Exports Versus Horizontal Foreign Direct Investment with Profit Shifting*

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Abstract

We study a firm which serves two unequally-sized markets and must choose where to locate its first production plant, and whether to open a second plant to serve the other market through local sales rather than exports. An exporter pays taxes only to the country where it locates its single production plant. A double-plant multinational pays taxes in both countries, but may shift taxable profits across countries, at a cost. We show that the usual proximity–concentration trade-off between fixed and trade costs is modified, depending on both the average tax of, and the tax difference between, the two countries. Moreover, in contrast to a standard result of the FDI literature, we find that increased market size asymmetry may make it more likely that the firm engages in horizontal FDI. From a global welfare viewpoint, it is always desirable to control the firm's profit shifting when the multinational structure is taken as given. However, the fact that the firm may react by changing its production structure may be a reason not to control profit shifting activities.

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1 Introduction

Horizontal foreign direct investment (FDI) has become a major policy issue in the past decades, as multinational firms carry out growing proportions of international economic activity (according to the OECD, around 60% of international trade involves transactions between two related parts of multinationals). The empirical evidence indicates that FDI by multinationals grew rapidly in the last 15 years of the 20th century, far outpacing the growth of international trade among industrialized countries. Foreign-owned multinationals employ 1 worker in every 5 in European manufacturing and 1 in every 7 in US manufacturing; they sell 1 euro in every 4 of manufactured goods in Europe and 1 dollar in every 5 in the US (OECD, 2001). Moreover, it is generally acknowledged that industries characterized by scale economies and imperfect competition are dominated by this kind of firms.[1]

Firms engaging in horizontal (or vertical, for that matter) FDI own fiscal entities at different locations and are, thus, capable of shifting profits from high- to low-tax locations. The existence of profit shifting through various mechanisms, such as royalty payments, transfer price manipulation and dividend remittances, is widely documented (see Hines, 1999, for a comprehensive survey of the empirical literature). A recent paper by Clausing (2003) uses explicit observations of both intrafirm and non intrafirm (market) prices of US international trade. She concludes that export (import) intrafirm prices do increase (decrease) with the tax rate of the destination (origin) country as compared to the market ones. Both the OECD (1995, 1998) and the European Commission (1992, 1998) have issued documents reacting to the widespread phenomenon of profit shifting.

From a theoretical viewpoint, the firm's choice on how to serve a foreign market has been treated in the literature by the so-called "proximity–concentration trade-off".[2] The trade-off states that serving foreign markets through local production is a good option under high trade costs, whereas concentrating production in just one location and exporting to the other markets is the best option when fixed set-up costs (e.g. building the factory, buying machines, training workers, etc.) are high.[3]

Arguably, one of the key factors influencing the firm's choice between trade and fixed costs to operate abroad is the market size. Indeed, a general result from the FDI literature is that horizontal FDI is more likely to occur when GDP (a good proxy for

[1] These stylized facts are documented and discussed in Markusen (1995), Markusen and Venables (1998), and Barba Navaretti *et al.* (2004).

[2] See, for example, Horstmann and Markusen (1992), Brainard (1993, 1997), and Markusen and Venables (2000). More recently, Helpman, Melitz and Yeaple (2004) have emphasized the role of intra-industry firm heterogeneity - in terms of productivity differences - in explaining the structure of international trade and investment when firms face a proximity-concentration trade-off.

[3] Similarly, the studies which put forward the "tariff-jumping" argument for FDI show that tariffs increase the cost of exports for the firm, thereby encouraging FDI - relative to exports - in the tariff-levying country. See Caves (1996, Ch. 2) for an excellent survey on this line of research.

country or market size) is more similar across countries.[4] Several empirical papers, including Devereux and Griffith (1998) and Head and Mayer (2002), show a robust positive relationship between market size and the likelihood to attract FDI. On the other hand, Devereux, Lockwood and Redoano (2004), who analyze OECD countries' tax-setting behavior over the period 1982-1999, find that country size (as measured by GDP) positively affects *statutory* corporate tax rates; Baldwin and Krugman (2004) obtain a similar result for *average* corporate tax rates. Moreover, there is extensive evidence that the corporate tax rate of the host country has a negative and significant impact on inward FDI (see, e.g., De Mooij and Ederveen (2002) for a synthesis of empirical studies based on EU data). If we put such empirical findings together, it follows that large countries are more likely to benefit from direct investments by foreign firms but also to set higher corporate tax rates which, in turn, should discourage foreign firms from investing there.

The theoretical literature has analyzed the relationship between firm location and fiscal policies mostly using single-plant firms. The notable exceptions here are the works by Behrens and Picard (2007) and by Bucovetsky and Haufler (2007). Behrens and Picard (2007) set up a symmetric two-country tax/subsidy competition model which builds on a New Economic Geography general equilibrium framework. They show that competition for mobile firms can be weakened when firms are allowed to establish an additional plant abroad rather than simply relocate production across countries. Namely, if trade costs are high relative to the cost of capital, only double-plant firms exist in the economy so that the tax base becomes immobile. In that case, governments may actually tax away firms' *organizational rents*, which lessens the incentives for harmful tax competition.[5] Bucovetsky and Haufler (2007), instead, use a traditional public finance approach to deal with capital tax competition when firms can endogenously choose their organizational structure and governments can commit to long-run tax discrimination policies between multinational and domestic firms. The main trade-off for governments is that granting tax breaks to multinationals softens tax rate competition, but it also provides incentives for firms to choose a multinational structure with the aim of enjoying tax savings. Interestingly, when the firms' organization choice responds elastically to tax breaks, a small coordinated increase in the tax preferences in favor of mobile firms may relax tax rate competition, thereby increasing global welfare.

Nevertheless, to the best of our knowledge, no effort has been made to study the interaction between the proximity–concentration trade-off and fiscal motivations when the possibility of profit shifting is explicitly taken into account. This paper aims at building the bridge between these two strands of the literature, i.e., to study how different profit tax rates influence the location–organization choice when multinationals may manipulate taxable profits in their favor, and countries' markets differ in size. Differently from us, Behrens and Picard (2007) do not take into account the possibility of asymmetric market size and profit shifting. By contrast, in Bucovetsky and Haufler

[4]See, e.g., Markusen and Venables (1998, 2000).

[5]Baldwin and Krugman (2004) get a similar result in a model with single-plant firms and asymmetric countries, where the bigger one ends up taxing away the firms' "agglomeration rents".

(2007), choosing a multinational structure confers tax savings to the firm at no cost, i.e., they do not model - as we do - an optimal tax avoidance decision taken by mobile firms. Moreover, they focus on the tax breaks versus fixed costs trade-off for the firm, while we consider both trade and tax savings stemming from horizontal FDI. However, both Behrens and Picard (2007) and Bucovetsky and Haufler (2007) endogenize fiscal policy decisions, which we take as given.

To this end, we develop a model where two countries of asymmetric market size levy corporate taxes on the profits generated within their borders and do not allow the firm to deduct its investment (fixed) costs from the corporate tax base. A monopolist must decide on whether to serve the two markets locally, i.e., with two local production plants (a multinational structure) or to set a production plant in one market and serve the other through exports (an exporter structure).[6] The trade-off here is that building a second production plant entails a fixed set-up cost, while serving the foreign market through exports involves positive trade costs. The fiscal policy affects the two production structures differently: an exporter pays taxes on its overall profits just in the country where its (unique) production plant is located; a multinational, instead, pays taxes to different national tax authorities, which possibly levy unequal tax rates. Hence, becoming multinational allows the firm to shift taxable profits - at some cost - to the low-tax country. By contrast, being an exporter which operates in the low-tax country can represent an indirect way of minimizing tax liabilities on worldwide profits. We analyze how the firm's location–organization choice depends on the tax rates set by the two countries, on market size asymmetry and on the ability to shift profits.

Our theoretical set-up is based on the literature about policy competition for FDI under imperfectly competitive markets, country-size asymmetries and trade costs.[7] This line of research develops from the contribution by Haufler and Wooton (1999), who analyze tax competition between two countries of unequal size trying to attract a foreign-owned monopolist. The existence of positive trade costs separating the two countries entails a location advantage in the larger market. As a result, the big country "wins" the competition for FDI, and it may even do so while imposing a positive (lump-sum) profit tax on the foreign firm (rather than subsidizing it). Ferrett and Wooton (2005) extend the previous model to a two-firm homogeneous good set-up and conclude that tax competition under (Cournot) duopoly does not create a "race to the bottom" in corporate tax rates. Bjorvatn and Eckel (2006) introduce a local firm in the big country competing with the foreign investor for the regional market, while there are no local competitors in the small country. An interesting result is that aggregate welfare (the

[6]We abstract here from "vertical" FDI involving fragmentation of the firm's production process across countries. See, e.g., Markusen (2002, Ch. 9) for a discussion of this form of FDI.

