

**Exporting versus foreign direct investment:
Learning through propinquity[†]**

Anthony Creane^a and Kaz Miyagiwa^b

We examine a firm's choice between exporting and foreign direct investment (FDI) under demand and cost uncertainty. FDI enables the foreign firm to meet shifting local demand more quickly, increasing profit. However, FDI means using local inputs, so when the foreign firm competes with the local firm, FDI correlates their costs, which proves harmful. We show that FDI is chosen when demand uncertainty is greater than cost uncertainty, and when the firms produce less similar products. When FDI is chosen, the local firm is harmed and host country welfare usually declines. These conclusions hold both in price and quantity competition.

JEL: D83, F12, F21

Key words: FDI, uncertainty, access mode choice, welfare, oligopoly.

^a Department of Economics, Michigan State University, East Lansing, MI 48824-1038 USA;
creane@msu.edu

^b Department of Economics, Emory University, Atlanta GA 30322-2240 USA;
kmiyagiwa@gmail.com

[†]We thank Jim Anderson, Carl Davidson, Steve Matusz, Denis Medvedev and participants at the Hitotsubashi Trade Conference, IIOC Conference, Midwest International Economics meetings, Latin American Econometric Society meetings and at seminars at Kobe University and George Washington University for their comments on preliminary work.

1. Introduction

Over the last quarter-century multinational activity measured by production and sales of foreign affiliates has grown at much faster paces than GDP and trade (Markusen, 2002). The impressive rise in multinational activity has prompted international trade economists to seek reasons why some firms choose foreign direct investment (FDI) over exporting. The seminal works of Caves (1971), Helpman (1984), Markusen (1984) have established that FDI decisions are influenced by technology characteristics such as firm-level and plant-level scale economies as well as country characteristics such as market sizes, differences in marginal costs, and trade costs.¹ Recent extensions in this literature emphasize what is known as the proximity-concentration trade-off, i.e., FDI is chosen over exporting if the FDI setup cost is cheaper than the transport costs.

There are other factors that determine FDI decisions. One such factor is private information and agency problems that it entails. This is the approach pioneered by Ethier (1986), who places internalization at the center of FDI decisions; see also Horstmann and Markusen (1996). Another factor is exchange-rate (or cost) uncertainty. For example, Sung and Lapan (2000) show that in the presence of exchange-rate volatility multinationals could prefer to maintain plants in multiple countries so as to shift production to a least-cost country after having learnt the cost realizations. Lastly, demand uncertainty can also affect FDI decisions. Demand for a firm's product can change suddenly due to changes in consumer preferences or other economic conditions, especially if a firm sells intermediate goods to downstream firms. In such a case a firm can respond more quickly by locating in the consuming country than by producing and shipping the product from its overseas plant.² This is the approach emphasized by Qiu and Zhou (2006), although they consider international merger, not FDI, as a device for learning foreign demand. In a dynamic model Kotseva and Vettas (2005) also highlight the importance of demand learning, as they study when a firm in a non-strategic setting switches from exporting to FDI.³

In this paper we extend the information-based approach to FDI decisions by considering cost uncertainty as well as demand uncertainty. We suppose that a foreign and a local firm compete in the latter's home market. With demand uncertainty we maintain the standard assumption; firms learn market demand shocks only by locating production in the home or consuming country. Thus, the

¹ Caves (1991) and Markusen (1995, 2003) review the literature.

² Proximity to where foreign buyers are is essential if foreign buyers (firms) adopt just-in-time strategies so that given quantities of the intermediate good must be delivered to the buyers' production sites on a moment's notice.

³ The proximity-concentration trade-off alluded to earlier also features in Kotseva and Vettas (2005)

home firm always knows market demand shocks, while the foreign firm becomes informed only by choosing FDI and producing in the home market. As for cost uncertainty, we assume that cost information remains private but that costs are distributed independently across countries. Thus, when the foreign firm exports, firms produce in separate countries, so the foreign firm does not know the rival's cost realizations. In contrast, with FDI the foreign firm procures its inputs in the home country and hence faces the same cost realizations that the rival does. For example, as firms employ labor from the common labor market or labor union, seeing wages increase signals to the foreign firm that its rival is also facing higher labor cost. Other aspects of FDI, e.g., using common local suppliers, enhance this effect. Thus, though cost information remains private, FDI enables the foreign firm to infer the rival's cost realization from observation of its own.⁴ This means that firms' cost realizations are correlated, which we show is harmful to firms.

We now preview our main findings. First, if cost uncertainty is relatively larger than demand uncertainty, then the foreign firm prefers exporting to FDI. This result is a direct consequence of the interplay between the demand uncertainty and the cost uncertainty noted above: Second, FDI decisions are also influenced by the degree of product differentiability. Specifically, FDI becomes less attractive as the firms produce more similar products. This is because demand information becomes less valuable as the goods become more homogenous. We thus expect a foreign firm to choose FDI over exporting when a home firm produces a sufficiently differentiated good and cost uncertainty is small relative to demand uncertainty. These two principal results hold both in quantity and price competition, which is surprising because in oligopoly models results often depend crucially on the type of competition one assumes.

We also analyze the effect of FDI on the home firm and home country welfare. We find that the home firm is almost always harmed by FDI when the foreign firm finds FDI profitable.⁵ The primary reason is that a correlation of costs works symmetrically on both firms, harming the home firm as much as it does the foreign firm. This finding may help to shed light on evidence that FDI

⁴ There is the well-known result in the industrial organization literature that duopolists prefer to share private cost information with Cournot competition but they prefer to conceal this cost information with (differentiated goods) Bertrand competition (e.g., Gal-or 1986). However, in that literature the characteristic of the distribution from which costs are drawn is fixed, while here firms draw independently with exporting but draw a common value with FDI. Thus, our setup is distinct and unique and our results differ from what that literature would offer.

⁵ Three conditions must hold simultaneously for the domestic firm to actually benefit: cost uncertainty is sufficiently great (but not too great to prevent the foreign firm from choosing FDI), the goods are relatively homogenous and the firms compete in prices. Thus, for example, even if the firms compete in prices and the goods are of *any* degree of product differentiation, if the demand and cost uncertainty are of the same magnitude, then the local firm is always harmed when the foreign firm prefers FDI.

reduces the productivity of local firms (Gorg and Greenaway 2004). In addition, in quantity competition the home firm loses its informational advantage with respect to local demand when the foreign firm chooses FDI.⁶

Turning to home consumers, we first find that the effect of FDI on consumer surplus – unlike our previous results – depends on whether the firms compete in prices or quantities. With quantity competition, we find that consumers benefit from FDI. That is because with FDI the foreign firm can respond to a high demand by expanding output. While the opposite holds when demand is low, consumers' marginal value is lower, so this effect is dominated by the beneficial output expansion at high demands. In price competition, however, the effect is reversed because a firm *raises* its price when demand is high. As a result, home consumers prefer FDI when the firms compete in quantities and prefer export when they compete in prices.

