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Distance and FDI When Contracts Are Incomplete

Gianmarco I. P. Ottaviano *

Alessandro Turrini **

***** Università L. Bocconi, Milano; GIIS, Geneva; CEPR

****** Università di Bergamo; UNCTAD; CEPR

Distance and FDI when Contracts are Incomplete*

Gianmarco I.P. Ottaviano† and Alessandro Turrini‡

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Abstract

We introduce incomplete outsourcing contracts in an otherwise standard model of MNEs based on the trade-off between proximity and concentration. This has both positive and normative implications. As to the former, incomplete outsourcing contracts can account for the observed emergence of FDIs in large markets not only when trade costs are large but also when trade costs are small. As to the latter implications, contractual incompleteness alters someway dramatically the choice of supply mode made when contracts are complete.

Keywords: Foreign direct investment, international trade costs, incomplete contracts.

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†Università 'L.Bocconi' Milano, GIIS Geneva, and CEPR.

‡Università di Bergamo, UNCTAD, and CEPR.

1 Introduction

We investigate how distance interacts with market size in determining foreign firms' choices to serve a local market through exports or FDI. In so doing, we modify an otherwise standard proximity-vs-concentration model of multinationals (see, e.g., Markusen, 1995) to allow for incomplete outsourcing contracts. All the rest given, contractual incompleteness affects someway dramatically the costs and benefits of the alternative supply modes. In particular, depending on market size, contractual incompleteness generates a non-linear relation between distance and FDI: for large host markets the share of foreign firms that choose FDI over export is the smallest at intermediate distance from the source country.

This result matches the stylized facts reported in Table 1. The table shows the average ratio of FDI inward stocks over trade for different country groups, classified according to the size of their market (GDP) as well as their distance from the countries that are the major sources of FDI flows.[1] For countries with small markets there is a clear positive association of FDI/trade ratios with peripherality. For countries with large markets FDI/trade ratios tend to be higher in central and peripheral regions, and lower in semi-central and semi-peripheral countries. This pattern turns out to be fairly robust with respect to the chosen classification of countries according to economic distance.

Market size		Central	Semi-central	Semi-periph.	Periph.
Small	N. obs.	1	6	16	45
	FDI/trade	0.02	0.1	0.27	0.27
Large	N. obs.	21	22	27	6
	FDI/Trade	0.24	0.22	0.19	0.23

Table 1 - Average FDI-trade ratios in different country groups, 1995

[1] FDI-trade ratios for each country are obtained dividing the value of FDI inflow stock (source: UNCTAD, 2001) by the value of total trade (imports(cif)+exports(fob), source: World Bank, 2001), both in current 1995 dollars. A better measure for FDI activity would be affiliates' sales, but these data are available only for a limited number of source countries. On average, affiliates' sales in a given country are between 2 and 3 times higher than the corresponding FDI stock and there is a quite strong correlation both across countries (see, e.g., Shatz and Venables, 2001) and in time series (see, e.g., UNCTAD, 2001). Countries with large (small) markets are defined as those with GDP (at 1995 US dollars, source: World Bank, 2001) above (below) the median. Central countries: NAFTA, EU and EFTA countries, Japan and China (including Taiwan and Hong Kong, province of China). Peripheral countries: Sub-Saharan Africa (except for South Africa and Mauritius); Central Asia, Myanmar, Laos, Nepal and Mongolia; Haiti, Pacific Island states. Semi-central countries: Australia; Rest of Europe (except former USSR states and including Cyprus); Argentina, Brazil and Chile; Turkey, India, South Korea, Thailand, Malesia, Singapore; Morocco, Tunisia, Egypt, Israel. Semi-peripheral countries: Russian Federation and former USSR states; West Asia (except Turkey), Pakistan, Bangladesh, Sri Lanka, Philippines, Indonesia, Vietnam, Cambodia; Rest of Central and South America; Algeria, South Africa and Mauritius; New Zealand and Papua New Guinea.

In our model the distinction between horizontal and vertical FDI is somehow blurred, as it is often in reality.[2] The production process consists of two activities: an 'upstream' activity that we interpret as the production of intermediate inputs, and a 'downstream' activity that we interpret as assembly (or commercialization). To keep the model as simple as possible, we focus on a local market where the final product is supplied only by foreign firms. These firms choose their supply mode between exports and FDI. This latter option, however, is available only in the downstream stage. This assumption is supported by empirical evidence. For instance, the share of value added on sales for US foreign affiliates is lower compared with domestically owned establishments based in the US, which means that only a subset of production stages are performed in foreign subsidiaries (see Hanson, Mataloni and Slaughter, 2001). So, in spite of the fact that FDI in our model is carried out with the aim of serving the local market (as it is typical of horizontal FDIs), FDI activity is associated with the geographical separation of production stages (as it is typical for vertical FDIs).

As implied by the proximity-vs-concentration framework, the choice of supply mode entails a trade-off. Exportation faces trade costs but saves on the additional costs of distant operations, while the opposite is true for FDI. In particular, we assume that carrying out FDI requires a local investment in assembly lines. The larger the investment, the lower the variable costs but the higher the plant-specific fixed costs. A firm that undertakes such investment is a multinational enterprise (henceforth, MNE) and faces a choice in terms of intermediate supply. The MNE can produce its intermediates in its country of origin and then ship them to the assembly lines. Alternatively, it can outsource their porduction to local suppliers.[3] Therefore, FDI always concerns a subset of activities, but these may or may not entail intra-firm trade depending on whether self-production or outsourcing are chosen.

The choice between self-production and outsourcing of intermediates introduces a second trade-off. Self-production incurs in trade costs because intermediates have to be shipped to the distant assembly line. Outsourcing saves on trade costs but faces additional costs on its own. We focus on the transaction costs associated with the outsourcing agreement between the MNEs and their local suppliers.[4] Specifically, we follow Grossman and Helpman (2002a, 2002b)

[2] Recent evidence shows that the benchmark distinction between horizontal and vertical FDI does not capture the growing importance of MNEs' expansion strategies which involve FDIs having both horizontal and vertical features (see Hanson, Mataloni and Slaughter, 2001).

[3] See, e.g., Hummels, Rapoport and Yi (2001) for empirical evidence on the growing importance of within-sector trade in intermediate inputs. Hanson, Mataloni and Slaughter (2001) report that the share of input purchases over sales for US foreign affiliates in 1994 is 12 per cent for manufacturing as a whole, with shares over 20 per cent in electronics and transport equipment.

