FDI as a signal of quality*

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Abstract: This paper considers a new-product firm’s choice between exporting and foreign direct investment (FDI) to access foreign markets. We find that, when quality is unknown to buyers, the firm may choose FDI over exporting to signal quality, even though FDI is a costlier mode of access than exporting. We then use the model to study the effect of local labor requirement policy imposed by the host country government.

JEL Classification: F12, F13

Keywords: Foreign direct investment (FDI), unknown quality, introductory prices, local labor employment

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* We thank Yuka Ohno for helpful comments and suggestions.
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1. Introduction

The success of a new-product firm depends crucially on how quickly and effectively it can inform buyers of the product’s quality. In the seminal work Mayer (1984) studied the nature of optimal export subsidization policy over time when foreign buyers gradually learn the quality of the country’s exports. Bagwell and Staiger (1989) and Bagwell (1991) applied game theory to demonstrate the welfare-enhancing role export subsidization plays in the presence of informational barriers to enter foreign markets.\footnote{In Bagwell and Staiger (1989) quality is exogenous while in Bagwell (1991) it is chosen by the firm. Also see Miyagiwa (2006).} Although these authors have focused exclusively on exporting, firms have other options to access foreign markets, such as foreign direct investment (FDI), licensing agreements and joint ventures. The present paper’s objective is to examine the firm choice between FDI and exporting when quality is unknown.\footnote{In Bagwell and Staiger (1989) quality is exogenous while in Bagwell (1991) it is chosen by the firm. Also see Miyagiwa (2006).}

Our model draws upon the work of Bagwell and Staiger (1989) and Bagwell (1991). Like them we suppose that a firm sells a new product to foreign markets over two periods. Buyers are initially uninformed of the product’s quality, and use the first-period price to form beliefs as to the product’s quality. In the second period buyers know the quality from experience or from reading consumer reports.

It is in such an environment that we consider the firm’s choice between exporting and FDI. We assume that FDI requires a fixed setup cost but does not reduce production cost. Thus, the firm never chooses FDI over exporting when quality is known. We find,
however, that when quality is unknown the firm may prefer FDI to exporting. More formally, we show that the model possesses a unique separating equilibrium outcome, which survives a refinement based on the intuitive criterion, and in which the firm producing a product of high quality earns a greater profit with FDI than with exporting. We also find that there is no pooling equilibrium with positive sales.

Host country governments often grant permission to foreign firms to locate in their territories on condition that firms employ a certain number of local workers. As an application of the model we look at the effect of such an employment requirement. We find that the requirement gives rise to a pooling equilibrium outcome in which the firm engages in FDI. Thus, the policy, while lowering the price and increasing local labor use by the firm, also allows the product of low quality to be produced locally. If buyers believe that the product is more likely to be of low quality, the firm switches from FDI to exporting, which may or may not raise host country welfare, depending on the type of export technology to be discussed below.

The remainder of the paper is organized in four sections. In the next section we give a more detailed description of the model. Section 3 is the main section, in which we present the sequential equilibrium of the model and demonstrate that FDI can serve as a signal of quality. Section 4 we examines the impact of employment policy. Section 5 concludes the paper.

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There is a large and expanding body of literature examining the choice between exporting and FDI. See Saggi (2000) for a survey of early works. Recent contributions include Helpman, Melitz and Yeaple (2004) and Creane and Miyagiwa (2006).
2. The model setup

A firm invents a new product and sells it to buyers in another country. Product development is stochastic in that product quality is random. For simplicity it is assumed that a new product is of high quality (H) with probability $\lambda \in (0, 1)$ and of low quality (L) with complementary probability $1 - \lambda$. The firm can produce a product of quality $q$ with constant marginal cost $c(q)$, with $c(H) > c(L)$.

