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Center for Operations Research
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Voie du Roman Pays, 34
B-1348 Louvain-la-Neuve
Belgium
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Transfer pricing rules, OECD guidelines, and market distortions

Kristian BEHRENS[1], Susana PERALTA[2]
and Pierre M. PICARD[3]

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Abstract

We study the impact of transfer pricing rules on sales prices, firms' organizational structure, and consumers' utility within a two-country monopolistic competition model featuring source-based profit taxes that differ across countries. Firms can either become multinationals, i.e., they serve the foreign market through a fully controlled affiliate; or they can become exporters, i.e., they serve the foreign market by contracting with an independent distributor. Compared to the benchmark cases, where tax authorities are either unable to audit firms or where they are able to audit them perfectly, the use of the OECD's Comparable Uncontrolled Price (CUP) or Cost-Plus (CP) rule distorts firms' output and pricing decisions. The reason is that the comparable arm's length transactions between exporters and distributors, which serve as benchmarks, are not efficient. We show that implementing the CUP or CP rules is detrimental to consumers in the low tax country, yet benefits consumers in the high tax country.

Keywords: transfer pricing, OECD guidelines, multinationals and exporters, organizational choice, arm's length principle.

JEL Classification: F12, H25, H26, H87, L14

[1] Department of Economics, Université du Québec, Montréal, Canada; Université catholique de Louvain, CORE, B-1348 Louvain-la-Neuve, Belgium; CIRPEE, Canada; and CEPR, London. E-mail: Behrens.kristian@uqam.ca
[2] Faculdade de Economia, Universidade Nova de Lisboa, Portugal; Université catholique de Louvain, CORE, B-1348 Louvain-la-Neuve, Belgium, and CEPR, London. E-mail: peralta@fe.unl.pt
[3] CREA, Université du Luxembourg, Luxembourg; Université catholique de Louvain, CORE, B-1348 Louvain-la-Neuve, Belgium. E-mail: Pierre.picard@uni.lu

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1 Introduction

Multinationals have strong incentives to minimize their tax liability by using transfer prices to manipulate corporate profits. High transfer prices charged for goods sold to affiliates operating in high tax countries serve as a tool that allows those firms to repatriate profits to low tax countries, thereby reducing their overall tax burden. When firms face no restrictions, transfer prices may become pure tax-evasion devices with no economic meaning. Obvious examples include firms which "sold toothbrushes between subsidiaries for $5,655 each", or others which were "buying plastic buckets for $973 each and tweezers for $4,896."[1] Tax authorities thus have a strong incentive to recover tax revenue by auditing multinationals, by restricting their freedom to set transfer prices, by contesting their tax declarations, and by negotiating possible settlements.

While transfer pricing certainly is often far from economic reality and puts strain on the corporate profits tax base, not all firms 'sell buckets for a thousand bucks'. Put differently, not all transfer prices are pure tax-evasion devices. Hence, when tax authorities do interfer with firms' transfer pricing decisions they are likely to create inefficiencies that distort market prices and firms' organizational choices, and which increase the cost of running global corporations. Furthermore, "a system that forces on multinational firms similar prices to those faced by unrelated firms misses the point of multinationals: to cut costs by locating their activities more efficiently around the world."[2] Business men complain that "transfer pricing [...] forces us to spend a lot of time doing things that are pointless from a business point of view. We have to waste time trying to price unfinished goods being 'sold' from one plant to another. [...] Businesses want to organise as if there were a single global or regional product market. Instead, tax is determining how they organise themselves. [...] The tax system promotes parochial thinking."[3]

To cope with these conflicting problems, the OECD has suggested a set of guidelines to alleviate market distortions while helping tax authorities and multinationals to reach mutually satisfactory agreements (OECD, 2001). The economic efficiency of those guidelines is generally based on the notion of *arm's length price*, which is "the price two unrelated parties would reach through bargaining in a competitive market" (Eden, 1998, p.602). As multinationals are known to operate in imperfectly competitive markets, the OECD guidelines are likely to reflect market distortions arising even between unrelated parties.

This paper studies the market distortions implied by the two mostly frequently used transfer pricing rules in the OECD guidelines, namely, the Comparable Uncontrolled Price (henceforth, CUP) and the Cost Plus (henceforth, CP) rules (see Ernst & Young, 2002). To do so, we develop

[1] *The Economist*, "A taxing battle", 1/31/2004, Vol. 370 Issue 8360, p.71–72; Op cit., "Discord over harmony", 11/12/2005, Vol. 377 Issue 8452, p. 82–82

[2] *The Economist*, "Taxing questions", 5/22/93, Vol. 327 Issue 7812, p.73.

[3] *The Economist*, "Gimme shelter", 01/29/2000, Vol. 354 Issue 8155, Special section p. 15–17.

a two-country trade model à la Krugman (1980) with corporate tax differentials and costly trade across countries. Firms have a single production plant and sell differentiated products in their domestic and their foreign markets. They can decide to become multinationals, by owning a foreign affiliate which markets and distributes the product in the foreign market; or they can become exporters by delegating these tasks to a foreign independent distributor. Exporters and independent distributors enter into arm's length relationships that generate inefficiencies because independent distributors have control over their tasks. Such inefficiencies do not arise within multinationals that keep full management control (Grossman and Hart, 1986). Once, firms have chosen their structures, they set their market prices, decide on how to split their transport costs among business units and decide on their transfer prices between units.

We show that transfer prices under OECD rules reflect the inefficiencies of arm's length relationships between exporters and independent distributors. In particular, when tax authorities apply the CUP rule, they constrain multinationals to set their transfer prices at the same levels than those prevailing in comparable uncontrolled transactions. Yet, comparable uncontrolled transactions need not, in general, be efficient. Transfer prices are thus biased upwards and affect positively the profits of multinationals producing in the low tax country and negatively those of multinationals producing in the high tax country. Concerning the pricing distortions, our key results may be summarized as follows. First, multinationals are indifferent as to the exact imputation of transport costs between their affiliates. Second, the CUP rule is equivalent to the CP rule in which transfer prices are set to the manufacturing cost reported by the affiliates *plus* an 'appropriate' margin in the industry. This result allows us to simplify the analysis of market distortions by covering the CUP and CP rules in the same discussion. Third, we show how the transfer pricing rules distort prices and outputs. On the one hand, multinationals producing in the high tax country are enticed to set too high sales prices and to manufacture too little of the goods they ship to the low tax country. This is because transfer prices are biased upward and force multinationals to repatriate profits against their will. Multinationals therefore inflate prices in the low tax country to increase their tax base there. On the other hand, multinationals producing in the low tax country set too high sales prices and manufacture too little of the goods they ship to the high tax country. The upward biased transfer price allows those firms to repatriate profits to the low tax country. Hence, they are enticed to inflate their shipments to the foreign affiliates. To sum up, we show that tax discrepancies give rise to price and output distortions under the OECD transfer pricing rules, whereas they do not when tax authorities acquire perfect information (perfect audit) or no information at all (no audit).

Turning to distortions in firms' organizational choices, our key results may be summarized as follows. First, the incentives to choose a multinational structure are always larger for the firms producing in the high tax country. This is because transfer prices allow multinationals to shift profits. One the one hand, the multinationals producing in the high tax country are able to

reduce their domestic tax base on their foreign sales, whereas their fellow-country exporters are not able to do so with their foreign independent distributors. On the other hand, the multinationals producing in the low tax country are obliged to report their foreign profits to the foreign tax authorities. They only avoid the inefficiency in the arm's length relationship with distributors in the exporter structure. Their incentives to 'go multinational' are therefore weaker. Second, we show that firms producing in the low tax country have quite surprisingly stronger incentives to go multinational when tax authorities apply the OECD rules than when they do not audit the firms at all.

Finally, we also discuss the impacts of transfer pricing rules on consumers' utility. Transfer pricing rules can have intensive (via the product prices) and extensive (via firms' structure) margin effects on consumers and those effects may conflict. We show that the intensive margin effects favor consumers in the high tax country because multinationals shipping to this country reduce their sales prices as compared to exporters. By contrast, extensive margin effects do not favor those consumers because foreign firms more often prefer to serve them through independent distributors who charge higher prices. Interestingly, the intensive margin effect dominates in the case of the OECD rules, so that consumers' utility is higher in the high tax country than it is in the low tax one. Hence, high tax countries may have lower consumer prices given firms organizational choices.

Related literature. Since the initial contributions by Copithorne (1971) and Horst (1973), empirical and theoretical research on transfer pricing has expanded rapidly. As summarized by Grezik (2001), empirical evidence suggests that transfer pricing behavior exists but is not uniform across industries. More recently, studies by Clausing (2003) and by Bartelsman and Beetsma (2003) confirm that transfer prices are significantly correlated with the tax rates faced by affiliates' and that they strongly hamper governments' effectiveness to raise revenue using corporate taxes. Swenson (2002) and Bernard *et al.* (2008) also report recent evidence on how multinationals manipulate their affiliates' sales prices. Turning to theory, most existing contributions focus on a single firm and assume fully efficient arm's lenght relationships. In addition, comparable uncontrolled transactions and 'appropriate' margins are mostly taken as exogenous or as being unrelated to the industry conditions that tax authorities are recommended to use. For instance, Itagaki (1979) considers a simple exogenous transfer price; Halperin and Srinidhi (1987) and Elitzur and Mintz (1996) assume an exogenous 'appropriate' mark-up under the CP rule; and Samuelson (1982) takes the multinational's (controlled!) mill price as the comparable uncontrolled price to assess foreign transactions.

The present paper departs from this literature in several ways. First, it discusses transfer pricing issues within an established intra-industry trade model (Krugman, 1980) that has been extensively used to explain the behavior of multinationals (Markusen, 2002; Barba Navaretti and Venables, 2004). Second, it analyzes the implications of imperfect arm's length relationships on transfer

pricing, whereas most of the literature assumes that arm's length relationships are efficient. Third, it considers the issue of the imputation of trade costs between multinationals' affiliates. While many studies discuss the impact of trade costs and tariffs on transfer prices, none has to the best of our knowledge investigated how affiliates declare those costs across countries. Finally, whereas the existing literature assumes the existence of uncontrolled firms for the aim of assessing comparable transactions, this paper discusses the emergence of such firms as the independent distributors that are choosen by exporters. Last, note that this paper also weakly relates to the discussions of inefficiencies in approportionment tax base rules (Nielsen *et al.*, 2003), of government competition in the design of transfer pricing rules (Mansori and Weichenrieder, 1999; Raimondos-Møller and Sharf, 2002; Peralta *et al.*, 2006), and on transfer pricing and tax competition (Elitzur and Mintz, 1996).

The remainder of the paper is organized as follows. In Section 2, we present the model. We study the exporter price and the trade cost imputation decisions in Section 3, and the multinational prices, trade cost imputation and transfer pricing decisions in Section 4. We do this for each possible transfer pricing rule. In Section 5, we then discuss the choice of production structure, whereas we analyze the implications of transfer pricing rules on consumers' utility in Section 6. We conclude in Section 7. All proofs are relegated to the Appendix.