[7]The baseline perfectly competitive Zodrow and Mieszkowski (1986)'s model has been extended for the case of asymmetric size countries by Bucovetsky (1991) and Wilson (1991). Both identify a "small region advantage", whereby the smaller country sets a lower tax, thus hosting a disproportionate share of firms and achieving the higher per-capita utility level. The traditional public finance approach, however, seems to be more appropriate when dealing with competition for portfolio investments rather than FDI since trade costs are typically not accounted for.

sum of regional welfare and the investor's profits) rises whenever the introduction of policy competition leads to a change in the investor's location decision. Finally, Haufler and Wooton (2006) study competition between a union of two countries and a third potential-host country. Countries' willingness to attract FDI stems from trade costs' saving, which are lower within the union than between the union and the outside country.

The remainder of the paper is organized as follows. Section 2 presents the model. Section 3 looks at the location–organization choice under asymmetric taxation, while Section 4 illustrates the main forces at work by focusing on two special cases, namely, symmetric countries and no fixed costs. Section 5 is devoted to the impact of profit shifting, whose desirability, from the total welfare viewpoint, is analyzed in Section 6. Section 7 concludes.

2 The model

We develop a partial equilibrium trade/location model in which a firm operates as a monopoly supplier of some final good in two countries (or regions) of different size.[8] The firm faces exogenous corporate tax rates and has to choose the most profitable way to serve the two markets. In line with Haufler and Wooton (1999), we assume that there is a single consumer in country A and $n > 1$ identical consumers in country B. Hence, without loss of generality, country A (resp., country B) represents the "small" ("large") market for the final good. Namely, the firm faces the following linear demands in the two countries:

$$q_{A}(p_{A}) = \alpha - p_{A}, \qquad q_{B}(p_{B}) = n\left(\alpha - p_{B}\right), \tag{1}$$

where q_{i} and p_{i} are the quantity and the consumer price prevailing in country i's market, $i = A, B$.

The firm has to make both a *location* and an *organization* choice. In other words, we let the firm decide where to locate its first - and possibly unique - production plant at a fixed cost, f. The final good is then produced at a constant marginal cost, w. Without loss of generality, we normalize $f = w = 0$. Moreover, the firm has to choose whether to export the final good to the other country or to engage in horizontal FDI, opening a second production plant abroad. When the monopolist chooses the former option, we shall refer to it as a "single-plant exporter" (denoted S_i, with $i = A, B$ depending on production plant's location); otherwise, we call it a "double-plant multinational" (denoted m). Shipping the final good to the other country entails a per unit trade cost $\tau > 0$.[9] Opening a second plant abroad instead implies a fixed cost $F \geq 0$.[10] We

[8] Horstmann and Markusen (1992) suggest that monopoly emerges as an equilibrium market structure when firm-specific fixed costs (e.g., R&D investments) are high enough to make entry by a second firm unprofitable.

[9] Positive trade costs are needed to separate the two markets, so that the location decision of the firm has real implications. Indeed, if trade costs were zero, operating profits of a single-plant exporter would be the same independently of where the firm locates its unique production plant.

[10] Our model would be unchanged if we allow the fixed costs of the second plant to be either smaller

follow the empirical evidence by Head and Mayer (2000) and Haskel and Wolf (2001) and postulate that the firm is able to segment its market, i.e. to set different consumer prices for the same final good sold in different markets. We denote by q_{ij} and p_{ij} the quantity sold and price set for the final good produced in country i for country j's market. Hence, operating profits of a single-plant exporter located in country i are given by

$$p_{ii}q_{ii} + (p_{ij} - \tau)q_{ij}, \quad i, j = A, B, \ i \neq j. \tag{2}$$

On the other hand, a multinational serving each market through local sales has operating profits of

$$p_{ii}q_{ii} + p_{jj}q_{jj} - F, \quad i, j = A, B, \ i \neq j. \tag{3}$$

Substituting the market demand functions (1) into (2) and (3) and differentiating yields profit-maximizing consumer prices for each location–organization choice by the firm[11]

$$p^*_{AA} = p^*_{BB} = \frac{\alpha}{2} \quad \text{and} \quad p^*_{AB} = p^*_{BA} = \frac{\alpha + \tau}{2}.$$

Accordingly, profit-maximizing quantities are given by

$$q^*_{AA} = \frac{\alpha}{2}, \qquad q^*_{AB} = n\frac{(\alpha - \tau)}{2},$$

and

$$q^*_{BB} = n\frac{\alpha}{2}, \qquad q^*_{BA} = \frac{\alpha - \tau}{2},$$

which lead to the following equilibrium operating profits

$$\frac{\alpha^2}{4} + n\frac{(\alpha - \tau)^2}{4} \qquad \text{for } S_A \tag{4}$$

$$n\frac{\alpha^2}{4} + \frac{(\alpha - \tau)^2}{4} \qquad \text{for } S_B \tag{5}$$

$$\frac{\alpha^2}{4} + n\frac{\alpha^2}{4} - F \qquad \text{for } m. \tag{6}$$

In order to have positive exports, we suppose that trade costs do not exceed the consumers' maximal willingness to pay for the final good, i.e., $\alpha > \tau$. In what follows, we also let

$$H \equiv \frac{\alpha^2}{4} > 0 \quad \text{and} \quad L(\tau) = L \equiv \frac{(\alpha - \tau)^2}{4} > 0$$

denote operating profits from local sales ("High") and from exports ("Low"), respectively.[12] The monopolist earns higher profits by selling its product locally than by

or larger than those needed to operate the first one, i.e. by letting $F = \xi f$, with $\xi \geq 0$ and $f \neq 0$. In the former case, namely for $\xi \in [0, 1)$, we say that there exist *firm-level scale economies*. In the latter, i.e. for $\xi > 1$, we have *firm-level scale diseconomies*.

[11] It is a straightforward exercise to show that the firm's pricing decisions do not depend on corporate profit tax rates.

[12] Note that $\partial L(\tau)/\partial \tau < 0$, meaning that lower trade costs lead to higher operating profits from exports. Moreover, we have that $L(0) = H$.

exporting it due to trade costs savings ($H > L$ and $nH > nL$ as long as $\tau > 0$). We define the operating profit differential as[13]

$$\Delta(\tau) = H - L(\tau) \geq 0$$

However, we cannot say *a priori* whether operating profits from local sales in the small country's market (H) are higher than operating profits from exports to the large country's market (nL). Indeed, we have that

$$H > nL \Longleftrightarrow n < \frac{\alpha^2}{(\alpha - \tau)^2},$$

meaning that if the difference in country size (n) is small enough and/or trade costs (τ) are sufficiently high, the former are likely to be higher than the latter, i.e. $H > nL$.

2.1 Location and organization choices

In the absence of corporate profit taxes, the optimal location and organization choices by the firm are easy to determine. The location decision depends on the difference between the profits it can realize by locating in one of the two countries and exporting to the other one. Using (4) and (5), a single plant exporter always prefers to locate in the big country, as the profit gain of serving the small market locally rather than through exports is equal to $(n-1)\Delta(\tau) > 0$, and is positively related to the level of trade costs. In the absence of trade costs, the firm would be indifferent between locations, despite the size difference.

The firm's organization decision is thus driven by the difference between the profits of a single-plant exporter from country B and those of a double-plant multinational, i.e., using (5) and (6), $F - \Delta(\tau)$. From this, it follows that the firm operates as an exporter from the big country if $F > \Delta(\tau)$, i.e., if the fixed costs it has to incur to open a second plant are sufficiently high and/or trade costs are low enough. This result is a simple restatement of the well-known *proximity-concentration* trade-off.

2.2 Corporate profit tax rates and profit shifting

We now consider a situation where each country $i = A, B$ imposes a tax rate $t_i \in [0, 1]$ on the firm's profits. We further assume that no country allows the firm to deduct its investment (fixed) costs from the corporate tax base.[14]

[13] To ease the notation, we will sometimes use Δ instead of $\Delta(\tau)$ in what follows. Note also that $\partial\Delta(\tau)/\partial\tau > 0$, i.e., the operating profit differential gets larger for higher values of trade costs.

[14] Allowing for cross-country differences in the deductibility of investment costs from the corporate tax base would introduce a second fiscal policy instrument at the government's disposal. Haufler and Schjelderup (2000) show that, in the presence of profit shifting, optimal corporate tax systems call for an incomplete - rather than a full - deductibility of investment expenditures as this allows governments to lower tax rates and reduces the incentive for the firm to shift profits abroad.