While FDI has conflicting effects on consumer surplus and home firm profit, it almost always decreases their sum, which constitutes home country welfare. The exception to this result occurs only when all three of the following conditions hold: the goods are highly differentiated (almost independent), demand uncertainty is large relative to cost uncertainty and at the same time the firms compete in quantities. A high degree of product differentiation implies that the home firm is little affected by the foreign firm's access model choice and that cost learning also has little or no effect on home consumers. Thus, FDI affects domestic welfare primarily through demand learning, which is positive with quantity competition as argued above.

Our analysis sheds light on other work examining similar issues. For example, consider the Qiu and Zhou (2006) analysis of international merger mentioned earlier; while there is no incentive to merge in Cournot competition in the absence of demand uncertainty, there is the case for merger when demand is uncertain and merger allows the foreign firm to learn home market demand. There is however an unasked question here: instead of merging, the foreign firm could locate production in the home country to acquire demand information.⁷ By choosing a merger the foreign firm must compensate the domestic firm with which it merges for its profit loss, while with FDI the foreign firm potentially captures the information without having to compensate its partner for the profit loss both from the merger (Salant, et al. 1983) and from the information rent loss. Thus, in the Qiu and

⁶ In price competition the home firm prefers the foreign firm to learn demand.

⁷ In some instances, countries discourage FDI or make it prohibitively expensive, but in such cases one might expect merger with a foreign corporation also to be discouraged. In addition, potentially FDI is less expensive than a merger as the experience of Daimler-Chrysler demonstrated.

Zhou (2006) environment FDI dominates merger (and strictly dominates what Qiu and Zhou (2006) call an output-coordination merger).⁸ Then, it is not clear why the foreign firm chooses merger when FDI is available in their model. Our model provides a resolution to this issue: in the presence of cost uncertainty FDI can be less profitable than merger and also gives the foreign firm a better threat point when negotiating with a domestic rival over a merger.

Second, consider a variant of our model, in which all firms are foreign. Our results imply that identical firms prefer to locate production in different countries to avoid a correlation of costs, so we expect some firms to export while others choose FDI. Thus, our analysis provides an explanation to the observed heterogeneity in access mode selections found even within narrowly defined industries where some firms engage in FDI while others export.

The remainder of the paper is organized in four sections. In the next section we present the main modeling assumptions. We then examine the outcomes when the firms compete in quantities (section 3) and then prices (section 4). Section 5 concludes and briefly considers additional extensions.

2. Environment

Suppose that a foreign firm (firm f) competes with a home firm (firm h) in the home market producing differentiated goods in quantities q_f and q_h , respectively. The home firm always produces at home but the foreign firm can locate in the foreign or the home country. The production costs are linear and depend on the location of production. Thus, the home firm's marginal cost is c_H whereas the foreign firm's marginal cost equals either c_H or c_F , depending on the choice of production location.

Assume that in the home market there is a continuum of identical consumers with separable, linear utility in the numeraire good and quadratic preferences for the differentiated goods.

$$U(q_f, q_h) = \alpha(q_f + q_h) - (\frac{1}{2})(q_f^2 + 2\delta q_f q_h + q_h^2), \alpha > 0, 1 \geq \delta > 0,$$

where $\delta \in [0, 1]$ is a measure of product substitutability.⁹ Given prices p_f and p_h , the consumer chooses q_f and q_h to maximize

⁸ In Qiu and Zhou (2006), there are multiple home firms, and the foreign firm merges with one of them.

⁹ This is a standard model to analyze and compare price and quantity competition and its welfare implications when there is learning. See, e.g., Vives (1984).

$$\alpha(q_f + q_h) - (\frac{1}{2})(q_f^2 + 2\delta q_f q_h + q_h^2) - p_f q_f - p_h q_h. \quad (1)$$

There is a random element to the local demand intercept with $E[\alpha] = \bar{\alpha}$ and $\text{Var}[\alpha] = \sigma_\alpha^2$.¹⁰

We model the interaction between the firms in three stages. In stage one the foreign firm chooses between the foreign and the home country to build a plant from which to serve home country buyers. The home firm has a plant in the home country. In stage two, nature draws values for the demand intercept, α , and costs, c_H and c_F , and reveals them to the home firm regardless of the foreign firm's location choice. Nature also reveals all three values to the foreign firm only if it locates in the home country; otherwise only the value of c_F is disclosed. This is all common knowledge. In stage three, given the foreign firm's location and the values revealed, the firms compete in quantities or prices in the home market.

Notice that we take the foreign firm's cost realization to be always observed by both firms. This set-up maximizes the amount of information the foreign firm learns with FDI, making it informationally most attractive relative to export, and yet we can show that correlation of costs through propinquity of location can make FDI too costly.¹¹ This asymmetry in the information structure however is not critical to our qualitative results.¹² We examine this point and outline the results under the other informational assumptions at the end of the next section after the presentation of our results.

We make additional assumptions to focus on the issue on hand. First, to prevent asymmetry in marginal costs from driving the results, we assume that country-specific costs are drawn independently from some common distribution, so that they have identical expected value and variance, i.e., $E[c_{j,N}] = \bar{c}_N = \bar{c}$ and $\text{Var}[c_{j,N}] = \sigma_{j,N}^2 = \sigma_c^2$.¹³ Once our main results are presented, relaxing the assumption on variance is straightforward and the implications are immediate. Second, we assume that the foreign firm incurs the same plant setup cost regardless of its location choice, and that export requires no transport cost while FDI involves no additional fixed costs. This makes the

¹⁰ Implicitly it is assumed that ε has finite support and α is large enough so that even at the lower limit of the support all firms have positive output. (The same implicit assumption will apply to the cost uncertainty assumed below.)

¹¹ As discussed in the introduction (cf. footnote 3) this also allows us to emphasize how our results are distinct (and indeed at times contradictory) to those in the information sharing literature.

¹² If the domestic rival did not learn the foreign firm's cost with exporting, then some of our results would be related to the information sharing literature (see, e.g., Vives 1990). Then FDI would be equivalent to the foreign firm forcing both firms to share information.

¹³ We show in Creane and Miyagiwa (2008) that with certainly any cost difference creates a welfare bias against FDI in this setting.

foreign firm indifferent between FDI and exporting in the absence of uncertainty, thereby eliminating the standard proximity-concentration trade-off familiar in the FDI literature. Then, in the absence of uncertainty the foreign firm is completely indifferent between exporting and FDI, as is the home firm to the foreign firm's choice.