[4] Transaction costs are at the centre of the theory of the firm since the pioneering work of Coase (1937). Williamson (1985) revived the insights of Coase relating the efficient determination of firms' boundaries to investment incentives in the presence of asset specificity and incomplete contracting. The first formalization of the hold-up problem in the presence of asset specificity and incomplete contracting is found in Grout (1984). Hart and Moore (1990) study the implications of alternative ownership structures on investment incentives within the firm.

and assume that the local input suppliers may find themselves held-up with the agreement due to contractual incompleteness and ex-post bargaining. The idea is that, if contracts cannot be written ex-ante due to unforeseeable contingencies and if the intermediate inputs requested are specific (i.e., of scarce alternative uses outside the MNE-supplier relationship), then the local subcontractor may end up underproducing the input, anticipating less than full reward for its services. Moreover, since also MNEs have to undertake relation-specific investments in an incomplete-contract environment, a *double-sided hold-up problem* arises. However, as opposed to input suppliers, MNEs have an outside option when engaging in outsourcing arrangements: they can fall back on intermediate self-production and exportation.

The role of the outside option in the ex-post bargaining process is at the source of the non-linearity between FDI and trade costs. It makes the payoff from FDI plus outsourcing depend on trade costs even though no trade takes place under that supply mode. To understand why this happens, consider again the trade-offs a firm faces when choosing its supply mode. First, it faces the traditional proximity-vs-concentration trade-off. Second, in the case of FDI, it faces the trade-off between outsourcing and intermediate exports. This second trade-off is entirely due to the contractual incompleteness and arises only if the ex-post bargaining power of the firm is small enough with respect to the cost of shipping intermediates.

Crucially, the level of trade costs affects both trade-offs. When trade costs are large, the first trade-off dominates and makes FDI more appealing than exports due to traditional proximity considerations. When trade costs are small, the second trade-off dominates. It is still true that small trade costs make exports more appealing than FDI due to proximity-vs-concentration considerations. However, they also strengthen the outside option of FDI plus intermediate exports. This 'outside option effect' increases the MNE's payoff from ex-post bargaining and therefore, it makes outsourcing more attractive. If market size is large enough such an outside option effect may prevail. This explains the non-monotonic relation between FDI and distance only in countries with large markets as reported in Table 1. Since the outside-option effect is entirely due to the hold-up problem, non-monotonicity disappears under contract completeness.

The remainder of the paper is structured as follows. In the next section we put our contribution into context by surveying some related literature. In Section 3 we present the structure of the model. In section 4 firms' equilibrium profits are computed under the alternative modes of serving the foreign market: final export, FDI plus intermediate export, and FDI plus outsourcing. In section 5 we characterize the equilibrium of the model. In Section 6 we provide comparative statics results and solve the model under complete contracts. Section 7 concludes.

2 Related literature

The role of both distance and size has been extensively investigated in the empirical literature on multinationals (henceforth, MNEs). A positive relation is found between market size and FDI inflows. Wheeler and Mody (1992), for instance, show that capital expenditures by US MNEs in a given market increase more than proportionally with market size. Furthermore, FDI flows are more intense among countries with similar market sizes (Markusen and Maskus, 1999; Carr, Markusen and Maskus, 2000). As to the empirical relation between economic distance and FDI flows, the picture is somehow less clear-cut. A first approach is to relate measures of FDI (stocks or flows) to measures of economic distance between source and host countries. As reported in Shatz and Venables (2001), controlling for market size, FDIs from most major sources (US, EU and Japan) tend to fall with the distance to the host country, as in gravity-type empirical analyses of trade volumes.[5] However, this approach cannot help to understand whether FDI becomes more or less likely than trade in serving foreign markets as economic distance rises. Brainard (1997) analyses at the sectoral level the share of exports over total US sales (including also US affiliate sales) in each foreign market. Trade costs are found to affect positively this measure of FDI activity versus trade. A firm-level analysis on Swedish MNEs with a similar aim is found Ekholm (1998), who investigates first the decision to serve a foreign market via exports or via FDI, and subsequently the pattern of Swedish exports over total Swedish sales. In her results distance is negatively related to the decision to undertake FDI in a given market, but, once the decision is taken, the share of affiliates sales on total Swedish sales rises with distance, as found in Brainard (1997). These contributions focus on horizontal FDIs. Other studies are targeted to international investments of a vertical type. Shatz (1999) considers exports of affiliates of US MNEs located in different developing countries. He finds a positive relation between exports directed to the US and measures of transport costs and trade openness.

As to the non-monotonic relation between FDI and distance for large markets reported in Figure 1, the existing literature suggests possible explanations that rely on the complex interplay between trade and transport costs, market size, factor endowments and the extent and composition of FDI (horizontal vs vertical). In particular, the theory of MNEs points out that the relation between the likelihood of FDI and distance depends crucially on the type of FDI considered. Horizontal FDIs, aimed at selling in the local market are more likely the higher transport costs are (see, e.g., Horstmann and Markusen, 1987; Brainard, 1993; Markusen and Venables, 1998). When FDI is vertical (Helpman, 1984), aimed at saving on costs in a particular production stage, it is instead more likely directed towards relatively close markets. The reason is that in this case FDI is not a substitute for trade, but rather a complement, since trade flows will occur intra-firm, and economic distance adds costs to the MNE. As illustrated

[5] A negative sign for distance (and a positive one for trade barriers in host countries) is also found in Carr, Markusen and Maskus (2000) that analyse the determinants of US affiliates' sales.

in Markusen and Maskus (2001) in general equilibrium models comprising both horizontal and vertical FDIs, when trade costs fall FDI between a given pair of countries may either rise or fall depending on countries' characteristics. In this paper we propose a model that provides an alternative explanation based on the incompleteness of outsourcing contracts.

3 The Model

Consider a country M endowed with L units of labour supplied inelastically by L identical workers. Workers share the same preferences defined over a unit-measure continuum of horizontally differentiated good Y and a homogenous good Z:

$$U = \ln\left(\int_{i=0}^{1} \sqrt{y(i)}\, di\right) + z. \tag{1}$$

where $y(i)$ is the consumption of variety i of good Y and z is the consumption of the homogenous good Z. Utility maximization then generates demands:

$$y(i) = Ap(i)^{-2},\ A = \frac{L}{\int_{i=0}^{1} p(i)^{-1} di} \tag{2}$$

where A is a measure of the local "market potential", which is increasing in the size of the market (L) and in the price of competing varieties.