The introduction of corporate profit taxes affects both location and organization choices by the monopolist in a non-trivial way. We assume that international taxation follows the "source" principle, i.e. profits are taxed where they are generated. Keen (1993) argues that the effective taxation of multinationals is source-based, even though tax codes may stipulate differently.[15] This implies that the overall profits of a single-plant exporter with its production plant in country i are taxed at the rate t_i. Hence, since price and quantity choices are independent of taxes, equilibrium after-tax profits of an exporter whose unique production plant is located in country A or in country B are given, respectively, by:

$$\Pi^{S_A} = (1 - t_A)(H + nL), \tag{7}$$

$$\Pi^{S_B} = (1 - t_B)(nH + L). \tag{8}$$

As an example, take an Italian shoes producer undertaking the entire production stage in Italy and selling a part of it (incurring trade costs) to a French reseller. The profits thus earned are taxed at the corporate tax rate prevailing in Italy. Instead, the Italian shoes producer may decide to build a second production plant in France, serving both the Italian and the French market through local sales and saving on trade costs. In that case, it has to pay taxes in both countries but it may (at a cost) shift taxable profits across the two.

We let Π_i^m denote the profits actually *realized* by the multinational at each location i, and π_i^m represent the profits *declared* to tax authorities in country i, $i = A, B$. The double-plant multinational has to declare the totality of its worldwide profits, i.e. $\pi_A^m + \pi_B^m = \Pi_A^m + \Pi_B^m$, but declared and actual profits in one country need not coincide. In particular, $\Pi_A^m - \pi_A^m = \pi_B^m - \Pi_B^m$, meaning that we allow for "tax avoidance", but not for "tax evasion". The profit-shifting costs are increasing in the difference between the profits realized and those declared, and may involve expected fines, or hiring tax experts in order to conceal any profit misdeclaration.[16] They depend on an exogenous parameter, γ, which reflects governments' intensity in controlling tax avoidance by multinationals. Alternatively, a lower γ may represent a more mobile tax base. In addition (in the spirit of Hines and Rice, 1994, and Huizinga and Laeven, 2006), we account for the fact that the firm's accounts have to be less distorted to accommodate profit shifting if realized profits are large, by assuming that the costs are proportional to the *percentage* of shifted profits. If, for instance, the multinational shifts profits through transfer price manipulation, the same variation in transfer prices allows it to shift a larger amount of profits out of (or into) a market where it sells more units of a good. Under the alternative specification with costs depending on the difference between realized and declared profits, the firm shifts the same amount irrespective of the level of realized

[15] Implicitly, we assume that the sales-office is a legal resident of the foreign country, i.e. it is a subsidiary (rather than a branch) of the multinational firm. See Gresik (2001, footnote 20) for the different tax treatment of branches and subsidiaries.

[16] See, e.g., Swenson (2001), Kind, Midelfart Knarvik and Schjelderup (2004), Peralta, Wauthy and van Ypersele (2006), and Amerighi (2007).

profits. This would be in contradiction with the empirical findings stating that large markets offer more profit shifting opportunities than small ones.[17] More specifically, when country i is the high-tax country so that the multinational is willing to shift part of its realized profits to country j, this entails a cost

$$C\left(\gamma, \pi_i^m, \Pi_i^m\right) = \frac{\gamma}{2}\frac{\left(\Pi_i^m - \pi_i^m\right)^2}{\Pi_i^m}, \ i = A, B, \ \gamma \geq 0.$$

Since multinationals are allowed to choose the level of declared profits in response to the tax rates set by the two countries, the introduction of the profit shifting possibility does not change the pricing decisions of firms.[18] Hence, operating profits are given by $\Pi_A^m = H$ and $\Pi_B^m = nH$, and the multinational's after-tax profits can be written as follows:

$$\Pi^m = \Pi_A^m + \Pi_B^m - t_i\pi_i^m - t_j\left(\Pi_i^m + \Pi_j^m - \pi_i^m\right) - \frac{\gamma}{2}\frac{\left(\Pi_i^m - \pi_i^m\right)^2}{\Pi_i^m} - F, \quad i, j = A, B, \ i \neq j.$$

Optimizing with respect to the level of declared profits in country i, we obtain

$$\frac{\Pi_i^m - \pi_i^m}{\Pi_i^m} = \frac{t_i - t_j}{\gamma}$$

which means that the multinational declares higher profits in the low-tax country, while no profit shifting takes place when the two countries tax corporate profits at the same rate. In order to ensure that the multinational declares positive profits in both countries, we assume that $\gamma > 1$.[19]

Substituting for $\Pi_A^m = H$ and $\Pi_B^m = nH$, we can rewrite optimal declared profits in the two countries as

$$\pi_A^m = H\left(1 - \frac{t_A - t_B}{\gamma}\right) > 0, \quad \pi_B^m = nH + H\left(\frac{t_A - t_B}{\gamma}\right) > 0 \quad \text{if} \quad t_A > t_B \tag{9}$$

and

$$\pi_A^m = H + nH\left(\frac{t_B - t_A}{\gamma}\right) > 0, \quad \pi_B^m = nH\left(1 - \frac{t_B - t_A}{\gamma}\right) > 0 \quad \text{if} \quad t_B > t_A. \tag{10}$$

[17] For instance, Hines (1999, p. 318) claims that *"the return to clever tax-avoiding activity is a function of the amount of income that can be reasonably rerouted"*. Gresik (2001) also points to the idea that larger-scale operations offer more room for profit shifting activities, although focusing on firm (rather than market) size.

[18] A straightforward envelope argument yields this result.

[19] Without this assumption, the multinational may declare negative profits in one country, which would then be subsidizing the multinational at the announced tax rate, an unrealistic situation we wish to avoid. In Section 4, we relax such an assumption by analyzing the limit case where profit shifting is costless, i.e. $\gamma = 0$.

Therefore, equilibrium after-tax profits of a double-plant multinational are given by

$$\Pi^m = (1-t_A)\,H + (1-t_B)\,nH - F + \begin{cases} H\frac{(t_A-t_B)^2}{2\gamma} & \text{if } t_A > t_B \\ \\ nH\frac{(t_A-t_B)^2}{2\gamma} & \text{if } t_B > t_A \end{cases} \tag{11}$$

where the last term represents the net gain to shift taxable profits in response to a tax differential across the two countries.

3 Taxes and the location–organization choice

We now look in detail at the firm's choice in the presence of profit tax rates, under the possibility of profit shifting. It is useful to think of the firm's decision as a two-stage one, whereby the firm starts by choosing where to locate its first production plant (the location decision) and then decides on whether to open a second plant in the other country (the organization decision). This is an artificial timing which will, however, help us to understand the main forces at work in our model.

3.1 Location choice with taxes

When deciding where to locate its unique production plant, the firm compares (7) with (8), yielding

$$\Pi^{S_B} - \Pi^{S_A} = (n-1)\,\Delta(\tau) + t_A\,(H+nL) - t_B\,(nH+L)\,.$$

This implies that

$$\Pi^{S_A} > \Pi^{S_B} \iff t_A < t^{AB}(t_B) < t_B$$

where

$$t^{AB}(t_B) \equiv t_B\frac{nH+L}{H+nL} - \frac{(n-1)\,\Delta(\tau)}{H+nL} \tag{12}$$

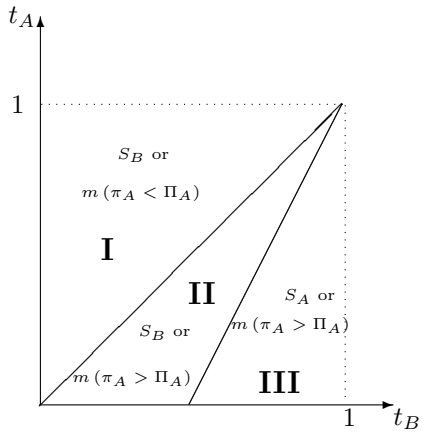
identifies the corporate profit tax rate country A can set such that the firm is indifferent between locating its unique production plant in the small or in the large country. In what follows, we will refer to condition (12) as the "location" condition. It is noteworthy that $t^{AB}(t_B) < t_B$ for any $t_B \in [0,1)$, i.e., the small country must offer a tax advantage to be able to attract the firm. As a consequence, there is a range of (low enough) big-country tax rates such that the small country can never attract the firm. In spite of that, the small country may now be able to induce the monopolist to locate there while this is not possible in the absence of taxes.

3.2 Organization choice with taxes

We now let the firm decide on whether to open a second production plant in the other country. In so doing, the firm incurs a fixed cost, but it saves trade costs on its foreign sales. Moreover, it can benefit from shifting profits to the more lightly taxed location. We now highlight the main trade-offs which are relevant for the monopolist's optimal location–organization choice for the general case with $\gamma > 1$. The exact expressions for the tax thresholds are derived in the Appendix.