3. Quantity competition

In this section we consider quantity competition. From the first-order conditions on (1), firm j faces inverse demand $p_j = \alpha - q_j - \delta q_k, j \neq k$. To derive the equilibrium we first characterize the third stage, depending on the foreign firm's location decision, and then work back to each previous stage.

3.A The third stage

In the third stage, the foreign firm has already made its location choice (exporting or FDI) and the demand and the cost shocks have been realized. There are thus two subgames to consider, depending on the foreign firm's mode choice.

3.A.i The foreign firm exports

If the foreign firm chose to export in stage one, it does not learn demand and the rival's cost realization, so the foreign firm chooses q_f to maximize the expected profit

$$E(\alpha - q_f - \delta q_h(\alpha, c_{h,H}) - c_{f,F})q_f$$

yielding the first-order condition

$$q_f(c_{f,F}) = E(\alpha - c_{f,F} - \delta q_h(\alpha, c_{h,H}))/2.$$

In contrast, having complete information, the home firm chooses q_h to maximize

$$(\alpha - q_h - \delta q_f(c_{f,F}) - c_{h,H})q_h$$

yielding the first-order condition

$$q_h(\alpha, c_{h,H}) = (\alpha - c_{h,H} - \delta q_f(c_{f,F}))/2. \quad (2)$$

From the first-order conditions and taking the foreign firm's expectation of the home firm's

choice (2), we obtain the following Bayesian-Nash equilibrium outputs (with superscript X to indicate the exporting decision):

$$q_f^X = \frac{\bar{\alpha}(2-\delta) - 2c_{f,N} + \delta\bar{c}_{h,N}}{4-\delta^2}$$

$$q_h^X = \frac{\alpha(2-\delta) - 2c_{h,N} + \delta c_{f,F}}{4-\delta^2} + \frac{\delta^2}{2} \frac{\alpha - \bar{\alpha} + c_{h,H} - \bar{c}_{h,H}}{4-\delta^2}$$

Third-stage equilibrium profits then are

$$\pi_f^X = (\alpha - q_f^X - \delta q_h^X - c_{f,F}) q_f^X.$$

$$\pi_h^X = (\alpha - q_h^X - q_f^X - c_{h,H}) q_h^X.$$

Note that the foreign firm's profit is linear in demand intercept and the home firm's cost shocks since they do not enter q_f^X .

3.A.ii Foreign firm chooses FDI

If the foreign firm chose FDI in stage one, both firms know the demand and (now common) cost shock and hence play a game of complete information. The usual calculus yields the following symmetric Nash equilibrium outputs:

$$q_j^{FDI} = (\alpha(2-\delta) - 2c_{j,H} + \delta c_{k,H})/(4-\delta^2) = (\alpha - c_H)/(2+\delta),$$

where the second equality hold because the firms face the same cost shock; i.e., $c_{j,H} = c_{k,H}$. Firm j 's third-stage equilibrium profit is given by

$$\pi_j^{FDI} = [\alpha - q_j^{FDI} - \delta q_k^{FDI} - c_{j,H}] q_j^{FDI}.$$

With these calculations the two possible third-stage games have been characterized. In stage two Nature moves, revealing relevant information to the firms according to the foreign firm's mode

selection. We now proceed to the first stage.

3.B The first stage

Note first that in our model the expected output is the same across access mode decisions; that is, $E[q_j^X] = E[q_j^{\text{FDI}}]$. Define this “mean” output as

$$\bar{q}_j^{(\cdot)} \equiv [\bar{\alpha}(2-\delta) - 2\bar{c}_{j,N} + \delta\bar{c}_{k,N}]/(4-\delta^2).$$

Further, since expected costs are equal, expected outputs are the same across firms and production locations; that is, $\bar{q}_j^{(\cdot)} = \bar{q}_k^{(\cdot)}$. It follows from the definitions of profits in section 3.A that the profit evaluated at the expected cost are also equal across access mode decisions and firms: $\pi_j^X(\bar{c}) = \pi_j^{\text{FDI}}(\bar{c})$. Denote this common profit by:

$$\bar{\pi}_j = [\alpha - \bar{q}_j - \delta\bar{q}_k - \bar{c}_{j,N}] \bar{q}_j.$$

We now compute the expected profits. If the foreign firm chose exporting in stage one, calculations yields

$$E[\pi_f^X] = \bar{\pi} + \frac{4}{(4-\delta^2)^2} \sigma_{f,F}^2 \quad (3)$$

Since the foreign firm does not learn about demand and the rival’s cost, it cannot respond to these shocks. That is, these shocks do not introduce variance into the foreign firm’s expected profit expression. The variance term in (3) thus reflects the effect of learning its own cost by the foreign firm as well as by the home firm. This learning is beneficial to the foreign firm for two reasons. First, because the foreign firm can respond to its cost shock, its profit is convex in its own cost shocks. Thus, the expected profit is greater than evaluated at the average cost. Second, the *home* firm learning the foreign firm’s cost is also beneficial to the latter for the following reason. A unit change in the foreign firm’s cost causes the home firm’s equilibrium output to change by $dq_h/dc_f = \delta/(4-\delta^2)$, which affects the foreign firm’s price-cost margin $(\alpha - q_f - \delta q_h - c_{f,F})$ by $-\delta^2/(4-\delta^2)$. Thus, the change in the home firm’s output is *as if* the foreign firm sees larger costs shocks, akin to a mean-preserving spread on the cost distribution of the foreign firm, which is beneficial because its profit is

convex in cost.¹⁴

Suppose next that the foreign firm chooses FDI. Then firms have complete information about demand and common cost. The firms' expected profit is symmetric and given by

$$E[\pi_j^{FDI}] = \bar{\pi} + \frac{(2+\delta)^2}{(4-\delta)^2} \sigma_a^2 + \frac{(2+\delta)^2}{(4-\delta)^2} \sigma_H^2, \quad (4)$$

where the firm indication on the cost variance has been dropped since the firms face the same shock specific to the home country.

Equation (4) differs from (3) in two respects. First, now the foreign firm can adjust to demand shocks. By the reason similar to the previous logic, the foreign firm's profit is convex in the demand because it can adjust output to this shock, meaning that demand information is valuable to the foreign firm as reflected by the positive coefficient on σ_a^2 in (4).