The product has a two-phase life. At the beginning of the first or introductory phase consumers do not know its quality but believe that it is of high quality with (prior) probability $\mu_0 \in (0, 1)$. Rational expectations imply that $\mu_0 = \lambda$. Consumers observe the first-period price as well as the country of origin and form posterior beliefs $\mu \in [0, 1]$ as to the probability that quality is high before deciding whether to buy the product or not. In the second or mature phase, all consumers know the product’s quality from experience or from reading consumer reports and buy the product only if it is of high quality.

We now present assumptions concerning demand for the product. Let $D(p, \mu)$ denote the demand function when consumers believe that with probability $\mu$ the product is of high quality. Assume that there is a choke price, $\bar{p}(\mu)$, defined by the equation $D(p, \mu) = 0$ and that it is increasing in $\mu$. $D(p, \mu)$ is continuously differentiable at $p \in (0, \bar{p}(\mu))$. Assume further that $D(p, 0) \equiv 0$, meaning that consumers do not knowingly buy a product of low quality.

\[^{3}\text{Other performance standards such as local content or export share requirements are also common: see}\]
Denote by $\pi(p, q, \mu)$ a gross profit to the firm producing a product of quality $q$ and enjoying consumer beliefs $\mu$:

$$\pi(p, q, \mu) \equiv D(p, \mu)[p - c(q)].$$

Assume that $\pi(p, q, \mu)$ is strictly concave in $p$ so that there is a unique price that maximizes $\pi(p, q, \mu)$. In particular, let $p^* \equiv \arg\max_p \pi(p, H, 1)$; i.e., $p^*$ is the profit-maximizing price for a high-quality type when quality is known. Then define $\pi^*$ by

$$\pi^* \equiv \pi(p^*, H, 1)$$

The firm can access foreign buyers either through exporting or through FDI; i.e., locating production directly in the consuming country. For simplicity assume that the firm’s marginal cost $c(q)$ is unaffected by the firm’s access mode choice.\(^4\)

FDI differs from exporting because it requires a fixed setup cost $k > 0$ that is to be incurred at the beginning of the first phase of production. Note that the setup cost is quality-type independent so that FDI alone cannot signal quality.\(^5\) Exporting does not require any setup cost, but we consider two cases, depending on the presence of fixed sales costs $f$. Such costs may include the cost of arranging for shipping and insurance services and the cost of maintaining sales agents aboard. The first case we consider assumes the absence of such fixed cost however. Then, since FDI imposes a setup cost

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\(^4\) The standard literature assumes that FDI reduces marginal cost, which makes FDI more preferable.

without reducing marginal cost, the firm never chooses FDI over exporting if consumers know a product’s quality. When quality is unknown however we show that there is a unique separating equilibrium outcome that survives a refinement based on the intuitive criterion, and in it the firm chooses FDI over exporting.

In the second case, we assume that exporting requires fixed sales cost $f > 0$ per period. If $k > (1 + \delta)f$, where $\delta > 0$ is the discount factor, then total fixed cost is greater with FDI than with exporting, so again the firm does not opt for FDI when consumers know quality. In this case, too, however, we find that the firm may choose FDI over exporting when quality is unknown.

3. Analysis

We assume that at the beginning of the first period consumers do not know a new product’s quality but believe that with prior probability $\lambda \in (0, 1)$ quality is high. The play of the game is as follows. The firm decides whether to export or engage in FDI, and also chooses the introductory-phase price. Consumers observe the price as well as the firm’s location choice, form posterior beliefs $\mu \in [0, 1]$ as to the probability that quality is high, and make purchasing decisions. In the second or mature phase consumers know quality from experiences or from reading consumer reports and purchase the product only if it is of high quality. As a solution concept we look for sequential equilibrium that satisfies a refinement based on the Cho-Kreps intuitive criterion.
We begin by examining a separating equilibrium, which occurs when the firm posts two distinct first-period prices reflecting quality-types so that the introductory price reveals quality. Since no consumers knowingly purchase a product of low quality, a firm has no sale if producing a low-quality product.