Good Z is produced under perfect competition using one unit of labour per unit of output. This good is freely traded on international markets and it is chosen as numeraire. Due to marginal cost pricing, this implies that also the equilibrium wage equals unity. Good Y is produced under monopolistic competition using a proportional amount of an intermediate good X per unit of output. There is a one-to-one relation between varieties and firms. Intermediates are variety-specific and one unit of intermediate is produced by one unit of labor.

In sector Y all firms are foreign-owned and supply the local market under three alternative modes. Under the final export mode (henceforth, mode X), intermediate and final productions take place abroad and the final output is shipped to M. In this case the production of $y(i)$ units of variety i requires an equal amount of units of a variety-specific intermediate input $x(i)$. Shipments face iceberg trade costs: for each unit shipped only a fraction $\tau \in (0, 1)$ reaches its final destination.

Under the intermediate export mode (henceforth, mode E), intermediates are produced abroad and then shipped to country M where final production takes place. For simplicity, we assume that intermediates incur the same trade cost τ as the final products. In this case, the production of $y(i)$ units of variety i requires spending an amount $I(i)^2$ of the numeraire in market M where $I(i)$ represents the amount of investment (FDI) in assembly. Such investment is

specific to country M and to variety i and affects the variable costs of assembly. In particular, we assume that the marginal cost of assembling one unit of input $x(i)$ into one unit of output y is $1/I(i)$. Accordingly, in choosing $I(i)$, Y-firms face a trade-off between the fixed cost $I(i)^2$ and the variable cost $1/I(i)$.

Under the outsourcing mode (henceforth, O), also intermediates are produced in country M. In this case, all technological conditions are the same as in mode E. However, local intermediate production requires firms to contract with local intermediate producers. Due to unforeseen contingencies, complete contracts cannot be written. Therefore, the surplus from the outsourcing agreement can be shared only after the delivery of the specific input on the basis of the barganing power of the two parties. The share of ex-post surplus appropriated by the local intermediate supplier is denoted by β, $\beta \in [0, 1]$. The surplus from the outsourcing agreement accruing to each party is given by the revenue generated by the final sales minus the value of each parties' outside options. For the intermediate suppliers no outside option is available, since the input characteristics are specific to the final producer (i.e., once produced for the firm i, intermediates are useless to any other Y-firm). On the contrary, as an outside option, the Y-firm can produce the intermediate input by itself abroad and ship it to M for final transformation as under mode E. The timing of events is as follows. First, the firm i chooses the level of investment $I(i)$ in local transformation. Then, the local intermediate supplier chooses the amount of input $x(i)$ to supply. The chosen sequence reflects a higher degree of irreversibility of assembly investment $I(i)$.[6]

To sum up, the sequence of actions for the whole game is described in Figure 1. In the first stage, Y-firms choose between modes X, E and O. If X is chosen, then the firm sets the level of production that maximizes profits. If E is chosen, there is a second stage in which the firm makes a decision about the investment I in the trasformation technology. Finally, if O is chosen, there are two additional stages. In the third the input supplier chooses the amount of input to produce. In the fourth there is bargaining over the surplus from the outsourcing agreement.

To ease notation, exploiting the symmetry across firms in terms of preferences and production technologies, the variety index i will henceforth be omitted. The only index used will denote the alternative chosen by MNEs to serve market M (i.e., X, E, or O).

4 Payoffs under alternative supply modes

An equilibrium is defined as a situation in which firms maximize profits, consumers maximize utility, and markets clear. In particular, it has to be true that, given the choices of all other Y-firms, each Y-firm serves market M in its preferred way, achieving a profit-maximizing scale of production for final as

[6] Were the Y-firm and the intermediate supplier to choose simultaneously rather than sequentially, the main results of the model would be unaffected (no multiple equilibria, non-linear relation between outsourcing and transport costs).

well as intermediate goods and making a profit-maximizing investment. To find such equilibrium we solve the model backwards. Each Y-firm chooses among the different modes by computing the corresponding payoffs backwards given an expectation on the choices made by all other Y-firms. These choices are summarized by a certain value for the market potential A:

$$A(m,n) = \frac{L}{n/p_o + m/p_E + (1-m-n)/p_x} \tag{3}$$

where m and n are the numbers of firms adopting modes O and E respectively. Therefore, the conjectures made by firms are expectations on the market potential variable A. Given A, investments, prices and quantities of final outputs and intermediate inputs can be readily obtained.

4.1 Final exports

When a Y-firm decides to serve the market through the export of the final good (mode X), intermediate production and transformation are both performed abroad. Recall that in this case the intermediate input transforms one-to-one into final output. Moreover, due to iceberg trade costs, an amount x of intermediate input satisfies a final demand equal to $x\tau$. The problem of the Y-firm can then written as follows:

$$\max_x \pi_X(x) = \Pi_X(x) = \sqrt{A\tau x} - x, \tag{4}$$

where π and Π denote operating and total profits respectively. The profit maximizing intermediate production is then:

$$x_X = \frac{A\tau}{4}. \tag{5}$$

The corresponding price can be obtained by substituting (5) into the inverse demand function $p = (A/y)^{\frac{1}{2}}$ implied by (2):

$$p_X = \frac{2}{\tau} \tag{6}$$

while the associated profits are:

$$\pi_X = \Pi_X = (p_X\tau - 1)x_X = \frac{A\tau}{4}. \tag{7}$$

As it is intuitive, these results show that, under the final export mode, outputs and profits fall while prices rise as trade costs increase (τ decreases) and the market potential rises.

4.2 FDI plus intermediate exports

Under mode E, the Y-firm manufactures inputs abroad and ships them to M for final transformation. FDI therefore takes place and the MNE has first to decide on the level of investment I and then on the level of output x. Solving backwards, in choosing x, for given I the firm's problem is:

$$\max_x \pi_E(x, I) = \sqrt{A\tau x I} - x \tag{8}$$

which yields the quantity:

$$x_E(I) = \frac{A\tau I}{4} \tag{9}$$

and the price:

$$p_E(I) = \frac{2}{\tau I} \tag{10}$$

with associated operating profits given by:

$$\pi_E(I) = [p_E(I)\tau I - 1]x_E(I) = \frac{A\tau I}{4}. \tag{11}$$

In choosing I the Y-firm solves:

$$\max_I \Pi_E(I) = \pi_E(I) - I^2, \tag{12}$$

This yields the profit-maximizing investment:

$$I_E = \frac{A\tau}{8}. \tag{13}$$

with associated price:

$$p_E = \frac{16}{A\tau^2} \tag{14}$$

The equilibrium total profits are therefore:

$$\Pi_E = \left(\frac{A\tau}{8}\right)^2 \tag{15}$$

As under mode X, under the intermediate export mode E, outputs and profits fall while prices rise as trade costs increase (τ decreases) and the market potential rises. However, firms' total profits fall with the square of transport costs. This is explained by the fact that higher trade costs and lower market potential reduce both operating profits at given I and firms' desired investment (see (13)).