Second, the coefficient of σ_H^2 differs from that of σ_F^2 in (3) because of the correlation of costs alluded to earlier: by locating in the home country the foreign firm now learns the home firm's cost, but more importantly exposes itself to the same cost shocks that the home firm faces.¹⁵ A unit change in the foreign firm's cost now induces the home firm's equilibrium output to change by $dq_h/dc_f = -1/(2+\delta)$, while the corresponding change when the foreign firm exported, it is recalled, was $dq_h/dc_f = \delta/(4-\delta^2)$. Thus, the foreign firm's price-cost margin ($\alpha - q_f - \delta q_h - c_{f,F}$) increases by $\delta/(2+\delta)$ while it decreased when it exported.¹⁶ Thus, since the cost shock *decrease* the price-cost margin, the change in the home firm's output is *as if* the foreign firm sees *smaller* costs shocks, i.e., a mean-preserving contraction on the cost distribution of the foreign firm, and so decreases expected profit to the foreign firm.¹⁷

3.C The access mode decision for the foreign firm

We are now in a position to address our main issue. The foreign firm chooses FDI whenever it is more profitable than exporting or if:

¹⁴ The net effect of a unit cost change (i.e., both the cost change and the change in the home firm's output) therefore equals $-(1 + \delta^2/(4 - \delta^2)) = -4/(4 - \delta^2)$ which is greater in magnitude than -1, so the coefficient of the variance term is $4/(4 - \delta^2)^2$.

¹⁵ Or, to put it another way, the information has gone from being private valued to being common valued.

¹⁶ Since its cost shock effect is -1, the net effect of a unit cost change equals $\delta/(2 + \delta) - 1 = -2/(2 + \delta)$, which is smaller in magnitude than -1.

¹⁷ As $-2/(2 + \delta) = -2(2 - \delta)/(4 - \delta^2)$ we have the coefficient of $(2 - \delta)^2/(4 - \delta^2)^2$ on the variance term.

$$E[\pi_f^{FDI}] - E[\pi_f^X] = \frac{(2-\delta)^2}{(4-\delta^2)^2} \sigma_a^2 + \frac{(2-\delta)^2}{(4-\delta^2)^2} \sigma_H^2 - \frac{4}{(4-\delta^2)^2} \sigma_{f,F}^2 > 0 \quad (5)$$

The second and third terms sum to less than zero under the assumption that the variances on the country-specific shocks are identical; $\sigma_H^2 = \sigma_{f,F}^2$ (recall that $\sigma_{j,N}^2 = \sigma_c^2$). Thus, the foreign firm's decision depends on whether the value from learning about the market demand is relatively greater than the value from learning about cost (that is, there is more uncertainty regarding demand than costs and hence more to learn and gain by relocating). Putting the variance in terms of σ_c^2 from (5) we have

Proposition 1: *When firms compete in quantities, FDI is the more profitable strategy to the foreign firm if:*

$$\sigma_a^2 \geq \frac{(4\delta - \delta^2)^{\frac{1}{2}}}{2 - \delta} \sigma_c^2.$$

That is, the demand uncertainty is sufficiently greater than the cost uncertainty or the goods are sufficiently heterogeneous.

Thus, if demand uncertainty is sufficiently greater than cost uncertainty, then FDI is always preferred. Furthermore, the right-hand side of the inequality in Proposition 1 is increasing in δ , meaning that, as the goods become less differentiated, FDI becomes less attractive. This has both the demand-side and the cost-side explanation. On the demand side, FDI allows the foreign firm to react to demand shocks, making its profit convex in the demand parameter. However, the home firm also responds, changing its output, which enters negatively in the foreign firm's profit through the term $-\delta q_h$. Effectively, this is like a mean-preserving contraction in the distribution of the demand parameter, reducing the value of the information. Thus, as δ increases or the goods become more homogenous, the demand information becomes less valuable. The logic on the cost-side works similarly. The home firm's output response to a cost shock dampens the change in profit, effectively making a mean-preserving contraction in the cost distribution, thereby reducing the value of the information.

3.D. Home country welfare

We next examine the effect of FDI on home firm profit, consumer surplus and home country welfare (home firm profits plus consumer surplus). The main focus is on when the foreign firm's and the home-country government's plant location choices diverge, and what type of government interventions can be inferred from it. In addition, the producer and consumer surplus effects can shed light on the political pressure the home government might face.

Begin with home firm profit. When the foreign firm exports, the home firm learns and responds to demand and two cost realizations. Thus, its expected profit contains the variance terms corresponding to those three shocks:

$$E[\pi_h^X] = \bar{\pi} + \frac{1}{4}\sigma_a^2 + \frac{1}{4}\sigma_{h,H}^2 + \frac{\delta^2}{(4-\delta^2)^2}\sigma_{f,F}^2. \quad (7)$$

Note that although we assume costs are drawn from the same distribution so that $\sigma_{f,F}^2 = \sigma_{h,H}^2$ we have kept the subscripts to clarify the role of various cost shocks in the location decision.

When the foreign firm chooses FDI, profits are identical across firms, so (4) also represents the home firm's expected profit. The relative effect of FDI on home profits is given by

$$E[\pi_h^{FDI}] - E[\pi_h^X] = \frac{-\delta(4+\delta)(2-\delta)^2}{4(4-\delta^2)^2}\sigma_a^2 + \frac{-\delta(4+\delta)(2-\delta)^2}{4(4-\delta^2)^2}\sigma_H^2 - \frac{\delta^2}{4(4-\delta^2)^2}\sigma_{f,F}^2 \quad (6)$$

All the terms in (6) are negative, and hence

Proposition 2: *The home firm is harmed by FDI.*

The intuition behind proposition 2 is straightforward. If the foreign firm chooses FDI, the home firm loses its advantage in its demand information and is also be harmed by having correlated cost.

Turning to home consumer welfare, recall from (1) that consumer surplus is

$$\alpha(q_f + q_h) - (\frac{1}{2})(q_f^2 + 2\delta q_f q_h + q_h^2) - p_f q_f - p_h q_h.$$

Substituting the derived inverse demand into this yields¹⁸

¹⁸ Recall that the Walrasian auctioneer in the Cournot model sets the prices to clear the market given the firms' output, i.e. the prices so that the consumer consumes the total amount brought to market.

$$q_f^2/2 + \delta q_f q_h + q_h^2/2.$$

Note that consumer surplus is convex in the firms' output, so it is increasing in output variability. This is because the consumer makes purchases after observing the prices. As a result, consumers are able to adjust their consumption between the two goods the firms produce and the numeraire good: when price is high for a good, the harm is mitigated as the consumers substitute away from it to the other goods, and when the price is low they can buy more of it.