3 A. Exporting with no fixed cost

Separating equilibrium requires that during the introductory phase the low-quality type has no incentive to mimic the price of a high-quality type, denoted by \( p(H) \). This condition is stated as

\[
D[p(H), 1][p(H) - c(L)] \leq 0. \tag{1}
\]

In equilibrium the high-quality type must also be willing to quote such a price; that is, \( p(H) \) must satisfy:

\[
D[p(H), 1][p(H) - c(H)] + \delta \pi^* \geq 0. \tag{2}
\]

Thus the following is the characterization of a separating equilibrium: the high-quality type posts \( p(H) \) satisfying (1) and (2) while the low-quality type chooses another price, say, \( p(L) = p^* \). This equilibrium outcome is supported by the following belief function: on the equilibrium path beliefs are \( \mu = 1 \) if \( p = p(H) \) and \( \mu = 0 \) if \( p = p^* \) and off the equilibrium paths beliefs are \( \mu = 0 \) (for all \( p \) not equal to \( p(H) \) or \( p^* \)).

\[^6\] The equilibrium price for the low-cost type can be any price other than \( p(H) \) as it has no sale. We just chose \( p^* \).
We illustrate a separating equilibrium outcome in Figure 1. The bottom curve corresponds to $\pi(p, H, 1)$, the profit to the high-quality type when quality is known. Adding the second-period profit $\delta \pi^*$ to it, we arrive at the top curve, representing $\pi(p, H, 1) + \delta \pi^*$, the profit to the high-quality type when it succeeds in separating from the low-quality type. In contrast, the middle curve depicts $\pi(p, L, 1)$, the profit the low-quality type earns when it succeeds in fooling buyers into believing that it is of high-quality. Condition (1) is satisfied only if $p(H) \leq c(L)$. There is a price $p(H)$ satisfying both (1) and (2), if the top curve cuts the horizontal axis to the left of $c(L)$ as drawn in the figure. The sufficient condition for that is

$$D[c(L), 1][c(L) - c(H)] + \delta \pi^* \geq 0$$

(3)

Since $p(H)$ satisfying (1) and (2) is not in general unique, there is a continuum of separating equilibria. However, an appeal to the intuitive criterion prunes all candidate prices with the exception of the highest price satisfying the condition (1), that is, $p(H) = c(L)$. The argument to prune $p(H) < c(L)$ is as follows. The low-quality type has no incentive to choose $p \in (p(H), c(L))$ even if $\mu = 1$ but the high-quality type does. Therefore, when $p \in (p(H), c(L))$ is observed buyers should put all probability weights to the high-quality type. With this refinement of the out-of-equilibrium beliefs the high-quality type indeed deviates to $p \in (p(H), c(L))$, thereby disturbing the candidate equilibrium at $p(H)$. This argument does not apply when $p(H) = c(L)$, however, and hence it alone survives a refinement based on the intuitive criterion.
Since \( c(H) > c(L) \), condition (1) implies that the first term on the left-hand side of (2) is negative. That is, a separating equilibrium implies dumping or sales below marginal cost during the first period.\(^7\) Because of the positive profit it earns during the mature period, the high-quality type is willing to sell below cost during the introductory phase, which the low-quality type cannot afford to imitate. Thus, a separating equilibrium exists only if the mature-phase profit is more than enough to cover the loss suffered during the introductory-phase loss, which is what the condition (2) says.\(^8\)

Now allow FDI. As stated earlier, FDI requires a fixed setup cost \( k > 0 \), regardless of quality. This implies that FDI alone cannot signal quality. That may be the case if consumers can tell whether or not there is FDI but cannot observe the actual size or cost of FDI from which to infer the product’s quality. In a separating equilibrium with FDI, the low-quality type has no incentive to masquerade as the high-quality type if

\[
D[p(H), 1][p(H) – c(L)] \leq k, \tag{4}
\]

while the high-quality type has an incentive to engage in FDI only if

\[
D[p(H), 1][p(H) – c(H)] + \delta \pi^* \geq k. \tag{5}
\]

