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Exports, FDI or Strategic Alliance?

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Entering a Foreign Market: Exports, FDI or Strategic Alliance?

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Abstract

The decision over exports vs. foreign direct investment (FDI) is usually discussed in an extension of the so-called Melitz model where firms with heterogeneous costs compete in a monopolistically competitive industry. The present paper starts from a situation where a potential foreign entrant would be just indifferent between exports and FDI in such a setting. However, by assuming oligopolistic interaction, strategic considerations are also taken into account. It is shown how the strategic impact of lower marginal cost makes FDI more attractive in a Cournot setting while exports are preferable under price competition in a market with differentiated goods. Beyond that it is also explored how a strategic alliance with a local incumbent could be a superior alternative for market entry.

Keywords: Entry strategies, Trade, FDI, Alliances, Oligopoly

JEL–classification: D43, L11, L41

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1 Introduction

While relatively unproductive firms only produce for the home market, the more productive competitors tend to also export or even invest in production facilities in foreign countries. In the theory of international trade this behavior can be explained by the so-called Melitz model (Melitz 2003). Extensions of the model state that the most productive firms prefer FDI (foreign direct investment) to exports (see Helpman et. al. 2004). Beyond that, it is also possible to use the Melitz model to tackle questions concerning decisions about outsourcing and offshoring (see e. g. Helpman 2006).

However, the Melitz model is based on monopolistic competition and therefore does not consider strategic interactions between oligopolistic competitors. As foreign market entry often takes place in oligopolistic industries, it seems to be important to understand these strategic considerations as well. Beyond that, such a setting also allows to analyze whether some sort of strategic alliance might be a superior alternative for market entry.

In order to deal with these questions, an oligopoly model is considered. The starting point is a Cournot duopoly with a domestic incumbent and a foreign entrant. If the foreign firm enters with the export strategy, it has a variable cost disadvantage due to trade costs. Entering by FDI avoids this cost disadvantage; however, there is a higher fixed cost as the firm has to set up another facility. Due to these cost differences, a firm entering by FDI is a more aggressive competitor. This is a strategic advantage in the Cournot setting as the other firm reacts with an output contraction.

The analysis is extended in two directions. By assuming more than one local competitor (Cournot oligopoly) the impact of the number of firms and the possibility of forming a strategic alliance with a local firm can be considered. Another extension considers product differentiation which allows to compare price and quantity strategies.

What happens if the entrant forms a strategic alliance with one of the competitors? Within such an alliance the entrant could transfers the know-how via licensing or franchising to one of the foreign firms that will then produce the additional variety. As another option, the two cooperating firms could set up a joint venture in order to produce and market the good. A strategic alliance might differ from exports and FDI with respect to production and transaction cost parameters. Depending on the specific circumstances, the alliance strategy might be more or less efficient than any of the two alternatives. However, beyond the impact on efficiency, such a cooperative venture could also affect incentives in a way that transforms to a strategic advantage for the cooperating firms. In particular, following a concept developed in Morasch (2000), the contract between the firms may be used as a strategic device that can be adapted to the specific situation in the product market.

While being more aggressive is a strategic advantage if the oligopolistic firms compete in quantities, the reverse is true under price competition. As price competition with

homogeneous products yields marginal cost pricing even in duopoly and a limit pricing monopolist under heterogeneous cost, the analysis has to be extended to a market with horizontally differentiated goods. Using a linear specification, it is straightforward to compare price and quantity competition in this setting.

Recently there have been a couple of papers who also consider oligopolistic competition in the context of the Melitz model or similar approaches. Bekkers/Francois (2013) and Collie (2016) both show that under oligopoly with differentiated products a positive welfare effect of trade is not assured even with free entry. Of these two papers Bekkers/Francois (2013) is more closely related to the initial Melitz model and the variant with an endogenous distribution of mark-ups in Melitz/Ottaviano (2008). However, while both these models consider oligopolistic competition, they do neither deal with individual entry decision nor with the potential strategic impact of the entry mode under oligopoly. More closely related to our paper is Barac/Moner-Colonques (2016) who consider simultaneous entry of two firms with FDI versus exports in an oligopolistic industry under cost heterogeneity. However, among other things their analysis differs from ours in considering technological spillovers from the more efficient incumbent firm to the less efficient foreign entrants. Finally, in a quite recent paper Bernard et. al. (2018) develop an alternative to the Melitz model that allows for large firms that consider their impact on market aggregates when deciding about their strategies. This quite complex general equilibrium model is used to provide testable predictions about international trade and competition. However, due to the complexity of interactions in this model, it cannot easily be adapted to analyze the specific impact of strategic interactions and alliance formation in the context of the entry decision of a single firm.

The rest of the paper is organized as follows. Section 2 starts with a situation where a firm would be indifferent by entering a foreign market with exports or FDI in a static version of the Melitz model. Analyzing a Cournot duopoly it is shown how the strategic effect due to lower marginal cost makes FDI more attractive. Using a linear specification, it is then explored whether and when this effect is likely to be of relevant magnitude. Section 3 extends the analysis to a Cournot oligopoly with more than one incumbent firm. This allows us to analyze how the number of competitors affects the strategic impact. And, as the central aspect of this section, we consider forming an alliance with one of the incumbents as an alternative entry strategy and compare it with exports and FDI. Section 4 assumes a market with differentiated products and shows how the strategic impact differs between price and quantity competition. Section 5 concludes.

2 Export vs. FDI in Cournot duopoly

In a market with heterogeneous firms it depends on relative productivity whether a firm decides to enter a foreign market via exports or FDI. This can be shown in a static

version of the Melitz model as proposed in Helpman (2006). Hereby it is assumed that firms compete in a monopolistically competitive industry. More productive firm with lower marginal cost will produce a higher quantity in equilibrium and earn higher profits. However, firms are assumed to be of negligible size relative to the size of the industry. This implies the absence of strategic considerations in such a setting.