Using equilibrium quantities in the third stage, we can calculate expected consumer surplus under the two regimes (exporting and FDI). Since expected outputs are the same with either mode, mean consumer surplus (that is, consumer surplus evaluated at expected cost and demand) is the same. Denote this mean consumer surplus $\overline{CS}_h = \bar{q}_f^2 + \delta \bar{q}_f \bar{q}_h + \bar{q}_h^2$. Using the equilibrium outputs q_i^x , we can write expected consumer surplus when the foreign firm exports as

$$E[CS_h^x] = \overline{CS}_h + \frac{1}{8} \sigma_\alpha^2 + \frac{1}{8} \sigma_{h,H}^2 + \frac{4-3\delta^2}{2(4-\delta^2)^2} \sigma_{f,F}^2.$$

If the foreign firm chooses FDI, then from q_i^{FDI} expected consumer surplus is

$$E[CS_h^{FDI}] = \overline{CS}_h + \frac{1+\delta}{(2+\delta)^2} \sigma_\alpha^2 + \frac{1+\delta}{(2+\delta)^2} \sigma_H^2.$$

Again, as the firms are facing the same cost there is only one variance term for the cost shock, subscripted with H . Thus, the effect of FDI on home consumer surplus is

$$E[CS_h^{FDI}] - E[CS_h^x] = \frac{(4+4\delta-\delta^2)(2-\delta)^2}{8(4-\delta^2)^2} \sigma_\alpha^2 + \frac{(4+4\delta-\delta^2)(2-\delta)^2}{8(4-\delta^2)^2} \sigma_H^2 - \frac{4(4-3\delta^2)}{8(4-\delta^2)^2} \sigma_{f,F}^2 \quad (7)$$

With (7) we find:

Proposition 3: *Profitable FDI increases expected domestic consumer surplus.*

Proof: From (7), FDI increases consumer surplus whenever

$$\sigma_\alpha^2 \geq \frac{\delta^2(4-8\delta+\delta^2)}{(2-\delta)^2(4+4\delta-\delta^2)} \sigma_c^2. \quad (8)$$

Combining this with the condition for FDI to be profitable from Proposition 1 yields

$$\sigma_\alpha^2 \geq \frac{(4\delta-\delta^2)^{\frac{1}{2}}}{2-\delta} \sigma_c^2 \geq \frac{\delta^2(4-8\delta+\delta^2)}{(2-\delta)^2(4+4\delta-\delta^2)} \sigma_c^2.$$

Thus, whenever the foreign firm chooses FDI it increases domestic expected consumer surplus.//

When $\delta > 2(2-3^{1/2}) \approx .54$, the right-hand side of (8) is negative while the left-hand side is positive. Thus, (8) holds, that is, consumers are better off with FDI than with exporting.

The explanation turns on both the demand and cost learning.¹⁹ On the demand side, with FDI the foreign firm responds to demand, producing more at high demand and less at low demand. Although the home firm moderates its output variability relative to the case in which export is chosen, the foreign firm's response to demand results in a net increase in output variability, which is beneficial to consumers due to convexity.²⁰ Turning to costs, where, unlike with demand, the unknown parameter changes from being private valued to being common valued, there are new effects. While FDI-induced correlation of costs causes an effect akin to a mean-preserving contraction in the cost distribution, as the goods become more homogenous (δ increases) the effect of a given output variability from firm j increases price variability for good i ($p_i = \alpha - q_i - \delta q_j$) benefiting consumers (the middle term in consumer surplus: $\delta q_j q_h$). Thus, FDI could harm consumers if demand uncertainty is small and if the goods are sufficiently heterogeneous.²¹ But these are exactly the condition under which the foreign firm would prefer not to choose FDI. That is, when FDI harms consumers, the foreign firm prefers to export.

We have found so far that, when the foreign firm would choose FDI, the home firm is harmed but the home consumers are better off. Thus, the effect on home country welfare is not immediately obvious. However, letting $W_h^{(\cdot)} = CS_h^{(\cdot)} + \pi_h^{(\cdot)}$ denote home welfare and using (6) and (7), we obtain the following change in welfare from FDI:

¹⁹ Consumers could be worse off from FDI. However, in that case FDI is less profitable to the foreign firm than exporting, and hence FDI will not be chosen by the foreign firm.

²⁰ While this gain is dampened as δ increases (since there is the secondary effect of the home firm reducing its output because of the strategic interaction), it still holds for $\delta = 1$ ($2/9 > 1/4$).

²¹ Only if the goods are independent ($\delta = 0$) and so the cost shocks have no effect on the rival's choice, does this effect disappear.

$$E[W_h^{FDI}] - E[W_h^X] = \frac{(2-3\delta)(2-\delta)}{8(4-\delta^2)} \sigma_\alpha^2 + \frac{(2-3\delta)(2-\delta)}{8(4-\delta^2)} \sigma_H^2 - \frac{4}{8(4-\delta^2)} \sigma_{f,F}^2.$$

With this we can conclude:

Proposition 4: Profitable FDI reduces expected domestic welfare

(A) when $\delta > 2/3$ or

(B) when $\delta < 2/3$ and $\sigma_\alpha^2 \leq \delta \frac{8-3\delta}{(2-\delta)(2-3\delta)} \sigma_c^2$.

By Case A, if the products are close enough substitutes, home country welfare declines with FDI. By Case B, with relatively differentiated goods, FDI can still reduce welfare if cost uncertainty is sufficiently larger than demand uncertainty in the sense of the above inequality. As the goods become relatively independent ($\delta \rightarrow 0$), however, the cost effects from learning disappear, while home country consumers benefit from the foreign firm learning their demand. Thus, when cost uncertainty is greater than demand uncertainty, profitable FDI can increase welfare only if the goods become relatively independent ($\delta < (4 - 10^{1/2}) \approx .28$).

Our analysis indicates that domestic consumers are made better off by FDI when it is profitable for the foreign firm but the effect is usually relatively small compared with the harm to the domestic firm. This is reflected in the political arena; usually there is no strong political representation for consumer interest, so there is little support for FDI when the domestic firm is opposed to it. Surprisingly, our results indicate that for the most part this would be the correct policy for the home country.

3.E Extensions to different information structures

In the preceding analysis we assumed that the home firm always observes the foreign firm's cost. As discussed in Section 2, this assumption enabled us to focus on the information the foreign firm could extract with FDI. Alternatively, we could use either of the two symmetric information structures: (A) no firms observe the rival's cost when exporting is chosen, or (B) both firms know each other's cost realizations regardless of the mode selection. These alternative assumptions

produce only secondary effects so our results are qualitatively unaffected.²² For example, if the goods are perfect substitutes ($\delta = 1$), then the foreign firm will still choose FDI only if the demand uncertainty is greater than the cost uncertainty. Likewise, the home firm is still harmed by FDI, while profitable FDI makes domestic consumers better off and the home country prefers exporting unless δ is sufficiently low (for the case of equal variances the critical δ is almost identical).