4.3 FDI plus outsourcing

Under the outsourcing mode O, each Y-firm performs final production in country M (hence it is an MNE) relying on a specific local intermediate supplier under incomplete contracts. The timing of events is such that first the Y-firm chooses its level of investment I, then the supplier chooses its output and finally the surplus from the outsourcing agreement is split between the two parties.

Solving backwards, we start with the bargaining stage. Contractual incompleteness implies that the surplus of the match is distributed between the Y-firm and its supplier through ex-post bargaining. Specifically, the MNE and the input supplier share the revenues from final sales $R = py$ solving the following problem

$$\max_{R_{MNE}} \left(R - R_{MNE}\right)^{\beta} \left(R_{MNE} - \pi_E\right)^{(1-\beta)}, \tag{16}$$

where β denotes the barganing power of the input supplier, and R_{MNE} the amount of revenues captured by the MNE. Moreover, π_E is the value of the MNE's outside option, i.e., the operating profit it would earn by importing rather than outsourcing the intermediate input. Due to the specificity of its input, the outside option of the supplier is instead zero. Thus, for the outsourcing agreement to be considered at all by the two parties, the associated revenues R cannot be lower than their outside options. Since the outside options are zero for the supplier and π_E for the MNE, for the outsourcing agreement to be considered at all the associated revenues must be higher than the operating profits under intermediate exports:

$$R > \pi_E \tag{17}$$

Denoting by R_S the amount of revenues accruing to the input supplier, the solution of (16) yields

$$R_{Supp} = \beta \left(R - \pi_E\right), \tag{18}$$

$$R_{MNE} = \left(1 - \beta\right)\left(R - \pi_E\right) + \pi_E. \tag{19}$$

The parties share the surplus from the agreement (i.e., revenues net of the sum of parties' outside options where the supplier has no outside option) according to their bargaining powers. For each party the share of surplus is added to the outside option. The expressions for R_{Supp} and R_{MNE} in (18) and (19) represent the payoffs of the input supplier and the MNE respectively from investing in the outsourcing relationship. In the case of the input supplier the investment consists of the production of an amount x of specific input. In the case of the Y-firm the investment is an amount I of numeraire in assembly. Of course, the stronger the bargaining power of the supplier β, the larger the weight of the outside option in the revenues accruing to the MNE.

Solving backwards, recalling that $y = xI$ and using the inverse demand function, the problem of the input supplier can be written as:

$$\max_x \beta(\sqrt{AxI} - \pi_E(I)) - x. \tag{20}$$

Note that, due to the timing of events, in problem (20) the term $\pi_E(I)$ is treated as exogenous. The necessary condition for this maximization problem generates the best-reply quantity of the input supplier:

$$x_O(I) = \beta^2 \frac{AI}{4}, \tag{21}$$

which, together with the associated final price

$$p_O(I) = \frac{2}{\beta I} \tag{22}$$

gives total revenues as a function of the investment I: $R_O(I) = p_O(I)x_O(I)I$.

The Y-firm maximizes profits with respect to I taking into account the best reply of the intermediate supplier and the effect that the investment has on its own outside option, $\pi_E(I)$. The problem for the Y-firm is therefore

$$\max_I \Pi_O(I) = (1-\beta)\ R_O(I) + \beta\, \pi_E(I) - I^2 \tag{23}$$

The necessary condition for (23) yields

$$I_O = \frac{\beta A}{4}\left[(1-\beta) + \frac{\tau}{2}\right] \tag{24}$$

which implies a price level equal to

$$p_O = \frac{8}{\beta^2 A\left[(1-\beta) + \tau/2\right]} \tag{25}$$

and the maximized profits

$$\Pi_O = \left(\frac{\beta A}{4}\right)^2 \left[(1-\beta) + \frac{\tau}{2}\right]^2 \tag{26}$$

Profits (26) are concave in β and reach a maximum at $\beta = (2+\tau)/4$. For given A, this would be the allocation of bargaining powers between parties that maximizes the MNE's payoff by striking the right balance between its incentive to invest and the supplier's incentive to produce. Profits are always positive, are equal to zero at $\beta = 0$ and equal to Π_E at $\beta = 1$. In the former case, the intermediate supplier has no incentive to produce. In the latter, the MNE has no claim on the surplus from outsourcing and thus falls back on its outside option.

Finally, given (17), for the outsourcing agreement to be considered at all by the two parties, it must be that $R(I_O) > \pi_E(I_O)$, which yields:

$$\beta > \frac{\tau}{2} \tag{27}$$

Whenever (27) is violated, the outside option of the MNE dominates its outsourcing payoff. This occurs when trade costs are small (τ large) and the bargaining power of the MNE is weak (β large). Intuitively, outsourcing is unappealing with respect to intermediate export when exporting intermediates is cheap and when the hold-up problem for the supplier is big (since in such a case intermediate production is small).

5 Choice of supply mode

In this section we determine the number of Y-firms that choose modes X, E, or O in equilibrium. We start with considering a situation in which no firm will ever choose mode O. This is the case when (27) is violated. The opposite case is addressed next.

5.1 Case 1: Intermediate exports dominate outsourcing

When (27) does not hold, mode O is dominated by mode E. Recalling that m and n are the numbers of firms adopting modes E and O respectively, the violation of (27) implies $n = 0$ for all parameter values. Then $(m, n) = (m^*, 0)$ is an equilibrium distribution of firms between modes E and X whenever no firm wants to change its mode. This happens for interior outcomes $m \in (0, 1)$ whenever:

$$\Delta_{X,E}(m) \equiv \Pi_X - \Pi_E = \frac{1}{4} A(m, 0)\, \tau - \frac{1}{64} A^2(m, 0)\, \tau^2 = 0 \tag{28}$$

and for corner outcomes $m = 1$ ($m = 0$) whenever $\Delta_{X,E}(m) < 0$ (> 0). In (28) the market potential measure is obtained by solving (3) after substituting for the equilibrium prices (6) and (14):

$$A(m, 0) = 4 \frac{\sqrt{(1 - 2m + m^2 + mL)} - (1 - m)}{\tau m}. \tag{29}$$

Solving (28) for m then yields:

$$m^* = \frac{L}{8} - 1. \tag{30}$$

which can be shown to be a stable equilibrium since $\partial \Delta_{X,E} / \partial m|_{m=m^*} > 0$. When $L > 16$ ($L < 8$) all firms choose mode E (X), that is, $m = 1$ ($m = 0$).

