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Abstract:
Global engagement of firms can take a variety of forms. We argue that there are considerable advantages of developing models that allow for a wide set of alternatives of organizational form. We illustrate this firstly using plant level data which allows us to distinguish firms that serve only the domestic market, firms that export final goods abroad, firms that outsource abroad the production of some of the intermediate inputs abroad, firms that own foreign plants abroad, and firms that do more than one of those activities. In our estimation we consider the relationship between productivity all the choice of organizational form. We then present a simple model of the firm that is flexible enough to capture the trade-offs between a great variety of organizational forms.

Keywords: Organizational Forms, Multinationals

JEL classification: F21, F23

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1 Introduction

The organization of international firms can be very complex. The liberalization of final goods, intermediate goods and capital markets is offering new opportunities for reshuffling cross-national border production patterns. Firms sell their products in foreign markets, locate production plants abroad, outsource the production of intermediate inputs to foreign firms or import intermediate goods from their own affiliates located abroad. Numerous studies, reviewed in Helpman (2006), document the recent explosion of interest in these activities. It is also clear from the same evidence that all firms do not face the same opportunities. For example, we know that, on average, more productive firms export more, invest abroad more and outsource more.

The observation that exporters are larger and more productive has motivated a new strand of theoretical research in international trade that introduces firm heterogeneity in traditional trade models.[1] The model by Melitz (2003) has proved to be very useful for analyzing a host of issues related to the organization of international production. For example, Helpman, Melitz and Yeaple (2004) demonstrate that the more productive firms will serve foreign markets using FDI, medium productivity firms will use exports to serve the foreign market while low productivity firms will only serve the domestic market. Grossman, Helpman and Szeidl (2006) allow for more complex strategies whereby firms can use FDI for both/either intermediate and/or final goods production. They show that the high productivity firms will produce both types of goods abroad, medium productivity firms will use FDI for the production of intermediate goods while they will assemble final goods at home and low productivity firms will produce both types at home and export final goods. By contrast, Antras and Helpman (2004) focus on the trade-off between outsourcing and FDI. They find that the high productivity firms insource abroad (FDI) and the low productivity firms will exit the market. Among the firms with medium productivity levels, the more productive firms will outsource abroad, the less productive firms will outsource at home while those in between will integrate.

The above studies make clear how rich the organizational form menu is. However, it is also clear that each of these studies focuses on a limited subset of the options available.[2] From a theoretical standpoint the

[1] See, for example, Montagna (2001), Jean (2002), Bernard, Eaton, Jensen and Kortum (2003) and Melitz (2003).

[2] We have only referred to those studies that rank firms according to productivity because they are closely related to our empirical work that we use to offer further motivation for our theoretical approach. However, other studies on the choice of organizational form also have restricted their attention to a small number of alter-

advantage of a narrow focus is tractability. But there are also disadvantages of ignoring some of the alternatives. Consider the following example. Suppose that we want to consider the relationship between FDI and exports ignoring the possibility that a firm might opt to produce final output in one place and intermediate inputs in another place (i.e. we restrict our attention to the integration case). In that case, we will compare the total costs of production in the two locations with transport costs. If we find that the difference in the costs of producing abroad (that include any additional fixed costs related to the establishment of new plants) and the corresponding home costs is relatively high compared to transport costs, we will conclude that the export strategy is the right choice. But suppose that what drives up the costs of foreign production is the cost of intermediates. In that case, the firm can choose the non-integration option whereby it produces all inputs at home and uses FDI for the assembly of the final goods consumed abroad.[3]