4. Price competition

In oligopoly models, oftentimes the results critically turn on the type of competition. In this section therefore we check the robustness of our results by extending our analysis to price competition. The derivations follow the outline of the previous section. Using again the first-order conditions on (1), but now inverting, firm j faces the following demand:

$$q_j = \alpha/(1 + \delta) - p_j/(1 - \delta^2) + \delta p_k/(1 - \delta^2), \delta \in (0, 1), j \neq k. \quad (9)$$

Note that demand is not defined with perfect substitutes ($\delta = 1$).

4.A The third stage

In the third stage each firm simultaneously sets price. Firm j chooses p_j to maximize its expectation of

$$\frac{\alpha(1 - \delta) - p_j + \delta p_k}{1 - \delta^2} (p_j - c_{j,N}). \quad (10)$$

From the first-order condition firm j 's best response is

$$p_j = (E[\alpha](1 - \delta) + \delta p_k + c_{j,N}) / 2,$$

where the expectation of α depends on the firm's information. For reference it is again useful to first calculate the outcome as if there were no uncertainty, i.e., each parameter equals its mean. In such a case, the Nash equilibrium price is

²² We have examined these cases in earlier versions, and the results are available from us on request.

$$\bar{p}_j = \frac{\bar{\alpha}(2 - \delta - \delta^2) + 2\bar{c}_{j,N} + \delta\bar{c}_{k,N}}{(4 - \delta^2)}$$

As the remainder of the derivations closely follows the steps from the previous section, the intermediate steps are omitted.

Suppose that the foreign firm chose in stage one to export. Then in stage three firms play a game of incomplete information. Calculations yield the Bayesian-Nash equilibrium prices;

$$p_f^x = \frac{\alpha(2 - \delta - \delta^2) + 2c_{f,F} + \delta\bar{c}_{h,H}}{(4 - \delta^2)}$$

$$p_h^x = \frac{\alpha(2 - \delta - \delta^2) + 2c_{h,H} + \delta c_{f,F}}{(4 - \delta^2)} - \frac{\delta}{2} \frac{(\alpha - \bar{\alpha})(2 - \delta - \delta^2) + \delta(c_{h,H} - \bar{c}_{h,H})}{(4 - \delta^2)}$$

In contrast, if the foreign firm chose FDI in stage one, then firms have complete information in stage three. As a result, equilibrium prices are

$$p_j^{FDI} = \frac{\alpha(2 - \delta - \delta^2) + (2 + \delta)c_{h,H}}{(4 - \delta^2)}.$$

From (9) we calculate the quantity demanded of each good in the third stage for given demand shocks and equilibrium prices, and then realized profits and consumer surplus. With these calculations we can now derive the expected profits, etc. in the first stage.

4.B The first stage

As with quantity competition, in the first stage the expected price is the same independent of the firm's access mode decision. That is, in stage one (before costs are realized), from the definitions above of p_j^x and p_j^{FDI} straightforward calculation yields $E[p_j^x] = E[p_j^{FDI}]$. It is convenient to define this “mean” price as $\bar{p}_j^{(\cdot)}$

$$\bar{p}_j^{(\cdot)} = \frac{\alpha(2 - \delta - \delta^2) + 2\bar{c}_{j,N} + \delta\bar{c}_{k,N}}{(4 - \delta^2)}$$

Since expected costs are equal, expected prices and outputs are also equal, i.e., $\bar{p}_j^{(\cdot)} = \bar{p}_k^{(\cdot)}$ and $\bar{q}_j^{(\cdot)} = \bar{q}_k^{(\cdot)}$. The profits evaluated at the expected cost are also equal across access modes and firms: $\pi_j^X(\bar{c}) = \pi_j^{FDI}(\bar{c})$. Define this common profit by $\bar{\pi}$. With these preparations we next compute expected profits.

With exporting, substituting p_h^X and p_f^X into the profit expression (10) and taking the expectation yields the foreign firm's expected profit

$$E[\pi_f^X] = \bar{\pi} + \frac{(2-\delta^2)^2}{(4-\delta^2)^2(1-\delta^2)} \sigma_{f,F}^2$$

and the home firm's expected profit

$$E[\pi_h^X] = \bar{\pi} + \frac{(1-\delta)^2}{4(1-\delta^2)} \sigma_\alpha^2 + \frac{1}{4(1-\delta^2)} \sigma_{h,H}^2 + \frac{\delta^2}{(4-\delta^2)^2(1-\delta^2)} \sigma_{f,F}^2. \quad (11)$$

With FDI, using p_j^{FDI} and taking the expectation of (9), firm j 's expected profit is

$$E[\pi_j^{FDI}] = \bar{\pi} + \frac{(1-\delta)^2}{(2-\delta)^2(1-\delta^2)} \sigma_\alpha^2 + \frac{(1-\delta)^2}{(2-\delta)^2(1-\delta^2)} \sigma_H^2. \quad (12)$$

Again, as the firms are facing the same cost there is only one variance term for the cost shock, subscripted with H .

4.C The access mode decision for the foreign firm

From (11) and (12), the foreign firm chooses FDI whenever FDI is more profitable than exporting or

$$E[\pi_f^{FDI}] - E[\pi_f^X] = \frac{(2+\delta)^2}{(4-\delta^2)^2} \sigma_\alpha^2 + \frac{(2+\delta)^2}{(4-\delta^2)^2} \sigma_{h,H}^2 - \frac{(2-\delta^2)^2}{(4-\delta^2)^2(1-\delta^2)} \sigma_{f,F}^2 > 0. \quad (13)$$

Learning the home country demand is still valuable to the foreign firm as shown by the first variance

term in (13). The correlating of cost shocks is still harmful to the foreign firm because the second and third terms on the right sum to less than zero under the assumption of equal cost variance across countries $\sigma_H^2 = \sigma_{f,F}^2 = \sigma_c^2$. Indeed, comparing (13) with (5) shows that the coefficients are quantitatively very similar (and exactly equal if $\delta = 0$) to those in quantity competition. As a result, we obtain a similar condition as we did with quantity competition:

Proposition 1P: *When firms compete in prices, FDI is the more profitable strategy to the foreign firm if the demand uncertainty is sufficiently greater than the cost uncertainty and the goods are sufficiently heterogeneous:*

$$\sigma_\alpha^2 \geq \delta \frac{4 - \delta - 2\delta^2}{(2 + \delta)^2 (1 - \delta)^2} \sigma_c^2.$$

Thus, the foreign firm's incentive to choose FDI remains the same in price competition as in quantity competition. The inequality above holds only if demand variance is just slightly larger than is needed in quantity competition. For example, if $\delta = 3/4$, then the above condition is approximately $\sigma_\alpha \geq 1.84\sigma_c$ while with quantity competition the condition is approximately $\sigma_\alpha \geq 1.25\sigma_c$.²³ Further, both for price and quantity competition, the value from learning demand information decreases as the goods become more homogenous. For example, in the case of equal variance, the maximum δ at which FDI is preferred is just slightly lower (approximately one-half) with price competition than with quantity competition.