To sum up, we have:

Proposition 1 *When $\beta < \tau/2$ FDI plus outsourcing (mode O) is never chosen. The choice between final exports (mode X) and FDI plus intermediate exports (mode E) is unaffected by trade costs and depends only on market size. In particular, the share of firms choosing FDI increases with market size.*

Trade costs are immaterial for the choice of mode because their changes affect modes X and E in the same way.

5.2 Case 2: Outsourcing dominates intermediate exports

When (27) holds there is a potential gain for the MNE from signing an outsourcing agreement. Therefore, in principle all three modes are viable options for a Y-firm to serve market M. However, by (15) and (26), it is readily shown that $\Pi_O > \Pi_E$ whenever (27) is satisfied. Thus, as before, only two modes are relevant. These modes are X and O, which implies $m = 0$. Then $(m, n) = (0, n^*)$ is an equilibrium distribution of firms between modes X and O whenever no firm wants to change its mode. This happens for interior outcomes $n \in (0, 1)$ whenever:

$$\Delta_{X,O}(n) \equiv \Pi_X - \Pi_O = \frac{1}{4}A(0,n)\,\tau - \left[\frac{\beta A(0,n)}{4}\right]^2 \left[(1-\beta) + \frac{\tau}{2}\right]^2 = 0 \quad (31)$$

and for corner outcomes $n = 1$ ($n = 0$) whenever $\Delta_{X,O}(n) < 0$ (> 0). In (31) the market potential measure is obtained by solving (3) after substituting for the equilibrium prices (6) and (25)

$$A(0,n) = \frac{-8\tau(1-n) + 8\sqrt{Ln\beta^2\left(\tau + 2(1-\beta)\right) + \tau^2\left(1-n\right)^2}}{2n\beta^2\left(\tau + 2(1-\beta)\right)}. \quad (32)$$

Solving (31) for n gives:

$$n^* = \frac{1}{8}[\tau + 2(1-\beta)]\frac{\beta^2[\tau + 2(1-\beta)]^2 L - 8\tau^2}{\tau^2\left(2\beta - \tau\right)}. \quad (33)$$

which can be shown to be a stable equilibrium since $\partial\Delta_{X,O}/\partial n|_{n=n^*} > 0$. Given (27), n^* is increasing in L. It is constrained between 0 and 1 for $L \in (L_X, L_O)$ with

$$L_X \equiv \frac{8\tau^2}{\beta^2\left[2\left(1-\beta\right) + \tau\right]^2},\ L_O \equiv \frac{2}{2\left(1-\beta\right) + \tau}L_X, \quad (34)$$

where $L_O > L_X$ is granted once more by (27). Corner outcomes $n = 0$ and $n = 1$ are attained for $L_X \geq L$ and $L \geq L_O$ respectively. It is readily verified that L_X is an increasing function of τ while L_O is decreasing in τ whenever

$$\tau > 4\left(1-\beta\right) \quad (35)$$

holds and increasing otherwise. Note that, for (35) to hold at some $\tau < 1$, it must be $\beta > 3/4$.

Thus, when $\beta > \tau/2$ the chosen mode of supply depends on both the size of the market and the level of trade costs. In particular, by simple inspection, (33) shows that the share of firms choosing mode O always rises with market size L ($\partial n^*/\partial L > 0$). The impact of trade costs on n^* is more complex. Indeed, differentiating (33) with respect to τ yields:

$$\frac{\partial n^*}{\partial \tau} = \frac{\beta^2[2(1-\beta)+\tau]^2[(3-2\beta)\tau - 4\beta(1-\beta)]\,L - 8\tau^3}{4\tau^3\,(\tau-2\beta)^2}, \tag{36}$$

which shows that $\partial n^*/\partial \tau > 0$ (< 0) as long as $L > \widetilde{L}$ $(< \widetilde{L})$, with

$$\widetilde{L} \equiv \frac{8\tau^3}{\beta^2[2(1-\beta)+\tau]^2[(3-2\beta)\tau - 4\beta(1-\beta)]}. \tag{37}$$

Under (27) $\widetilde{L}$ is a decreasing function of τ that falls between L_X and L_O as long as (35) holds. Thus, when $L \in (L_X, L_O)$ and (35) holds, we have $\partial n^*/\partial \tau > 0$ $(\partial n^*/\partial \tau < 0)$ for $L > \widetilde{L}$ $(L < \widetilde{L})$. Moreover, since $\widetilde{L}$ is decreasing in τ, we can have $L > \widetilde{L}$ $(L < \widetilde{L})$ for large (small) τ and $L > \widetilde{L}$ for large τ. This happens if L is large enough, namely, larger than the smallest possible value of $\widetilde{L}$ (i.e., $\widetilde{L}|_{\tau=1}$).

To sum up, we have:

Proposition 2 *When $\beta > \tau/2$ FDI plus intermediate exports (mode E) is never chosen. The choice between final exports (mode X) and FDI plus ousourcing (mode O) is affected by both market size and trade costs. In particular, the share of firms choosing FDI increases with market size. It also increases with trade costs if market size is small. On the contrary, the relation between the share of firms chosing FDI and trade costs is U-shaped if market size is large enough.*

The source of this non-linearity lies in contractual incompleteness. This makes the payoff from mode O depend on trade costs even though no trade takes place under that mode. To understand why this happens, consider the trade-offs a Y-firm faces when choosing its supply mode. First, it faces the traditional proximity-vs-concentration trade-off: final exports incur trade costs but save on the costs of distant assembly lines whereas the opposite is true for FDI. Second, in the case of FDI, a Y-firm faces the trade-off between outsourcing and intermediate exports. Outsourcing saves on trade costs but incurs the costs of ex-post bargaining. FDI under intermediate exports incurs the former costs but saves on the latter. This second trade-off is entirely due to contractual incompleteness and arises only if the ex-post bargaining power of the Y-firm in small enough with respect to the cost of shipping intermediates ($\beta > \tau/2$).[7]

Crucially, the level of trade costs affects both trade-offs. When trade costs are large, the first trade-off dominates and makes FDI more appealing than exports due to traditional proximity considerations. When trade costs are small, the second trade-off dominates. It is still true that small trade costs make exports more appealing than FDI due to proximity-vs-concentration considerations. However, they also strengthen the outside option of FDI plus intermediate

[7] This is formally shown in the next section, where the complete contract outcome is fully characterized.

exports. This outside-option effect increases the Y-firm's payoff from ex-post bargaining and therefore makes outsourcing more attractive. The more so the larger the market size.