In this paper, we argue that there are considerable advantages of developing models that allow for a wider set of alternatives of organizational form. In the following section, we demonstrate empirically potential gains from following a more general approach. Using a plant level database from the Republic of Ireland we examine the relationship between productivity and the likelihood of adapting a given organizational form. Our sample consists of firms that serve only the domestic market, firms that export final goods abroad, firms that outsource abroad the production of some of the intermediate inputs abroad, firms that own foreign plants abroad, and firms that do more than one of those activities. In our first estimation we consider the impact of productivity on the trade-off between exports and outsourcing, ignoring completely FDI, and we find (a) that exporters are more productive than non-exporters, and (b) exporting firms that also outsource some of the intermediate inputs abroad are more productive than firms that only export. In our second estimation we examine the relationship between productivity and the trade-off between exports and FDI, this time ignoring outsourcing, and we find similar results. Namely, (a) that exporters are more productive than non-exporters, and (b) exporting firms that also invest abroad

natives; see, for example, Yeaple (2003) on the choice between the two types of FDI, McLaren (2000) and Grossman and Helpman (2002) on the trade-off between outsourcing and integration, Grossman and Helpman (2003, 2005), Grossman, Helman and Seizdl (2005) on the trade-off between outsourcing and FDI in intermediate inputs (offshoring), and Ottaviano and Turini (2007) on the choice beteen exports, FDI and outsourcing.

[3]Helpman (2006) refers to a number of studies that demonstrate the tendency towards further fragmentation of production as is evident by the tremendous growth of trade in inputs across national borders.

are more productive than firms that only export. Lastly, in our third estimation we consider all three activities, i.e. exports, outsourcing and FDI. Once more, we find that exporters are more productive than non-exporters and that firms that own plants abroad are even more productive but we also find that firms that outsource are not more productive unless they also invest abroad. The results of the third estimation indicate that the relationship between productivity and outsourcing that we have found in our first estimation is driven by those firms that invest abroad.

In a recent study, Tomiura (2007) using Japanese data, has found that firms that outsource are more productive than firms that only export although less productive than firms that invest abroad, and these findings are consistent with the theoretical predictions in Antras and Helpman (2004). In our sample, firms that only outsource are not more productive than domestic firms. The difference in these estimations might be due to differences between Irish and Japanese firms, which is reflected in the composition of the two samples: over 90 percent of Japanese firms are purely domestic, while only a quarter of Irish firms do not engage in any type of internationalization activity. Hence, it is not clear that results for Japan should be expected to also apply to a small and highly open economy. Overall, our study makes clear some of the advantages of using models that allow for a richer structure of organization form.[4]

In section 3, we present a simple model of the firm that is flexible enough to capture the trade-offs between a great variety of organizational forms. Our work is mainly methodological, aiming to distinguish within a unique framework the plethora of alternatives available to international firms, and thus we follow a partial equilibrium approach. More specifically, our firm has the following options: it can produce final output either/both home or/and abroad; it can produce intermediate goods either/both home or/and abroad; it can outsource intermediate inputs either home or abroad. When the firm produces final output both home and abroad we say that it follows a 'horizontal FDI' strategy while when it produces final output only abroad we say that it follows a 'vertical FDI' strategy. Furthermore, when the firm produces both final output and intermediate inputs in the same location we say that

[4]Earlier empirical studies have followed a more restricted approach. For example, Bernard, Jensen and Schott (2005), Girma, Görg and Strobl (2004), Head and Ries (2003) and Helpman, Melitz and Yeaple (2004) focus on the impact of productivity on the trade-off between FDI and exports while Görg, Hanley and Strobl (2008) and Hijzen, Inui and Todo (forthcoming) examine the relationship between productivity and outsourcing.

the firm is 'integrated'.[5] We demonstrate how the choice among the alternatives depends on (a) the relative strengths of the domestic and the foreign demand for the firm's final output, (b) its available technology for producing final and intermediate goods, and (c) costs that include productions expenditures (both fixed and variable) and transport costs.

2 Organizational Form and Productivity

In this section, we provide some empirical evidence that demonstrates the potential advantages of using models that allow for a rich menu of organizational forms. Our data come from the Annual Business Survey of Economic Impact (ABSEI), an annual survey of a large sample of manufacturing and services plants in the Republic of Ireland. Plants are included in this survey if they have at least 10 employees, but are not necessarily dropped if they fall below this threshold. The coverage is about 60 to 80 percent of the targeted population. Data from the ABSEI are available to us for the years 1999 and 2000.