2 The model

2.1 Preferences

Consider an economy with two countries, labeled $i = 1, 2$. Variables associated with each country will be subscripted accordingly. Each country hosts the same mass L of consumers–workers, which have identical Cobb-Douglas CES preferences given by:

$$U_i = z^{1-\mu}\left(\int_{\Omega_i} q_{ii}(v)^{\frac{\sigma-1}{\sigma}}\mathrm{d}v + \int_{\Omega_j} q_{ji}(v)^{\frac{\sigma-1}{\sigma}}\mathrm{d}v\right)^{\frac{\mu\sigma}{\sigma-1}} \qquad j \neq i, \tag{1}$$

where $q_{ji}(v)$ denotes the consumption of variety v in country i when it is produced in country j; where Ω_i denotes the set of varieties produced in country i, with mass n_i; and where z is a homogenous good. The parameters $\sigma > 1$ and $0 < \mu < 1$ denote the elasticity of substitution between the varieties of the differentiated good and consumers' expenditure share for that good, respectively. In what follows, we normalize the total mass of varieties produced in each country to one ($n_i \equiv 1$, for $i = 1, 2$).

Consumers maximize utility (1) subject to their budget constraint

$$\int_{\Omega_i} p_{ii}(v)q_{ii}(v)\mathrm{d}v + \int_{\Omega_j} p_{ji}(v)q_{ji}(v)\mathrm{d}v + p_i^z z = I_i, \quad j \neq i, \tag{2}$$

where $p_{ji}(v)$ denotes the price of variety v produced in country j and sold in country i; and where p_i^z is the price of the homogenous good. Given identical and homothetic preferences, I_i stands for the aggregate income in country i. Maximizing (1) subject to (2), we readily obtain the following aggregate demands:

$$q_{ii}(v) = \frac{p_{ii}(v)^{-\sigma}}{\mathbb{P}_i^{1-\sigma}}\mu I_i \quad \text{and} \quad q_{ji}(v) = \frac{p_{ji}(v)^{-\sigma}}{\mathbb{P}_i^{1-\sigma}}\mu I_i \tag{3}$$

where

$$\mathbb{P}_i^{1-\sigma} \equiv \int_{\Omega_i} p_{ii}(v)^{1-\sigma}\mathrm{d}v + \int_{\Omega_j} p_{ji}(v)^{1-\sigma}\mathrm{d}v, \quad j \neq i \tag{4}$$

stands for the CES price index in country i.

Using expressions (1) and (3), as well as the demand for the homogenous good $z = (1-\mu)I_i/p_i^z$ finally yields the representative consumer's indirect utility as follows

$$V_i = \frac{\mu^\mu(1-\mu)^{1-\mu}}{\mathbb{P}_i^\mu (p_i^z)^{1-\mu}} I_i \tag{5}$$

2.2 Technology, transport costs and taxes

We assume that labor is the only factor of production and that it is perfectly mobile across sectors. All workers in the country have the same unit productivity and, therefore, earn the same wage. In the homogenous good sector, firms produce with a constant returns to scale technology using labor only, and firms trade their outputs at no cost. This good is produced in both countries at equilibrium provided L is large enough which we assume from now on. Trade of the homogenous good then implies that $p_i^z = p = w_i^z = 1$ for $i = 1, 2$, where the last equality reflects our choice of this good as the numéraire.

In the differentiated industry, each firm produces and sells one firm-specific variety v, which allows us to also use v as a firm index. Each firm incurs three types of costs. First, each firm has the same unit input requirement, which we normalize to one without loss of generality. Second, it incurs an 'iceberg' (ad-valorem) transport cost $\tau > 1$ for shipping the good from the country of production to the foreign market: for one unit of any variety to arrive at its destination, the firm has to ship τ units of it. This assumption has become a staple element in international economics since Krugman (1980). Last, each firm incurs a cost for distributing its product in each local market. This cost depends on the variety v and is proportional to the multinational's sales in each local market. More formally, variety v is associated with a *variety-specific marketing efficiency* parameter $\varphi_i(v) \in [0, 1]$ such that a share $1 - \varphi_i(v)$ of each unit of profit made in a market is lost in the marketing process. Such costs subsume the cost heterogeneity in advertising, marketing, learning, expertise, retail and distribution, which generally differ across varieties.

Firms have a single production plant and two options for accessing the export market:[4]

[4]Note that we do not discuss the 'proximity-concentration' trade-off, highlighted in the international trade

1. they can sell their good to a foreign independent distributor who bears the marketing cost associated with the variety sold. We refer to this case as the *exporter structure*;

2. they can transfer their good to a fully owned and controlled foreign affiliate, who bears the variety's marketing cost. We refer to this case as the *multinational structure*.

Our setup encapsulates the *arm's length principle* that is at the core of the OECD transfer pricing guidelines. The independent distributor in the exporter structure is able to sell the traded good with an additional mark-up. The exporting firm must thus balance the inefficiency of independent distribution (which stems from double marginalization) with its variety-specific marketing cost that it would incur if it chooses a multinational structure.

In what follows, we put the superscript x on variables pertaining to exporters, the superscript d on variables pertaining to distributors, while we put no superscript on those pertaining to multinationals. Let r_i^x and r_i stand for the transfer prices of exporters and of multinationals, respectively. We refer to the former as the *external transfer price* (between exporters and distributors) and to the latter as the *internal transfer price* (within multinationals). We denote by x_i and m_i the mass of exporters and of multinationals established in country i. By assumption, $m_i + x_i = 1$ for $i = 1, 2$, so that the total mass of producers satisfies $m_1 + x_1 + m_2 + x_2 = 2$.

By contrast to the homogenous good sector, shipping the differentiated good across countries is costly. We naturally assume that the same transportation costs are incurred independently of whether the firm chooses an exporter or a multinational structure. Yet, in both cases the question arises as to how firms will split these transport costs among exporters and distributors, or among affiliates. Note that this question is important in the presence of tax differences across countries as the multinational may alleviate its tax burden by imputing a larger share of transport costs to the affiliate located in the high tax country. Put differently, the split of the transport bill may serve as a transfer-pricing instrument. In what follows, we denote by $\tau_{ii} \geq 1$ the transport costs borne by the upstream unit (either multinational or exporter) producing the good in country i, and by $\tau_{ij} \geq 1$ the transport costs borne by the downstream unit (either affiliate or independent distributor) marketing the good in country $j \neq i$ where it is consumed.[5] By definition of iceberg transport costs we have $\tau_{ii}\tau_{ij} = \tau$ as the full costs must be jointly borne by the upstream and downstream units.

Insert Figure 1 about here.

literature, where firms incur additional fixed costs for doing FDI in order to save on variable transport costs. This trade-off has been extensively documented elsewhere in the literature (see, e.g., Markusen, 2002; Barba Navaretti and Venables, 2004).

[5]We rule out the case where either $\tau_{ii} < 1$ or $\tau_{ij} < 1$ as this would amount to cross-subsidization by charging negative transport costs to one unit of the firm.

Figure 1 summarizes how the value of production changes as exported goods move from the domestic production unit to the foreign unit, and then to the market. Note that the *full transfer price* $r_i\tau_{ij}$ represents the total cost borne by the foreign unit (distributor or affiliate) in this distribution chain.

Turning to taxes, all differentiated firms pay source-based corporate profits taxes at a rate t_i on profits made in country i.[6] Let $\theta_i \equiv 1 - t_i$ denote the 'after-tax rate of profit' in country i, i.e., a gross profit of one dollar yields an after-tax profit of θ_i dollars that can be distributed to shareholders. In what follows we assume, without loss of generality, that country 1 is the high-tax country. Formally, $\theta_1 < \theta_2$ (i.e., $t_1 > t_2$). Profits are assumed to be distributed to absentee shareholders. Also, for simplicity, tax revenues are not directly redistributed to consumers. When taken together, the foregoing assumptions imply that the two countries have the same aggregate income $I_i = w_i L = L$ for $i = 1, 2$.

3 Exporter structure

We begin by characterizing the choice of exporting firms. By assumption, the exporting firm does not have nexus in the foreign market and must hence rely on an independent distributor who sells its product there and who bears the marketing cost. Because there is no possibility to write complete contracts between the two firms, this arm's length relationship is not efficient (Grossman and Hart, 1986). This is because the independent distributor has the right to manage his firm and negotiates the price at which he buys the goods from the exporter.

For the sake of clarity let us drop the reference to the variety v and focus on exporters located in country i, the subsequent results applying to any variety and any country. The timing is as follows: first, the exporter and the independent distributor located in the other country negotiate an external transfer price r_i^x for the good and decide how to impute transport costs among the exporter and the distributor, τ_{ii}^x and τ_{ij}^d, with $\tau_{ii}^x \tau_{ij}^d = \tau$; then, the independent distributor sets a price p_{ij}^x and supplies the good to his local market, whereas the exporter sets the price p_{ii}^x at which she supplies her local market. The relationship between the exporter and the distributor is specific and costly to break. As a result, both firms cannot earn anything outside their established relationship. [7] The exporter is fully taxed in her country of establishment. Her after-tax profit is

[6] Keen (1993) argues that the effective taxation of multinationals is source based, even though tax codes may stipulate otherwise. This is referred to as the 'separate entity approach', i.e., tax authorities treat multinationals' affiliates as separate firms when determining tax liability (OECD, 2001).

[7] Independent distributors make irreversible investments in advertising, marketing, and distribution channels. Exporters sink similar investments on behalf of their distributors. The specific relationship is also often written down in, and enforced by, exclusivity contracts that stipulate large penalties in the case of a unilateral separation.

thus given by $\Pi_i^x \equiv \pi_{ii}^x + \pi_{ij}^x$, where

$$\pi_{ii}^x \equiv \theta_i \left(p_{ii}^x - 1\right) q_{ii}^x \varphi_i \quad \text{and} \quad \pi_{ij}^x \equiv \theta_i \left(r_i^x - \tau_{ii}\right) \tau_{ij} q_{ij}^x$$

denote the after-tax profits she makes from sales in her domestic and export markets, respectively; and where $q_{ij}^x \equiv q_{ij}(p_{ij}^x)$ for $i, j = 1, 2$. In this expression, the exporter sells to her distributor at the external transfer price r_i^x. It bears the marketing cost φ_i (associated with the variety v produced in country i) at home but not abroad. Exporters and distributors are negligible to the market and, therefore, take the price indices $\mathbb{P}_i$ and $\mathbb{P}_j$ as given when setting their optimal prices.

