TRANSFER PRICING RULES, OECD GUIDELINES, AND MARKET DISTORTIONS

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Abstract

We study the impact of transfer pricing rules on prices, firms' organizational structure, and consumers' utility in a two-country monopolistic competition model with source-based profit taxes. Firms can either be multinationals and serve the foreign market through a fully controlled affiliate, or be exporters and serve the foreign market by contracting with an independent distributor. The use of the OECD's comparable uncontrolled transfer price (CUP) rule distorts firms' output and pricing decisions, because the comparable arm's length transactions between exporters and

distributors—which serve as the benchmark—are not efficient. We show that the CUP rule is detrimental to consumers in the low-tax country, yet benefits consumers in the high-tax country when compared to the benchmark of unconstrained profit shifting. Using the OECD rule increases tax revenue at the expense of consumer surplus. Those results also hold under the alternative cost-plus transfer pricing rule.

1. Introduction

Multinationals manipulate transfer prices to minimize their tax liabilities. High transfer prices for sales of goods to affiliates in high-tax countries are used to repatriate profits to low-tax countries, thereby reducing the overall tax burden. When firms face no restrictions, transfer prices may become pure tax-evasion devices with no economic meaning. Obvious examples include firms that "sold toothbrushes between subsidiaries for $5,655 each," or that 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, restricting their freedom to set transfer prices, contesting their tax declarations, and negotiating possible settlements.

When tax authorities interfere with transfer prices they may, however, generate inefficiencies that distort consumer prices and firms' organizational choices.

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] 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 satisfying agreements (OECD 2001). These guidelines are based on the notion of *arm's length price*, i.e., "the price two unrelated parties would reach through bargaining in a competitive market" (Eden 1998, p. 602). However, as most multinationals operate in imperfectly competitive markets, the OECD guidelines are likely to be affected by market distortions arising between unrelated parties.

This paper studies the market distortions arising under 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 a two-country trade model in the wake of Krugman (1980) that features

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cross-country corporate tax differentials. Firms have a single production plant and sell differentiated products in their domestic and foreign markets. They may serve the foreign market by owning a foreign affiliate which markets and distributes the product (i.e., they are multinationals) or by delegating these tasks to a foreign independent distributor (i.e., they are exporters). Exporters and distributors are linked by arm's length relationships that generate inefficiencies because the distributors have control over their tasks. Such inefficiencies do not arise within multinationals that keep full management control (Grossman and Hart 1986).

We show that the transfer prices which abide by the OECD rules reflect the inefficiencies of arm's length relationships between exporters and independent distributors. Tax authorities constrain multinationals to set their transfer prices at the level prevailing in comparable uncontrolled transactions. This seems reasonable when those transactions are efficient, but when they are not they can distort transfer prices and bias them upward. We show that this is good news for the multinationals that produce in the low-tax country, who react by increasing their shipments to the high-tax country. Conversely, the upward-biased transfer price entails a cost for the multinationals in the high-tax country, who are forced to repatriate profits against their will. As a consequence, multinationals in the high-tax country increase their price in the foreign market and reduce their sales there. Naturally, these distortions arise neither when multinationals are free to set their transfer prices and choose to repatriate all the profits to the low-tax country, nor when tax authorities constrain the transfer price to equal the *marginal cost* of serving the foreign market (a benchmark that is used by, e.g., Kind, Midelfart-Knarvik, and Schjelderup, 2005; Amerighi 2006; Peralta, Wauthy, and Van Ypersele 2006; and Nielsen, Raimondos-Moller, and Schjelderup 2008, 2010). As expected, pricing distortions translate into distorted organizational choices. Firms in both countries have less incentives to go multinational when tax authorities apply the OECD rules than when they can repatriate all profits, and this is reflected in more inefficient arm's length relationships between exporters and independent distributors.