There are two kind of costs if a firm wants to sell to a market. There is a fixed cost which is identical for all firms and a variable cost which depends on the specific productivity θ_j of a given firm j. The fixed cost for selling to the domestic market is given by f_D. The rising straight line in figure 1 that starts at $-f_D$ indicates the domestic profits π_D of a firm as a function of the productivity measure Θ.[1] A firm with a higher productivity will choose a lower profit maximizing price which yields higher sales and lower average cost. Together this implies higher profits for a more productive firm. Only firms to the right of the threshold level Θ_D will produce for the domestic market.
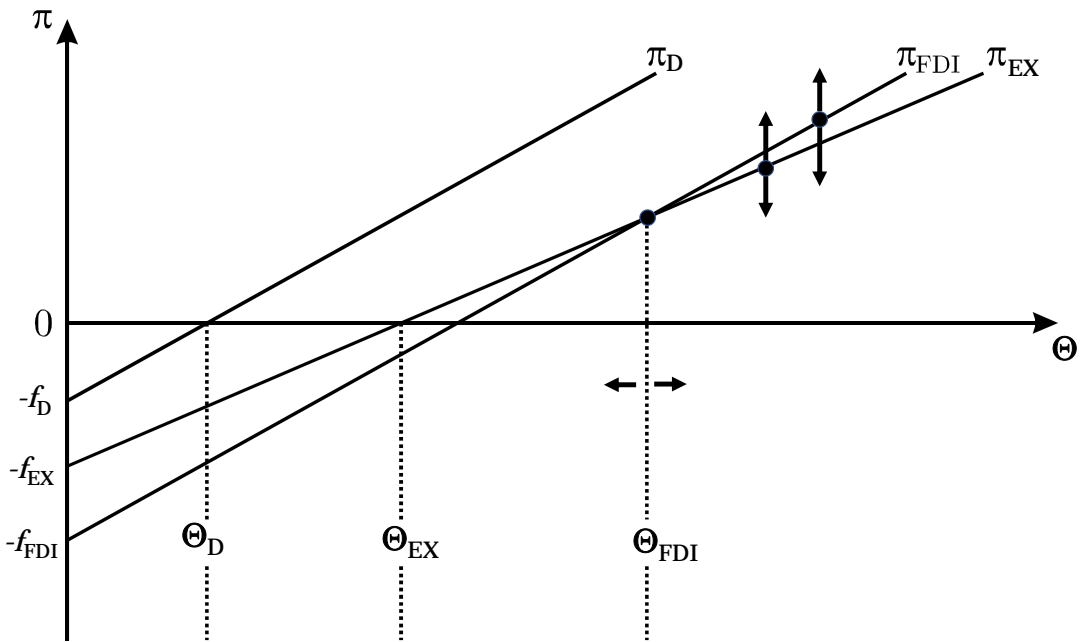

Figure 1: Exports vs. FDI in the Melitz model

Beyond selling to the domestic markets, firms could also sell to foreign markets. This could either be done by exporting or by setting up a production facility in the foreign

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[1] Assuming a demand function with constant demand elasticity ϵ derived from a constant elasticity of substitution utility, and variable production costs given by c/θ_j, setting $\Theta \equiv \theta^{\epsilon-1}$ yields a linear function $\pi(\Theta)$. See Helpman (2006, p. 593) for details.

country (FDI). For simplicity we assume that there is only one foreign market which has the same demand elasticity as the domestic market. The fixed cost for exporting to the foreign market, f_{EX} is assumed to be higher than f_{D}, and the exporting firm must incur iceberg trading costs. This implies that π_{EX} is below π_{D} and also flatter due to the variable trading cost. The fixed cost for FDI is even higher. However, in this case there is no trading cost and therefore π_{FDI} is as steep as π_{D}. As a result, firms with a productivity above Θ_{EX} will not only produce for the local market but also sell to the foreign market. If the productivity is below Θ_{FDI} they will do so by exporting, if it is above they opt for FDI.

The Melitz model tries to explain important empirical facts in international trade and investment across markets. Our question is much narrower, as we want to explore the foreign market entry strategy of a single firm. The analysis in the Melitz model is already quite complex with monopolistic competition and it would be hardly tractable if oligopolistic interaction should be considered as well.[2] While sticking to the basic cost structure with respect to fixed and variable costs, the actual analysis will therefore be performed in standard partial equilibrium oligopoly models. In a first step the basic strategic forces will be presented in a graphical analysis. Afterwards a linear specification will be used to shed some light on the quantitative importance of strategic aspects.

The impact of strategy considerations can most easily be illustrated in a Cournot duopoly setting as displayed in figure 2.[3] We assume that the entering firm E and the domestic incumbent I have identical and constant marginal cost c if firm E uses the FDI strategy. With the export strategy the marginal cost of firm E is higher due to the trading cost t. The reaction curves in the diagram depict profit maximizing quantities for a given quantity of the other firm. For each value of x_{I}, an exporting firm will choose a lower quantity x_{E} than a firm that entered with the FDI strategy. This is due to the higher marginal cost $c + t$. Accordingly the reaction curve of a firm entering with the export strategy, $r_{\text{E}}^{\text{EX}}(x_{\text{I}})$, is to the left of the reaction curve under FDI, $r_{\text{E}}^{\text{FDI}}(x_{\text{I}})$.

At the intersection between $r_{\text{E}}^{\text{EX}}(x_{\text{I}})$ and $r_{\text{I}}(x_{\text{E}})$ we obtain the Cournot-Nash equilibrium **a**. At this equilibrium the quantity of the incumbent, $x_{\text{I}}^{*\text{EX}}$, exceeds the quantity of the entrant, $x_{\text{E}}^{*\text{EX}}$. Now consider that the entrant contemplates about changing his

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[2]The additional complexity introduced by oligopolistic competition can be observed in Bernard et. al. (2018) who develop an alternative model for international trade under imperfect competition that considers the possibility of large firms. This model is quite helpful to analyze some empirical facts that cannot be addressed in the Melitz model. However, due to the large number of additional interactions, such a general equilibrium setting is less well suited to deal with the question how strategic considerations affect the entry mode of a single firm for a given market.

[3]In figure 2 the reaction curves are straight lines, which will be the case with linear demand. However, this assumption is not necessary: as long as the reaction curves are downward sloping and the reaction curve of the entering firm E is steeper than the reaction curve of the incumbent I, we obtain identical qualitative results.
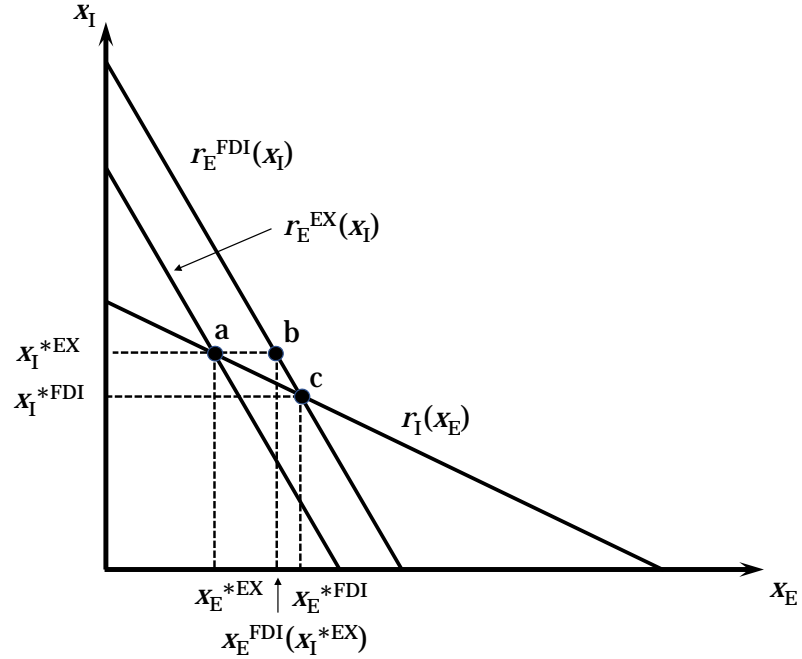
Figure 2: Exports vs. FDI in a Cournot Duopoly