In the second stage, the exporter sets the price p_{ii}^x that maximizes her domestic profit π_{ii}^x. This price is given by

$$p_{ii}^x = \frac{\sigma}{\sigma - 1},$$

i.e., the firm applies a constant mark-up to unit production costs. Her domestic after-tax profit is then given by $\pi_{ii}^x = \kappa \theta_i \mathbb{P}_i^{\sigma-1} \varphi_i$, where $\kappa \equiv \mu L \sigma^{-\sigma} (\sigma - 1)^{\sigma-1} > 0$ is a positive bundle of parameters. Analogously, the independent distributor maximizes his after-tax profit

$$\pi_j^d \equiv \theta_j \left(p_{ij}^d - r_i^x \tau_{ij}^d\right) q_{ij}^d \varphi_i, \tag{6}$$

where $r_i^x \tau_{ij}^d$ is the *full transfer price* he pays to the exporter for each unit that he supplies to the market; and where $q_{ij}^d \equiv q_{ij}(p_{ij}^d)$. This full transfer price includes the transport cost imputed to the distributor in the destination country. Maximizing (6) with respect to p_{ij}^d yields the consumer price

$$p_{ij}^d = \frac{\sigma}{\sigma - 1} r_i^x \tau_{ij}^d,$$

so that the distributor's and the exporter's profits are given by

$$\pi_j^d = \kappa \theta_j \mathbb{P}_j^{\sigma-1} \left(r_i^x \tau_{ij}^d\right)^{1-\sigma} \varphi_i \quad \text{and} \quad \pi_{ij}^x = \kappa \theta_i (\sigma - 1) \mathbb{P}_j^{\sigma-1} \left(r_i^x \tau_{ij}^d - \tau\right) \left(r_i^x \tau_{ij}^d\right)^{-\sigma}. \tag{7}$$

Note that the independent distributor and the exporter are concerned only with the full transfer price $r_i^x \tau_{ij}^d$, which thus becomes the unique decision variable to negotiate on.

In the first stage, we assume a Nash bargaining process, where $0 < \alpha < 1$ stands for the distributor's bargaining power. The transfer price and the transport cost imputation maximize the Nash product $N = \left[\pi_j^d\right]^{\alpha} \left[\pi_{ij}^x\right]^{1-\alpha}$, where the price indices $\mathbb{P}_i$ for $i = 1, 2$ are taken as given. This product is a function of the full transfer price $r_i^x \tau_{ij}^d$, which implies that the imputation of transport costs has no impact on the bargaining outcome. In other words, any change in the imputation of transport costs results in an equal opposite change in the equilibrium transfer price. This yields our first result, namely that exporters are indifferent to the imputation of the transport costs. The unique solution to the maximization of N is computed as

$$r_i^x \tau_{ij}^d = \beta \tau, \quad \text{where} \quad \beta \equiv \frac{\sigma - \alpha}{\sigma - 1}. \tag{8}$$

The parameter β is a measure of the inefficiency of the arm's length relationship in the exporter structure. It measures the mark-up over the marginal cost τ that the exporter includes in her external transfer price. The transfer price and the market price are then equal to:

$$r_i^x = \beta\tau_{ii}^x \quad \text{and} \quad p_{ij}^d = \frac{\sigma}{\sigma-1}\beta\tau. \tag{9}$$

There is obviously a *double marginalization* issue as the exporter and the independent distributor do not internalize the impact of their pricing decisions on each other's profit. This issue becomes less severe as the bargaining power of the distributor increases: the full transfer price $r_i^x\tau_{ij}^d$ is equal to the cost τ of serving the export market when the independent distributor has all bargaining power ($\alpha = 1$). In this case, he decides on both the external transfer price and the consumer price.

Using expressions (9), the exporter's after-tax profit can be decomposed into its domestic and foreign parts as follows:

$$\pi_{ii}^x = \kappa\theta_i\mathbb{P}_i^{\sigma-1}\varphi_i \quad \text{and} \quad \pi_{ij}^x = \kappa\theta_i\mathbb{P}_j^{\sigma-1}\tau^{1-\sigma}\gamma, \tag{10}$$

where $\gamma \equiv \beta^{-\sigma}(\beta-1)(\sigma-1) \in (0, 1/e)$ and where $e \equiv 2.71828\ldots$ is Euler's number. The parameter γ captures the disadvantage of serving the foreign market through an independent distributor. It increases with σ and falls with α.

Let us summarize the foregoing results as follows.

Proposition 1 *(i) Exporters are indifferent to the imputation of transport costs. (ii) Exporters incur a cost because of the inefficiency of their arm's length relationship with the independent distributor.*

Although specific to the Dixit-Stiglitz model with iceberg transport costs, the first result is important as this model is a natural benchmark in international economics. It dispells any ambiguity about the imputation of transport costs and eases the subsequent analysis about firms' organizational choices and consumers' benefits.

4 Multinational structure

Contrary to exporters, multinationals can shift profits between their units using internal transfer prices. They can also minimize their tax liability using an appropriate imputation of transport costs across their units. By integrating their upstream and downstream activities across countries, multinationals also avoid the inefficiencies of arm's length relationships with an independent distributor since the multinational retains the full control over its consumer prices. By contrast, the multinational has to incur itself the marketing cost.

We focus on a multinational v producing in country i, and we again suppress the variety index v. Variables pertaining to multinationals carry no superscripts. The multinational sets its domestic and foreign product prices p_{ii} and p_{ij}, its internal transfer price r_i and its domestic and foreign imputation of transport costs, τ_{ii} and τ_{ij} where $\tau_{ii}\tau_{ij} = \tau$. Sales of $p_{ij}q_{ij}$ dollars in the foreign market require to supply the foreign unit with a value of $\tau_{ij}p_{ij}q_{ij}$ dollars and to produce domestically for a value of $\tau_{ii}\tau_{ij}p_{ij}q_{ij}$ dollars. Internal shipments are given an accounting value of $r_i\tau_{ij}p_{ij}q_{ij}$ dollars. All values are deflated by the variety-specific marketing parameter φ_i. Therefore, the multinational's profit includes three terms: (i) the profit from domestic sales taxed at the domestic rate

$$\pi_{ii} \equiv \theta_i \left(p_{ii} - 1\right) q_{ii}\varphi_i; \tag{11}$$

(ii) the profit declared by the foreign affiliate taxed at the foreign rate

$$\pi_{ij}^{\text{for}} \equiv \theta_j \left(p_{ij}q_{ij} - r_i\tau_{ij}q_{ij}\right) \varphi_i; \tag{12}$$

(iii) the profit declared by the domestic affiliate from its sales to her foreign affiliate, taxed at the domestic rate

$$\pi_{ij}^{\text{dom}} \equiv \theta_i \left(r_i\tau_{ij}q_{ij} - \tau_{ii}\tau_{ij}q_{ij}\right) \varphi_i. \tag{13}$$

Expressions (12) and (13) can be added to give the after-tax profits from foreign sales

$$\pi_{ij} \equiv \pi_{ij}^{\text{for}} + \pi_{ij}^{\text{dom}} = \theta_j \left(p_{ij} - R_i\right) q_{ij}\varphi_i \tag{14}$$

where $q_{ii} \equiv q_{ii}(p_{ii})$ and $q_{ij} \equiv q_{ij}(p_{ij})$; and where

$$R_i \equiv r_i\tau_{ij} - \frac{\theta_i}{\theta_j}\left(r_i\tau_{ij} - \tau\right) \tag{15}$$

measures the multinational's *tax-adjusted marginal cost* of serving the foreign market.[8] Note that expression (15) shows that the tax-adjusted marginal cost is a convex combination of the multinational's marginal cost and the full transfer price. As in the exporter structure, the multinational only cares about the full transfer price $r_i\tau_{ij}$. However, in contrast to an exporter, the multinational may not be allowed to freely set its internal transfer price r_i because of restrictions imposed by the tax authorities. Hence, the imputation of transport costs is *a priori* ambiguous and may depend on transfer pricing rules. Finally, the multinational's total profit is given by $\Pi_i \equiv \pi_{ii} + \pi_{ij}$.

We now analyze the multinational's pricing decisions under various transfer pricing rules. First, we analyze the two benchmark cases of perfect audit and no audit, where tax authorities are able either to acquire full information on true production costs or no information at all, respectively.

[8]By analogy with Hyde and Choe's (2005) double accounting system, where firms keep two sets of books, R_i is the cost accounting figure used for managerial incentive purposes whereas r_i is the fiscal accounting figure used for tax purposes.

Then, we analyze the pricing decisions of the multinational under the two transfer pricing rules of comparable uncontrolled pricing (CUP) and cost-plus. We assume that multinationals comply with the transfer prices enforced by tax authorities whenever the latter do decide on a particular rule. Put differently, we disregard the issues of non-compliance and penalties that tax authorities may impose (see, e.g., Hyde and Choe, 2005; Choe and Hyde, 2007).

4.1 Perfect audit

Suppose that tax authorities are able to acquire perfect information about the cost τ_{ii} at which the multinational supplies the good to her foreign unit, and impose the constraint $r_i = \tau_{ii}$ on the multinational's transfer price. Under this transfer pricing rule, the multinational's imputation of its transport cost does not affect her full transfer price $r_i\tau_{ij}$ and hence her tax-adjusted marginal cost R_i, which are both constant and equal to τ. Hence, the imputation of transport costs does not affect prices and profits.

More specifically, the multinational producing in country i chooses p_{ii} and p_{ij} to maximize her profit, given by

$$\Pi_i = \theta_i(p_{ii} - 1)q_{ii}\varphi_i + \theta_j(p_{ij} - \tau)q_{ij}\varphi_i.$$

It is readily verified that her profit-maximizing prices are as follows

$$p_{ii}^o = \frac{\sigma}{\sigma - 1} \quad \text{and} \quad p_{ij}^o = \frac{\sigma}{\sigma - 1}\tau, \tag{16}$$

where we use the superscript o for the perfect audit case. Her profits from the domestic and foreign sales are given by

$$\pi_{ii}^o = \kappa\theta_i\mathbb{P}_i^{\sigma-1}\varphi_i \quad \text{and} \quad \pi_{ij}^o = \kappa\theta_j\mathbb{P}_j^{\sigma-1}\tau^{1-\sigma}\varphi_i. \tag{17}$$

4.2 No audit

Suppose now that tax authorities are unable to acquire information about the multinational's costs and to impose any transfer price. Unconstrained multinationals are however willing to declare losses to claim tax credits in the high tax country 1. Yet, no tax authority will indefinitely grant tax credits to multinationals which repeatedly declare losses. In our static model, this means that tax authorities constrain the multinationals to declare non-negative profits in their jurisdiction.

The multinational finds the prices p_{ii} and p_{ij}, the transfer price r_i and the transport cost imputation τ_{ii} and τ_{ij} that maximize its total profit Π_i subject to the constaints $\pi_{ii} + \pi_{ij}^{\text{dom}} \geq 0$ and $\pi_{ij}^{\text{for}} \geq 0$. As expected, the multinational shifts all the profits generated in the high tax country to the low tax country, and sets the same prices as those it would set in the absence of taxes (see the proof in the Appendix):

$$p_{ii}^* = \frac{\sigma}{\sigma - 1} \quad \text{and} \quad p_{ij}^* = \frac{\sigma}{\sigma - 1}\tau, \tag{18}$$

where the superscript $*$ stands for the no audit case. Since those prices are independent of τ_{ii} and τ_{ij}, the multinational is indifferent as to the imputation of its transport costs. Because the tax is lower in country 2, the after-tax profits in each market are given by

$$\pi_{ii}^* = \kappa\theta_2 \mathbb{P}_i^{\sigma-1}\varphi_i \quad \text{and} \quad \pi_{ij}^* = \kappa\theta_2 \mathbb{P}_j^{\sigma-1}\tau^{1-\sigma}\varphi_i. \tag{19}$$

The two benchmark cases of perfect audit and no audit are hardly realistic as they assume either a too myopic or a too sophisticated behavior on behalf of tax authorities. Tax authorities do realize that firms can use transfer prices to shift profits and therefore use various transfer pricing rules to constrain the firms. We now examine in more detail the two most frequently used rules which are recommended by the OECD.