We provide a detailed analysis of the impacts of transfer pricing rules on consumers' utility and governments' tax revenues. Transfer pricing rules have *intensive and extensive margin effects* on consumers—via product prices and the share of multinationals—and those two effects may conflict. We show that the intensive margin favors consumers in the high-tax country, because multinationals shipping to this country set lower prices than exporters. By contrast, extensive margin effects hurt these consumers because foreign firms more often prefer to serve them through independent distributors who charge higher prices. Interestingly, the intensive margin effect dominates under the OECD rules, so that consumers' utility is higher in the high-tax country than it is in the low-tax country. Hence, high-tax countries may have lower consumer prices given firms' organizational choices. Moreover, the gain in the high-tax country is more than offset by the loss in the low-tax country,

i.e., the OECD guidelines are globally distorting from the consumers' point of view. Although transfer pricing rules do raise global tax revenue, the desirability of their implementation depends on the marginal utility of that tax revenue.

1.1. Related Literature

Since 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 prices are manipulated, but not uniformly across industries.[3] For instance, Swenson (2001) uses data on the prices of U.S. imports from Canada, France, Germany, Japan, and the United Kingdom and finds significant, albeit small, impacts of taxes on reported prices. Her data set, however, does not distinguish between related and unrelated party trade. By contrast, Clausing (2003) and Bernard, Jensen, and Schott (2008) use detailed databases that differentiate transactions between related and unrelated parties. They confirm the existence of transfer prices that significantly depart from arm's lengths prices and that are consistent with tax burden minimization.

Turning to theory, most existing contributions focus on a single firm and assume—without explicitly modeling them—fully efficient arm's length relationships where the transfer price between producers and distributors is equal to the marginal production cost. 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. Samuelson (1982) even takes the multinational's controlled mill price as the comparable uncontrolled price to assess foreign transactions. More recently, authors use the marginal cost of production as the arm's length benchmark (see, e.g., Kind *et al.* 2005; Amerighi 2006; Peralta *et al.* 2006). A perfectly competitive, exogenously given, benchmark transfer price is also used in the analysis of separate accounting and formula appointment (Nielsen *et al.* 2010).

More closely related to our paper, the literature offers some discussion about transfer pricing and firms' organization. In Nielsen *et al.* (2008), a

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[3] Devereux (2007) points out that this literature differs in the nature and the aggregation level of the data used, as well as in the empirical strategies. See Table 2 in Devereux (2007) for a thorough classification of the papers according to the type of data used and the test of profit shifting implemented. Indirect tests of transfer pricing mechanisms use aggregate data, for example, on profitability across countries or on affiliates' debt levels (for recent contributions see, e.g., Bartelsman and Beetsma 2003; Desai, Fooley, and Hines 2004; and Huizinga and Laeven 2007). Direct tests use available information on affiliates (e.g., Clausing 2003; Bernard *et al.* 2008).

multinational firm may delegate its pricing decisions to its foreign affiliate and use transfer prices to both shift taxes and strengthen the affiliate's competitive advantage. As a consequence, when tax differences are large, the firm sets a high transfer price for tax shifting purposes while it centralizes its pricing decisions because the affiliate's loss of competitiveness exacerbates the distortions caused by delegation. In Devereux and Keuschnigg (2009), transfer prices are used not only to shift taxes but also to relax borrowing constraints in affiliated firms. Imposing the arm's length principle in transfer pricing has two distorting effects: it leads affiliates to reduce their output and revenue, which inefficiently worsens their credit possibilities. As a result, multinational firms may prefer to outsource in the foreign market. In contrast to our paper, those contributions do not outline the role of inefficiency of the arm's length relationship on the firm's choice between serving the foreign market through FDI or an independent distributor.

Our paper differs from the existing literature in several ways. First, it embeds transfer pricing within a well-established intraindustry 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 for transfer pricing, whereas most of the literature assumes that arm's length relationships are efficient. Finally, whereas the existing literature assumes the existence of uncontrolled firms for the aim of assessing comparable transactions, our paper derives the arm's length benchmark endogenously as the outcome between independent distributors and exporters. The endogenous choice of organization and prices in our model comes, however, at the cost of a few simplifying assumptions. In particular, like Devereux and Keuschnigg (2009), we do not model an optimal concealment decision on behalf of firms and we take taxes as exogenously given.[4] Rather, this paper assumes a precise application of transfer pricing guidelines to focus on the relationship between export market inefficiencies and transfer pricing strategies. As we will argue, the impact of concealment costs can be readily inferred from our discussion of CUP and unconstrained pricing.