Let \( \tilde{p}_1 \) denote the upper zero (root) of the equation:

\[
D(p, 1)[p – c(L)] – k = 0 \tag{6}
\]

\(^7\) Miyagiwa and Ohno (2006) examine another instance in which dumping serves as a signal.
\(^8\) When the mature-phase profit is insufficient or \( c(L) \) is so low compared with \( c(H) \), there is no price satisfying both (1) and (2), the situation that arises when the top curve cuts the horizontal axis to the left of
derived from (4). Then the following is a separating equilibrium outcome: the high-quality type chooses \( p(H) = \tilde{p}_1 \), the low-quality type chooses \( p(L) = p^* \). It is supported by the belief system: \( \mu = 1 \) only if \( \tilde{p}_1 \) is observed and zero if any other price is observed. It is readily checked that this is the unique separating equilibrium outcome that survives a refinement based on the intuitive criterion.

This separating equilibrium outcome with FDI is illustrated in Figure 1. As shown there we have \( \tilde{p}_1 > p^* \); that is, with FDI the firm distorts the first-phase price upward to signal quality, while with exporting the price is distorted downward.

**Proposition 1**: Suppose that \( f = 0 \) and that (3) holds. Then, the model possesses a separating equilibrium outcome with exporting or with FDI that satisfies the intuitive criterion. In it, the firm signals quality by setting an introductory-phase price equal to \( c(L) (< p^*) \) with exporting and equal to \( \tilde{p}_1 (> p^*) \) with FDI. When both exporting and FDI are available modes of access, the firm chooses FDI over exporting.

The first two results have been demonstrated. The last claim of the proposition is obvious from Figure 1. Formally to show this, take the difference in profit between exporting and FDI:

\[
D(c(L), 1)(c(L) - c(H)) - D(\tilde{p}_1, 1)(\tilde{p}_1 - c(H)) + k.
\]

\( c(L) \). In this case there is no separating equilibrium. There is a pooling equilibrium outcome, in which the firm makes no sale (both types choosing the same price and the beliefs are \( \mu = 0 \) at all \( p \)).
Use (6) to rewrite the above as

\[ D(c(L), 1)[c(L) - c(H)] - D(\tilde{p}_i, 1)[\tilde{p}_i - c(H)] + D(\tilde{p}_i, 1)[\tilde{p}_i - c(L)] \]

\[ = [D(\tilde{p}_i, 1) - D(c(L), 1)][c(H) - c(L)] < 0, \]

The inequality follows because the first term is negative due to the fact that \( \tilde{p}_i > c(L) \). Thus, the profit with FDI exceeds the profit with exporting so that the firm chooses FDI over exporting.

3. B. Exporting with fixed cost

We now turn to the case in which exporting requires fixed cost \( f > 0 \) per period. It is assumed that \( f < k \). There is a separating equilibrium if there is a price \( p(H) \) that satisfies the incentive-compatibility conditions

\[ D[p(H), 1][p(H) - c(L)] \leq f \] \hspace{1cm} (7)

for the low-quality type and

\[ D[p(H), 1][p(H) - c(H)] + \delta \pi^e \geq (1 + \delta)f \] \hspace{1cm} (8)

for the high-quality type. Let \( \tilde{p}_c \) denote the upper zero of the equation

\[ D(p, 1)[p - c(L)] - f = 0, \] \hspace{1cm} (9)
associated with (7).

The model possesses a unique separating equilibrium outcome with exporting that survives a refinement based on the intuitive criterion. In it, the high-quality type chooses \( \tilde{p}_e \) and the low-quality type chooses \( p^* \). This equilibrium outcome is supported by the belief system that puts \( \mu = 1 \) when \( \tilde{p}_e \) is observed and \( \mu = 0 \) otherwise.