When choosing its location, the firm prefers to operate as a single plant from the small country only when t_A is sufficiently smaller than t_B. This implies that, when it comes to the organization choice, the firm may decide to operate as *(i)* a single plant from country B or a multinational shifting profits from A to B, when $t_A > t_B$; *(ii)* a single plant from country B or a multinational shifting profits from B to A, when $t_B > t_A > t^{AB}$; or *(iii)* a single plant from country A or a multinational shifting profits from B to A, when $t_A < t^{AB}$. The relevant regions in the $(t_B, t_A)-$space are identified as **I**, **II**, and **III**, respectively, in Figure 1. Region **II** will play an important role in our analysis, in the sense that the firm opens its first plant in the high-tax country, which is also the biggest market, so that the second production plant can be used as a profit shifting device. We shall refer to this case as *fiscally-advantageous second plant*. On the contrary, in regions **I** and **III**, the second production plant is opened in the high-tax country and the firm shifts profits back to the country where it locates the first plant. In these cases, for sure, the second production plant is not opened due to fiscal motivations. We shall refer to these latter situations as *fiscally-disadvantageous second plant*.

Figure 1: The organization choice with taxes



Let us look at region **I** first, where $t_A > t_B$. Using (8) and (11), we get

$$\Pi^m - \Pi^{S_B} = \underbrace{(1-t)\,\Delta(\tau) - F}_{\text{modified proximity-concentration trade-off}} + \underbrace{\underbrace{H\frac{(t_A - t_B)^2}{2\gamma}}_{\text{profit-shifting effect}} - \underbrace{(H+L)\frac{(t_A - t_B)}{2}}_{\text{tax bill effect}}}_{\text{tax difference effect}} \quad (13)$$

where

$$t \equiv \frac{t_A + t_B}{2}$$

is the average tax rate of the two countries.

In the presence of corporate taxes and profit shifting, the organization choice is generally driven by two distinct effects: a *modified proximity-concentration* trade-off, which relies on the *level* of taxes, and a *tax difference* effect, which depends on the difference in the two countries' tax rates. The modified proximity-concentration trade-off weighs down the gain to serve markets locally by the average tax rate, as higher tax rates reduce the additional net profit from serving markets through local sales rather than through exports. As for the tax difference effect, we may further decompose it into a positive *profit-shifting* component and a negative *tax bill* one. The former represents the net gain of the multinational structure from shifting taxable profits out of the high-tax country. The latter is due to the different taxation of the profits realized in the small country. With a fiscally-disadvantageous second plant, the profits in the second market are taxed at a higher tax rate than if the market were served through exports.

We now handle region **II**, where $t_B > t_A > t^{AB}$. Using (8) and (11), we obtain

$$\Pi^m - \Pi^{S_B} = \underbrace{(1-t)\,\Delta(\tau) - F}_{\text{modified proximity-concentration}} + \underbrace{nH\frac{(t_B - t_A)^2}{2\gamma} + (H+L)\frac{(t_B - t_A)}{2}}_{\text{tax difference effect}} \qquad (14)$$

where the only dissimilarity with respect to (13) is the tax difference effect. When $t_B > t_A$, profit shifting goes in the opposite direction, i.e., from B to A, and it is of a higher magnitude than before. Moreover, we are dealing with a fiscally-advantageous second plant, so that the tax bill component is positive. Operating as a multinational allows the firm to pay taxes on high profits (H) at the lowest tax rate (t_A) instead of paying taxes on low profits (L) at the highest tax rate (t_B).

Finally, in region **III**, where $t_A < t^{AB}$, we use (7) and (11) and we get

$$\Pi^m - \Pi^{S_A} = \underbrace{(1-t)\,n\Delta(\tau) - F}_{\text{modified proximity-concentration}} + \underbrace{nH\frac{(t_B - t_A)^2}{2\gamma} - n(H+L)\frac{(t_B - t_A)}{2}}_{\text{tax difference effect}}. \qquad (15)$$

The net profit difference is analogous to (13), with t_A replaced by t_B and scaled up by n, as the firm decides on the possibility of opening a second plant in the big market. Since this second plant is fiscally-disadvantageous, the tax-bill effect is negative.

The discussion above allows us to pinpoint the importance of the average tax, on the one hand, and the tax difference, on the other. We summarize our findings in the two following Propositions.

Proposition 1 (Average tax and organization choice) *The gain of the monopolist from opening up a second plant to serve the foreign market is decreasing in the average tax of the two countries.*

The firm prefers to serve markets through local sales because that allows it to save on trade costs; however, since that gain is eroded by taxes, a higher average tax level decreases the firm's incentive to open a second production plant abroad. Such a theoretical result finds empirical support in a recent paper by Buettner and Ruf (2007), which uses a firm-level panel data to study the impact of taxation on the decision of German multinationals to hold or establish a subsidiary in other European countries or abroad. In particular, statutory corporate tax rates are found to have a strong negative impact and turn out to be at least as important as labor cost differences for explaining the observed location decisions.[20] In their words, "a policy directed towards the attraction of multinationals should care for low levels of [...] the statutory tax rate on corporation profits" (Buettner and Ruf, 2007, p. 162).

Proposition 2 (Tax difference and organization choice) *The gain of the monopolist from opening up a second plant is increasing in the tax difference*

(i) *in the case of a fiscally-advantageous second plant, i.e., when the first production plant is in the high-tax big country;*

(ii) *in the case of a fiscally-disadvantageous second plant as long as the tax difference is large enough and the cost to shift profits is sufficiently low.*

Proof. In region **I**, using (13), the tax-difference effect may be written as $g(x) \equiv \frac{x}{2}\left(x\frac{H}{\gamma} - (H+L)\right)$, where $x \equiv t_A - t_B > 0$. It is easy to check that $x\frac{H}{\gamma} - (H+L) < \frac{H}{\gamma} - H - L < 0$, for all $x \in (0,1)$ and $\gamma > 1$, hence $g(x) < 0$ always holds true in the relevant tax range. Moreover, $\partial g(x)/\partial x > 0$ for $x > \gamma\frac{H+L}{2H}$, and $\partial^2 g(x)/\partial x^2 > 0$. Since $\gamma\frac{H+L}{2H} < 1$ if and only if $\gamma < 1 + \frac{\Delta}{H+L}$, we have that $g(x)$ is increasing for high x, if γ is low enough; otherwise, it monotonically decreases for any $x \in [0,1]$.

In region **II**, both the profit-shifting and the tax bill effects are positive, and the profit difference is obviously increasing in $t_B - t_A$.

In region **III**, the argument follows by defining $x \equiv t_B - t_A$ and noticing that $h(x) \equiv nH\frac{x^2}{2\gamma} - n(H+L)\frac{x}{2} = ng(x)$. ■

Contrary to what one should expect, it is not always true that the firm decides to operate as a multinational so as to take advantage of high tax differentials. This usual argument forgets the endogeneity of the firm's location–organization choice, i.e., it focuses on the case of a fiscally-advantageous second plant (region **II**). This would correspond, empirically, to firms headquartered in the high-tax and big market core European regions (Baldwin and Krugman, 2004), which consider opening a second production plant in the low-tax peripheral regions. The tax-difference effect has always the sign of the tax-bill component, i.e., the firm has an incentive to open up a second

[20] Similarly, Devereux and Griffith (1998) find that taxes are a quantitatively significant factor in the choice of location of subsidiaries within Europe for US enterprises.

production plant only if it does so in the low-tax country. When the firm builds its second production plant in the high-tax country, the possibility of shifting a part of its profits does not compensate for the increased tax bill. This is due to the fact that profit shifting is costly, so that the firm is unable to cancel out the tax disadvantage of having to pay taxes in the high-tax country. Moreover, with fiscally-disadvantageous second plants, the tax difference effect becomes more negative, thereby working against a multinational structure, for higher values of γ (when profit shifting gets more costly), and also for lower values of τ (the exporter profits taxed at the low tax rate become larger).