The remainder of the paper is organized as follows. In Section 2, we present the model. We study the exporter structure and the arm's length price in Section 3, and the multinational structure and transfer pricing decisions in Section 4. In Section 5, we then discuss the choice of production structure. We analyze the implications of transfer pricing rules on consumers' utility in Section 6. We conclude in Section 7. All proofs, as well as some model extensions, are relegated to the Appendix.

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[4] A similar approach is taken by Amerighi and Peralta (2010), Klein and Schmitdke (2008), Mansori and Weichenrieder (2001), and Raimondos-Møller and Scharf (2002).

2. The Model

2.1. Preferences

Consider two countries, labeled $i = 1, 2$. Variables associated with each country will be subscripted accordingly. Each country has a unit mass of consumers/workers who have identical Cobb–Douglas CES preferences given by

$$U_i = z^{1-\mu} \left[\int_0^1 q_{ii}(v)^{\frac{\sigma-1}{\sigma}} dv + \int_0^1 q_{ji}(v)^{\frac{\sigma-1}{\sigma}} dv \right]^{\frac{\mu\sigma}{\sigma-1}} \qquad j \neq i, \qquad (1)$$

where $q_{ji}(v)$ denotes the consumption of variety v in country i when it is produced in country j; and where z is a homogenous good. We normalize the mass of varieties produced in each country to one. The parameters $\sigma > 1$ and $0 < \mu < 1$ denote the elasticity of substitution across varieties and consumers' expenditure share for the differentiated good, respectively.

The consumers' budget constraint is given by

$$\int_0^1 p_{ii}(v) q_{ii}(v) dv + \int_0^1 p_{ji}(v) q_{ji}(v) dv + p_i^z z = I_i, \quad j \neq i, \qquad (2)$$

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 obtain the following demands:

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

where

$$\mathbb{P}_i^{1-\sigma} \equiv \int_0^1 p_{ii}(v)^{1-\sigma} dv + \int_0^1 p_{ji}(v)^{1-\sigma} dv, \quad j \neq i \qquad (4)$$

stands for the CES price index in country i. Using (1) and (3), we then obtain the representative consumer's indirect utility

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

2.2. Technology, Distribution Costs, and Taxes

We assume that labor is the only production factor and that it is perfectly mobile across sectors. All workers in a country have the same unit productivity and, therefore, earn the same wage. In the homogenous sector, firms produce with a constant returns to scale technology using labor only, and firms trade their output at no cost. The homogenous good is produced in both

countries at equilibrium provided L is large enough, which we assume to hold. Trade in the homogenous good, taken as the numéraire, then implies that $p_i^z = p = w_i^z \equiv 1$ for $i = 1, 2$.

In the differentiated industry, each firm produces and sells one firm-specific variety v. We hence use v as a firm index. Each firm incurs two types of costs: a common unit input requirement that we normalize to one without loss of generality; and a cost for distributing its product in each local market. The latter 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 firms.

Each firm has a single production plant and two options for accessing the export market. First, it may sell the good to a foreign independent distributor who bears the marketing cost associated with the variety sold. The independent distributor sells the traded good with an additional mark-up to the final consumer. We term this the *exporter structure*. Observe that our setup thus encapsulates the *arm's length principle* that is at the core of the OECD transfer pricing guidelines. Second, the firm may transfer the good to a fully owned and controlled foreign affiliate who bears the marketing cost. We term this the *multinational structure*. Which structure the firm chooses depends on the trade-off between the double marginalization inefficiency in the exporter structure and the variety-specific marketing cost in the multinational structure.[5]

In what follows, we superscript by x (respectively, d) variables pertaining to exporters (respectively, distributors). Variables pertaining to multinationals bear no superscript. We denote by x_i and m_i the mass of exporters and of multinationals in country i. By assumption, $m_i + x_i = 1$, so that the total mass of producers satisfies $m_1 + x_1 + m_2 + x_2 = 2$. All firms—exporters, distributors, and multinationals—are negligible to the market and take the price indices $\mathbb{P}_i$ and $\mathbb{P}_j$ as given.