entry strategy. Choosing FDI, the marginal cost would be lower but the fixed cost higher. Producing x_E^{*EX} is therefore no longer profit maximizing. Assuming that the incumbent does not change its quantity, it would be optimal to depart to point **b** on the reaction curve $r_E^{FDI}(x_I)$ and produce quantity $x_E^{FDI}(x_I^{*EX})$. This kind of reaction would also be observed under monopolistic competition: for given demand, a firm with lower marginal cost maximizes its profit by choosing a higher quantity (or charging a lower price). However, in the oligopoly setting there is an additional strategic effect. When determining the equilibrium quantity, the incumbent will now consider that the reaction curve of the entrant has shifted outward. This yields an output reduction to the new equilibrium quantity x_I^{*FDI}, and as residual demand for the entrant increases, an additional output expansion to x_E^{*FDI} is profitable. Together this yields the equilibrium under FDI in point **c**. If an entrant is indifferent between exporting in **a** and FDI in **b**, we would be exactly at the intersection between the profit schedules for exporting and FDI in figure 1. However, the strategic effect renders the FDI strategy more profitable as the incumbent firm reduces output relative to the equilibrium with an exporting entrant.

To get an idea about the magnitude of the strategic effect, we will now consider a linear Cournot duopoly. As we are only interested in the relative impact on profits, we could use

the easiest formulation with demand $p(x_I, x_E) = 1 - (x_I + x_E)$, and normalized marginal production cost $c = 0$. If we also normalize fixed cost for domestic production and for exporting to $f_D = f_{EX} = 0$, we get the following profit functions for the incumbent firm and the exporting entrant:

$$\pi_I(x_I, x_E) = [1 - (x_I + x_E)]x_I \tag{1}$$
$$\pi_E(x_I, x_E) = [1 - (x_I + x_E)]x_E - tx_E. \tag{2}$$

The resulting equilibrium quantities for the incumbent and the exporting firm are:

$$x_I^{*EX} = \frac{1+t}{3} \tag{3}$$
$$x_E^{*EX} = \frac{1-2t}{3} \tag{4}$$

In equilibrium, profits of the incumbent and an entrant with the FDI strategy only differ with respect to the fixed cost f_{FDI}. To determine the profit impact of the strategic effect — the move from point **b** to point **c** in figure 2 — this fixed cost must be set in a way that profits with the export strategy in point **a** are equal to profits that would result with the FDI strategy in point **b**. Therefore we must set $\pi_E^{EX}(x_I^{*EX}, x_E^{*EX})$ equal to $\pi_E^{FDI}(x_I^{*EX}, r_E^{FDI}(x_I^{*EX}))$ and solve for f_{FDI}. To obtain this equation, we must first determine $r_E^{FDI}(x_I^{*EX})$ by inserting x_I^{*EX} into the profit function of the firm entering with the FDI strategy. Solving the first-order condition for profit maximization with respect to x_E^{FDI} yields

$$r_E^{FDI}(x_I^{*EX}) = \frac{2-t}{6} \tag{5}$$

Note that the quantity produced is higher than x_E^{*EX} but still declining in t. This stems from the fact that the incumbent chooses a higher quantity if faced by a less competitive exporting entrant. The resulting profit for the entrant with the FDI strategy is given by

$$\pi_E^{FDI}(x_I^{*EX}, r_E^{FDI}(x_I^{*EX})) = \frac{(2-t)^2}{36} - f_{FDI} \tag{6}$$

When solving for the fixed cost that equalizes profits under exporting with profits under FDI assuming the quantity of the incumbent remains unchanged, we obtain

$$\hat{f}_{FDI} = \frac{t(4-5t)}{12}. \tag{7}$$

Note that the exporting strategy is only viable for $t < 0.5$. While the fixed cost $\hat{f}_{FDI}$ that equalizes profits for the two entry strategies rises in t for values close to zero, it actually declines when approaching $t = 0.5$. This is due to the fact that the incumbent covers nearly the whole market in the asymmetric cost equilibrium, which implies that residual demand and consequently the profit potential for the entrant with the FDI strategy is relatively low.

π

0,10

0,08 $\pi_{\mathbf{E}}^{\mathbf{FDI}}(x_{\mathbf{I}}^{*\mathbf{EX}},\, \hat{f}_{\mathbf{FDI}}) + \hat{f}_{\mathbf{FDI}}$

0,06 $\pi_{\mathbf{E}}^{*\mathbf{FDI}}(\, \hat{f}_{\mathbf{FDI}})$ (point **c**)

0,04

0,02 $\pi_{\mathbf{E}}^{*\mathbf{FDI}} - \pi_{\mathbf{E}}^{\mathbf{FDI}}(x_{\mathbf{I}}^{*\mathbf{EX}})$ $\pi_{\mathbf{E}}^{\mathbf{FDI}}(x_{\mathbf{I}}^{*\mathbf{EX}},\, \hat{f}_{\mathbf{FDI}})$ (point **b**) [$=\pi_{\mathbf{E}}^{*\mathbf{EX}}$ (point **a**)]
(strategic effect)