3.D. Home country welfare

The effect of FDI on home profits is

$$E[\pi_h^{FDI}] - E[\pi_h^X] = \frac{\delta(4 - \delta)(1 - \delta)^2}{4(1 - \delta^2)(2 - \delta)^2} \sigma_\alpha^2 - \frac{\delta(4 - 3\delta)}{4(1 - \delta^2)(2 - \delta)^2} \sigma_{h,H}^2 - \frac{\delta^2}{(4 - \delta^2)^2 (1 - \delta^2)} \sigma_{f,F}^2 \quad (14)$$

Here price competition has a different qualitative result: the home firm benefits from the foreign firm learning the home demand intercept, whereas it was harmed in quantity competition. This is because

²³ The reason for this with price competition differs though. As is well known, in Bertrand competition (perfect substitutes) with constant marginal cost the equilibrium is determined by the marginal cost (so long as marginal cost is less than the demand intercept) and so learning the exact demand intercept has no value. Thus, as the goods become more homogenous the value of learning the demand intercept decreases.

in price competition a rival's response amplifies the demand shock: when there is a high (low) demand intercept, a rival responds with a higher (lower) price, which is equivalent to an even greater (smaller) demand intercept for the firm (see eq. 13). This is akin to a mean-preserving spread in the distribution of the demand intercept.²⁴ In contrast, in quantity competition when there is high (low) demand, the rival increases (decreases) output, which is akin to dampening the change in the demand intercept. Despite this qualitative difference in demand learning, the general qualitative result is the same because the demand effect is small relative to the loss from correlating the cost. As a result, unless the demand uncertainty is much greater than the cost uncertainty, the home firm is harmed by FDI. From (14) we obtain:

Proposition 2P: *When firms compete in prices, the home firm is harmed by FDI if*

$$\sigma_a^2 \leq \delta \frac{16 - 8\delta + 8\delta^2 + 3\delta^3}{(2 + \delta)^2 (1 - \delta)^2 (4 - \delta)} \sigma_c^2.$$

Notice that the coefficient on σ_c^2 in proposition 2P is greater – at least three times greater than the coefficient on σ_c^2 in proposition 1P. Thus, when the foreign firm prefers FDI, the home firm is harmed unless the variance on demand uncertainty is at least three times larger than that on cost uncertainty. For highly differentiated products this condition is more stringent. For example, if $\delta = 1/4$, the demand variance needs to be over five times greater for the home firm not to be harmed.

Corollary: *The foreign firm prefers FDI and it harms the home firm when*

$$\sigma_a^2 \in \left\{ \delta \frac{16 - 8\delta + 8\delta^2 + 3\delta^3}{(2 + \delta)^2 (1 - \delta)^2 (4 - \delta)} \sigma_c^2, \delta \frac{4 - \delta - 2\delta^2}{(2 + \delta)^2 (1 - \delta)^2} \sigma_c^2 \right\}.$$

In particular, the home firm is harmed by profitable FDI if the demand variance is less than three times greater than the cost variance.

Consider next home consumer welfare. If the foreign firm exports, substituting the equilibrium prices and quantities into (1) and taking the expectation yields

²⁴ This effect also exists for the foreign firm, but it is secondary because the *size* of the price changes from a change in α decreases faster in δ .

$$E[CS_h^X] = \overline{CS}_h + \frac{(1-\delta)(5+3\delta)}{8(1-\delta^2)} \sigma_\alpha^2 + \frac{1}{8(1-\delta^2)} \sigma_{h,H}^2 + \frac{4-3\delta^2}{2(4-\delta^2)^2(1-\delta^2)} \sigma_{f,F}^2$$

If the foreign firm chooses FDI, then expected consumer surplus is

$$E[CS_h^{FDI}] = \frac{1}{(1+\delta)(2-\delta)^2} \sigma_\alpha^2 + \frac{1}{(1+\delta)(2-\delta)^2} \sigma_{h,H}^2.$$

The effect of FDI on home consumer surplus is

$$E[CS_h^{FDI}] - E[CS_h^X] = -\frac{(1-\delta)^2(12+4\delta-3\delta^2)}{8(1-\delta^2)(2-\delta)^2} \sigma_\alpha^2 + \frac{4-4\delta-\delta^2}{8(1-\delta^2)(2-\delta)^2} \sigma_{h,H}^2 + \frac{4-3\delta^2}{2(4-\delta^2)^2(1-\delta^2)} \sigma_{f,F}^2. \quad (15)$$

From (15) we find the second difference between price and quantity competition. With price competition, when the consumer values the product more, the firm raises its price, and when they value the product less the firm lowers the price. As a result consumers are harmed when the foreign firm chooses FDI. In contrast, with quantity competition when the consumer values the product more, the firm increases its output, benefiting consumers. From (15) we obtain:

Proposition 3P: *FDI reduces home expected consumer surplus.*

Turning to home country welfare from (14) and (15) we have

$$E[W_h^{FDI}] - E[W_h^X] = -\frac{(1-\delta)^2(6+3\delta)}{8(1-\delta^2)(2-\delta)} \sigma_\alpha^2 + \frac{(2-5\delta)}{8(1-\delta^2)(2-\delta)} \sigma_H^2 - \frac{1}{2(4-\delta^2)(1-\delta^2)} \sigma_{f,F}^2.$$

Consumers are harmed by FDI. The home firm could benefit from FDI only if demand uncertainty is far greater than cost uncertainty, but that is the condition that harms consumers even more. Thus, we can conclude:

Proposition 4P: *FDI reduces home country welfare.*

Thus, both in price and quantity competition FDI reduces home country welfare if the firms produce similar goods. Even if they produce highly differentiated goods, home country welfare declines under

strong cost uncertainty.