Turning to taxes, all differentiated firms pay source-based corporate profit 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

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[5] We do not discuss the "proximity-concentration" trade-off, highlighted in the international trade literature, where firms may incur additional fixed costs of FDI in order to save on variable trade costs. This trade-off has been extensively documented before (see, e.g., Markusen 2002; Barba Navaretti and Venables 2004).

[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).

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 ($t_1 > t_2$, i.e., $\theta_1 < \theta_2$).

3. Exporter Structure

We first characterize the choices of exporting firms that have no nexus in the foreign market and thus must rely on an independent distributor to sell their products and bear the marketing costs. Since it is generally not possible to write complete contracts between the two firms, this arm's length relationship is not efficient (Grossman and Hart 1986). The reason is that the independent distributor has the right to manage his firm and negotiates the price at which he buys the goods from the exporter. This source of external contracting inefficiencies in international transactions is empirically relevant, as outlined by Spencer (2005) and Nunn (2007).

To simplify notation, let us drop the reference to the variety v and focus on exporters located in country i. All of our subsequent results apply to any variety and any country. The exporter is fully taxed in his country of establishment. Let r_i^x stand for the transfer prices of exporters, which we refer to as the *external transfer price* (i.e., between exporters and distributors). His after-tax profit is given by $\Pi_i^x \equiv \pi_{ii}^x + \pi_{ij}^x$, where $\pi_{ii}^x \equiv \theta_i (p_{ii}^x - 1) q_{ii}^x \varphi_i$ and $\pi_{ij}^x \equiv \theta_i (r_i^x - 1) q_{ij}^x$ denote the after-tax profits he makes from sales in his domestic and his export markets, respectively; and where $q_{ij}^x \equiv q_{ij}(p_{ij}^x)$. In the exporter structure, the exporter bears the marketing cost, φ_i, at home but not abroad. Yet, the exporter has less control over his transfer price r_i^x.

The timing is as follows. In the first stage, the exporter and the distributor located in the other country negotiate an external transfer price r_i^x for the good. Afterward, the independent distributor sets a price p_{ij}^x and supplies the good to his local market, while the exporter sets the price p_{ii}^x at which he supplies his domestic market. The relationship between the exporter and the distributor is assumed to be specific and costly to break, and neither firm can earn anything outside the established relationship.[7] In the second stage, the exporter sets the price p_{ii}^x that maximizes his domestic profit, π_{ii}^x, which yields $p_{ii}^x = \sigma/(\sigma - 1)$. Hence, the firm applies a constant mark-up to unit production costs. Analogously, the independent distributor maximizes his after-tax profit

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

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[7] Independent distributors make irreversible investments in advertising, marketing, and distribution channels. Exporters make similar investments on behalf of their distributors. The specific relationship is often written down in, and enforced by, exclusivity contracts that stipulate large penalties in the case of unilateral separation. This assumption is common in papers that study the trade-off between vertical integration and outsourcing (Spencer 2005).

where $q_{ij}^d \equiv q_{ij}(p_{ij}^d)$, setting the consumer price $p_{ij}^d = r_i^x \sigma/(\sigma - 1)$. The distributor's and the exporter's profits are then given by

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

We follow Klein and Schmidtke (2008) and assume Nash bargaining in the first stage, where $0 < \alpha < 1$ stands for the distributor's bargaining power. The transfer price r_i^x that maximizes the Nash product $[\pi_j^d]^\alpha [\pi_{ij}^x]^{1-\alpha}$ is equal to

$$r_i^x = \beta, \quad \text{where} \quad \beta \equiv \frac{\sigma - \alpha}{\sigma - 1}. \qquad (8)$$