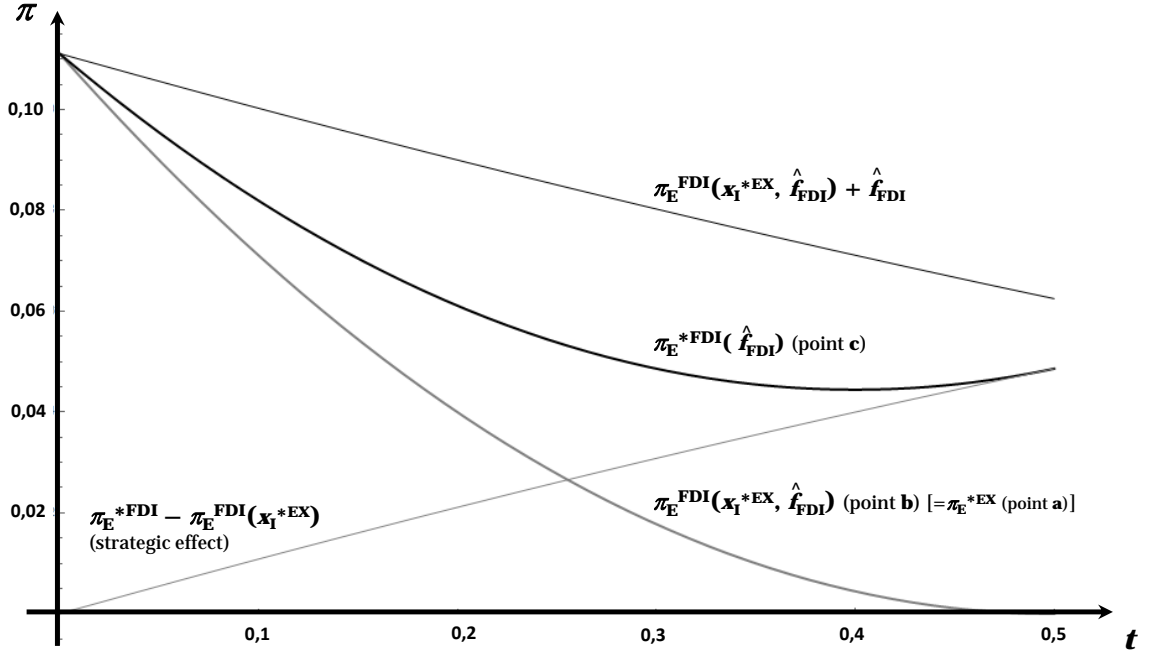0,1   0,2   0,3   0,4   0,5 t

Figure 3: Linear Cournot Duopoly - Exports vs. FDI

Based on this information, we are now able to compare the profits in point **b** and **c**. Figure 3 displays profits as a function of t in the relevant range $t \in [0, 0.5]$. The thick line represents the equilibrium profits of a firm that enters with the FDI strategy. Note that revenue does not depend on t in this case. The reason for the slope of this curve is the impact of t on $\hat{f}_{\mathrm{FDI}}$ (details see above). The declining gray line below displays profits for a firm entering with FDI without the strategic effect (the profits in point **b** in figure 2). Note that $\hat{f}_{\mathrm{FDI}}$ has been determined in a way that these profits are identical to the profits of a firm that enters with the export strategy (the profits of such a firm in point **a** in figure 2). The downward sloping line in the upper part of the graph displays the variable part of the profits of an entrant with the FDI strategy in point **b** in figure 2. Although the fixed cost $\hat{f}_{\mathrm{FDI}}$ is not subtracted from the revenue, this curve is nevertheless downward sloping because a higher t implies a higher equilibrium quantity $x_{\mathrm{I}}^{*\mathrm{EX}}$ of the incumbent which implies a lower residual demand for the entrant. Finally, the upward sloping line that starts at the origin depicts the strategic effect (profit change due to the movement from **b** to **c** in figure 2).

At first sight the impact of the strategic effect seems to be limited — the profit changes amount to about 1/10th of the trade cost t. However, if one considers the change in c that would be necessary to obtain the same profit without the strategic effect, i.

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e. for a constant quantity of the incumbent, the magnitude appears more relevant. Straightforward calculations show that the necessary reduction Δc would equal $t/2$. Therefore, we can state as a preliminary result from the duopoly analysis that the impact of the strategic effect is likely to be economically relevant.

3 Cournot oligopoly and alliance formation

While there are situations with a monopolistic incumbent in a foreign market, it is much more likely that there are already some competing firms in this market. Therefore, we will now consider a Cournot oligopoly with $n \geq 3$ firms. To make the analysis as simple as possible, we still assume some entry barriers which yield a given number of domestic firms earning positive profit. We also still assume that all firms have identical production costs that are normalized to zero.

This setting allows us to work with aggregate reaction curves . Therefore a graphical representation is still feasible.[4] In the exporting vs. FDI scenario the entrant is still a single player. However, its reaction curve $r_E(X_I)$ with $X_I = (n-1)x_I$ shows how it optimally responds to the joint output of all incumbent firms together. For the incumbent firms the aggregate reaction curve $R_I(x_E)$ displays the joint production of all incumbents at the given production of the entrant, assuming each incumbent firm behaves as a Cournot competitor relative to the other firms.

We are going to deal with two questions in the oligopoly setting. The first one is the impact of the number of domestic competitors on the strategic effect when comparing exporting and FDI. The second aspect is the possibility of another strategy for market entry: the entering firm may form some sort of alliance with one of the domestic competitors. Restricting attention to the strategic impact, we will assume that forming an alliance will neither affect fixed costs nor variable costs of the cooperating firms relative to entry with the FDI strategy.

The graphical representation for the export vs. FDI scenario in the Cournot oligopoly setting is qualitatively identical to the duopoly analysis. The only difference is that the aggregate reaction curve of the incumbents, $R_I(x_E)$, is steeper than the individual reaction curves and this steepness increases with the number of incumbent firms. As a graphical analysis of exports vs. FDI in the oligopoly setting would therefore not give any additional information relative to the duopoly analysis, we will now first restrict attention to the scenario with alliances and consider exports and FDI not until determining explicit solutions in the linear model.

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[4]As only the joint reaction of all domestic firms together (or the outsiders if we consider the possibility of an alliance) is relevant, such a graphical representation would also be possible with heterogeneous costs as long as all firms produce in each equilibrium.

To understand the proposed concept of a strategic alliance it is helpful to compare it with a non-strategic alliance. Such a kind of cooperation has been discussed in the context of merger analysis. In both cases the group of firms that forms an alliance or merges aims to maximize joint profits. However, only in a strategic alliance these firms are able to commit to a certain joint strategy before outsiders decide about their strategies. Under these circumstances joint profits of alliance members will never decline relative to the situation without an alliance: the cooperating firms behave together as a Stackelberg leader and thus may set their strategy in a way that is beneficial to them. However, if the cooperating firms and the remaining outsiders simultaneously decide about their strategic variable, an unintended strategic effect may eventually yield a profit reduction for the alliance members.