4.3 Comparable uncontrolled price

The most widely used transfer pricing rule recommended by the OECD is the *Comparable Uncontrolled Price* (henceforth, CUP). Under CUP, the tax authorities constrain the multinationals to set their transfer prices to the price of a comparable uncontrolled transaction with an independent firm (the so-called arm's length principle). According to the OECD (2001, Chap. II-2.11), "the CUP method is a particularly reliable method where an independent entreprise sells the same product as is sold between two associated enterprises." However, comparing different transactions is not easy. The OECD recognizes that particular care should be taken for the accounting of transport costs and of product differentiation (OECD, 2001, Chap. II-2.15–2.19).

Since varieties are symmetric in our model, a valid basis for price comparisons is given by the prices prevailing in the relationship between the exporter in country i and the independent distributor in country j. The tax authority observes the total cost borne by the independent distributor for each unit it sells which, by (8), is equal to $r_i^x \tau_{ij}^d = \beta\tau$. This is precisely the comparable uncontrolled price that the tax authorities impose on transactions within the multinationals. Hence, under the CUP rule, the transfer prices of multinationals producing in country i are restricted, such that

$$r_i\tau_{ij} = r_i^x \tau_{ij}^d = \beta\tau \qquad \Longleftrightarrow \qquad r_i = \beta\tau_{ii},$$

where we have used the identity $\tau_{ii}\tau_{ij} = \tau$. As in the case of no audit, multinational affiliates may end up declaring permanent losses by setting their sales price p_{ij} below their full transfer price $r_i\tau_{ij}$. Thus, to avoid perpetual tax credits, tax authorities impose $p_{ij} \geq r_i\tau_{ij}$ so that $\pi_{ij}^{\text{for}} \geq 0$.[9]

Suppose first that multinationals have no incentives to declare losses in their foreign market. Using (15), the tax-adjusted marginal cost of serving the foreign market is given by

$$R_i = \tau\left[\beta - \frac{\theta_i}{\theta_j}(\beta - 1)\right]$$

[9]Multinationals declare positive profits in their country of production, $\pi_{ii} + \pi_{ii}^{\text{dom}} > 0$, because $r_i\tau_{ij} = \beta\tau \geq \tau$.

so that the optimal product prices are

$$p_{ii}^c = \frac{\sigma}{\sigma - 1} \quad \text{and} \quad p_{ij}^c = \frac{\sigma}{\sigma - 1} R_i, \tag{20}$$

where superscript c denotes the variables under the CUP rule. The multinationals have no incentives to declare losses when $p_{ij} \geq r_i \tau_{ij}$, which is equivalent to

$$\frac{\theta_j}{\theta_i} \geq \widehat{\theta}, \quad \text{where} \quad \widehat{\theta} \equiv \frac{\sigma(\beta - 1)}{\beta} = \frac{\sigma(1 - \alpha)}{\sigma - \alpha} \in (0, 1). \tag{21}$$

The above inequality is always satisfied for multinationals producing in the high tax country $i = 1$ because $\theta_2/\theta_1 \geq 1$. It is satisfied for multinationals producing in the low tax country $i = 2$ if and only if $\theta_1/\theta_2 \geq \widehat{\theta}$.

Two points are worth noting. First, *under CUP, the multinational is indifferent as to the imputation τ_{ii} and τ_{ij} of transport costs*. This is because multinationals only care about the full transfer price $r_i \tau_{ij}$, which is exactly the comparable uncontrolled price that the tax authorities observe from the relationship between exporters and distributors. Any change in the transport cost imputation is offset by a change in the transfer price.

Second, *the CUP transfer price is affected by the inefficiency existing in the arm's length relationship between exporters and distributors*, since the latter is used as a point of comparison. A larger inefficiency β translates into a higher transfer price r_i, which itself makes tax-adjusted marginal costs diverge: $R_1 \geq \tau \geq R_2$. The upward bias on the transfer price is not profitable for the multinationals that produce in the high tax country 1 and that want to shift profits into the other country. Because $R_1 \geq \tau$, those multinationals have incentives to reduce their domestic tax base by reducing their shipments to the foreign market and to increase their foreign tax base by selling at a higher price there. Conversely, the upward bias on the transfer price is profitable for the multinationals that produce in the low tax country 2 and that want to shift profits into that country. Because $R_2 \leq \tau$, those multinationals have incentives to expand their domestic tax base by increasing their shipments to the foreign market and by reducing their foreign tax base by selling at a lower price there. Hence, *the CUP transfer prices yield under-production by the multinationals producing in the high tax country; and over-production by the multinationals producing in the low tax country.*

The profits generated in each market are given by

$$\pi_{ii}^c = \kappa \theta_i \mathbb{P}_i^{\sigma - 1} \varphi_i \quad \text{and} \quad \pi_{ij}^c = \kappa \theta_j \mathbb{P}_j^{\sigma - 1} R_i^{1 - \sigma} \varphi_i \quad \text{if} \quad \theta_j/\theta_i \geq \widehat{\theta}. \tag{22}$$

Suppose finally that multinationals have incentives to declare losses in their foreign market. This happens for multinationals producing in the low tax country 2 when $\theta_1/\theta_2 < \widehat{\theta}$. The tax authority in the high tax country 1 constrains those multinationals to erase their permanent losses by setting $p_{21} = r_2 \tau_{21}$, and imposes the full transfer price $r_2 \tau_{21} = \beta \tau$. Because the latter price

is independent of the transport cost imputation τ_{22} and τ_{21}, multinationals are again indifferent with regard to that imputation. One can verify that p_{21} is smaller than the corresponding price under perfect audit and under no audit, i.e., the firm has an incentive to produce too much. At this price, a multinational producing in the low tax country 2 repartiates the following profit from foreign sales:

$$(\pi_{21}^{\text{dom}})^c = \kappa\theta_2 \mathbb{P}_1^{\sigma-1} \tau^{1-\sigma} \left(\frac{\sigma}{\sigma-1}\right)^{\sigma} \gamma\varphi_2 \quad \text{if} \quad \theta_1/\theta_2 < \widehat{\theta}. \tag{23}$$

4.4 Cost plus

The second most widely used transfer pricing rule recommended by the OECD is the *Cost Plus* rule (henceforth, CP). Under CP, the tax authorities compute the transfer price by applying an 'appropriate' margin to the cost of multinationals. The OECD (2001, Chap. II-11) recommends that "an appropriate mark-up is [...] added to [the multinational's] cost, to make an appropriate profit in the light of functions performed and the market conditions." The tax authorities have several ways to estimate what is an 'appropriate margin', depending on their information about the technology and the market conditions of the industry. In most cases, the tax authorities ask for a succinct industry survey in the country where the multinational produces to obtain a rough estimate of the mark-ups in that industry.

Let the tax authorities in country i define the 'appropriate' margin using the aggregate measure

$$\eta_i \equiv s_i \frac{r_i - \tau_{ii}}{\tau_{ii}} + (1 - s_i) \frac{r_i^x - \tau_{ii}^x}{\tau_{ii}^x}, \tag{24}$$

where the mark-ups contain the transfer prices r_i and the production plus transport costs τ_{ii} borne by the multinational producer established in country i; and where $0 < s_i < 1$ and $1 - s_i$ are the weights put on multinationals' and exporters' mark-ups, respectively. For example, the weight on multinationals' mark-ups is equal to $s_i = m_i/(m_i + x_i)$ if the tax authorities weight mark-ups by the mass of firms; whereas it is equal to $s_i = m_i q_i^c/(m_i q_i^c + x_i q_i^x)$ if it weights mark-ups by output volumes.

We first consider a multinational that produces in the high tax country 1 and that wants to shift profits into the low tax country 2 by using a low transfer price r_1. Since the low tax country always gains from multinationals' tax avoidance, this country does not impose restrictions on the multinational's transfer price. We thus just need to study the behavior of the tax authorities in the high tax country 1. Under the CP rule, the tax authorities in the high tax country use η_1 as a *lower bound* on the mark-ups of domestic multinationals:

$$\eta_1 \leq \frac{r_1 - \tau_{11}}{\tau_{11}} \quad \Longleftrightarrow \quad r_1 \geq \tau_{11}(1 + \eta_1). \tag{25}$$

This constraint prevents firms from shifting too much profit by transferring the good at too low a price. Consider next a multinational that produces in the low tax country 2 and that wants to

shift profits to its domestic production unit through a high transfer price. The tax authorities use η_2 as an *upper bound* on the mark-ups so that

$$\eta_2 \geq \frac{r_2 - \tau_{22}}{\tau_{22}} \qquad \Longleftrightarrow \qquad r_2 \leq \tau_{22}(1+\eta_2). \tag{26}$$

We now compute the 'appropriate' margins η_1 and η_2 consistent with equilibrium. The 'appropriate' margins depend on transfer prices, while transfer prices depend on the constraints on the 'appropriate' margins. In equilibrium, those constraints must be consistent with the transfer prices. Let us first suppose that multinationals have no incentive to declare perpetual losses. They set their transfer prices so that the foregoing constraints on 'appropriate' margins are binding. The equilibrium is readily computed by replacing $(r_i - \tau_{ii})/\tau_{ii}$ by η_i in expression (24) and by using r_i^x as defined by (9). We successively get

$$\eta_i = s_i\eta_i + (1-s_i)\frac{1}{\tau_{ij}^d}\frac{r_i^x\tau_{ij}^d - \tau}{\tau_{ii}^x} = s_i\eta_i + (1-s_i)(\beta-1), \qquad i=1,2,$$

which reduces to $\eta_i = \beta - 1$. As a result, the weighting scheme used for computing the 'appropriate' margin is immaterial for the equilibrium value of this margin. Furthermore, using the binding constraints (25) and (26), we obtain the transfer price under CP given by

$$r_i = \beta\tau_{ii}.$$

Hence, *multinationals are imposed the same constraint under CUP and CP transfer pricing rules*, so that their total profits are the same. The two main results pertaining to CUP apply to CP: (i) multinationals are indifferent as to the imputation of transport costs and (ii) transfer prices are affected by the inefficiency existing in the arm's length relationship between exporters and independent distributors. As under the CUP transfer pricing rule, multinationals producing in the low tax country 2 have incentives to declare perpetual losses in their foreign market when $\theta_1/\theta_2 < \widehat{\theta}$. Since they are not allowed to declare losses, the multinationals set their break-even price $p_{21} = r_2\tau_{21}$. It can be shown that CUP and CP remain equivalent when $\theta_1/\theta_2 < \widehat{\theta}$.