We depict this equilibrium in Figure 2, which replicates Figure 1. There, any price equal to or higher than \( \tilde{p}_e \) discourages the low-quality type from masquerading as the high-quality type, and at the same time satisfies (8). Although there are other prices satisfying both conditions, \( \tilde{p}_e \) alone survives a refinement based on the intuitive criterion. Observe that since \( \tilde{p}_e > p^* \), the firm distorts the introductory price upward.\(^9\)

With FDI the equilibrium is the same as in the case of exporting without fixed cost: in a unique intuitive separating equilibrium outcome the high-quality type posts \( \tilde{p}_i > p^* \) and consumers assign \( \mu = 1 \) when observing \( \tilde{p}_i \) and \( \mu = 0 \) when observing any other price. This equilibrium outcome with FDI is repeated in Figure 2.

We now compare the profits accruing to the high-quality type with FDI and with exporting. Given \( k > f \), a comparison of (6) with (9) implies that \( \tilde{p}_i < \tilde{p}_e \), as seen in Figure

\(^9\) Bagwell and Riordan (1991) are the first to show that high and declining prices signal quality.
2. Turning to the profit to the high-quality type, the difference between FDI and exporting is given by

\[ D(\tilde{p}_i, 1)[\tilde{p}_i - c(H)] - k - D(\tilde{p}_e, 1)[\tilde{p}_e - c(H)] + (1 + \delta)f. \]

Apply the mean-value theorem to rewrite the above as

\[
(\tilde{p}_i - \tilde{p}_e\{D(p', 1) + D_p(p', 1)[p' - c(H)]\} + [(1 + \delta)f - k],
\]

where \( p' \in (\tilde{p}_i, \tilde{p}_e) \). The first term in (10) is positive, as it is a product of two negative expressions. The second term is non-negative for \( k \in (f, (1 + \delta)f] \). Thus, for such \( k \) the high-quality type earns a greater profit with FDI than with exporting. This result is intuitive because FDI is cheaper than exporting for the high-quality type but is more expensive for the low-quality type (\( k > f \)).

More interesting is the case in which \( k > (1 + \delta)f \) so that FDI is costlier than exporting for both quality types. Then, the firm would never choose FDI over exporting when quality is known. Recall that the first term in (10) depends on the difference, \( k - f \), and hence it is not infinitesimal. Therefore, if \( k \) is arbitrarily close to (but still exceeding) \((1 + \delta)f\), the first term in (10) dominates the second, implying that the profit is greater with FDI than with exporting (recall that \( \delta \) can exceed unity.) We formalize this result in

**Proposition 2:** Suppose that \( k > (1 + \delta)f \). There is \( k_0 \) sufficiently close to \((1 + \delta)f\) such that for all \( k \in \{(1 + \delta)f, k_0\} \) the high-quality type prefers FDI to exporting.
3. C. Pooling equilibrium

We now examine a pooling equilibrium. A pooling equilibrium occurs when the firm chooses an identical introductory-phase price regardless of the product’s quality so consumers gain no new information from observing the price. We thus put \( \mu = \lambda \). We are interested in a pooling equilibrium in which the firm has sale in the introductory phase; that is, there is a \( p \) such that \( D(p, \lambda) > 0 \).