Salant/Switzer/Reynolds (1983) were the first to point out this negative consequence of a merger. In a Cournot oligopoly joint profit maximization of the merging firms calls for an output reduction relative to the sum of pre-merger outputs. As a reaction, outsiders will expand output which negatively affects the profits of the merger. This unintended strategic effect may dominate the internalization advantage of joint profit maximization. As a result mergers without synergies are only profitable if almost all firms in an industry join together.[5]

The situation may be visualized in a diagram with reaction curves showing the aggregate quantities of cooperating firms and remaining outsiders, respectively. Consider a Cournot market with n oligopolists and let two firms form an alliance. Variables which refer to cooperating firms are labeled by subscript A while subscript O indicates outsiders: X_A stands for the total quantity produced by the alliance members, Π_A for the joint profit of these firms, and X_O for total production of the other firms ("outsiders")in the industry. The different equilibria will be indicated by $\mathbf{n}$ for the initial non–cooperative Cournot equilibrium, $\mathbf{m}$ for the equilibrium where the alliance members behave like a merger (no commitment by cooperating firms) and $\mathbf{s}$ for the equilibrium with a strategic alliance (cooperating firms behave together as a Stackelberg leader relative to the rest of the industry).

Figure 4 displays three aggregate reaction curves: The reaction function $R_O(X_A)$ shows the aggregate output X_O of outsiders that results in a Cournot equilibrium between these oligopolists for a given level of total output produced by the cooperating firms. $R_A^{\mathbf{n}}(X_O)$ refers to the total output of cooperating firms if they would behave like non–cooperating Cournot competitors — the intersection of the two reaction curves is the Cournot equilibrium $\mathbf{n}$. Finally, $R_A^{\mathbf{m}}(X_O)$ shows the total production of the cooperating

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[5]Note that this result does not carry over to an oligopoly with price competition (strategic complements). Because outsiders raise their prices as a reaction to the price increase by the merger, mergers are always profitable (see Deneckere/Davidson 1985).

firms that maximizes joint profits for a given total output of outsiders. The isoprofit contours refer to joint profits Π_A of the cooperating firms.
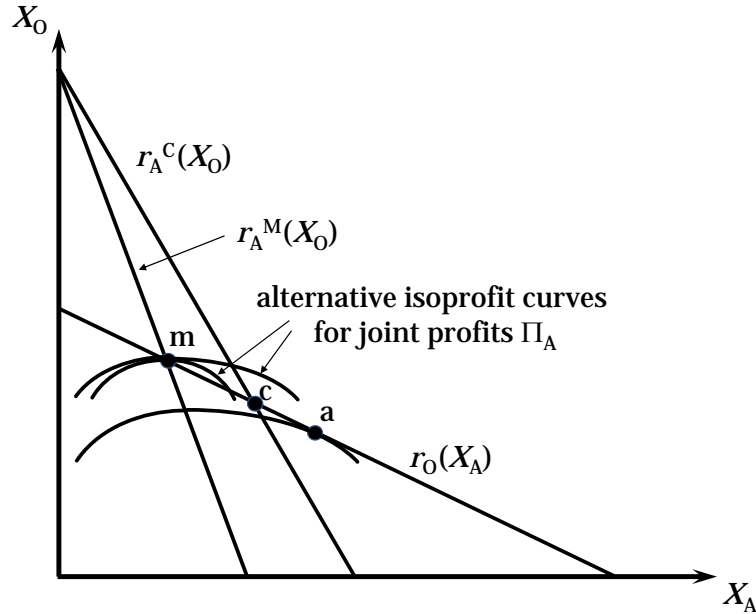

Figure 4: Impact of Strategic Alliance vs. Merger in Cournot Oligopoly

Note that $R_A^m(X_O)$ is left to $R_A^n(X_O)$ for $X_O > 0$ because cooperating firms consider the negative external effect of an output increase on the profits of their partners and thus reduce output relative to the initial Cournot equilibrium. Whether cooperation without commitment (i. e. a merger) is profitable depends on the isoprofit contour at the merger equilibrium $\mathbf{m}$: If the isoprofit curve intersects with $R_O(X_A)$ to the left of the initial non–cooperative Cournot equilibrium $\mathbf{n}$, profits are increased, otherwise they are lower than under Cournot competition.

The situation for the merging firms would be much more comfortable if they were able to commit to some output level: Like a Stackelberg leader they could then determine the tangential point of their joint isoprofit curve with the aggregate reaction curve of outsiders - in figure 4 this results in point $\mathbf{s}$. This would yield profits that are at least as high as in the initial Cournot equilibrium. However, it is by no means clear how a merger could achieve such a commitment. As will be argued now, strategic alliances differ from mergers insofar as they offer a commitment device.

What should enable the alliance members to commit to an output level different from the Cournot solution? The idea is that the alliance contract may serve this purpose:

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incentives in the product market will be changed if the contract somehow leads to payments between alliance members which are based on their individual output decisions. Such a contract has to be binding and must usually be observed by the other firms in the industry, since a secret agreement might not induce the intended reaction by outsiders.[6]

In practice it is not common that firms forming a strategic alliance simply sign a contract which stipulates output based payments — one reason might be that such contracts would be banned by antitrust legislation in most countries. However, as shown in Morasch (2000) the same strategic effect will be achieved if the cooperating firms establish a production joint venture for an intermediate product, agree on an appropriate transfer price, and equally share in the resulting profits or losses of the joint venture. In this case a member firm will reduce output relative to the Cournot level if the transfer price exceeds the marginal costs of the intermediate product and expand output if it has to pay less than these marginal costs. In contrast to cartel,s such production joint ventures are usually allowed by antitrust authorities, especially if they are related to some innovation collaboration on earlier stages.

In a next step we demonstrate in the Cournot oligopoly with linear demand that a strategic alliance with one of the incumbent firms is preferable to the FDI strategy from a strategic perspective (assuming costs are the same in both settings). On the other hand it can easily be seen that a non–strategic alliance (like a merger) would be worse than the FDI strategy.

Solving the linear oligopoly model for exporting and FDI, respectively, is similar to the duopoly analysis. As we assume that domestic incumbents are symmetric, they will produce identical quantities in equilibrium. We can therefore just aggregate the $(n-1)$ first-order conditions to one joint condition where $X_I = nx_I$. For the situation with exports as entry strategy this yields the following two first order conditions:

$$1 - nx_I - x_E = 0 \tag{8}$$

$$1 - (n-1)x_I - 2x_E - t = 0 \tag{9}$$

Solving for x_E and $X_I = (n-1)x_I$ would result in the reaction functions described above. Based on these reaction functions or by simultaneously solving the two equations, we obtain equilibrium quantities

$$x_I^{*\mathrm{EX}} = \frac{1+t}{n+1}, \tag{10}$$

$$x_E^{*\mathrm{EX}} = \frac{1-nt}{n+1}. \tag{11}$$

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[6]See Katz (1991) for a thorough discussion of whether and when contracts may serve as commitment devices.