6 Overview of results

In this section we discuss our findings. We start with a graphical presentation of comparative statics results. Then, we characterize the complete contract environment to highlight the impact of contractual incompleteness on the choice of supply mode.

6.1 Comparative statics

Three scenarios can be distinguished depending on the values of β. Figure 2.a characterizes the equilibrium configurations in the (L, τ) space for $0 < \beta < 1/2$ so that all supply modes can arise depending on market size and trade costs. For $\tau > 2\beta$ the figure portrays Case 1, in which mode O is always dominated for any L and the choice between X and E is determined by market size considerations only. For $\tau < 2\beta$ the figure depicts Case 2, in which mode O may dominate. In this case, outsourcing is more likely to emerge as the equilibrium mode the larger the market size and the higher the trade costs.

Figure 2.b characterizes the equilibrium configurations for $1/2 < \beta < 3/4$ so that only Case 2 arises. In this case mode E is always dominated and, since condition (35) is violated, the attractiveness of mode O with respect to mode X increases not only with market size but also with trade costs.

Figure 2.c illustrates the situation for $3/4 < \beta < 1$. Case 2 is still the relevant one but now condition (35) can be satisfied. For $\tau < 4(1-\beta)$ the figure is qualitatively the same as Figure 2.b: mode O is more appealing the larger the market size and the trade costs. However, for $\tau > 4(1-\beta)$ the appeal of outsourcing may exhibit a non-monotonic behaviour with respect to trade costs. In particular, when market size is large enough (but smaller than L_O), as τ rises from $4(1-\beta)$ towards 1, the share of firms choosing mode O first falls and then rises.

This non-monotonic behavior is due to the outside-option effect, which can prevail only when market size and the bargaining power of the local input suppliers are sufficiently large. A large market size is required because Y-firm investments are proportional to the size of the market, so that the outside option effect is also stronger the larger is the M market. A strong bargaining power for suppliers is required because the surplus from the outsourcing agreement is lower the greater the hold-up problem for the input supplier. Moreover, the outside option effect dominates only when trade costs are relatively small. This can be understood by noting that the payoffs of the Y-firm in both the alternatives of export and outsourcing are continuous in the level of trade costs and that prohibitive trade costs will leave the Y-firm with the only alternative of outsourcing. So, increasing trade costs when they are already high will nec-

essarily make FDI more likely. An opposite effect can only be found at medium or low levels of trade costs.

6.2 Complete contracts

To understand the role of contractual incompleteness, it is useful to compare the previous results with the equilibrium outcome under complete contracts. When complete contracts are feasible, the Y-firm and its local supplier set I and x as to maximize the joint surplus from the outsourcing agreement, S_O, and agree ex-ante on the sharing rule β. The joint surplus is revenues net of variable and fixed costs:

$$S = \sqrt{AxI} - x - I^2 \tag{38}$$

which is maximized for intermediate supply:

$$x_S = \frac{A^2}{32} \tag{39}$$

and investment in assembly:

$$I_S = \frac{A}{8} \tag{40}$$

The corresponding price can be obtained by substituting (39) into the inverse demand function $p = (A/y)^{\frac{1}{2}}$ implied by (2):

$$p_S = \frac{16}{A} \tag{41}$$

Substituting (39) and (40) in (38) gives the maximized joint surplus $S_S = A^2/64$. Thus, under complete contracts, the payoff from outsourcing accruing to the Y-firm is not Π_O but rather:

$$\Pi_S = (1-\beta)\left(\frac{A}{8}\right)^2 \tag{42}$$

Differently from (26), for given A, (42) is a decreasing function of β. The larger the MNE's share of surplus, the higher its profits from outsourcing. The reason is that, in the absence of hold-up problems, the MNE's investment, the supplier's output, and therefore the final revenues are independent from the division between parties. Accordingly, the parameter β acts as a sort of frictional cost on the MNE's revenues.

As in the case of incomplete contracts, two cases arise depending on the relative value of β and τ. If $\beta > (1-\tau^2)$ then $\Pi_E > \Pi_S$ so that FDI plus

outsourcing is dominated by FDI under intermediate exports. In this case, $n = 0$ for all parameter values. Accordingly the features of the outsourcing contract are immaterial and the equilibrium distribution of firms between modes E and X is clearly the same as in Case 1 under incomplete contracts:

Proposition 3 *When $\beta > (1 - \tau^2)$ FDI plus outsourcing (mode O) is never chosen. The choice between final exports (mode X) and FDI plus intermediate exports (mode E) is unaffected by trade costs and depends only on market size. In particular, the share of firms choosing FDI increases with market size.*

Things turn out to be different if $\beta < (1 - \tau^2)$. In this case, $\Pi_E < \Pi_S$ so that $m = 0$ for all parameter values. Then $(m, n) = (0, n_S^*)$ is an equilibrium distribution of firms between modes X and O whenever no firm wants to change its mode. This happens for interior outcomes $n \in (0, 1)$ whenever:

$$\Delta_{X,S}(n) \equiv \Pi_X - \Pi_S = \frac{1}{4} A_S(0, n)\, \tau - (1 - \beta) \left(\frac{A_S(0, n)}{8} \right)^2 = 0 \tag{43}$$

and for corner outcomes $n = 1$ ($n = 0$) whenever $\Delta_{X,S}(n) < 0$ (> 0). In (43) the market potential measure is obtained by solving (3) after substituting for the equilibrium prices (6) for p_X and (41) for p_O:

$$A_S(0, n) = \frac{-4\tau\,(1 - n) + 4\sqrt{\tau^2\,(1 - n)^2 + nL}}{n} \tag{44}$$

Solving (43) for n gives:

$$n_S^* = \frac{1}{8}\,(1 - \beta)\,\frac{(1 - \beta)L - 8\tau^2}{\tau^2\,(1 + \beta)} \tag{45}$$

which can be shown to be a stable equilibrium since $\partial \Delta_{X,S} / \partial n|_{n = n_S^*} > 0$. As under contractual incompleteness, with complete contracts the share of MNEs is increasing in L. It is also constrained between 0 and 1 for $L \in (L_X^S, L_O^S)$ with

$$L_X^S \equiv \frac{8\tau^2}{1 - \beta},\ L_O^S \equiv \frac{2}{1 - \beta} L_X^S \tag{46}$$

Corner outcomes $n = 0$ and $n = 1$ are attained for $L_X^S \geq L$ and $L \geq L_O^S$ respectively. Unlike under incomplete contracts, these two thresholds are both increasing functions of τ. Moreover, by simple inspection of (45), the share of firms choosing mode O under contractual completeness always rises with market size and trade costs.