If there is no fixed sale cost with exporting, the pooling equilibrium price \( p \) must satisfy these incentive-compatibility conditions:

\[
D(p, \lambda)[p - c(L)] \geq 0
\]

\[
D(p, \lambda)[p - c(H)] + \delta \pi^* \geq 0.
\]

There is a continuum of prices satisfying these conditions. However, we show in the appendix that all such prices fail the intuitive criterion test. It is straightforward to show that the same result holds with FDI or with exporting with fixed sale cost. Thus,

**Proposition 3:** The model possesses no pooling equilibrium survives a refinement based on the intuitive criterion and in which the firm has positive sale.\(^{10}\)

We close this section with the following observation. It is commonly assumed in the literature that FDI reduces marginal cost of production. In our model lower marginal costs not only make FDI more attractive an option than exporting but also have the effect

\(^{10}\) There is a pooling equilibrium with no sale; see footnote 8.
of raising the introductory price with FDI. The reason is that an increase in profit due to lower marginal cost makes it more attractive for the low-quality type to masquerade as a high-quality type, and such a temptation is curbed only if the introductory-phase price is raised sufficiently to make masquerading unattractive for the low-quality type again.

4. Local labor employment requirements

TRIMs enable local governments to impose performance requirements on foreign firms locating in their territories. TRIMs can be implemented in a variety of forms, but here we focus on the local labor employment requirement, which is often a precondition for granting permission for FDI. More specifically, we assume that the firm locating in the host country is required to employ a certain number of local workers that exceeds the equilibrium level of employment discussed in the previous section. To satisfy the requirement the firm then must lower the price so it can increase output. Let \( \hat{x} \) denote the target output that satisfies the requirement, and define the associated target price \( \hat{p}(\mu) \) by the equation \( \hat{x} = D(p, \mu) \). To simplify the exposition assume that \( \hat{x} > D(p^*, 1) \), or

\[
\hat{p}(1) < p^*,
\]

meaning that the firm must employ more local labor than it would when quality is known. This assumption is justified because otherwise the requirement has no impact during the mature phase.
Since \( \hat{p}(1) < \tilde{p}_i \), the firm cannot use the price \( \tilde{p}_i \) to separate as shown in the previous section, and the separating equilibrium with FDI described there ceases to exist. The model possesses the separating equilibrium with exporting described in the previous section because the employment requirement does not affect the firm if it chooses to export. We now show that the model also possesses a pooling equilibrium in which the firms engage in FDI. To prove the existence of a pooling equilibrium, we consider a pooling equilibrium at \( \hat{p}(\lambda) \), the price at which the requirement constraint is exactly binding when beliefs are \( \mu = \lambda \). This price must satisfy the incentive-compatibility conditions:

\[
D(p, \lambda)[p - c(L)] \geq k
\]

\[
D(p, \lambda)[p - c(H)] + \delta \pi^* \geq k,
\]

where \( \pi^* = \hat{\lambda}[\hat{p}(1) - c(H)] \) is the maximum profit accruing to the high-quality type under the employment requirement during the mature phase.

Suppose that there is another price \( p' \) which yields the same profit to the low-quality type as in the equilibrium if a deviation to it fools consumers into believing that it produces a product of high quality. That is,

\[
D[\hat{p}(\lambda), \lambda][\hat{p}(\lambda) - c(L)] = D(p', 1)[p' - c(L)]
\] (11)
We must have $p' < \hat{p}(\lambda)$; otherwise we have $D((\hat{p}(\lambda), \lambda]) > D(p', 1)$ so that the requirement is violated at $p'$. Then, the low-quality firm has no incentive to deviate to any price $p'' \leq p'$. Therefore, for the high-quality type

$$D(p', 1)[p' - c(H)] - D[\hat{p}(\lambda), \lambda][\hat{p}(\lambda) - c(H)]$$

$$= [c(L) - c(H)][D(p', 1) - D(\hat{p}(\lambda), \lambda] < 0$$

where (11) is used to establish the equality, while the inequality follows since $D(p', 1) > D(p', \lambda) > D[\hat{p}(\lambda), \lambda].$

Since $D(p, 1)[p - c(H)]$ is increasing at $p'$, the last inequality means that the high-quality type has no incentive to deviate to any price $p'' \leq p'$ whenever the low-quality type has no incentive to deviate to $p'$ even under the most favorable belief assessment of $\mu = 1$. Thus, this pooling equilibrium survives a refinement based on the intuitive criterion.