Similar to the analysis in the Cournot duopoly we must then determine the profit maximizing reaction of a firm that enters with the FDI strategy (this yields point **b** in figure 2):

$$r_{\mathrm{E}}^{\mathrm{FDI}}(X_{\mathrm{I}}^{*\mathrm{EX}}) = \frac{2 - (n-1)t}{2(n+1)} \tag{12}$$

The resulting profit for the entrant with the FDI strategy is given by

$$\pi_{\mathrm{E}}^{\mathrm{FDI}}(X_{\mathrm{I}}^{*\mathrm{EX}}, r_{\mathrm{E}}^{\mathrm{FDI}}(X_{\mathrm{I}}^{*\mathrm{EX}})) = \frac{(2 - (n-1)t)^2}{4(n+1)^2} - f_{\mathrm{FDI}}. \tag{13}$$

When solving for the fixed cost that equalizes profits under exporting with profits under FDI, assuming the quantity of the incumbents remains unchanged, we obtain

$$\hat{f}_{\mathrm{FDI}} = \frac{t(4 - (3n-1)t)}{4(n+1)}. \tag{14}$$

Based on this, it is straightforward to calculate and compare profits for some values of n and t with and without the strategic effect in a similar fashion as in the Cournot duopoly. However, before we proceed with this analysis, we will also determine profits for a strategic alliance as this will allow us to compare this entry alternative with the export and the FDI strategy.

For a non–strategic alliance where the cooperating firms behave like a merger, we can just take the variable part of the equilibrium profits in the FDI setting in an industry with $(n-1)$ firms and divide the result by two (the fixed cost is not affected by the decision to cooperate). For a strategic alliance we need to take the joint reaction function of the $(n-2)$ outsiders and insert it in the joint profit function for the two alliance members:

$$\Pi_A(X_A, R_O(X_A)) = [1 - X_A - \frac{n-2}{n-1}(1 - X_A)]X_A = \frac{1}{n-1}[1 - X_A]X_A \tag{15}$$

Profit maximization then yields equilibrium quantities of alliance members and outsiders. Based on these quantities, the variable part of the profit is again given by dividing the resulting alliance profit by two:

$$\pi_A^s = \frac{1}{8(n-1)} \tag{16}$$

The actual profits of the entrant are then determined by subtracting the appropriate value for $\hat{f}_{\mathrm{FDI}}$ at the considered combination of t and n.

Figure 5 shows profits for industries with $n = 3$ to $n = 8$ firms for trade costs $t = 0.1$.[7] As expected, profits under FDI are for all n larger than profits of an exporting entrant.

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[7]The value $t = 0.1$ has been chosen as it results in positive profits for an exporting entrant as long as the number of incumbents does not exceed $(n-1) = 8$. This allows us to show a reasonable amount of qualitatively different settings (including cases where an exporting entrant is only a marginal player).
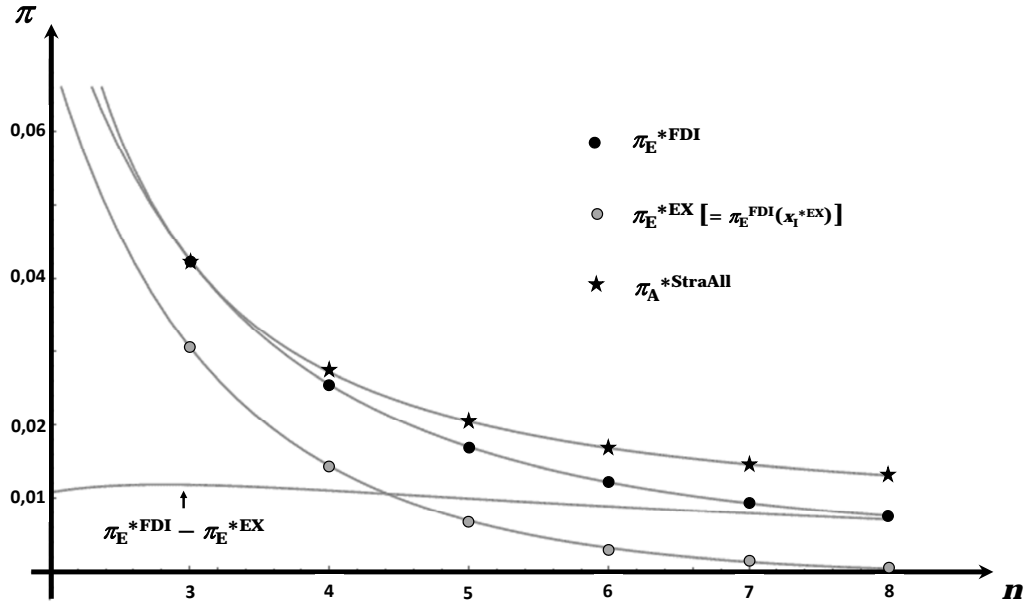
Figure 5: Strategic Alliance vs. FDI and Exports in Cournot Oligopoly for $t = 0.1$

The absolute value of the profit gain (indicated by the nearly horizontal line in the lower part of the figure) is almost constant. However, as a higher number of competitors yields lower profits for an exporting entrant, the relative advantage of the FDI strategy is more pronounced in an industry with more competitors. The strategic alliance solution yields the same profit as FDI for an industry with only one additional competitor (outsider). If four or more firms are active in the market, profits are higher with the strategic alliance and the profit difference increases with the number of competitors. In the present setting with $t = 0.1$ an entrant forming a non–strategic alliance would fare better as an exporting entrant (not shown in the graph). However, for $t = 0.05$ the non–strategic alliance would be even worse than entering with the export strategy.

4 Price and quantity competition with heterogeneous products

Extending the analysis to a situation with product differentiation does not yield qualitatively different results as long as we stick to quantities as the strategic variable. However, the strategic effect is qualitatively different if price strategies are considered.

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Whether it is plausible to assume price or quantity competition depends mainly on the importance of capacity decision in a given industry. While oligopolistic firms are not likely to be price takers (especially in markets with product differentiation), it may very well be the case that decision about capacity restrict the price setting game. As shown by Kreps/Scheinkman (1983), competition in a market with firms that first set quantities and afterwards decide about pricing is similar to Cournot competition. On the other hand, there are markets where capacity restrictions are less relevant. This is for example the case in market for information goods like software or movies. Therefore it is important to take a look at price setting games as well.

As can be seen in figure 6 reaction curves are upward sloping (strategic complements) in a heterogeneous good duopoly with price strategies : if one firm increases the price, the other firm would also react with a price increase. Considering our case with exports vs. FDI as an entering strategy, the entrant would choose a lower price under FDI. Starting from the export strategy equilibrium **a**, this will result in a move to **b** as long as the incumbent does not change its price. However, given the lower price of the entrant, the incumbent has an incentive to reduce its price as well. This yields the FDI equilibrium **c** with lower prices charged by both firms. Unlike the situation in the Cournot setting, the strategic effect yields a result with lower profits relative to point **b** for both incumbent and entrant. A potential entrant that is indifferent between exporting in point **a** and FDI in point **b** will now prefer the export strategy.