The data set provides plant level information on standard variables such as employment and output, but also on nationality of ownership, expenditure on R&D and training activities at the plant level. In terms of international activities of firms, the data provide information on exports and, quite uniquely, outward investment and international outsourciExporting and outsourcingng. For these two categories we exploit dummy variables which are equal to one if a firm has "any overseas offices or distribution facilities" and if the plant has "out-sourced production to other countries". Taking all this information together we can deduct whether a domestic firm is an exporter, a multinational or outsources production abroad, and whether a firm combines different modes of foreign activity. This provides us with a rich description of internationalization activities of firms, similar to Tomiura (2007).

Our sample consists of 1,305 domestic plants. Table 1 shows the breakdown of firms into different categories of internationalization. Note, firstly, that 26 percent of observations relate to firms that are purely domestic, i.e., do not export, not invest abroad, nor outsource. At the other end of the spectrum, 5 percent of firms engage in all three activities simultaneously. By far the most important category of firms is only export, which applies to 45 percent of observations, while 15

[5]Notice that in the literature the terms vertical and horizontal have been used to distinguish either different types of FDI or different relations between the production of inputs and output. This has not been a cause of confusion as these organization forms till now have been considered separately. Here we choose these terms to capture the two different types of FDI. In the verical FDI case we can think of the firm as having its headquarters at home and its production plant abroad.

percent of firms invest abroad and export (but do not outsource production) simultaneously.[6] This distribution of firms is in stark contrast to Tomiura's (2007) work on Japanese data. He finds that 90 percent of firms are purely domestic, i.e., do not engage in any internationalization activity. Roughly 4 percent of firms are exporters only, with the remainder of firms being fairly evenly distributed across the other categories. This undoubtedly reflects the very open nature of the Irish economy and also casts doubt on the applicability of Tomiura's findings to very open economies.

Table 1: Distribution of firms across internationalisation categories

Internationalisation mode	Percent of observations
FDI, exporting and outsourcing	5.5
FDI and exporting	15.3
Exporting and outsourcing	7.9
Exporting only	45.1
Purely domestic	26.3

Note: categories are mutually exclusive.

In order to show the advantages of using a general approach when classifying firms according to their internationalization activities, as motivated by the theoretic model, we relate plant level characteristics to the choice of mode. To do so we estimate the probability that a firm chooses one of the modes of internationalization, conditional on a number of plant characteristics. This is done using a multinominal logit approach. The plant level characteristics considered are labour productivity (sales per employee, similar to Tomiura, 2007), plant size (measured as employment size) and dummy variables for whether or not a plant is R&D active and provides formal training. The choice of variables is broadly motivated by recent theoretical models, as well as by the related empirical literature which show that productivity, size, and measures of technology and skills are important determinants of the choice to become an exporter or invest abroad. However, it should also be noted that the main point of this exercise is not only to show that these variables matter, but more importantly that the effect of variables, and here in particular productivity, depends on how exactly we define the mode of internationalization.

[6] The number of firms that only outsource, only invest abroad, or invest abroad and outsource (but not export) are negligible. We therefore drop those firms from the analysis, as they appear to be outliers.

In our first empirical analysis, we allow for only three types of internationalization: exporting and FDI, only exporting, and purely domestic. Hence, we ignore the possibility of outsourcing. The results are reported in Table 2. They show, firstly, the choice to do both exporting and FDI compared to remaining purely domestic is positively related to all plant characteristics: productivity, size, R&D and training. We also find that the choice only to export compared with being purely domestic is positively related to size, R&D and training, but not labour productivity.[7]

Table 2: Multinomial logit:
Exporting (X) and FDI

	X	X, FDI
Productivity	-0.001 (0.001)	0.006 (0.001)***
R&D dummy	0.892 (0.103)***	1.687 (0.137)***
Training dummy	0.239 (0.103)**	0.628 (0.149)***
Employment	0.007 (0.002)***	0.009 (0.002)***
Constant	-0.082 (0.095)	-2.301 (0.154)***
# of obs.	2596	2596
Pseudo R2	0.08	0.08
Wald	296.71***	296.71***

Baseline category is: purely domestic
Robust standard errors in parentheses

In the second analysis in Table 3 we only consider exporting and outsourcing and ignore the possibility that plants may also invest abroad. The results show that the choice to do both exporting and outsourcing relative to remaining purely domestic is positively related to all plant level variables, while the choice only to export is not related to productivity.