**Proposition 4**: With local labor employment requirements, the model possesses a pooling equilibrium outcome, which survives a refinement based on the intuitive criterion and in which both types engage in FDI.

Although the procedure to prove Proposition 4 does not pin down a unique intuitive equilibrium outcome, we may use $\hat{p}(\lambda)$ as the focal price because it maximizes the profit to the high-quality type.
Now we have shown that in the presence of local labor employment requirements there are a pooling equilibrium with FDI and a separating equilibrium with exporting (shown in the previous section). The choice between exporting and FDI then depends on the equilibrium profits in both cases. The more demanding the requirement, the smaller the profit from FDI and hence exporting is more likely to be chosen over FDI, in general. If exporting is chosen, local labor employment is nil. With no fixed cost in exporting, the firm signals at c(L), thereby increasing consumer surplus with a lower introductory price that is below cost. In this case, host country welfare increases. If exporting requires fixed cost, however, a switch to exporting raises the price, thereby reducing host country welfare.

5. Concluding remarks

In this paper we consider a new-product firm’s choice between exporting and FDI to access foreign buyers. The product has a two-phase life, and can be of high or low quality. Foreign buyers do not know the product’s quality before the first or introductory phase, but know the quality during the mature phase from experience or from reading consumer reports. Consumers never knowingly buy the product of low quality.

We assume that FDI does not change marginal costs but requires a fixed setup cost, which is quality-type independent. Thus, the firm has no incentive to engage in FDI when quality is known. However, we find that, when quality is unknown the firm may choose FDI over export in order to signal quality.
We also consider the effect of local labor employment requirements imposed by the host country government. We show that under such requirements both the high-quality type and the low-quality type engage in FDI, although such an outcome is impossible before the requirement. Quite naturally, however, if the requirement is too severe, the firm switches from FDI to exporting, which increases host country welfare with an offer of a lower introductory price when there is no fixed cost in exporting but decreases host country welfare by raising the price when exporting requires fixed cost. Similar results are likely to emerge if the host country government introduce any TRIM policy, such as local content or export share requirements that disturb the pre-policy separating equilibrium in which the firm engages in FDI. Filling the details is left for future work.
Appendix: Proof of Proposition 3

Let \( p_0 \) be a pooling equilibrium price so that \( D(p_0, \lambda) > 0 \). Given that \( D(p, \lambda) < D(p, 1) \) and the choke price \( \overline{p}(\mu) \) is decreasing in \( \mu \), there is a price \( p' > p_0 \) satisfying the equation:

\[
D(p_0, \lambda)[p_0 - c(L)] = D(p', 1)[p' - c(L)].
\] (A1)

The low-cost type is indifferent between the equilibrium and deviating to \( p' \) under the assumption that a deviation to \( p' \) fools consumers into believing that it is the high-quality type. Given that \( D(p, 1)[p' - c(L)] \) is deceasing at \( p' \), the low-quality type has no incentive to deviate to any price \( p'' \geq p' \) even if a deviation puts \( \mu = 1 \). In contrast,

\[
D(p', 1)[p' - c(H)] - D(p_0, \lambda)[p_0 - c(H)]
\]

\[
= [D(p', 1) - D(p_0, \lambda)][c(L) - c(H)] > 0
\]

where (A1) is used to show the equality. The strict inequality implies that there is a \( p'' \) (\( > p' \)) to which the high-quality type alone will deviate if it convinces consumers that the product is of high quality. Then consumers, when observing such \( p'' \), should put all probability weights on the high-quality good. This refinement of out-of-equilibrium beliefs induces the high-quality type indeed to deviate, thereby disturbing the original equilibrium. The same argument holds for FDI and for exporting with fixed costs as well.

QED
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Figure 1: Separating equilibrium with no fixed cost in exporting
Figure 2: Separating equilibrium with fixed cost in exporting