Lastly, we evaluate the impact of market size asymmetry on the firm's organization choice. This follows from differentiating (13), (14), and (15) with respect to n, so that we can state

Proposition 3 (Market size asymmetry and organization choice) *In the presence of taxes and profit shifting, the gain of the monopolist from opening up a second plant is*

(i) *not affected by market size asymmetry, in the case of a fiscally-disadvantageous second plant, when the first plant is in the low-tax big country;*

(ii) *increasing in market size asymmetry, in the case of a fiscally-advantageous second plant, i.e., when the first plant is in the high-tax big country;*

(iii) *either decreasing or increasing in market size asymmetry, in the case of a fiscally-disadvantageous second plant, when the first plant is in the low-tax small country.*

Proof. In region **I**, using (13), we have that $\partial\left(\Pi^{m}-\Pi^{S_B}\right)/\partial n = 0$. In region **II**, using (14), we have that $\partial\left(\Pi^{m}-\Pi^{S_B}\right)/\partial n > 0$ as the profit-shifting effect is always increasing in n. Finally, in region **III**, using (15), we have that $\partial\left(\Pi^{m}-\Pi^{S_A}\right)/\partial n = (1-t)\,\Delta + g(x)$, where $(1-t)\,\Delta \geq 0$, $x \equiv t_B - t_A$ and $g(x) < 0$ is defined in the same way as in the proof of Proposition 2. Hence, the overall impact of n can be either positive or negative depending on the relative importance of these two opposing effects. ■

The traditional literature on FDI generally claims that horizontal FDI is more likely to take place between countries of similar size (Markusen and Venables, 1998; 2000). In our framework, this means that the firm's incentive to choose a multinational structure should be higher as n gets closer to 1. But this need not always be the case in the presence of taxes and profit shifting. In particular, with a fiscally-advantageous second plant (region **II** in Figure 1), the larger is country B's market relative to country A's (i.e., the higher is n), the more profitable horizontal FDI becomes relative to exports. This is due to the fact the gain from shifting taxable profits is positively related to the amount of profits that the firm actually realizes in the big market, which, in turn, increases with the market size. In the case of fiscally-disadvantageous second plants (regions **I** and

III), instead, increased market size asymmetry has either no or an ambiguous impact on the firm's choice to become multinational. In region **I**, the firm locates its first plant in the low-tax big country and, if it decides to establish a second production plant in the high-tax small country, it will shift profits from A to B. But the amount of profits realized in the small country (hence, shifted profits) do not depend on n. In region **III**, the firm has the option to set up its second plant in the high-tax big country and shift profits to the small country. When the net gain of serving the big market locally rather than through exports (trade cost savings) overrides the negative tax difference effect of shifting profits out of the high-tax big country, an increase in the size of the big market relative to the small one will make it more likely that the firm chooses to engage in horizontal FDI.

4 Two special cases

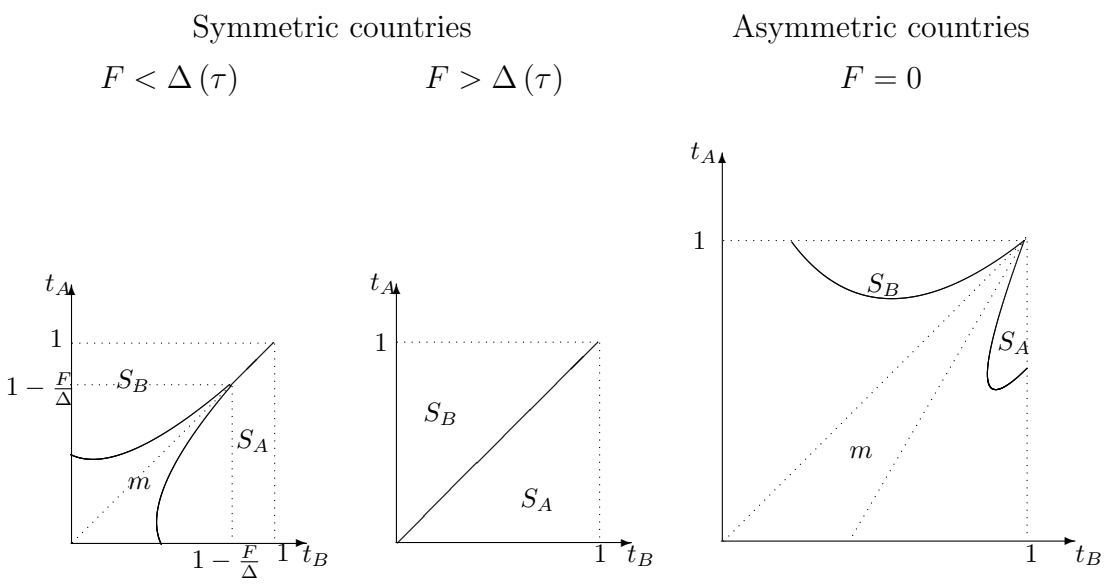
The combination of the average tax and the tax difference effects implies that the decision to open the second plant abroad depends non-linearly on the tax rates. We now illustrate this non-linearity by focusing on two simple limiting cases: one where the markets in the two countries are of equal size, and another where the fixed cost to open the second production plant is nil. Both situations are depicted in Figure 2.

4.1 Symmetric countries

In order to focus on the rich effects of the tax rates in our setting, we let the equally-sized countries ($n = 1$) set unequal corporate tax rates. Not surprisingly, the firm's decision is symmetric around the axis $t_A = t_B$, i.e., the firm always locates its first production plant in the low-tax country. The firm's location–organization choice depends on how F compares to $\Delta(\tau)$. Given market size symmetry, the firm opens its first plant in the low-tax country, so that the second plant is always fiscally-disadvantageous. This implies, according to Proposition 2, that the tax difference effect is always negative. Hence, the firm decides to operate as a multinational only when the modified proximity-concentration trade-off is sufficiently positive. If this trade-off is negative even with a zero tax rate (the case $F > \Delta$ on the central panel of Figure 2), then the firm never operates as a multinational.

Let us now look at the left panel of Figure 2. Suppose that the tax rates are equal, $t_A = t_B$. Then, the tax difference effect is nil, and the firm's organization choice depends only on the modified proximity-concentration trade-off. For a given value of F, as t decreases, opening up a second plant abroad becomes more interesting for the monopolist. An alternative way to interpret this is that there exists a value of t such that the firm finds it more profitable to pay a non tax-deductible cost (the fixed cost F) than a tax-deductible cost (the trade cost τ). Let us start from a high equal tax rate situation where the firm chooses S_B (i.e., $t > 1 - \frac{F}{\Delta}$) and let t_B decrease (for t_A and F fixed). Then, the increase in the tax difference makes it even less profitable for the firm

Figure 2: Two special cases



to operate as a multinational. If, instead, we start from an equal tax rate situation such that the firm operates as a multinational, the same tax difference effect leads the firm to switch to a single-plant structure as we let t_B decrease. However, further decreasing t_B also decreases the average tax rate and leads the firm to prefer a multinational structure again. When the average tax is sufficiently low, on the other hand, the monopolist always opens the second production plant.

The above discussion puts forward the idea that the introduction of taxes, even in a symmetric-country set-up, changes the monopolist's decision in an important manner. For values of F such that the monopolist always operates as a multinational in the absence of taxes, it may now happen that it decides to become a single-plant exporter. Furthermore, in a tax-free economy, the monopolist is always indifferent between being a single-plant exporter from either country since countries are of the same size. This is no longer the case here and a marginal tax rate difference induces the monopolist to locate in the low-tax country.

4.2 Additional plants at zero cost

The assumption that there are no fixed costs to open a second production plant abroad may capture the idea that the firm has a one-time fixed cost (e.g., to develop the product, market and advertise it) whereas production *per se* only entails marginal costs related to the amount of output produced. Notice that the absence of fixed costs does not change the location condition (12). Moreover, the modified proximity-concentration trade-off

is always positive, which favors the option of opening a second plant. This also implies that in the case of a fiscally-advantageous second plant (region **II**), the firm always operates as a multinational.

In the absence of taxes, the monopolist would always opt to serve the two markets from local production plants. This is no longer the case when fiscal motives are taken into account. Let us look at the cases of a fiscally-disadvantageous second plant, i.e., regions **I** and **III** on Figure 1. Then, both the tax difference and the modified proximity-concentration trade-off suggest that when both tax rates are sufficiently high and different enough, the firm does not open the second production plant. The intuition is the same as in the symmetric case. For a given $t_A > t_B$, m dominates S_B for low and high t_B, while S_B is better for intermediate values of t_B. When t_A gets low enough, m is always the optimal organization, for the main advantage of operating as an exporter from country B, which is to save tax payments in (the high-tax) country A, disappears. By contrast, when tax rates are equal, the advantage of becoming multinational is to increase profits in the foreign market by serving it locally rather than through exports, and this comes at no cost, since $F = 0$. Hence, whenever tax rates are identical, the optimal organization is always a multinational one.

5 The impact of profit shifting

In this Section, we analyze in more detail how the possibility of shifting taxable profits across countries affects the firm's location–organization choice. Arguably, the profit shifting ability plays an important role, which we address in the following result.