The parameter β captures the mark-up over marginal cost that the exporter includes in his external transfer price, and it is a measure of the inefficiency of the arm's length relationship. The market price is then equal to

$$p_{ij}^d = \frac{\sigma}{\sigma - 1}\beta. \qquad (9)$$

Expression (9) highlights the *double marginalization* problem that stems from the exporter and the independent distributor not internalizing the impact of their pricing decisions on each other's profit (e.g., Spencer 2005). When the distributor has all the bargaining power, he decides on both the external transfer price and the consumer price so that the double marginalization vanishes. In other words, the inefficiency increases with the exporter's bargaining power $1 - \alpha$. To sum up, as in the incomplete contracts literature following Grossman and Hart (1986), *exporters incur a cost because of the inefficiency of their arm's length relationship with the independent distributor.*

For future reference, let us use (8) and (9) to write the exporter's after-tax profit as the sum of its domestic and foreign parts as follows:

$$\pi_{ii}^x = \kappa \theta_i I_i \mathbb{P}_i^{\sigma-1} \varphi_i \quad \text{and} \quad \pi_{ij}^x = \kappa \theta_i I_j \mathbb{P}_j^{\sigma-1} \gamma, \qquad (10)$$

where $\kappa \equiv \mu \sigma^{-\sigma}(\sigma - 1)^{\sigma-1} > 0$; and where $\gamma \equiv \beta^{-\sigma}(\beta - 1)(\sigma - 1) \in (0, 1/e)$, with e being 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.

4. Multinational Structure

We next characterize the choices of multinational firms that operate with a fully owned foreign subsidiary. Contrary to exporters, multinationals can shift profits between their units using transfer prices. Let r_i stand for that transfer price, which we refer to as the *internal transfer price* (i.e., within multinationals). By integrating their upstream and downstream activities across

countries, multinationals can not only manipulate transfer prices but also avoid the inefficiencies of arm's length relationships with an independent distributor. The multinational retains full control over its consumer prices, yet has to incur itself the marketing cost.

To simplify notation, let us drop the reference to the variety v and focus on multinationals located in country i. All of our subsequent results apply to any multinational and any country. The multinational sets its domestic and foreign product prices p_{ii} and p_{ij}, as well as its transfer price r_i. Both domestic and foreign profits are deflated by the firm-specific marketing parameter φ_i.

Let $q_{ii} \equiv q_{ii}(p_{ii})$ and $q_{ij} \equiv q_{ij}(p_{ij})$. The multinational's profit includes three terms: the profit from domestic sales taxed at the domestic rate, $\pi_{ii} = \theta_i (p_{ii} - 1) q_{ii}\varphi_i$; the profit declared by the foreign affiliate taxed at the foreign rate, $\pi_{ij}^{\text{for}} = \theta_j (p_{ij} - r_i) q_{ij}\varphi_i$; and the profit declared by the multinational from its sales to its affiliate taxed at the domestic rate, $\pi_{ij}^{\text{dom}} = \theta_i (r_i - 1) q_{ij}\varphi_i$. Adding the latter two yields the multinational firm's *after-tax profits from foreign sales* as follows: $\pi_{ij} \equiv \pi_{ij}^{\text{for}} + \pi_{ij}^{\text{dom}} = \theta_j (p_{ij} - R_i) q_{ij}\varphi_i$, where

$$R_i \equiv r_i - \frac{\theta_i}{\theta_j}(r_i - 1) \tag{11}$$

denotes the multinational's *tax-adjusted marginal cost* of serving the foreign market.[8] The multinational's total profit is of course given by $\Pi_i \equiv \pi_{ii} + \pi_{ij}$. Note that expression (11) shows that the tax-adjusted marginal cost is a convex combination of the multinational's marginal cost and its transfer price, the weights being parameterized by the tax rates. As in the exporter structure, the multinational only cares about the transfer price r_i. However, in contrast to the case of 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.

