to create disincentive for these types of innovations. Alternatively, domestic economy should provide higher incentive for FDI.

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