4.5 Summary and discussion

The foregoing sections provide a simple answer to the question about the impact of international tax differentials on firms' imputation of transport costs: *tax differentials do not matter for that imputation*. Furthermore, they also give a simple answer to the question about the possible differences between CUP and CP transfer pricing rules: *there are no differences in our model*. Our foregoing results on the multinationals' pricing decisions may be summarized as follows:

Proposition 2 *(i) Multinationals are indifferent as to the imputation of transport costs under perfect audit, no audit, CUP and CP transfer pricing rules. (ii) CUP and CP transfer pricing*

rules are equivalent. Prices, production incentives and profits are the same under both rules, and the transfer prices reflect the inefficiency existing in the arm's length relationship. (iii) Compared to the perfect audit and no audit cases, multinationals producing in the high tax country ship too little to their export market, whereas multinationals producing in the low tax country ship too much to their export market.

Note that the inefficiency with CUP and CP transfer pricing is related to the additional mark-up that is present in the arm's length relationship between exporters and independent distributors. The transfer prices are thus above the 'technological cost' τ of serving foreign markets. This inefficiency decreases when product varieties become better substitutes. Indeed, β falls as σ rises. In the limit, $\beta \to 1$ when $\sigma \to \infty$, in which case the inefficiency entirely vanishes. More formally:

Corollary 1 *When products are close to perfect substitutes ($\sigma \to \infty$), the CUP and CP transfer pricing rules yield the same transfer prices as under perfect audit.*

Corollary 1 provides an economic rationale for the OECD guidelines. However, it also prompts us to be careful. Firstly, the CUP and CP rules only converge to the perfect audit case in the limit of a perfectly competitive industry; those rules yield quite different outcomes otherwise. Secondly, at this competitive limit, profits tend to zero so that taxation and the choice of a transfer pricing rule become irrelevant issues. Finally, even very small profits can still be ranked under different organizational structures. Hence, firms may not choose the same structure under the different transfer pricing rules even when goods are very close substitutes. We will turn to this issue in the next section by examining more closely firms' organizational structure.

5 Choice of organizational structure

We now turn to the firms' choices of organizational structure. Recall that a firm can either export its goods by relying on an independent distributor in the foreign market, or it can become a multinational operating a fully owned foreign affiliate. Inefficiencies in the arm's length relationship with the distributor as well as tax considerations provide incentives for 'going multinational'.

In what follows, to isolate the 'pure' effects of transfer pricing rules on firms' organizational choices, we remove compositional effects by assuming that each country has the same firm distribution. More specifically, we assume that in each country the variety-specific efficiency parameters $\varphi_i(v)$ are distributed according to the cdf $F(\varphi) : [0,1] \to [0,1]$ and $F' > 0$. Hence F is simply the inverse of φ_i. In each country i, a firm v with $\varphi_i(v)$ chooses to operate a multinational structure if doing so yields higher profits than being an exporter:

$$\pi_{ii} + \pi_{ij} \geq \pi_{ii}^x + \pi_{ij}^x \tag{27}$$

Note that the multinational's profit on foreign sales π_{ij} depends on its efficiency parameter $\varphi_i(v)$, whereas its revenue from sales to the distributor π_{ij}^x does not depend on it (as the distributor bears the distribution costs).

We first analyze the choice of organizational structure in the perfect audit and in the no audit benchmark cases. We then turn to the OECD rules and finally compare the different cases.

5.1 Perfect audit

When the tax authorities can perfectly monitor the multinationals, they apply a transfer price equal to τ. Each firm compares its profits as a multinational (17) with its profits as an exporter (10). A firm v producing in country i chooses a multinational structure if its variety-specific efficiency parameter $\varphi_i(v)$ exceeds the threshold

$$\varphi_i^o \equiv \frac{\theta_i}{\theta_j}\gamma,$$

whereas it chooses an exporter structure otherwise. Country i hence hosts a mass of exporters $F(\varphi_i^o)$ and a mass of multinationals $1 - F(\varphi_i^o)$. Two comments are in order. First, although tax authorities are able to impose the 'right' transfer price, they cannot correct the inefficiencies in the arm's length relationship between exporters and distributors. Larger inefficiencies imply a smaller value of γ, which reduces the thresholds φ_i^o and yields fewer exporters in both countries. Second, since $\theta_1 < \theta_2$, we have $0 < \varphi_1^o < \gamma < \varphi_2^o$. The mass of multinationals in the high tax country $1-F(\varphi_1^o)$ therefore exceeds the mass of multinationals in the low tax country $1-F(\varphi_2^o)$. Compared to exporters, multinationals pay more taxes on the profits made in the high tax country 1. By contrast, exporters can repatriate some of those profits through the mark-ups that they negotiate with the independent distributors. Hence, *firms producing in the low tax country* 2 *have smaller incentives to adopt a multinational structure*. In contrast, firms producing in the high tax country 1 prefer a multinational structure because all their foreign profits generated in the low tax country are taxed there.

5.2 No audit

Suppose next that tax authorities are unable to acquire information about the multinationals' costs and do, therefore, not impose any transfer price. Multinationals can then shift all their profits to the low tax country 2 and are thus fully taxed at the lowest rate. The trade-off between an exporter structure and a multinational structure is clear for the firms producing in the low tax country 2. Since multinationals and exporters are taxed at the same rate there, taxation is irrelevant to their choice which is only driven by the trade-off between the inefficiencies in the arm's length relationship and the variety-specific marketing inefficiency they incur as a multinational.

Comparing expressions (10) and (19) reveals that a firm v producing in the high tax country 2 chooses a multinational structure if and only if its variety-specific efficiency parameter $\varphi_2(v)$ exceeds the threshold

$$\varphi_2^* \equiv \gamma.$$

Conversely, the firms producing in the high tax country 1 face a slightly different trade-off because their profits in each market are taxed differently depending on their choice of structure. Comparing expressions (10) and (19) reveals that a firm v chooses the multinational structure if and only if its variety-specific efficiency parameter $\varphi_1(v)$ exceeds the threshold

$$\varphi_1^* \equiv \frac{\theta_1}{\theta_2}\gamma - \left(1 - \frac{\theta_1}{\theta_2}\right)\left(\frac{\mathbb{P}_1}{\mathbb{P}_2}\right)^{\sigma-1}\tau^{\sigma-1}.$$

Since $\theta_1 < \theta_2$, we have $\varphi_1^* < \varphi_2^*$. Hence, *firms producing in the high tax country* 1 *also have larger incentives to adopt a multinational structure*. The mass of multinationals producing in the high tax country $1 - F(\varphi_1^*)$ indeed exceeds the mass of multinationals producing in the low tax country $1 - F(\varphi_2^*)$. Observe that the multinationals producing in country 1 can avoid the taxes that country 1 exporters must pay on the profit generated by foreign sales. In contrast, the multinationals producing in country 2 cannot avoid such taxes. They can only alleviate the inefficiency arising in the arm's length relationship. Their incentives to go multinational are therefore weaker.

Having analyzed the two benchmark cases, we now turn to the impact of the OECD transfer pricing rules on firms' organizational choices.

5.3 OECD transfer pricing rules

As shown by Proposition 2, firms make the same pricing and output choices under CUP and CP transfer pricing rules. We may hence restrict our analysis to the CUP rule. Recall from Subsection 4.3 that if $\theta_j/\theta_i > \widehat{\theta}$, the tax authorities impose the transfer price $r_i = \beta\tau_{ii}$ to multinationals producing in i. Comparing expression (10) and (22) reveals that a firm v producing in country i chooses the multinational structure if and only if its variety-specific efficiency parameter $\varphi_i(v)$ exceeds the threshold

$$\varphi_i^c \equiv \gamma\frac{\theta_i}{\theta_j}\left(\frac{R_i}{\tau}\right)^{\sigma-1} = \gamma\frac{\theta_i}{\theta_j}\left[\beta - \frac{\theta_i}{\theta_j}(\beta - 1)\right]^{\sigma-1}. \tag{28}$$

Observe that (28) is affected by both the tax differential and by the inefficiency in the arm's length relationship between exporters and distributors. Because $\theta_1 < \theta_2$, expression (28) always applies to firms producing in the high tax country $i = 1$, where it applies to firms producing in the low tax country $i = 2$ only if the tax differential is small enough ($\theta_1/\theta_2 > \widehat{\theta}$). For a large enough tax differential ($\theta_1/\theta_2 > \widehat{\theta}$), multinationals producing in country 2 are constrained to report no losses.

Their profits under a multinational structure (23) then exceed their profits under an exporter structure (10) if $\varphi_2(v)$ is larger then

$$\widetilde{\varphi}_2^c \equiv \left(\frac{\sigma-1}{\sigma}\right)^{\sigma}.$$

We can now compare the firms' organizational choices in both countries. One can readily verify that $\varphi_1^c < \gamma < \varphi_2^c \leq \widetilde{\varphi}_2^c$. Consequently, *firms producing in the low tax country* 2 *have smaller incentives to adopt a multinational structure* so that the mass of multinationals producing in the low tax country $1 - F(\varphi_2^c)$ is smaller than the mass of multinationals producing in the high tax country $1 - F(\varphi_1^c)$. This conclusion concurs with the two benchmark cases.

It is instructive to compare the OECD rules with the perfect audit case by re-writing expression (28) as $\varphi_i^c = \varphi_i^o \left(R_i/\tau\right)^{\sigma-1}$. The incentives for going multinational are thus similar to the perfect audit case safe for a corrective term including the tax-adjusted marginal cost R_i of serving the foreign market. On the one hand, this tax-adjusted marginal cost exceeds τ for multinationals producing in the high tax country 1, thus implying that $\varphi_1^c > \varphi_1^o$. Put differently, *the firms producing in the high tax country* 1 *have less incentives to choose a multinational structure than under perfect audit*. The reason is that the CUP transfer price is too large and therefore forces the multinational to shift too much profit into her affiliate producing in the high tax country 1. Although those multinationals minimize this loss by under-producing for the foreign market, they still see their profits fall, thus making them worse off than under perfect audit. Conversely, for multinationals producing in the low tax country 2, $R_2 < \tau$, which implies that $\varphi_2^c < \varphi_2^o$. Hence, *the firms producing in the low tax country* 2 *have larger incentives to choose a multinational structure than under perfect audit*. The reason is that the larger CUP transfer price enables these firms to shift profits to the low tax country 1 by over-producing for the foreign market, which is beneficial to them.

Insert Figure 2 about here.

Firms' organizational choices are summarized by Figure 2, which depicts the loci of the above thresholds under perfect audit (o), no audit ($*$), as well as CUP and CP transfer pricing rules (c). In each case, the vertical distance of φ from the x-axis measures the mass of exporters $F(\varphi)$, whereas the vertical distance between φ and the top of the figure measures the mass of multinationals $1 - F(\varphi)$. Some computations, using the foregoing results, allow us to rank the thresholds as follows (see the Appendix for additional details):

$$\varphi_1^* < \varphi_1^o < \varphi_1^c < \varphi_2^* < \varphi_2^c < \varphi_2^o \tag{29}$$

We can furthermore show that the thresholds $(\varphi_1^*, \varphi_1^o, \varphi_1^c)$ are increasing functions of the tax differential θ_1/θ_2, whereas the thresholds $(\varphi_2^c, \varphi_2^o)$ are decreasing functions of it. Note that all thresholds

tend to γ as the tax differential vanishes ($\theta_1/\theta_2 \to 1$). In other words, when tax differences are very small, firms' organizational choices solely reflect the trade-off between the inefficiency in the arm's length relationship between exporters and distributors and the variety-specific marketing inefficiency of multinationals. When tax differentials get larger (θ_1/θ_2 decreases), the firms producing in the high tax country 1 have larger incentives to choose the multinational structure, whereas those producing in the low tax country 2 have larger incentives to choose the exporter structure. Hence, the firms' organizational incentives diverge across countries as tax differences grow larger.