Table 3: Multinomial logit:
Exporting (X) and outsourcing (Z)

[7] The result that choosing to export compared to remaining domestic is not related to productivity is in line with Girma et al. (2004).

	X	X, Z
Productivity	0.001 (0.001)	0.002 (0.001)**
R&D dummy	1.007 (0.102)***	1.405 (0.152)***
Training dummy	0.298 (0.103)***	0.382 (0.159)**
Employment	0.007 (0.002)***	0.008 (0.002)***
Constant	-0.141 (0.104)	-2.063 (0.151)***
# of obs.	2596	2596
Pseudo R2	0.06	0.06
Wald	214.57***	214.57***

Baseline category is: purely domestic
Robust standard errors in parentheses

In Table 4 we then allow for all possible choices and combinations of FDI, exporting and outsourcing. In line with the earlier results we still find that the choice only to export relative to a purely domestic plant is not related to productivity, but otherwise is positively related to size, R&D and training. We also find that the choice to engage in all three activities simultaneously is positively related to all plant level characteristics, as is the choice to engage in exporting and FDI, but not outsourcing. However, we now find that the choice to do exporting and outsourcing, but not FDI, relative to remaining purely domestic is not related to plant level productivity or training activity. Hence, the previously found result that firms with higher productivity levels are more likely to choose exporting and outsourcing (Table 3) is only true for firms that also do FDI - but not for firms you do not invest abroad. This, hence, shows that it is important to take into account all possibilities when considering firms' internationalization modes and the relationship of those with plant level characteristics, in particular productivity.[8]

Table 4: Multinomial logit:
Exporting (X), FDI and outsourcing (Z)

[8] We have also performed a robustness check which defines the R&D and training variables as intensities (i.e., expenditure on the activity relative to sales) instead of zero/one type dummies. However, the results on the relationship between productivity and the choices remains robust to this alteration.

	EX, FDI, Z	X, FDI	X, Z	X
Productivity	0.006 ***	0.006 ***	0.002	-0.001
	(0.001)	(0.001)	(0.002)	(0.001)
R&D	1.800 ***	1.651 ***	1.203 ***	0.840 ***
	(0.238)	(0.148)	(0.175)	(0.106)
Training	0.615 **	0.633 ***	0.273	0.234 **
	(0.253)	(0.164)	(0.185)	(0.106)
Employment	0.010 ***	0.009 ***	0.007 ***	0.007 ***
	(0.002)	(0.002)	(0.002)	(0.002)
Constant	-3.717 ***	-2.588 ***	-2.278 ***	-0.203 **
	(0.247)	(0.172)	(0.184)	(0.097)
# of obs	2596	2596	2596	2596
Pseudo R2	0.06	0.06	0.06	0.06
Wald	315.92***	315.92***	315.92***	315.92***

Baseline category is: purely domestic
Robust standard errors in parentheses

3 The Choice of Organizational Form

This section sketches a theoretical model that allows consideration of many possible organisational forms. A firm uses an Ethier (2005) type technology for combining a variety of inputs to produce final output, Y:

$$Y = (aI + bZ)^{\gamma} \left(\min\{cS, dU\}\right)^{1-\gamma} \tag{1}$$

The technology brings together under constant returns to scale an intermediate material input with labor. The intermediate input can either be produced at home, I, in which case we say that the firm is integrated or can be outsourced, Z. The firm also uses both skilled, S, and unskilled, U, labor in fixed proportions. We are going to begin with the case where the firm supplies only the home market, produces only at home and gets its inputs only from home. Let w_I, w_Z, w_S, and w_U denote the corresponding input prices at home.[9]

The firm will be integrated if $\frac{w_I}{a} < \frac{w_Z}{b}$ while will outsource the intermediate input if $\frac{w_I}{a} > \frac{w_Z}{b}$. In the former case, the firm incurs two types of fixed costs; namely fixed costs related to the production of final output, F_Y, and fixed costs related to the production of the input, F_I.