Proposition 4 (Profit shifting and the location–organization choice) *Increasing the ability to shift profits makes it more likely that a firm chooses the multinational structure.*

Proof. The proof follows by computing the threshold values of F above which the firm does not open the second production plant and noticing that they are all decreasing in γ. For the three regions depicted in Figure 1, they are given, respectively, by:

$$\begin{aligned}
\widehat{F}_{\mathbf{I}} &= (1-t)\,\Delta(\tau) + H\frac{(t_A - t_B)^2}{2\gamma} - (H+L)\frac{(t_A - t_B)}{2} \\
\widehat{F}_{\mathbf{II}} &= (1-t)\,\Delta(\tau) + nH\frac{(t_B - t_A)^2}{2\gamma} + (H+L)\frac{(t_B - t_A)}{2} \\
\widehat{F}_{\mathbf{III}} &= (1-t)\,n\Delta(\tau) + nH\frac{(t_B - t_A)^2}{2\gamma} - n(H+L)\frac{(t_B - t_A)}{2}
\end{aligned} \tag{16}$$

■

The above Proposition shows that corporate taxation introduces a further incentive for the firm to operate as multinational. Indeed, there are some tax configurations that

make it profitable to open a second production plant even for relatively high values of the fixed costs. Not surprisingly, less costly profit shifting increases the tax ranges for which a firm prefers to build the second production plant abroad.

We now illustrate the firm's choice in two limiting cases, i.e., when profits can be shifted at no cost, and when there are no profit shifting opportunities. We begin with the case $\gamma = 0$, which may capture the idea that national tax authorities of the two countries are particularly lenient with multinational firms and with their tax avoidance activities, resulting, e.g., from a high concern for consumer surplus relative to fiscal revenue.

Costless profit shifting does not alter the firm's location decision, i.e., condition (12) is still valid. When profit shifting entails no cost, however, the multinational declares its worldwide profits in the low-tax country and its equilibrium after-tax profits can be written as

$$\Pi^m_{\gamma=0} = (1 - \min\{t_A, t_B\})(n+1)H - F.$$

When $t_A > t_B$, the firm, as a multinational, declares its overall profits in country B and no profits in country A, and the relevant net profit comparison is given by:

$$\Pi^m_{\gamma=0,\ t_A>t_B} - \Pi^{S_B} = (1 - t_B)\Delta(\tau) - F$$

When $t_B > t_A$, instead, the firm, as a multinational, pays taxes on its worldwide profits just in country A, and the relevant profit comparison is either with S_B or with S_A. In the former case (region **II**), it is straightforward to obtain

$$\Pi^m_{\gamma=0,\ t_B>t_A} - \Pi^{S_B} = (1 - t_A)(n+1)H - F - (1 - t_B)(nH + L)$$

so that the firm prefers to open the second production plant as long as

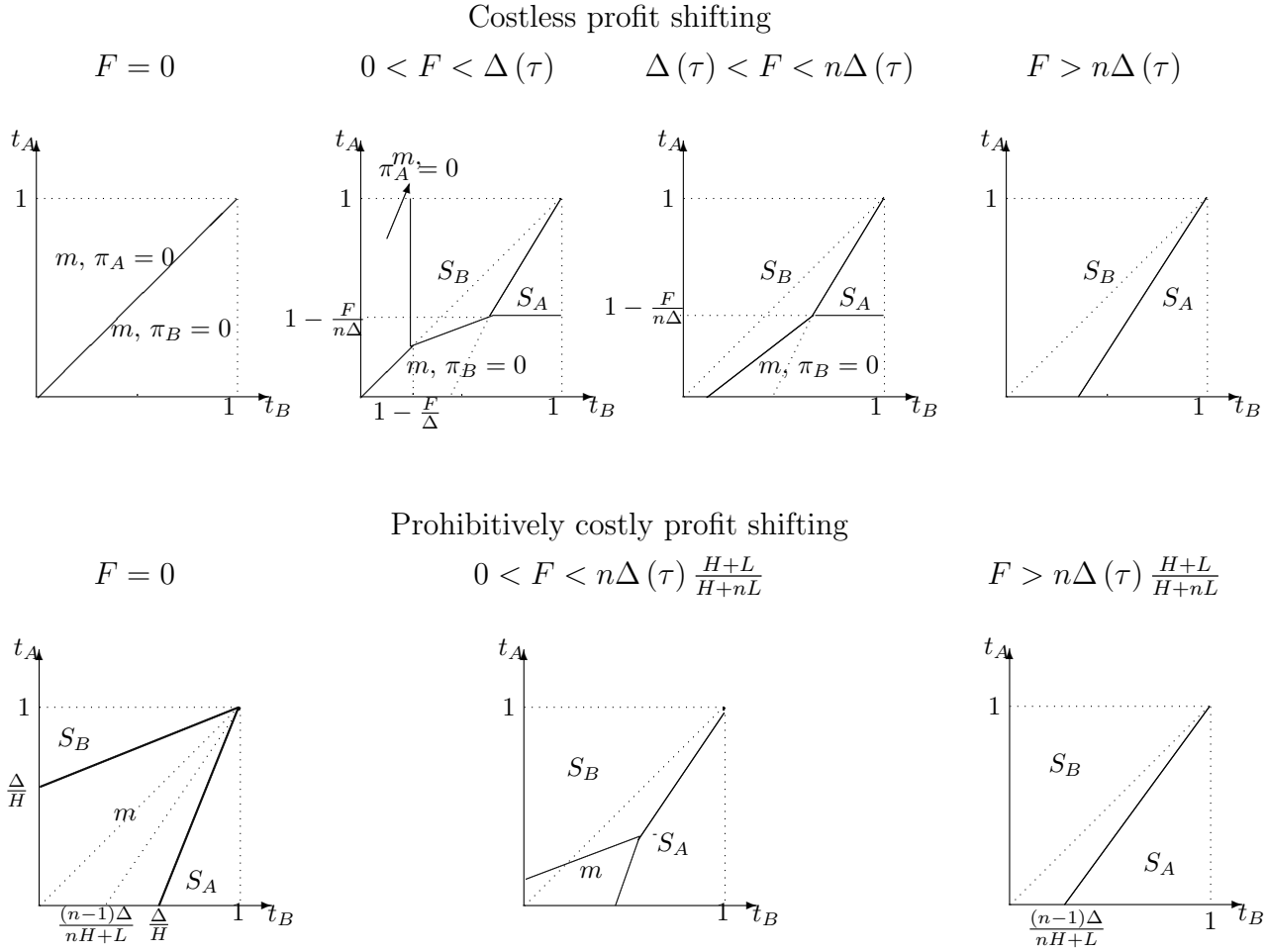
$$t_A \leq t^{Bm}_{\gamma=0,\ t_B>t_A}(t_B) = t_B \frac{nH + L}{(n+1)H} + \frac{\Delta(\tau) - F}{(n+1)H}.$$

In the second case (region **III**), we have

$$\Pi^m_{\gamma=0,\ t_B>t_A} - \Pi^{S_A} = (1 - t_A)n\Delta(\tau) - F.$$

Whenever $F > n\Delta(\tau)$, it never pays to operate as a multinational, for the maximum a firm can earn by running two production plants instead of one is $n\Delta(\tau)$, and it arises in a scenario in which the smallest tax rate is zero and the first production plant is in the small country. On the other hand, when $F = 0$, it is always profitable to open the second production plant and pay taxes on overall worldwide profits in the low-tax country. We are left with the two intermediate cases $0 < F \leq \Delta$ and $\Delta < F \leq n\Delta$. In this latter case, it never pays to be a multinational declaring zero profits in the small country. This would happen for $t_A > t_B$, in which case the first production plant would be in B, and the maximum gain to open a second production plant, Δ, outweighs the cost, F. For lower values of F, i.e., $0 < F < \Delta(\tau)$, instead, both of the profit shifting directions are possible. All of these possibilities are illustrated in the top line of Figure 3.

Figure 3: The impact of profit shifting



We then focus on a situation where the two countries' governments are eager to tax the multinational's profits, and this makes profit shifting so costly that the profits declared in each country coincide with those effectively realized there, i.e. $\pi_i^m = \Pi_i^m$, $i = A, B$. This happens when national tax authorities of both countries can easily monitor the multinational's activities and are thus capable of determining correctly the firm's tax liabilities in each country.