To sum up, we have:

Proposition 4 *When $\beta < (1 - \tau^2)$ FDI plus intermediate exports (mode E) is never chosen. The choice between final exports (mode X) and FDI plus ousourcing (mode O) is affected by both market size and trade costs. In particular, the share of firms choosing FDI increases with market size and trade costs.*

This proves that, as claimed above, the non-monotonicity described in Proposition 2 is entirely due to contractual incompleteness. Note also the opposite role of parameter β. Under complete contracts, for mode O to arise as an equilibrium configuration, both β and τ have to be small (specifically, $\beta < (1-\tau^2)$). Intuitively, as already pointed out, the joint surplus from outsourcing is independent from β. For small values of τ the exporting modes are expensive, and for small values of β the Y-firm's share of surplus and therefore its payoff from outsourcing are large. Under incomplete contracts, if mode O arises, τ has still to be small but β has to be large (precisely, $\beta > \tau/2$). This is due to the fact that the joint surplus from outsourcing depends on the ex-post bargaining powers of the two parties. In particular, it drops to zero as β goes to zero. The reason is that, under incomplete contracts, if its ex-post bargaining power is negligible, the supplier does not produce any amount of intermediate for fear of being held up.

These results are summarized in Figure 3, which shows that for large trade costs (small τ) and small MNE's shares of surplus from outsourcing (large β), Y-firms choose between final exports and FDI plus intermediate exports favoring the former over the latter when market size is small. For small trade costs (large τ) and large MNE's shares of surplus from outsourcing (small β), Y-firms choose between final exports and FDI plus intermediate exports favoring the former over the latter when market size is small. Lower trade costs promote the choice of X over O, while trade cost changes have no impact on the choice between X and E.

Comparing Figures 2 and 3 points out that contractual incompleteness alters someway dramatically the choice of supply mode made when contract are complete. In particular, the trade-off between modes E and O is completely reversed. Indeed, for low trade costs, all the rest given, MNEs may shift from intermediate exports for local assembly to local outsourcing due to improvements in the writing and enforceability of outsourcing contracts.

7 Conclusions

We have introduced contractual incompleteness in an otherwise standard model of MNEs based on the trade-off between proximity and concentration. This has been shown to alter the results of the original set-up from both a positive and a normative points of view.

In terms of positive implications, we have shown that, for large markets, incomplete outsourcing contracts can account for the emergence of FDIs not only when trade costs are large (as predicted by the proximity-vs-concentration set-up) but also when trade costs are small (as pointed out by empirical observation). The reason is the positive effect that lower trade costs have on the ex-post bargaining position of MNEs with resect to local subcontractors.

In terms of normative implications, we have shown that contractual incompleteness alters someway dramatically the choice of supply mode made when contracts are complete. In particular, for low trade costs, all the rest given,

MNEs may shift from intermediate exports plus local assembly to intermediate outsourcing due to improvements in the writing and enforceability of outsourcing contracts.

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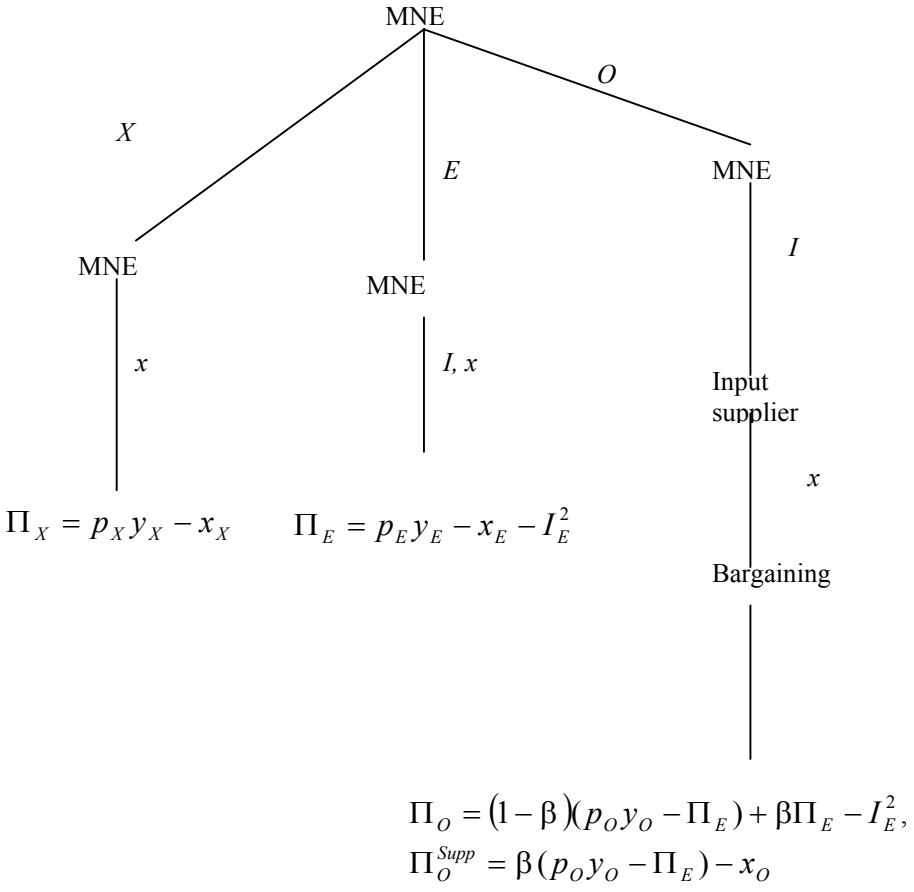