[9]For labor these prices are wages. In the case of the intermediate input these prices reflect any variable costs associated either with their production (in the case of integration) or with their purchase from other firms (in the case of outsourcing). In the latter case, these can be both explicit and implicit, the latter reflecting trade-offs arising because of contractual incompleteness. Helpman (2006) provides a very interesting overview of this literature in the context of international firms.

In contrast, when the firm outsources the input it incurs only those fixed costs related to the production of final output.

We, first, consider the case of vertical integration, $\frac{w_I}{a} < \frac{w_Z}{b}$. The firm solves the following problem:

$$\max_{I,S} w_I I + \left(w_S + w_U \frac{c}{d}\right) S$$

$$s.t. \quad (aI)^{\gamma} (cS)^{1-\gamma} = \bar{Y} \tag{2}$$

where $\bar{Y}$ denotes the exogenous output target. The f.o.c. are:

$$w_I = \lambda a \gamma (aI)^{\gamma-1} (cS)^{1-\gamma}$$

and

$$w_S + w_U \frac{c}{d} = \lambda c (1-\gamma) (aI)^{\gamma} (cS)^{-\gamma}$$

where λ is the Lagrangian multiplier: After some algebraic manipulation we derive the following solutions for I, S and U:

$$I = \frac{\Delta^I \bar{Y}}{(a\Delta^I)^{\gamma} c^{1-\gamma}} \tag{3}$$

$$S^I = \frac{\bar{Y}}{(a\Delta^I)^{\gamma} c^{1-\gamma}} \tag{4}$$

and

$$U^I = \frac{\bar{Y}}{(a\Delta^I)^{\gamma} c^{-\gamma} d} \tag{5}$$

where the superscript I indicates that this is the solution for the integration case, and $\Delta^I = \frac{\gamma}{1-\gamma} \frac{w_S + w_U \frac{c}{d}}{w_I}$. Profits for the vertical integration case, Π^I, are given by:

$$\Pi^I = \bar{Y} - F_Y - F_I - w_I I - \left(w_S + w_U \frac{c}{d}\right) S^I \tag{6}$$

Next consider the case of outsourcing, i.e. when $\frac{w_I}{a} > \frac{w_Z}{b}$. Following the same steps as above we derive the following solution:

$$Z = \frac{\Delta^Z \bar{Y}}{(b\Delta^Z)^{\gamma} c^{1-\gamma}} \tag{7}$$

$$S^Z = \frac{\bar{Y}}{(b\Delta^Z)^{\gamma} c^{1-\gamma}} \tag{8}$$

and

$$U^Z = \frac{\bar{Y}}{(b\Delta^Z)^{\gamma} c^{-\gamma} d} \tag{9}$$

where the superscript Z indicates that this is the solution for the outsourcing case, and $\Delta^Z = \frac{\gamma}{1-\gamma}\frac{w_S+w_U\frac{c}{d}}{w_Z}$. Profits for the outsourcing case, Π^Z, are given by:

$$\Pi^Z = \bar{Y} - F_Y - w_z Z - \left(w_S + w_U\frac{c}{d}\right) S^Z \tag{10}$$

Comparison of (6) and (10) determines the firm's optimal choice.

3.1 International Transactions

Now, suppose that only a fraction h of the firm's final output is consumed at home while the remaining is consumed abroad. Once more, we assume that the output targets are fixed which implies that without any further loss of generality we can ignore relative prices. We further assume that both types of labour are always hired locally. Let w_I^*, w_Z^*, w_S^*, and w_U^* denote the the input prices abroad and F_Y^* and F_I^* the corresponding fixed costs. In addition, we allow for imperfect technology transfer across borders and thus a $*$ on the technology parameters, a, b, c, d, and γ captures differences in the technologies used home and abroad.