Equilibrium after-tax profits of the multinational are thus given by

$$\Pi_{\gamma=\infty}^m = (1 - t_A) H + (1 - t_B) nH - F.$$

Once again, the firm's location decision is unchanged and driven by condition (12). As for the firm's organization choice, using (13), (14), and (15), and not surprisingly, the profit-shifting gain vanishes and the tax difference effect retains only its negative tax bill component. Hence, the firm's choice is now driven by the following conditions

$$\Pi_{\gamma=\infty}^m \geq \Pi_B^s \iff t_A \leq t_{\gamma=\infty}^{Bm}(t_B) = t_B \frac{L}{H} + \frac{\Delta(\tau) - F}{H} \tag{17}$$

$$\Pi_{\gamma=\infty}^m \geq \Pi_A^s \iff t_A \geq t_{\gamma=\infty}^{Am}(t_B) = t_B \frac{H}{L} + \frac{F - n\Delta(\tau)}{nL} \tag{18}$$

where both $t_{\gamma=\infty}^{Bm}$ and $t_{\gamma=\infty}^{Am}$ are linear functions of t_B. It is also straightforward to check that the three indifference loci, $t_{\gamma=\infty}^{Bm}$, $t_{\gamma=\infty}^{Am}$, and t^{AB}, cross at $t_B = 1 - F(nL + H)/(n\Delta(H + L))$. Based on this intersection point and on the fact that $t_{\gamma=\infty}^{Am}$ has the greatest slope, and $t_{\gamma=\infty}^{Bm}$ the smallest, we may easily draw the graphs in the bottom line of Figure 3, from which it is clear that the monopolist chooses a multinational organization when corporate profit tax rates are close enough. In particular, the left panel clearly highlights the trade-off between the average tax and the tax difference: the lower is the average tax, the higher is the tax difference compatible with a multinational structure. The center panel displays a case where the fixed cost F is intermediate, hence the second plant is a good option only when the average tax is sufficiently low. Finally, the right panel shows that the value of F above which the firm never opens the second plant, independently of the tax rates, is lower than when profit shifting is costless. Overall, comparing the top and bottom panels of the Figure shows the expected result that the multinational structure is more likely when profit shifting is not constrained. Put otherwise, when profit shifting is impossible, the firm uses a different channel to lower its overall tax liabilities, namely, concentrate production in the low-tax country. In such a sense, the decision to operate as a single-plant exporter from the low-tax country represents an indirect way of shifting the overall corporate tax base.

Armed with the above results on the likely effects of profit shifting on the firm's location–organization choice, we now address the desirability of limiting the extent of profit shifting behavior by multinational firms.

6 Is profit shifting desirable?

In this Section we look at the desirability to constrain the firm's profit shifting ability. The conventional wisdom is that allowing multinational firms to shift their profits to the lowest-tax country decreases the total tax revenue. Thus, profit shifting is regarded as a harmful practice from a global welfare viewpoint. We show below that, once one takes into account the firm's location–organization choice, it need not be the case.

Suppose that the consumer's utility function is linear in a numéraire good and quadratic in the good supplied by the monopolist, yielding the linear demand we use in our model. Assume further that governments use tax revenue to finance lump-sum transfers to consumers. When the firm is owned in equal parts by each of the $n+1$ consumers residing in the two countries, it is straightforward to show that the indirect utility V_i of the consumer located in country i ($i = A, B$) is given by

$$V_A = \text{consumer surplus} + \text{tax revenue} + \text{firm's net profits}/(n+1)$$
$$V_B = \text{consumer surplus} + \text{tax revenue}/n + \text{firm's net profits}/(n+1)$$

Therefore, we can write total welfare in the two countries as $V^j = V_A + nV_B$, where $j \in \{S_A,\ S_B,\ m\}$ denotes the firm's location–organization choice. Notice that consumer surplus is simply given by $H/2$ or $L/2$, depending on whether the firm serves the market locally or from a foreign location.

6.1 Constraining a multinational

We begin by considering the case where the firm operates as a multinational. Using equations (9), (10), and (11), total welfare in the two countries can be written as

$$V^m = \frac{3(n+1)H}{2} - F - \begin{cases} H\frac{(t_A-t_B)^2}{2\gamma} & \text{if } t_A > t_B \\ \\ nH\frac{(t_A-t_B)^2}{2\gamma} & \text{if } t_B > t_A \end{cases} \tag{19}$$

from which it immediately follows that total welfare increases with the cost to shift profits, γ. This allows us to state the following result.

Proposition 5 (Profit shifting and welfare when structure is given) *When the multinational structure is given, the optimal policy is to make profit shifting prohibitively expensive.*

The intuition here is simple. Notice that the firm's tax bill is a pure transfer between the firm's owners and the consumers, hence it cancels out in terms of total welfare. However, the firm bears a cost for its profit shifting activities. For instance, when $t_A > t_B$, the multinational shifts $\Pi_A - \pi_A = H\left(\frac{t_A-t_B}{\gamma}\right)$ from A to B and bears a cost of $H\frac{(t_A-t_B)^2}{2\gamma}$, which is decreasing in the cost to shift profits. It is important to stress

here that one wants to avoid profit shifting because of the cost incurred by the firm, i.e., even neutralizing the alleged harmful effect of profit shifting on tax revenue. If we were to reintroduce this effect by supposing, e.g., that only a fraction of the firm is owned by the two countries' residents, then the motivation to limit profit shifting would be even stronger.

Proposition 5 is derived by supposing that the multinational firm does not modify its structure in response to a change in the cost of profit shifting. However, we know from Proposition 4 that as γ increases the firm is less likely to operate as a double-plant multinational, with the subsequent consumer surplus loss. Hence, taking into account the firm's location–organization choice may alter the conclusion about the optimality of restricting the profit shifting ability. That is the object of the next subsection.

6.2 Constraining a structure-optimizing monopolist

We start by identifying the optimal location–organization choice of the firm if both governments can collaborate and jointly decide the structure of the firm without altering its pricing and profit shifting decisions. In that sense, this is a second-best exercise, since we are not correcting for monopoly pricing distortions.

First of all, it is straightforward to show that it is never optimal to have an exporter from the small country. Indeed, we have that

$$V^{S_B} = \frac{3}{2}(nH + L) > V^{S_A} = \frac{3}{2}(H + nL)$$

as long as $n > 1$ and $\tau > 0$. A straightforward implication is that, if the two governments were to coordinate their corporate tax policies, they should never choose a pair of taxes (t_B, t_A) such that $t_A < t^{AB}(t_B)$.

Hence, it all comes down to comparing an exporter from the big country to a multinational, which gives

$$V^m - V^{S_B} = \frac{3}{2}\Delta(\tau) - F - \begin{cases} H\frac{(t_A - t_B)^2}{2\gamma} & \text{if } t_A > t_B \\ nH\frac{(t_A - t_B)^2}{2\gamma} & \text{if } t_B > t_A \end{cases} \tag{20}$$

and it is evident that there exists a value of the fixed cost F above which optimality requires the firm to operate as a single-plant exporter from the big country.

In order to evaluate the optimality of the market outcome, we shall abstract from the cases when the firm may decide to operate as an exporter from the small country, i.e., region **III** in Figure 1, for this can never be optimal. Let $\widehat{F}^o$ denote the critical values of F above which it is not optimal for the firm to open the second production plant. Using (16) and (20), we obtain

$$\widehat{F}_{\mathbf{I}} - \widehat{F}^o_{\mathbf{I}} = -\left(t + \tfrac{1}{2}\right)\Delta(\tau) + \tfrac{H}{\gamma}(t_A - t_B)^2 - (H + L)\tfrac{t_A - t_B}{2} \tag{21}$$

$$\widehat{F}_{\mathbf{II}} - \widehat{F}^o_{\mathbf{II}} = -\left(t + \tfrac{1}{2}\right)\Delta(\tau) + \tfrac{nH}{\gamma}(t_A - t_B)^2 + (H + L)\tfrac{t_B - t_A}{2} \tag{22}$$

for region **I** and **II**, respectively.

In the Appendix, we show that, when A is the high-tax country ($t_A > t_B$), $\widehat{F}_{\mathbf{I}} < \widehat{F}^o_{\mathbf{I}}$, i.e., there is a range of F values under which the firm operates as a single-plant exporter, when total welfare is maximized under a multinational structure. The intuition here is as follows. First, notice that the firm's gain of serving the small market locally is partly eroded by taxes, and the firm does not fully internalize the total welfare gain because it does not take into account the consumer surplus variation. Second, we are dealing with fiscally-disadvantageous second plants, so that the firm faces a cost to open the second production plant. This tax bill effect does not have any impact on total welfare as it represents a pure transfer of resources between the firm's owners and the consumers. On the other hand, when B is the high-tax country ($t_B > t_A$), we are dealing with a fiscally-advantageous second plant so that the firm faces an incentive to open the second production plant which does not matter for total welfare. If countries are very asymmetric in size, we have a range of F under which the firm decides to open the second production plant, when optimality would require it to operate as an exporter from the big country. This is because a higher n gives the firms more profit shifting opportunities, increasing the advantage to open the second fiscally-advantageous plant.

The above discussion shows that the market outcome is, in general, not optimal. However, the governments of the two countries have a simple instrument to make the market outcome closer to the optimal one, namely, the cost to shift profits. Interestingly, this may involve giving more profit shifting opportunities to the firm in order to induce it to choose the multinational structure when it is optimal to do so.

Proposition 6 (Profit shifting and welfare when structure is endogenous) *When the firm's location–organization choice is endogenous, it may be optimal to give more latitude for the multinational to shift profits into the low-tax country. This happens when the small country sets the highest tax rate, or when it sets the lowest and country-size asymmetry is not too large.*

Such a striking result is consistent with the finding by Bucovetsky and Haufler (2007), who show that, when the firms' choice of organizational form responds elastically to tax preferences, coordinated efforts at reducing tax discrimination between domestic and multinational firms may decrease global welfare.