Let us summarize the foregoing results as follows.

Proposition 3 *(i) Firms' incentives to choose a multinational structure are always larger in the high tax country ($\varphi_1^k < \varphi_2^k$, for $k = o, *, c$). (ii) In the high tax country, the incentives to choose a multinational structure are always lower under CUP and CP than under perfect audit and no audit ($\varphi_1^* < \varphi_1^o < \varphi_1^c$). (iii) Firms' incentives to choose a multinational structure in the low tax country lie between the incentives under perfect audit and no audit ($\varphi_2^* < \varphi_2^c < \varphi_2^o$). (iv) Those incentives diverge as tax differences increase (i.e., as θ_1/θ_2 decreases).*

Note that the foregoing results also hold when products become close to perfect substitutes (i.e., $\sigma \to \infty$). Despite the equivalence of transfer prices shown in Corollary 1, the profits made by the firms under the different transfer pricing rules are not the same, so that firms are not indifferent as to their organizational structure. We summarize this result in the following corollary.

Corollary 2 *When products are close to perfect substitutes ($\sigma \to \infty$), the mass of firms choosing a multinational structure under CUP and CP does not converge to their mass under full audit. The ranking (29) continues to apply.*

Having characterized firms' organizational choices under the different transfer pricing rules, we now investigate the efficiency properties of those choices. In so doing, we will focus on consumer's utility as this is an aspect that is usually disregarded in the discussion on the desirability of the design of transfer prices.

6 Consumer's utility

The OECD transfer pricing rules are designed to help tax authorities and multinationals to find mutually satisfying solutions to transfer pricing disputes, thereby minimizing conflict and costly litigation. Those rules are also presented as a means to achieve the OECD's objectives: to promote a high standard of living and the efficient use of economic resources. In the hypothetical context of perfect competition, transfer pricing rules should help tax authorities to assess the true transfer prices and to alleviate market distortions generated by tax differentials across countries. Transfer

pricing rules do, however, no longer achieve these goals in the context of imperfect competition when firms' prices and organizational structures differ from the efficient ones. In such a case, some consumers may loose from transfer pricing rules, while others may gain. The literature on transfer pricing has predominantly focused on tax revenue and production efficiency. Less attention has been devoted to how transfer pricing rules affect the 'standard of living', i.e., consumers' utility. This is the focus of this section. To ease the presentation, we restrict our analysis to the case of sufficiently small tax differentials, i.e., $\theta_1/\theta_2 > \widehat{\theta}$ as defined in (21). This restriction concurs with the OECD case where corporate profits tax differentials rarely exceed 40%.

Let $r = o, *, c$ denote the different transfer pricing rules (no audit, full audit, or the OECD rules). The consumer's utility (5) is an increasing function of the CES price index

$$\begin{aligned}\mathbb{P}_i^{1-\sigma} &\equiv \left(p_{ii}^r\right)^{1-\sigma} + (1-m_j)\left(p_{ji}^x\right)^{1-\sigma} + m_j\left(p_{ji}^r\right)^{1-\sigma} \\ &= \left[\left(p_{ii}^r\right)^{1-\sigma} + \left(p_{ji}^x\right)^{1-\sigma}\right] + m_j\left[\left(p_{ji}^r\right)^{1-\sigma} - \left(p_{ji}^x\right)^{1-\sigma}\right]. \end{aligned} \tag{30}$$

Using the foregoing results of Sections 3 and 4, we know that $p_{ii}^r = \sigma/(\sigma-1)$ and that $p_{ji}^x = \beta\tau\sigma/(\sigma-1)$, both of which are independent of the transfert pricing rules, the location of multinationals, and the location of consumers. Hence, the first bracket in expression (30) is constant. A transfer pricing rule r has two effects on consumer's utility in country i. First, there is an effect at the *intensive margin* through their impact on foreign multinationals' prices p_{ji}^r for serving market i. Second, there is an effect at the *extensive margin* through their impact on the mass of foreign multinationals m_j. We study each of those effects in turn.

Intensive margin. Expressions (9), (16), (18) and (20) allow us to rank the sales prices in the foreign markets as follows:

$$p_{21}^c < p_{ij}^o = p_{ij}^* < p_{12}^c < p_{ij}^x, \quad \forall i,j \quad \text{and} \quad i \neq j. \tag{31}$$

Observe that the highest prices p_{ij}^x are always set by the independent distributors, which is due to the double marginalization arising in the arm's lenght relationship. The lowest prices p_{21}^c are set by the multinationals that ship from the low tax country 2 to the high tax country 1 under the OECD rules. Since their transfer prices exceed their marginal costs, those firms cut their prices to inflate their shipments to the high tax country which allows them to transfer back profits into the low tax country. By contrast, the multinationals shipping from the high tax country 1 set a high sales price p_{12}^c in the foreign market in order to inflate their foreign profits and benefit from the low tax rate there.

As the tax differential between countries 1 and 2 widens (θ_1/θ_2 decreases), *the gap in multinationals' sales prices also widens across countries, which provides a consumption advantage to country 1* because its imports get cheaper ($p_{21}^c < p_{12}^c$). This advantage is magnified by larger tax differences. Hence, for a given industry structure, the high tax country has access to cheaper

products under OECD rules. To clarify this point, let us study the intensive margin by focusing on the firms' structure in the absence of tax differential. In that case, since $m_1^r = m_2^r = 1 - F(\gamma)$, the mass of exporters remains constant and consumers' utility only depends inversely on multinationals' sales prices. Because $p_{ji}^x > p_{ji}^r$ for all r, expression (31) implies that for this fixed structure

$$U_2^c < U_i^o = U_i^* < U_1^c$$

Hence, as tax differentials increase, prices and consumers' utility remain the same under perfect audit and under no audit; whereas prices and consumers' utility diverge under OECD rules. In the latter case, this provides a consumption advantage (resp., disadvantage) to the high (resp., low) tax country.

Extensive margin. Transfer pricing rules have extensive margin effects since they influence firms' organizational structure. Because the mass of multinationals m_i^r is equal to $1 - F(\varphi_i^r)$, we can make use of (29) to derive the following ranking:

$$m_2^o < m_2^c < m_2^* < m_1^c < m_1^o < m_1^*$$

In words, the high tax country 1 has the largest mass of multinationals under perfect audit while the low tax country 2 has the lowest mass under no audit. As can be seen from Figure 2, firms' structures diverge as tax differentials increase: more firms choose to become multinationals in the high tax country 1 and more firms choose the exporter structure in the low tax country 2. Thus, for given prices, the high tax country is served by more exporters through independent distributors whereas the low tax country is served by more multinationals through their affiliates. Because independent distributors set the highest prices, consumers in the high tax country lose while those in the low tax country gain. To clarify this point, let us again look at the case without tax differences (in which case $p_{ij}^r = p_{ij}^o = p_{ij}^* = \beta\tau\sigma(\sigma - 1)$). Because consumers' utility in country i depends on the mass of multinationals in the *other* country, we readily obtain

$$U_1^* < U_1^o < U_1^c < U_2^* < U_2^c < U_2^o.$$

Firms' organizational choices bestow a consumption disadvantage (resp., advantage) upon consumers residing in the high (resp., low) tax country. One can show that the extensive margin effect is stronger for larger tax differentials. Nevertheless, this effect goes in the opposite direction of the intensive margin effect, so that the combined effect is a priori unclear.

Combined margins. We first study the cross-country differences in consumers' utility for a given transfer pricing rule. Because there is no intensive margin effect under either perfect audit or no audit, the extensive margin effect trivially dominates under those rules:

$$U_1^o < U_2^o \quad \text{and} \quad U_1^* < U_2^*.$$

Hence, consumers' utility is lower in the high tax country 1 because more firms choose an exporter structure in other country to escape taxation and, therefore, increase the number of distributors and price inefficiencies in serving the high tax country. Under OECD rules, we have

$$U_1^c > U_2^c \quad \Longleftrightarrow \quad \frac{m_2^c}{m_1^c} = \frac{1 - F\left[\gamma \frac{\theta_2}{\theta_1} \left(\frac{R_2}{\tau}\right)^{\sigma-1}\right]}{1 - F\left[\gamma \frac{\theta_1}{\theta_2} \left(\frac{R_1}{\tau}\right)^{\sigma-1}\right]} > \frac{\left(\frac{\beta\tau}{R_1}\right)^{\sigma-1} - 1}{\left(\frac{\beta\tau}{R_2}\right)^{\sigma-1} - 1} \tag{32}$$

which is independent of transport costs τ because R_i is proportional to τ. Since the two sides of this inequality are smaller than one, it does not generally hold. Nevertheless, as shown in the Appendix, this condition is always satisfied when tax differentials are small ($\theta_1/\theta_2 \to 1$) and when the distribution F is uniform, $F(\varphi) = \varphi$. Under those conditions, the intensive margin effect dominates the extensive margin effect: consumers are better off in the high tax country 1 because they benefit more from the cheaper imports from their foreign multinationals than they lose from the increased presence of distributors who charge higher prices.

Proposition 4 *(i) Consumers' utility is lower in the high tax country than in the low tax country under perfect audit and no audit. (ii) The opposite result holds true under OECD rules for small tax differences and for a uniform distribution of the efficiency parameters φ_i. (iii) The cross-country gap in consumers' utility widens as tax differentials increase.*

Last, we study the differences in consumers' utility between different transfer pricing rules. A transfer pricing rule r yields higher consumer utility in country i than another rule s if

$$U_i^r > U_i^s \quad \Longleftrightarrow \quad \mathbb{P}_i^r < \mathbb{P}_i^s \quad \Longleftrightarrow \quad \frac{m_j^r}{m_j^s} > \frac{\left(p_{ji}^x / p_{ji}^s\right)^{\sigma-1} - 1}{\left(p_{ji}^x / p_{ji}^r\right)^{\sigma-1} - 1}.$$

We readily obtain

$$U_1^o < \min\{U_1^*, U_1^c\} \quad \text{and} \quad U_2^c < U_2^o < U_2^*.$$

Furthermore

$$U_1^* < U_1^c \quad \Longleftrightarrow \quad \frac{m_2^c}{m_2^*} = \frac{1 - F\left[\gamma \frac{1}{\theta} \left(\frac{R_2}{\tau}\right)^{\sigma-1}\right]}{1 - F(\gamma)} > \frac{\beta^{\sigma-1} - 1}{(\beta\tau/R_2)^{\sigma-1} - 1} \tag{33}$$

As is the case with (32), the latter inequality does not depend on τ because R_i is proportional to τ. Yet, it cannot be clearly signed without some additional assumptions. As before, we can show that this inequality is always satisfied when tax differences are small and in the case of a uniform distribution of φ_i. We can summarize those results, taking the no audit case as a natural benchmark, as follows.