3.1.1 Exports

In this case all production takes place at home, i.e. there is integration, and the firm exports a fraction $1-h$ of its output. We assume that there is an 'iceberg' transport cost τ per unit of exports. Then profits Π^E are given by:

$$\Pi^E = (1-(1-h)\tau)\bar{Y} - F_Y - F_I - w_I I - \left(w_S + w_U\frac{c}{d}\right) S^I \tag{11}$$

3.1.2 FDI

We are going to distinguish between vertical and horizontal FDI. We have vertical FDI when all final output production takes place abroad and thus the output consumed at home is imported. Under horizontal FDI the firm produces at home the fraction of out put consumed at home and produces abroad the remaining. In this section, we consider the case where the firm is integrated.

Vertical Now the firm incurs transport costs when it imports part of the its output produced abroad. Profits $\Pi^{VFDI}$are:

$$\Pi^{VFDI} = (1-h\tau)\bar{Y} - F_Y^* - F_I^* - w_I^* I^* - \left(w_S^* + w_U^*\frac{c^*}{d^*}\right) S^{I*} \tag{12}$$

where

$$I^* = \frac{\Delta^{I*}\bar{Y}}{\left(a^*\Delta^{I*}\right)^{\gamma^*} c^{*(1-\gamma^*)}}$$

$$S^{I*} = \frac{\bar{Y}}{\left(a^* \Delta^{I*}\right)^{\gamma*} c^{(1-\gamma*)}}$$

and $\Delta^{I*} = \frac{\gamma^*}{1-\gamma^*} \frac{w_S^* + w_U^* \frac{c^*}{d^*}}{w_I^*}$.

Horizontal In this case the firm avoids transport costs but incurs all types of fixed costs. The CRS technology implies that profits Π^{HFDI} are:

$$\Pi^{HFDI} = \bar{Y} - F_Y - F_I - F_Y^* - F_I^* - h\left(w_I I + \left(w_S + w_U \frac{c}{d}\right) S^I\right) - (1-h)\left(w_I^* I^* + \left(w_S^* + w_U^* \frac{c^*}{d^*}\right) S^{I*}\right) \quad (13)$$

3.1.3 Outsourcing

When the firm outsources the production of intermediate inputs incurs an additional transport cost related to their transfer. We assume that this additional cost is reflected in their price. Profits Π^{Z*} (where the $*$ indicates that the firm outsources abroad) are:

$$\Pi^{Z*} = \left(1 - (1-h)\,\tau\right) \bar{Y} - F_Y - w_z^* Z^* - \left(w_S + w_U \frac{c}{d}\right) S^{Z*} \quad (14)$$

where

$$Z^* = \frac{\Delta^{Z*} \bar{Y}}{\left(b \Delta^{Z*}\right)^{\gamma} c^{1-\gamma}}$$

$$S^{Z*} = \frac{\bar{Y}}{\left(b \Delta^{Z*}\right)^{\gamma} c^{1-\gamma}}$$

and $\Delta^{Z*} = \frac{\gamma}{1-\gamma} \frac{w_S + w_U \frac{c}{d}}{w_{*Z}}$.

3.1.4 Multiple Transactions

Up to this point we have derived the costs of individual foreign activities. However, many globally engaged firms have multiple activities and the above taxonomy is inadequate for classification purposes. For example some firms have foreign affiliates (FDI) and at the same time outsource the production of inputs. Others produce inputs in one country while they produce final output in another. In this section, we add to the above taxonomy a few commonly encountered types of multinationals.

Vertical FDI and Outsourcing This type of firm produces all final output abroad and also outsources the intermediate input. The firm can outsource either home or abroad and below we consider the latter case. The price of outsourcing in this case, w_z^{**}, must be lower than the price w_Z^* the firm would have to pay had be producing at home as it avoids

transport costs related to the import of input. Profits Π_Z^{VFDI} are given by:

$$\Pi_Z^{VFDI} = (1 - h\tau)\,\bar{Y} - F_Y^* - w_z^{**} Z^{**} - \left(w_S^* + w_U^* \frac{c^*}{d^*}\right) S^{Z**} \qquad (15)$$

where

$$Z^{**} = \frac{\Delta^{Z**} \bar{Y}}{\left(b\Delta^{Z**}\right)^{\gamma*} c^{(1-\gamma*)}}$$

$$S^{I**} = \frac{\bar{Y}}{\left(b\Delta^{I**}\right)^{\gamma*} c^{(1-\gamma*)}}$$

and $\Delta^{I**} = \frac{\gamma^*}{1-\gamma^*} \frac{w_S^* + w_U^* \frac{c^*}{d^*}}{w_Z^{**}}$.