For the numerical analysis we start from a system of inverse demand that is properly rooted in a utility maximization problem. The setting is based on the love of variety approach of product differentiation pioneered by Spence (1976) and Dixit/Stiglitz (1977). Here the consumption side for the duopoly setting is given by a representative consumer with linear-quadratic utility

$$U(x_{\mathrm{I}}, x_{\mathrm{E}}; x_0) = \alpha(x_{\mathrm{I}} + x_{\mathrm{E}}) - \frac{1}{2}(x_{\mathrm{I}}^2 + x_{\mathrm{E}}^2 + 2b x_{\mathrm{I}} x_{\mathrm{E}}) + x_0 \qquad (17)$$

with x_{I} and x_{E} indicating the specific types of the differentiated good produced by firm 1 or 2, respectively, and x_0 a numeraire good which is assumed to be produced in another sector of the economy and has been added linearly to ensure that the marginal utility of income is equal to one. The parameter α is a measure of market size while b describes the degree of substitutability between the products of the two firms: If the products are perfect substitutes $b = 1$, if they are independent $b = 0$. For the ease of computation, the market size parameter is normalized to $\alpha = 1$. The consumer maximization problem then leads to the following linear inverse demand functions:

$$p_i = 1 - x_i - b x_j \quad \text{with} \quad j \neq i \qquad (18)$$

These inverse demand functions can be used to determine the equilibria in the quantity setting game similar to the Cournot analysis (for $b = 1$ we get the Cournot duopoly).
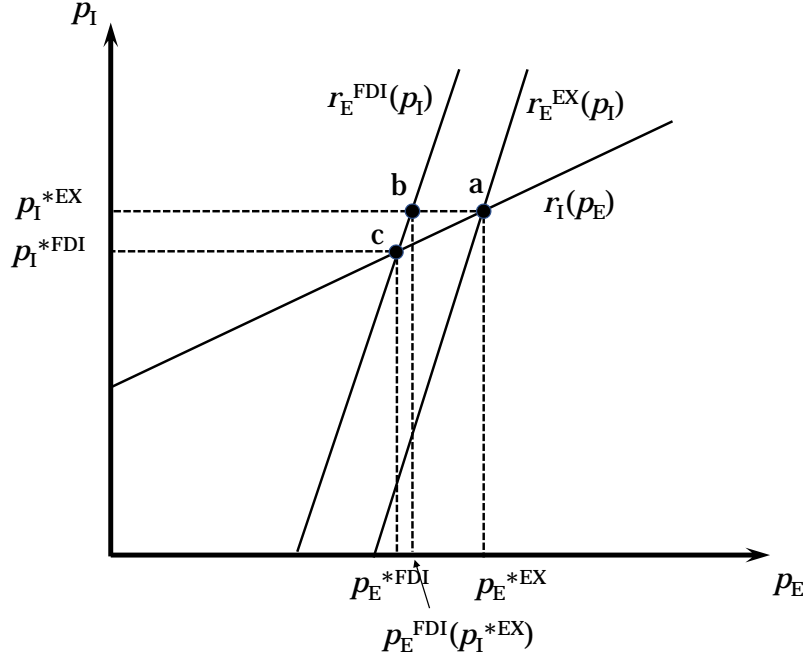
Figure 6: Exports vs. FDI in a Duopoly with Price Strategies

To analyze the price setting game the inverse demand system must be inverted. Based on the two inverse demand functions straightforward calculations yield demand functions expressing quantity demanded as a function of the two prices:

$$x_i(p_I, p_E) = \frac{1}{1-b^2}[(1-b) - p_i + bp_j] \quad \text{with} \quad j \neq \tag{19}$$

Note that this demand functions are not defined at $b = 1$ (this would be the Bertrand price duopoly with homogeneous goods).

Still assuming marginal production cost $c = 0$ and normalizing fixed cost for domestic production and for exporting to $f_D = f_{EX} = 0$, profit functions for the incumbent firm and the exporting entrant in the quantity setting game are given by

$$\pi_I(x_I, x_E) = [1 - (x_I + bx_E)]x_I \tag{20}$$

$$\pi_E(x_I, x_E) = [1 - (bx_I + x_E)]x_E - tx_E. \tag{21}$$

This results in the following equilibrium quantities for the incumbent and the exporting firm:

$$x_I^{*EX} = \frac{2 - b + bt)}{4 - b^2} \tag{22}$$

$$x_E^{*EX} = \frac{2 - b - 2t}{4 - b^2} \tag{23}$$

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As in the Cournot analysis we must determine the quantity produced by the entrant in point **b** in order to calculate the value of $\hat{f}_{\text{FDI}}$. This quantity is given by

$$r_{\text{E}}^{\text{FDI}}(x_{\text{I}}^{*\text{EX}}) = \frac{4 - 2b - b^2 t}{2(4 - b^2)} \tag{24}$$

The resulting profit for the entrant with the FDI strategy is then given by

$$\pi_{\text{E}}^{\text{FDI}}(x_{\text{I}}^{*\text{EX}}, r_{\text{E}}^{\text{FDI}}(x_{\text{I}}^{*\text{EX}})) = \frac{(4 - 2b - b^2 t)^2}{4(4 - b^2)^2} - f_{\text{FDI}} \tag{25}$$

When solving for the fixed cost that equalizes profits under exporting with profits under FDI under the assumption that the quantity of the incumbent remains unchanged, we obtain

$$\hat{f}_{\text{FDI}} = \frac{4(4 - 8b + 5b^2 - b^3) + 4t(4 + 4b - 7b^2 + 2b^3) - t^2(16 + 8b - 8b^2 - b^4)}{4(2 - b)^2(2 + b)^2}. \tag{26}$$

For price competition the analysis has to be performed by using the demand functions. This yields the following profit functions:

$$\pi_{\text{I}}(p_{\text{I}}, p_{\text{E}}) = p_{\text{I}}[\frac{1}{1 - b^2}[(1 - b) - p_{\text{I}} + b p_{\text{E}}] \tag{27}$$

$$\pi_{\text{E}}(p_{\text{I}}, p_{\text{E}}) = p_{\text{E}}[\frac{1}{1 - b^2}[(1 - b) - p_{\text{E}} + b p_{\text{I}}] - t[\frac{1}{1 - b^2}[(1 - b) - p_{\text{E}} + b p_{\text{I}}]. \tag{28}$$