Proposition 5 *(i) Consumers' utility falls in both countries when tax authorities switch from no audit to perfect audit. (ii) Consumers' utility falls even more in the low tax country, but it increases in the high tax country, when tax authorities switch from no audit to OECD rules, provided that tax differences are small and that the distribution of the efficiency parameters φ_i is uniform.*

When tax authorities switch from no audit to perfect audit, more firms choose a multinational structure to avoid taxation. Consequently, there are less inefficient exporter-distributor arm's length relationships. Since multinationals do not distort their prices under perfect audit, prices fall on average. By contrast, when tax authorities switch from no audit to OECD rules, consumers are better off in the high tax country 1 because they benefit from lower prices set by multinationals producing in the foreign country. In the low tax country 2, consumers are worse off because foreign multinationals inflate their prices there and reduce quantities shipped to benefit from the low tax rates.

7 Conclusions

We have developed a monopolistic competition model that analyzes the impacts of OECD transfer pricing rules on firms' market decisions, their organizational choices, and consumers' utility. Multinationals compete with exporters, and the arm's length relationships between exporters and independent distributors serve as a natural benchmark for tax authorities to gauge the multinationals' profit shifting behavior.

Using as benchmarks the cases where the tax authorities are either unable to audit the multinationals or are able to audit them perfectly, we have shown that the Comparable Uncontrolled Price and the Cost-Plus method suggested by the OECD are equivalent. In the high tax country, the incentives to operate a multinational structure with fully owned and controlled affiliates are lower than under both benchmarks when OECD rules are enforced. Firms are thus more likely to adopt an exporter structure using an independent distributor, which directly affects the market outcome because of inefficient double marginalization. In the low tax country, the incentives to operate a multinational structure with fully owned and controlled affiliates lie somewhere in between the two benchmarks. We may thus conclude that the choice of a transfer pricing rule has a direct impact on firms' decisions as to how to serve foreign markets.

When markets are not competitive, the multinationals' transfer prices are not constrained to be efficient market prices even under OECD rules. Instead, the 'appropriate margin' or the 'comparable uncontrolled price' are too high because of double marginalization arising in the comparable transaction between exporters and independent distributors. This gives rise to production inefficiencies which affect consumers' utility. We show that consumers' utility in the low tax country is highest in the no-audit case. The reason is that multinationals set lower prices than the local

independent distributors who contract with exporting firms, and that the incentives to operate a multinational structure are largest when there is no audit. By constrast, in the high tax country OECD rules impose a lower marginal cost to foreign firms serving that market, thus translating into a price advantage for consumers. Thus, consumers' utility is higher under OECD rules than under no-audit. Finally, it is worth noting that perfect audit is never the optimal policy for any of the two countries. Indeed, given the price advantage of multinationals *vis-à-vis* exporters, a too restrictive transfer pricing policy may entice an excessive number of firms to operate as exporters, thereby harming consumers. This result suggests that consumers' welfare should be taken into consideration when evaluating the desirability of a given transfer pricing policy.

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Appendix: Proofs

Proof of Proposition 2. Under no audit, a multinational producing in country i finds the transfer price r_i, the imputation of transport cost τ_{ii} and τ_{ij}, and the local and export prices p_{ii} and p_{ij} that maximize her total profit

$$\Pi_i = \theta_i \left[(p_{ii} - 1) q_{ii} \varphi_i + (r_i - \tau_{ii}) \frac{\tau}{\tau_{ii}} q_{ij} \varphi_i \right] + \theta_j \left(p_{ij} - r_i \frac{\tau}{\tau_{ii}} \right) \varphi_i q_{ij}$$

subject to the constraint that she cannot declare permanent losses in any country:

$$\pi_{ii} + \pi_{ij}^{\text{dom}} = (p_{ii} - 1) q_{ii} \varphi_i + (r_i - \tau_{ii}) \varphi_i \frac{\tau}{\tau_{ii}} q_{ij} \geq 0$$

$$\pi_{ij}^{\text{for}} = \left(p_{ij} - r_i \frac{\tau}{\tau_{ii}} \right) \varphi_i q_{ij} \geq 0.$$

A marginal increase in r_i increases total profit if and only if $d\Pi_i/dr_i = (\theta_i - \theta_j)(\tau/\tau_{ii})\varphi_i q_{ij} \geq 0$ which holds true if and only if $\theta_i \geq \theta_j$. Hence the optimal transfer price is always a corner solution that makes one of the constraints binding. Assume first that $i = 1$, so that $\theta_i - \theta_j < 0$. In this case, $\pi_{ii} + \pi_{ij}^{\text{dom}} = 0$, and the transfer price becomes $r_1^* = \tau_{11} - (p_{11} - 1)(q_{11}/q_{12})(\tau_{11}/\tau)$. Plugging r_1^* in the total profit yields $\Pi_1 = \pi_{12}^{\text{for}} = \theta_2 \left[(p_{11} - 1)q_{11} + (p_{12} - \tau)q_{12}\right]\varphi_1$, which is independent of the imputation τ_{11} and τ_{12} of transport costs. The optimal prices are thus equal to $p_{11}^* = \sigma/(\sigma - 1)$ and $p_{12}^* = \tau\sigma/(\sigma - 1)$ as given in Section 4.2. Assume next that $i = 2$, so that $\theta_i - \theta_j > 0$. In this case, $\pi_{21}^{\text{for}} = 0$ so that the transfer price is constrained to $r_2^* = p_{22}\tau_{22}/\tau$. The firm's total profit becomes $\Pi_2 = \pi_{22} + \pi_{21}^{\text{dom}} = \theta_2 \left[(p_{22} - 1)q_{22} + (p_{21} - \tau)q_{21}\right]\varphi_2$, which is also independent of the transport cost imputation. The optimal prices are thus also equal to $p_{22}^* = \sigma/(\sigma - 1)$ and $p_{21}^* = \tau\sigma/(\sigma - 1)$. □

Proof of Proposition 3. We need to rank the thresholds φ_i and we need to assess their changes with respect to changes in tax differentials. Let $\theta \equiv \theta_1/\theta_2 < 1$. We may then rewrite the thresholds as follows: $\varphi_1^o = \gamma\theta$, $\varphi_2^o = \gamma\theta^{-1}$, $\varphi_1^* = \gamma\theta - (1 - \theta)\left(\mathbb{P}_1/\mathbb{P}_2\right)^{\sigma-1}\tau^{\sigma-1}$, $\varphi_2^* = \gamma$, $\varphi_1^c = \gamma\theta\left(\beta - \theta(\beta - 1)\right)^{\sigma-1}$ and $\varphi_2^c = \gamma\theta^{-1}\left(\beta - \theta^{-1}(\beta - 1)\right)^{\sigma-1}$.

(i) We first show how the threshold φ_i varies with θ. It is readily verified that $d\varphi_1^o/d\theta > 0$ and $d\varphi_2^o/d\theta < 0$. Furthermore, $d\varphi_1^*/d\theta = \gamma + \left(\mathbb{P}_1/\mathbb{P}_2\right)^{\sigma-1}\tau^{\sigma-1} > 0$ whereas $d\varphi_2^*/d\theta = 0$. Note also that $d\varphi_1^c/d\theta = \gamma\left[\beta - \theta(\beta - 1)\right]^{\sigma-2}\left[\beta - \theta\sigma(\beta - 1)\right]$, which is positive because $\beta - \theta(\beta - 1) \geq 1$ and $\beta - \theta\sigma(\beta - 1) \geq \beta - \sigma(\beta - 1) = \alpha > 0$. Last, $d\varphi_2^c/d\theta = -\gamma\theta^{-2}\left[\beta - \theta^{-1}(\beta - 1)\right]^{\sigma-2}\left[\beta - \theta^{-1}\sigma(\beta - 1)\right]$ is negative for any θ exceeding $\widehat{\theta} \equiv \sigma(\beta - 1)/\beta$.

(ii) We obtain the ranking $\varphi_1^r < \gamma \leq \varphi_2^r$, for $r = o, *, c$ since all the thresholds φ_i are equal to γ in the absence of tax differentials ($\theta = 1$) and because $d\varphi_1^r/d\theta < 0 \leq d\varphi_2^r/d\theta$ for $r = o, *, c$.

(iii) We further obtain the ranking $\varphi_1^* < \varphi_1^o < \varphi_1^c$ because $\varphi_1^* = \varphi_1^o - (1 - \theta)\left(\mathbb{P}_1/\mathbb{P}_2\right)^{\sigma-1}\tau^{\sigma-1} < \varphi_1^o$ and because $\varphi_1^c = \theta\gamma\left[\beta - \theta(\beta - 1)\right]^{\sigma-1} > \theta\gamma = \varphi_1^o$ since $\beta - \theta(\beta - 1) \geq 1$.

(iv) Finally, we get the ranking $\varphi_2^* < \varphi_2^c < \varphi_2^o$ and $\varphi_2^c \leq \tilde{\varphi}_2^c$. Indeed, we have $\varphi_2^* < \varphi_2^c$ because $d\varphi_2^*/d\theta = 0 > d\varphi_2^c/d\theta$. We furthermore have $\varphi_2^c = \varphi_2^o\left[\beta - \theta^{-1}(\beta - 1)\right]^{\sigma-1} < \varphi_2^o$ since $\beta - \theta^{-1}(\beta - 1) < 1$ for any $\theta > \widehat{\theta}$. Also, by definition of $\tilde{\varphi}_2^c = \sup_{\theta > \widehat{\theta}}\varphi_2^c$, we have $\varphi_2^c < \tilde{\varphi}_2^c$. □

Proof of Corollary 2. We compute the limits of the thresholds in Proposition 4 when $\sigma \to \infty$. First of all, we have $\gamma \to \gamma_\infty \equiv (1 - \alpha)e^{-(1-\alpha)}$ where $e = 2.71828\ldots$ denotes Euler's number. It is then immediate to verify that $\varphi_{1\infty}^c = (1 - \alpha)\theta e^{-(1-\alpha)\theta}$. Furthermore, $\varphi_{2\infty}^c = (1 - \alpha)\theta^{-1}e^{-(1-\alpha)\theta^{-1}}$ if $\theta \geq \widehat{\theta}$ (or equivalently $\theta \geq (1 - \alpha)$), whereas $\tilde{\varphi}_{2\infty}^c = e^{-1}$ if $\theta < \widehat{\theta}$ (or equivalently $\theta < (1 - \alpha)$).