Vertical FDI without Integration The firm produces final output abroad and the intermediate input at home. The new price of the input w_I^{**} reflect the transport costs associated with its transfer abroad. Profits Π_W^{VFDI} (where the subscript W denotes without integration) are:

$$\Pi_W^{VFDI} = (1 - h\tau)\,\bar{Y} - F_Y^* - F_I - w_I^{**} I^{**} - \left(w_S^* + w_U^* \frac{c^*}{d^*}\right) S^{I**} \qquad (16)$$

where

$$I^{**} = \frac{\Delta^{I**} \bar{Y}}{\left(a\Delta^{I*}\right)^{\gamma*} c^{*(1-\gamma*)}}$$

$$S^{I**} = \frac{\bar{Y}}{\left(a\Delta^{I**}\right)^{\gamma*} c^{*(1-\gamma*)}}$$

and $\Delta^{I*} = \frac{\gamma^*}{1-\gamma^*} \frac{w_S^* + w_U^* \frac{c^*}{d^*}}{w_I^{**}}$. Notice that the productivity of the input a is not starred because it is produced at home.

Horizontal FDI and Outsourcing We consider the case when both the domestic and the foreign affiliates are outsourcing abroad. Profits Π_Z^{HFDI} are:

$$\begin{aligned}\Pi_Z^{HFDI} = \bar{Y} - F_Y - F_Y^* - h\left(w_Z^* Z + \left(w_S + w_U \frac{c}{d}\right) S^{Z*}\right) - \\ (1-h)\left(w_Z^{**} Z^{**} + \left(w_S^* + w_U^* \frac{c^*}{d^*}\right) S^{I**}\right)\end{aligned} \qquad (17)$$

Horizontal FDI without Integration We consider the case when the intermediate input is produced by the domestic affiliate and then a fraction is exported to the foreign affiliate. The firm avoids the fixed costs associated with the production of the intermediate input abroad, however, the cost of the input for the foreign affiliate w_I^{**} includes the transport cost associated with its transfer abroad. Profits Π_W^{HFDI} are:

$$\Pi_W^{HFDI} = \bar{Y} - F_Y - F_I - F_Y^* - h\left(w_I I + \left(w_S + w_U \frac{c}{d}\right) S^I\right) - (1-h)\left(w_I^{**} I^{**} + \left(w_S^* + w_U^* \frac{c^*}{d^*}\right) S^{I**}\right) \quad (18)$$

3.2 Optimal Transactions

The above analysis of the model has identified three types of variables that can affect the optimal choice of transactions; namely, variables related to costs, variables related to technology and variables related to the demand for final output at home and abroad.

3.2.1 Costs

The model includes three types of costs: fixed, variable and transport. Fixed costs are incurred when the firm establishes a plant for the production of either final output or intermediate input. Variable costs include outlays on the intermediate input (that depend on whether the input is produced by the firm or is outsourced) and labor payments (both skilled and unskilled). Finally, transport costs are incurred when goods and inputs are transferred across borders. A firm that does not opt for horizontal FDI will incur costs related to the transfer of final output while a firm that is neither integrated nor outsourcing locally will incur costs related to the transfer of the intermediate input.

3.2.2 Technology

There are good reasons to believe that technology transfer across borders cannot always be perfect. For example, technological differences in the production of the input (whether produced by the same firm or outsourced) will shown up in differences between a (in the case of in-firm production) or b (outsourcing) and their corresponding starred values. Similarly, worker productivity differences are captured by differences between c (for skilled) and d (unskilled) and their corresponding values abroad. In addition, differences in costs related to the assembly of final output are depicted by the parameters γ and γ^*.

3.2.3 Demand

The choice of international transactions will affect the cost of production which in turn will affect the demand for final output at home and abroad. To keep things simple, we have taken demand as exogenously given. Nevertheless, for a given total demand $\bar{Y}$ the optimal choice of financial transactions will depend on differences between domestic and foreign demand captured by the parameter h.