This resulting equilibrium prices for the incumbent and the exporting firm, respectively, are:

$$p_{\text{I}}^{*\text{EX}} = \frac{2 - b - b^2 + bt)}{4 - b^2} \tag{29}$$

$$p_{\text{E}}^{*\text{EX}} = \frac{2 - b - b^2 + 2t}{4 - b^2}. \tag{30}$$

Note that equilibrium prices of both the entrant and the incumbent increase with rising trade costs. Similar to the previous analysis we need to determine the price chosen by the entrant in point **b** in order to calculate the value of $\hat{f}_{\text{FDI}}$. This price is given by

$$r_{\text{E}}^{\text{FDI}}(p_{\text{I}}^{*\text{EX}}) = \frac{4 - 2b - 2b^2 + b^2 t}{2(4 - b^2)} \tag{31}$$

The resulting profit for an entrant that enters with the FDI strategy is then given by

$$\pi_{\text{E}}^{\text{FDI}}(x_{\text{I}}^{*\text{EX}}, r_{\text{E}}^{\text{FDI}}(x_{\text{I}}^{*\text{EX}})) = \frac{(4 - 2b - 2b^2 + b^2 t)^2}{4(4 - b^2)^2(1 - b^2)} - f_{\text{FDI}} \tag{32}$$

We can now obtain the fixed cost that equalizes profits under exporting with the profits that result under FDI under the assumption that the quantity of the incumbent remains unchanged:

$$\hat{f}_{\text{FDI}} = \frac{t(8 - 4b - 4b^2 - t(4 - 3b^2))}{4(4 - 5b^2 + b^4)^2}. \tag{33}$$

Based on this information, we are able to compare the profits in point **b** and **c** for both price and quantity competition. Figure 7 is similar to figure 3. It is based on a value of the substitutability parameter $b = 3/4$ and therefore considers a situation with relatively close substitutes. The dashed lines depict the situation with quantity setting. These are qualitatively identical to the ones for the Cournot duopoly. The solid lines refer to price setting. Here the profits under FDI are lower than under exporting and consequently the strategic effect is negative. Also note that the variable part of the profit in point **b** is rising in t. This is due to the fact that an exporting entrant with a higher trade cost would be less aggressive which in turn induces the incumbent to raise its price. But this higher price is good news for the entrant with the FDI strategy.
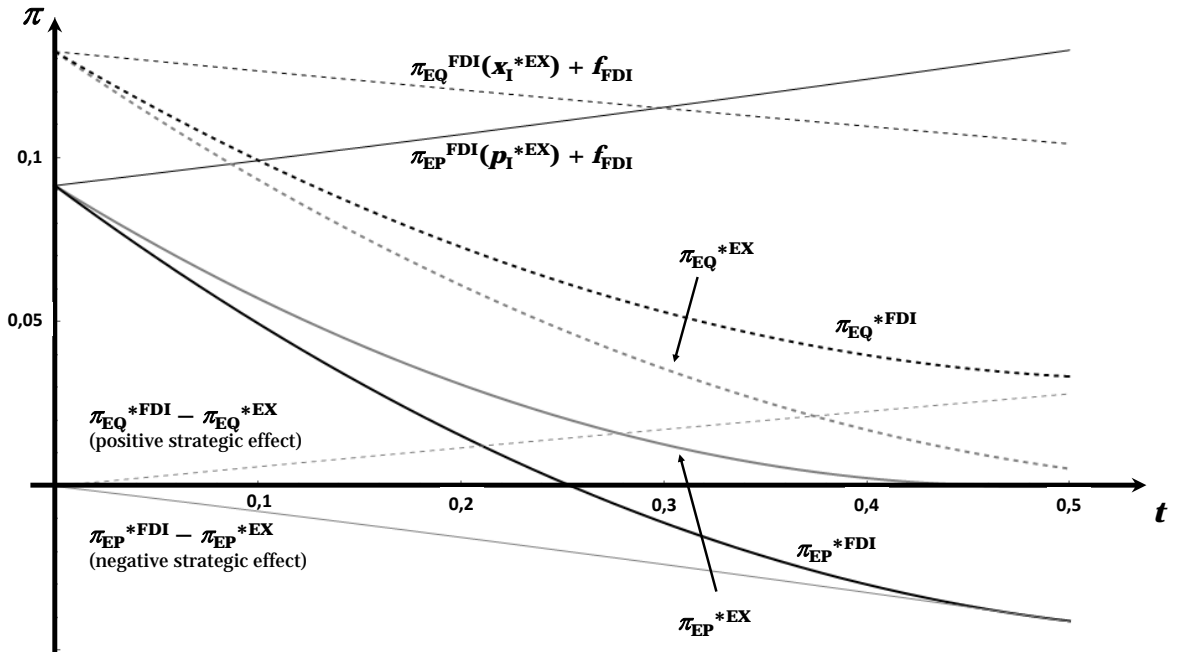

Figure 7: Linear Model – Exports vs. FDI with Price vs. Quantity Strategies

5   Conclusion

How does the strategic impact in oligopoly competition affect the optimal strategy for entering a foreign market? Three options have been compared: Exporting, foreign direct investment (FDI), and the formation of a strategic alliance with one of the domestic incumbents.

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We started from a situation where a firm would be indifferent between exporting and FDI as long as strategic considerations are absent (e. g. in a monopolistic competition setting). It has been shown that the additional strategic impact under oligopoly makes the FDI strategy more attractive in a Cournot oligopoly or a quantity setting oligopoly with heterogeneous products. This is due to the fact that lower marginal costs under FDI (no trade cost) yield higher output by the entrant that in turn induces a output reduction by the domestic incumbents. This result is reversed under price strategies where lowering the own price induces lower prices of the other firms.

Abstracting from any effects on cost, an alliance between the entrant and a domestic incumbent is the most preferable entry strategy as long as the cooperating firms are able to use the alliance contract as a strategic commitment device (alliance members behave together like a Stackelberg leader). However, if such a strategic contract is not feasible, the alliance has an unintended strategic effect: the cooperating firms internalize the negative impact of aggressive behavior on the partner and therefore reduce output or raise prices. While raising prices in a price setting oligopoly benefits both alliance members and outsiders, the output reduction of a non–strategic alliance in a Cournot setting yields an output expansion by outsiders that negatively affects the profits of the alliance members.

Beyond these qualitative results it has been shown that the strategic effect might have an order of magnitude that is economically relevant. In the Cournot duopoly setting the switch from exporting to FDI has a strategic impact that raises the profits of the entrant by the same amount as a reduction of the marginal cost by half of the trade cost. Therefore it seems fair to say that firms deciding about their entry strategy for a foreign market should not only look at the cost differences of different strategies but also consider the strategic effect.

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