5. Conclusions

We consider information-based FDI decisions under demand and cost uncertainty in a model in which the foreign firm competes with the home firm in the home market. FDI allows the foreign firm to learn home demand, which increases its expected profit. However FDI also means buying labor and other inputs from the local markets. Thus, even if cost information is private, the foreign firm can infer the rival's cost by observing its own cost realization. More importantly, buying its inputs from the same national market as does the home firm correlates the firms' costs. We find that this correlation of costs reduces the value from learning cost information. Intuitively, the harm arises because a correlation of costs reduces a firm's ability to exploit the cost information. For example, if a firm learns it has low cost it exploits this information by expanding its output. However, with correlated cost the rival too would expand its output, mitigating the benefit from the information. This effect, like the demand effect, exists in both price and quantity competition. Thus, FDI decisions hinge on the balance of the benefit from learning demand shocks against the harm from correlation of costs. We conclude that the foreign firm chooses FDI over exporting if demand uncertainty is sufficiently greater than cost uncertainty.

Our second finding is that the FDI decision also depends on the substitutability of the goods the firms produce. Somewhat counter-intuitively, the more closely related the goods, the less valuable the demand information acquisition is to the foreign firm in both price and quantity competition, though for different reasons. In quantity competition, this is because a firm's ability to exploit the information learnt is mitigated by the rival's reaction to this same information. For example, a firm reacts to the news that demand is stronger than expected by expanding output. However, the rival also expands its output, lowering the market price for the firm. The more substitutable the goods firms produce, the greater the price effect, and hence the less valuable the demand information. In price competition this effect is reversed so the firm benefits from this the more substitutable the goods that they produce.²⁵ However, as the goods become closer substitutes, information about the demand intercept becomes less important for the equilibrium prices – indeed, with Bertrand competition (i.e., perfect substitutes) the equilibrium price is determined by cost. The upshot is that the more substitutable the goods the firms produce, the less valuable the demand

²⁵ For example, when the firm learns that demand is stronger than expected, it raises its price and the rivals raises its price to the firm's benefit.

information becomes and hence the more likely that the foreign firm chooses exporting over FDI.

These two effects mean that the foreign firm would choose FDI over exporting only if the firms do not produce close substitutes or if the demand uncertainty is sufficiently large relative to the cost uncertainty. This result holds both in price and quantity competition and so offers a testable hypothesis. The insight here can also help explain the heterogeneity in access mode selections observed. Specifically, if our model were modified so that all firms are foreign, then when demand uncertainty is small we would have identical firms preferring to locate production in different countries to avoid a correlation of costs.

Turning to home welfare analysis, we find that the home firm is generally harmed by FDI that is profitable to the foreign firm. The exception to this occurs when demand uncertainty is significantly greater (at least three times the variance) than cost uncertainty and the firms compete in prices. Turning to home consumers, they benefit from FDI if the firms compete in quantities because the firms increase production when consumers have a high marginal value, which consumers are willing to trade-off for less production when they have low demand (that is, little value for the product). Despite the beneficial effect on consumers, however, FDI that is profitable to a foreign firm is usually harmful to the home country as a whole. In price competition the effect on consumers is reversed because consumers see higher prices exactly when their marginal values are high. Thus, the negative welfare effect of FDI is exacerbated when firms compete in prices. In conclusion, FDI is likely to decrease domestic country welfare. The exception to this conclusion occurs if all three of the following conditions are met: the goods are sufficiently differentiated, cost uncertainty is sufficiently greater than demand uncertainty (to the extent that FDI occurs) and the firms compete in quantities.

The results here provide insights to previous work regarding FDI and more specifically FDI under uncertainty (e.g., Qiu and Zhou 2006 and Sung and Lapan 2000). In particular, Qiu and Zhou (2006) consider whether the foreign firm would choose to merge with a domestic firm to gain demand information, finding that in quantity competition such a merger could be profitable under conditions when mergers are not normally profitable. However, since there is cost to an output-coordination merger (so merger is normally not profitable), the foreign firm would not choose merger if FDI is available. Our results resolve this issue: if there are cost uncertainties the foreign firm could prefer such a costly merger to FDI so as to avoid correlating its cost. Our result also points to an interesting avenue for future research: examination of the role of product differentiation in information-gathering international merger versus FDI in the presence of cost uncertainty. Potentially output-coordination mergers with a foreign firm could be preferable for a home firm even when the goods are relatively homogenous (unlike in Qiu and Zhou 2006) because the home firm no longer

would face the cost of losing its demand-information (since the foreign firm would choose instead FDI) and would eliminate the cost of correlating its cost with the foreign firm.

Our analysis suggests other directions in research. One would be to consider other types of learning. For example, propinquity of production allows firms to gain specific information regarding the rivals, including firm-specific demand information (as opposed to common demand examined here) and firm-specific cost information. A second possibility is to relax our assumption regarding equal cost variances, which would change the relative value of learning the country specific costs. The implication though is relatively straightforward, e.g., greater home cost uncertainty would make FDI relatively more attractive. A third manner in which to extend the results would be to have more than one foreign or home firm. These possible extensions are left for future research.

References

- Caves, R. E., 1971, International corporations: the industrial economics of direct investment, *Economica* 38, 1 – 27.
- Caves, R. E., 1996, *Multinational enterprise and economic analysis*, 2nd edition, London: Cambridge University Press.
- Creane, A., and Miyagiwa, K., 2008, Foreign direct investment and the welfare effects of cost harmonization, 1090566 SSRN working paper series
- Ethier, W. J., 1986, The multinational firm, *Quarterly Journal of Economics* 101 (November), 805-833
- Gal-Or, E. 1986, Information Transmission – Cournot and Bertrand Equilibrium, *Review of Economic Studies* 53, 85-92
- Gorg, H. and D. Greenaway, 2004, “Much ado about nothing? Do domestic firms really benefit from foreign investment?” *World Bank Research Observer* 19(2), 171-197.
- Helpman, E.; Melitz, M. J.; and Yeaple, S. R., 2004, Export versus FDI with heterogeneous firms. *American Economic Review* 94, 300-316
- Horstmann, I. J., and Markusen, J. R., 1996, Exploring new markets: direct investments, contractual relations and the multinational enterprise, *International Economic Review* 37, 1 – 19.
- Kotseva, R., and N. Vettas, 2005, Foreign direct investment and export dynamics with demand learning, CERP Discussion Paper 5262
- Markusen, J. R.; 1995, The boundaries of multinational enterprises and the theory of international trade. *Journal of Economic Perspectives*, Vol. 9, No. 2, Spring, 169-189
- Markusen, J. R., 2003, *Multinational firms and the theory of international trade*; Cambridge, MIT Press
- Qiu L. D. and W. Zhou, 2006, International mergers: incentives and welfare, *Journal of International Economics* 68, 38-58
- Sung, H., and H. E. Lapan, 2000, Strategic foreign direct investment and exchange-rate uncertainty, *International Economic Review* 41, 411-423
- Vives, X. 1990. Trade association disclosure rules, incentives to disclose information and welfare. *Rand Journal of Economics* 21(3): 409-30