Table 5 lists all types of firms analyzed above together with the variables that affect their total costs. Since what matters for the choice of all inputs is their relative costs adjusted for differences in technological parameters we report the relevant ratios.[10]

Table 5: Cost Comparisons

Firm Type	Relevant Variables
Exports	$h, \gamma, \tau, F_Y, F_I, \frac{w_I}{a}, \frac{w_s}{c}, \frac{w_U}{d}$
VFDI	$h, \gamma^*, \tau, F_Y^*, F_I^*, \frac{w_I^*}{a^*}, \frac{w_s^*}{c^*}, \frac{w_U^*}{d^*}$
HFDI	$\gamma, \gamma^*, F_Y, F_I, \frac{w_I}{a}, \frac{w_s}{c}, \frac{w_U}{d}, F_Y^*, F_I^*, \frac{w_I^*}{a^*}, \frac{w_s^*}{c^*}, \frac{w_U^*}{d^*}$
Outsourcing (Z)	$h, \gamma, \tau, F_Y, \frac{w_Z^*}{b}, \frac{w_S}{c}, \frac{w_U}{d}$
VFDI & Z	$h, \gamma^*, \tau, F_Y^*, \frac{w_Z^{**}}{b^*}, \frac{w_s^*}{c^*}, \frac{w_U^*}{d^*}$
VFDI W*	$h, \gamma^*, \tau, F_Y^*, F_I, \frac{w_I^{**}}{a}, \frac{w_s^*}{c^*}, \frac{w_U^*}{d^*}$
HFDI & Z	$\gamma, \gamma^*, F_Y, \frac{w_z^*}{b}, \frac{w_s}{c}, \frac{w_U}{d}, F_Y^*, \frac{w_z^{**}}{b^*}, \frac{w_s^*}{c^*}, \frac{w_U^*}{d^*}$
HFDI W*	$\gamma, \gamma^*, F_Y, F_I, \frac{w_I}{a}, \frac{w_s}{c}, \frac{w_U}{d}, F_Y^*, \frac{w_I^{**}}{a}, \frac{w_s^*}{c^*}, \frac{w_U^*}{d^*}$

*: without integration

In order to demonstrate some of the advantages of our general approach consider once more the example that we mentioned in the Introduction. Suppose that we focus on the choice between horizontal FDI and exports ignoring for the moment that firms can also follow the 'non-integration' strategy. Horizontal FDI requires that the firm incurs fixed costs for the production of both final output and intermediate inputs where the former can be related to the establishment of an assembly plant and the latter with the establishment of a production plant. Suppose that F_I^* is prohibitively high. in that case we might conclude that

[10]By no means the above table provides a complete classification of all possible organizational forms. However, the model is sufficiently flexible to account for transactions that we have so far ignored. For example, firms have the option to outsource either in the home market or abroad but above we have only focused on the latter case. Also, when we considered the non-integration vertical FDI case (fragmentation of production) we have assumed that the firm produces final output abroad and intermediate inputs at home but the reverse is also possible.

the firm might opt to produce only at home and use exports to satisfy the foreign demand for its final output. However, if transport costs, τ, are also relatively high then the firm might choose to produce all inputs at home and establish a single plant abroad for assembling final output sold there and thus avoid both the high fixed costs associated with establishing a production plant abroad and high transport cost associated with exports.

4 Conclusion

There are many strategies available to firms that attempt to compete in international commodity markets. These strategies are the subject of study of the fast growing literature on the organization of firms. The majority of studies have focused on only a couple of the many alternative strategies available. We have argued that potentially this narrow focus might lead to wrong predictions concerning the behavior of multinational firms and have provided some empirical evidence from plant level data for the Republic of Ireland that support our argument. We have also proposed a simple partial equilibrium model that is sufficiently flexible to allow for a much more general analysis of the choices available to multinationals. The next challenge is to embed it in a general equilibrium framework that would allow us to understand what determines the distribution of firms according to their type of organization.

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