7 Concluding remarks and possible extensions

This paper augments the standard proximity-concentration trade-off set-up by introducing market size asymmetry and fiscal considerations. We show that taking into account taxes and profit shifting changes the proximity-concentration trade-off non-trivially, depending on both the average tax rate of the countries and the tax difference. Higher average taxes make it less likely that a firm operates as a multinational. When it comes to tax differentials, we show that its impact depends on whether the second production

plant is *fiscally-advantageous*, i.e., in the low-tax country or *fiscally-disadvantageous*, i.e., in the high-tax country. When the first production plant is located in the high-tax country, we say that the second plant is fiscally-advantageous and tax differences induce the firm to prefer a multinational structure. This can only happen when the big country is also the high-tax one and can illustrate a firm located in the (high-tax) European "core" regions considering whether to open a second plant in the (low-tax) "periphery". On the contrary, when the first plant is located in the low-tax country, then larger tax differences can make it less likely that a firm operates as a multinational. Moreover, in sharp contrast to a standard result of the FDI literature, we find that increased market size asymmetry may make it more likely that the firm chooses a multinational - rather than an exporting - structure in order either to benefit from greater profit shifting opportunities or to achieve important trade cost savings in the big market.

Since the introduction of profit-shifting costs makes the location–organization choice depend non-linearly on tax rates, we illustrate the relationship between taxes and the firm's choice in two special cases, namely, symmetric countries and no cost to open a second production plant. The second case is interesting in that it shows that introducing taxes may lead the firm to keep a single-plant structure even when it is costless to open a second plant abroad.

We then look at the impact of profit shifting on the firm's organization decision. Not surprisingly, the gain to open the second production plant is always increasing in the ability to shift profits. We then use this fact to show that it may be optimal for the two countries to give the firm more latitude to shift profits when there is a sub-optimal number of multinationals in the world.

We conclude with some remarks on possible extensions. Firstly, all our results hold with a non-linear market demand, as long as the ranking of before-tax profits between local sales and exports are kept. The profit-shifting cost function can be generalized to any convex function. The crucial feature is that it generates a gain from profit shifting which is a convex function of the tax difference. The most crucial step in terms of future research is to endogenize tax setting by the countries. This exercise proves difficult due to the non-linearities induced by the profit shifting possibilities. Hopefully, this will shed light on the welfare effects of such policies and the desirability of some forms of tax harmonization and/or coordination between countries.

Appendix

Taxes and the location–organization choice

Region I When $t_A > t_B$, we solve (13) with respect to t_A and find that $\Pi^{S_B} > \Pi^m$ if t_A is greater than

$$\tilde{t}^{Bm}(t_B) = t_B + \gamma - \sqrt{\frac{\gamma}{H}}\sqrt{\gamma H + 2(F - \Delta(1 - t_B))}$$

where we have eliminated one of the roots of the quadratic equation, which is greater than 1. The root exists for $t_B > 1 - \frac{2F+\gamma H}{2\Delta}$, and outside this range, $\Pi^{S_B} < \Pi^m$ for any tax pair. Moreover, $\tilde{t}^{Bm}\left(1 - \frac{2F+\gamma H}{2\Delta}\right) = 1 - \frac{2F+\gamma H}{2\Delta} + \gamma > 1$. Also, $\tilde{t}^{Bm}(t_B)$ is a convex function which attains a minimum at $t_B = 1 - \frac{F}{\Delta} - \frac{\gamma H}{2\Delta} + \frac{\gamma\Delta}{2H}$. Finally, notice that $\tilde{t}^{Bm}(t_B) = t_B$ when $t_B = 1 - \frac{F}{\Delta}$. Thus, since $1 - \frac{F}{\Delta} > 1 - \frac{F}{\Delta} - \frac{\gamma H}{2\Delta} + \frac{\gamma\Delta}{2H}$, $\tilde{t}^{Bm}(t_B)$ reaches its minimum above the 45 °-line.

Region II When $t_B > t_A > t^{AB}(t_B)$, we solve (14) with respect to t_A and find that $\Pi^{S_B} > \Pi^m$ if t_A is greater than

$$\hat{t}^{Bm}(t_B) = t_B + \frac{\gamma}{n} - \frac{1}{n}\sqrt{\frac{\gamma}{H}}\sqrt{\gamma H + 2n\left(F - \Delta\left(1 - t_B\right)\right)}$$

(where the greatest root is higher than t_B, so we have eliminated it). The root $\hat{t}^{Bm}(t_B)$ exists for $t_B > 1 - \frac{2nF+\gamma H}{2n\Delta}$ and is a convex function of t_B which attains a minimum at $t_B = 1 - \frac{2nF+\gamma H}{2nK} + \frac{\gamma\Delta}{2nH}$. Moreover, $\hat{t}^{Bm}(t_B) = t_B$ when $t_B = 1 - \frac{F}{\Delta}$. Not surprisingly, $\hat{t}^{Bm}(t_B)$ and $\tilde{t}^{Bm}(t_B)$ cross at this point. In addition, $\hat{t}^{Bm}(t_B) < t_B$ if and only if $t_B > 1 - \frac{F}{\Delta}$. Given that $1 - \frac{F}{\Delta} > 1 - \frac{2nF+\gamma H}{2nK} + \frac{\gamma\Delta}{2nH}$, we conclude that $\hat{t}^{Bm}(t_B)$ is increasing in the relevant range.

Region III When $t_B > t^{AB}(t_B) > t_A$, we solve (15) with respect to t_A and find that $\Pi^{S_A} > \Pi^m$ if t_A is between the two roots defined by

$$t^{Am\pm}(t_B) = t_B - \frac{\gamma L}{H} \pm \frac{1}{H}\sqrt{\frac{\gamma}{n}}\sqrt{\gamma n L^2 + 2H\left(F - \left(1 - t_B\right)n\Delta\right)}$$

These two roots exist if and only if $t_B > 1 - \frac{F}{n\Delta} - \frac{\gamma L^2}{2H\Delta}$. Outside this range, $\Pi^{S_A} < \Pi^m$ for any tax pair. Also, $t^{Am\pm}\left(1 - \frac{F}{n\Delta} - \frac{\gamma L^2}{2H\Delta}\right) = 1 - \frac{F}{n\Delta} - \frac{\gamma n L^2}{2H\Delta} - \frac{\gamma L}{H} < 1 - \frac{F}{n\Delta} - \frac{\gamma L^2}{2H\Delta}$. Moreover, $t^{Am+}(t_B)$ is increasing and concave whereas $t^{Am-}(t_B)$ is convex and attains a minimum at $t_B = 1 - \frac{F}{n\Delta} + \frac{\gamma(H-2L)}{2\Delta}$. Moreover, $t^{Am+} < t_B$ only for $t_B < 1 - \frac{F}{n\Delta}$.

Optimality of the market outcome

As regards region **I**, let $m(x,\gamma) \equiv H\frac{x^2}{\gamma} - (H+L)\frac{x}{2}$ with $x \equiv t_A - t_B$. The function $m(x,\gamma)$ is convex and has two zeros, $x = 0$ and $x = \gamma(H+L)/2H$, hence its maximum value is either 0, if $\gamma(H+L)/2H > 1$, or $m(1,\gamma) = H/\gamma + (H+L)/2$, otherwise. Now

$$\frac{H}{\gamma} + \frac{H+L}{2} \in \left(\frac{\Delta}{2}, -\frac{H+L}{2}\right), \forall\gamma > 1$$

and since $-(t+1/2)\Delta$ is at most equal to $-\Delta/2$, this proves that $\widehat{F}_{\mathbf{I}} - \widehat{F}^o_{\mathbf{I}}$.

As for region **II**, let $x \equiv t_B - t_A \in [0,1]$ and define the function $r(x,\gamma,n) \equiv nH\frac{x^2}{\gamma} + (H+L)\frac{x}{2} \geq 0$. Notice that $r(x,\gamma,n) \in \left[0, \frac{nH}{\gamma} + \frac{H+L}{2}\right]$. Hence, it may happen that

$\widehat{F}_{\mathbf{II}} - \widehat{F}^o_{\mathbf{II}} < 0$. Namely, there exists a value of n, $\tilde{n}(\gamma) \equiv \frac{[H(1+2t_A)-L(1+2t_B)]\gamma}{2H(t_B-t_A)^2}$ such that $\widehat{F}_{\mathbf{II}} > \widehat{F}^o_{\mathbf{II}}$ for $n > \tilde{n}(\gamma)$, and $\widehat{F}_{\mathbf{II}} < \widehat{F}^o_{\mathbf{II}}$ otherwise.

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