Next, we have $\varphi_{1\infty}^o = \theta(1 - \alpha)e^{-(1-\alpha)}$, $\varphi_{2\infty}^o = \theta^{-1}(1 - \alpha)e^{-(1-\alpha)}$, $\varphi_{1\infty}^* = -\infty$ and $\varphi_{2\infty}^* = (1 - \alpha)e^{-(1-\alpha)}$. Finally, we obtain $\varphi_{1\infty}^* = -\infty$ because $\lim_{\sigma\to\infty}\left(\mathbb{P}_1/\mathbb{P}_2\right)^{\sigma-1} = \left(m_2 + x_2\right)/\left(m_1 + x_1\right) = 1$ is finite, whereas $\tau^{\sigma-1} \to \infty$. At that limit, we then have $\varphi_{1\infty}^r < \varphi_{2\infty}^r$, $r = o, *, c$, whereas $\varphi_{1\infty}^* < \varphi_{1\infty}^o < \varphi_{1\infty}^c$ and $\varphi_{2\infty}^* < \varphi_{2\infty}^c < \varphi_{2\infty}^o$. □

Proof of Proposition 4. Let $\theta \equiv \theta_1/\theta_2 < 1$. Given a transfer pricing rule $r = o, *, c$, consumers' utility in country i exceeds that in country j if

$$\mathbb{P}_i^r < \mathbb{P}_j^r \quad \Longleftrightarrow \quad \frac{m_j^r}{m_i^r} > \frac{\left(p_{ij}^x/p_{ij}^r\right)^{\sigma-1} - 1}{\left(p_{ji}^x/p_{ji}^r\right)^{\sigma-1} - 1},$$

which yields condition (32) for the OECD rules. We now provide sufficient conditions under which (32) is satisfied. First, condition (32) is satisfied for small tax differences. To see this, let

$$G(\theta) \equiv \ln\left[1 - F\left(\gamma \frac{1}{\theta}\left(\frac{R_2}{\tau}\right)^{\sigma-1}\right)\right] - \ln\left[1 - F\left(\gamma\theta\left(\frac{R_1}{\tau}\right)^{\sigma-1}\right)\right]$$

and

$$H(\theta) \equiv \ln\left[\left(\frac{\beta\tau}{R_1}\right)^{\sigma-1} - 1\right] - \ln\left[\left(\frac{\beta\tau}{R_2}\right)^{\sigma-1} - 1\right].$$

Note that $G(1) = H(1) = 0$ since $R_1 = R_2$ in that case. Condition (32) then shows that $U_1^c > U_2^c$ if and only if $G(\theta) > H(\theta)$. Let $\theta = 1 - \varepsilon$ where $\varepsilon > 0$ is small. Using a linear approximation, the latter inequality becomes $G(1) - \varepsilon G'(1) > H(1) - \varepsilon H'(1)$, i.e., $G'(1) < H'(1)$. We readily obtain $G'(1) = 2\gamma(\beta - 1)(\sigma - 1)[-F'(\gamma)]/[1 - F(\gamma)]$ and $H'(1) = 2\beta^{\sigma-1}(\sigma - 1)(\beta - 1)/(\beta^{\sigma-1} - 1)$, so that

$$G'(1) < H'(1) \quad \Longleftrightarrow \quad \frac{-\gamma F'(\gamma)}{1 - F(\gamma)} < \frac{\beta^{\sigma-1}}{\beta^{\sigma-1} - 1},$$

which is always true since $0 < F'(\gamma) \leq 1$.

We next show that condition (32) is satisfied for the uniform distribution $F(x) = x$. Indeed, given that assumption and using the definition of β, we get that $U_1^c > U_2^c$ if and only if

$$\frac{1 - (1-\alpha)\frac{\sigma-1}{\sigma-\alpha}\frac{1}{\theta}\left(1 - \frac{1-\alpha}{\sigma-\alpha}\frac{1}{\theta}\right)^{\sigma-1}}{1 - (1-\alpha)\frac{\sigma-1}{\sigma-\alpha}\theta\left(1 - \frac{1-\alpha}{\sigma-\alpha}\theta\right)^{\sigma-1}} > \frac{\left(1 - \frac{1-\alpha}{\sigma-\alpha}\theta\right)^{1-\sigma} - 1}{\left(1 - \frac{1-\alpha}{\sigma-\alpha}\frac{1}{\theta}\right)^{1-\sigma} - 1},$$

where numerators and denominators are positive. Defining the function $Z(y) \equiv \ln[1 - y(\sigma-1)(1-y)^{\sigma-1}] + \ln[(1-y)^{1-\sigma} - 1]$, this condition can be written more simply as $Z(y_2) > Z(y_1)$ where $y_2 \equiv \theta^{-1}(1-\alpha)/(\sigma-\alpha)$ and $y_1 \equiv \theta(1-\alpha)/(\sigma-\alpha)$. Because $\theta > \hat{\theta}$, we have the conditions $1/\sigma > y_2 > y_1 > \sigma(1-\alpha)^2/(\sigma-\alpha)^2$. Therefore the condition $Z(y_2) > Z(y_1)$ is satisfied if $Z(y)$ is an increasing function for any $0 < y < 1/\sigma$, which is always true because

$$Z'(y) = (\sigma - 1)\frac{(1-y)\left[(1-y)^{-\sigma} - 1\right] + (1-y)^{\sigma-1}(1 - y\sigma)}{\left[(1-y)^{1-\sigma} - y(\sigma-1)\right]\ \left[1 - (1-y)^{\sigma-1}\right]\ (1-y)} > 0$$

Indeed, in this expression, the numerator and the denominator are positive because $y < 1/\sigma < 1$ and because $(1-y)^{1-\sigma} - y(\sigma-1)$ is a function that is equal to 1 at $y = 0$ and increases to higher values for $y > 0$. □

Proof of Proposition 5. We derive conditions under which (33) is satisfied. The proof is similar to that of Proposition 4. First, condition (33) is satisfied for small tax differences. Indeed, let

$$G(\theta) = \ln\left[1 - F\left(\gamma\frac{1}{\theta}\left(\frac{R_2}{\tau}\right)^{\sigma-1}\right)\right] - \ln\left[1 - F(\gamma)\right]$$

and

$$H(\theta) = \ln\left(\beta^{\sigma-1} - 1\right) - \ln\left[(\beta\tau/R_2)^{\sigma-1} - 1\right]$$

Note that $G(1) = H(1) = 0$. Condition (33) then becomes $U_1^c > U_1^*$ if and only if $G(\theta) > H(\theta)$. Let $\theta = 1 - \varepsilon$ where $\varepsilon > 0$ is small. Using a linear approximation, the foregoing inequality becomes $G(1) - \varepsilon G'(1) > H(1) - \varepsilon H'(1) \iff G'(1) < H'(1)$. We readily obtain $G'(1) = \gamma(\beta - 1)(\sigma - 1)\left[-F'(\gamma)\right]/\left[1 - F(\gamma)\right]$ and $H'(1) = \beta^{\sigma-1}(\sigma - 1)(\beta - 1)/(\beta^{\sigma-1} - 1)$, so that

$$U_1^c > U_1^* \quad \iff \quad \frac{-\gamma F'(\gamma)}{1 - F(\gamma)} < \frac{\beta^{\sigma-1}}{\beta^{\sigma-1} - 1}$$

which is always true since $0 < F'(\gamma) \leq 1$.

Second, condition (33) is satisfied for the uniform distribution $F(x) = x$. To see this, note that, using the definition of β and γ, and after straightforward manipulation, condition $U_1^c > U_1^*$ becomes:

$$\frac{1 - \frac{1-\alpha}{\theta}\frac{\sigma-1}{\sigma-\alpha}\left(1 - \frac{1-\alpha}{\sigma-\alpha}\frac{1}{\theta}\right)^{\sigma-1}}{1 - (1-\alpha)\left(\frac{\sigma-\alpha}{\sigma-1}\right)^{-\sigma}} > \frac{\left(\frac{\sigma-\alpha}{\sigma-1}\right)^{\sigma-1} - 1}{\left(\frac{1}{1 - \frac{1-\alpha}{\sigma-\alpha}\frac{1}{\theta}}\right)^{\sigma-1} - 1}$$

As in the proof of Proposition 4, we can use the function $Z(y) \equiv \ln[1 - y(\sigma - 1)(1 - y)^{\sigma-1}] + \ln[(1 - y)^{1-\sigma} - 1]$, so that the last condition can be written more simply as $Z(y_2) > Z(y_0)$ where $y_2 \equiv \theta^{-1}(1 - \alpha)/(\sigma - \alpha)$ and $y_0 \equiv (1 - \alpha)/(\sigma - \alpha)$. Because $\theta > \hat{\theta}$, we still have $1/\sigma > y_2 > y_0 > 0$. Therefore the condition $Z(y_2) > Z(y_0)$ is satisfied if $Z(y)$ is an increasing function for any $0 < y < 1/\sigma$, which we have proved in the proof of Proposition 4. □

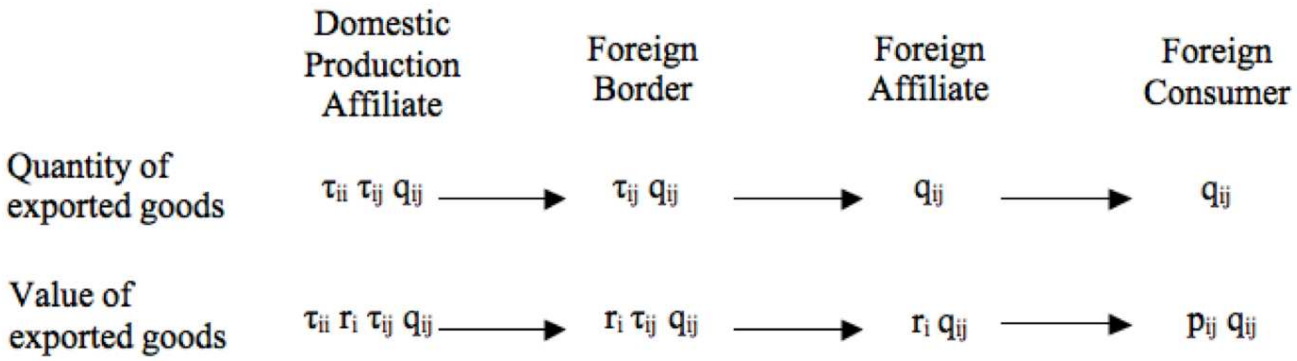

Figure 1: Imputation of transport costs and value of production under iceberg transport costs

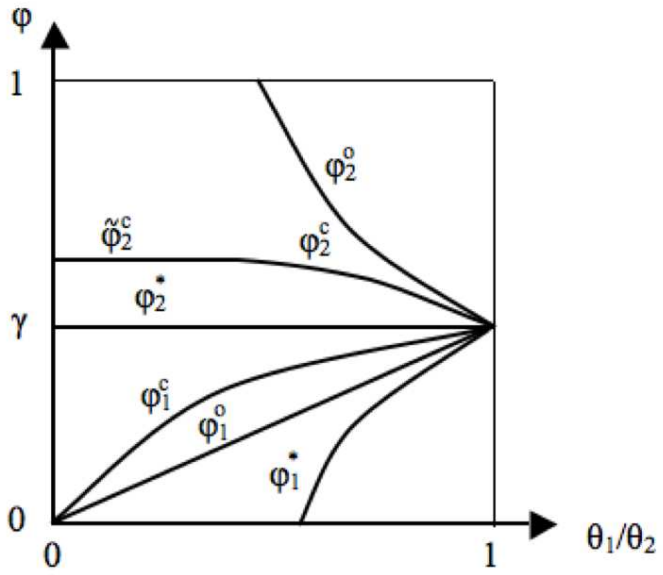

Figure 2: Choice of organizational structure

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