Figure 1 - Sequence of actions

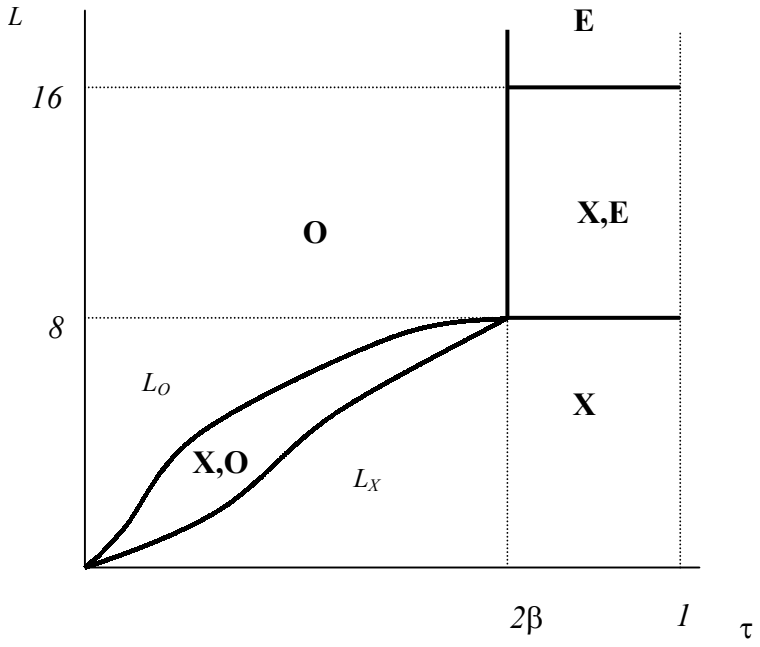

Figure 2.a - The choice between exports and FDI (β<1/2)

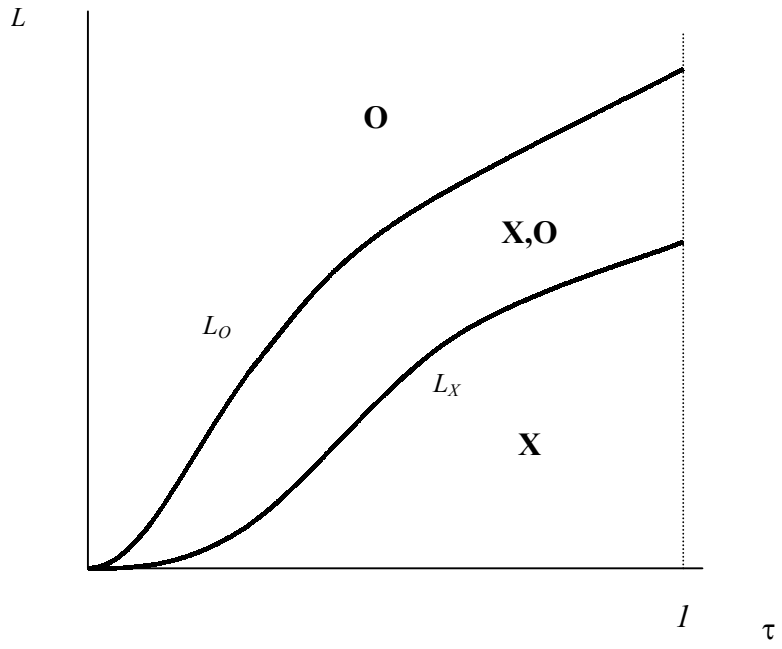

Figure 2.b - The choice between exports and FDI (1/2<β<3/4)

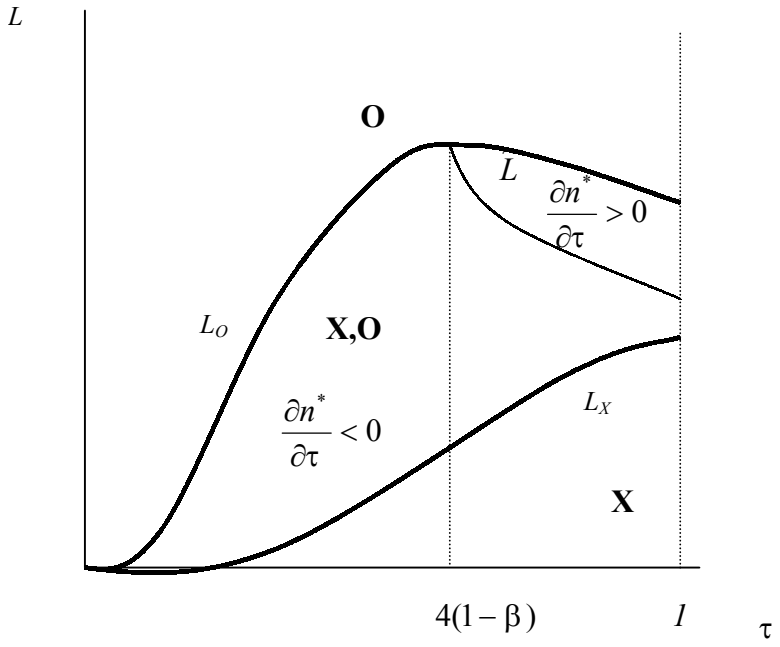

Figure 2.c - The choice between exports and FDI (β>3/4)

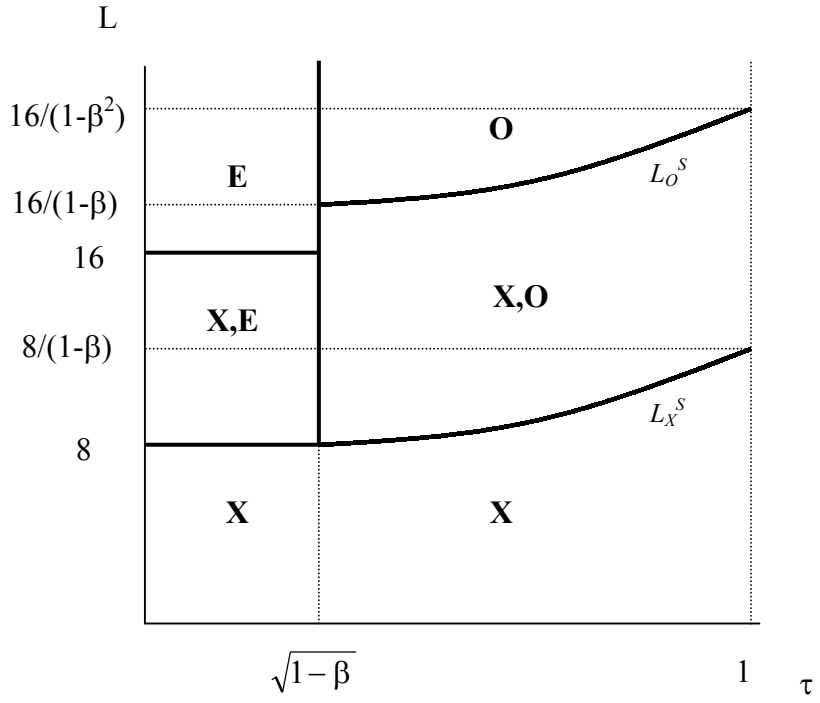

Figure 3 - Exports and FDI under complete contracts