We now discuss the firms' pricing and production decisions under the CUP transfer pricing rule (see Appendix A.1 for results using alternative rules). Since varieties are symmetric in our model, a valid basis for comparison in that case are the prices prevailing between an exporter in country i and an independent distributor in country j. The tax authorities observe the cost borne by the distributor for each unit it sells which, by (8), equals $r_i^x = \beta$. This is precisely the *comparable uncontrolled price* that the tax authorities impose on transactions within the multinationals.[9] Multinational affiliates may eventually declare losses by setting their sales price p_{ij} below the

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[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.

[9] In practice, tax authorities may sanction multinationals reporting transfer prices that deviate from observable equivalent market transactions. In our simple model, where firms

transfer price r_i. Yet, no tax authority will indefinitely grant tax credits to multinationals that repeatedly declare losses. In our simple static model, we capture this by imposing a nonnegativity constraint on profits in both countries (see Peralta *et al.* 2006). To avoid granting perpetual tax credits, tax authorities impose $p_{ij} \geq r_i$ so that $\pi_{ij}^{\text{for}} \geq 0$.[10]

Suppose first that multinationals have no incentives to declare affiliate losses in their foreign market. Recalling that (11) is the tax-adjusted marginal cost of serving the foreign market, the optimal product prices are given by

$$p_{ii}^c = \frac{\sigma}{\sigma - 1} \quad \text{and} \quad p_{ij}^c = \frac{\sigma}{\sigma - 1} R_i, \tag{12}$$

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

$$\frac{\theta_j}{\theta_i} \geq \widehat{\theta}, \quad \text{where} \quad \widehat{\theta} \equiv \frac{\sigma(\beta - 1)}{\beta} = \frac{\sigma - \sigma\alpha}{\sigma - \alpha} \in (0, 1). \tag{13}$$

Observe that the foregoing inequality is always satisfied for multinationals producing in the high-tax country 1, because $\theta_2/\theta_1 \geq 1$. For multinationals producing in the low-tax country 2 it is, however, satisfied if and only if $\theta_1/\theta_2 \geq \widehat{\theta}$. From now on, we assume that this condition holds.[11]

The profits generated in each market are given by

$$\pi_{ii}^c = \kappa \theta_i I_i \mathbb{P}_i^{\sigma-1} \varphi_i \quad \text{and} \quad \pi_{ij}^c = \kappa \theta_j I_j \mathbb{P}_j^{\sigma-1} R_i^{1-\sigma} \varphi_i \quad \text{if} \quad \theta_j/\theta_i \geq \widehat{\theta}. \tag{14}$$

As in Devereux and Keuschnigg (2009), we now compare the CUP prices with the prices set by *unconstrained multinationals*, i.e., multinationals that face no restrictions on their transfer prices. These firms are, therefore, able to shift all profits generated in the high-tax country to the low-tax country. Consequently, they set the same prices as those they would set in the absence of taxes (see Appendix A.2 for the proof):

$$p_{ii}^* = p_{ij}^* = \frac{\sigma}{\sigma - 1}, \tag{15}$$

where asterisks superscript unconstrained values. Because the tax rate is lower in country 2, the after-tax profits in each market are given by

$$\pi_{ii}^* = \kappa \theta_2 I_i \mathbb{P}_i^{\sigma-1} \varphi_i \quad \text{and} \quad \pi_{ij}^* = \kappa \theta_2 I_j \mathbb{P}_j^{\sigma-1} \varphi_i. \tag{16}$$

The presence of θ_2 in those expressions is due to the fact that multinationals producing in either country $i = 1, 2$ pay their taxes in the low-tax country 2.

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are homogenous, the equivalent transactions give the exact value of the price that tax authorities impose.

[10] Multinationals do not declare losses in their country of production, i.e., $\pi_{ii} + \pi_{ij}^{\text{dom}} > 0$, because $r_i = \beta \geq 1$.

[11] Behrens, Peralta, and Picard (2010) analyze the case where $\theta_1/\theta_2 < \widehat{\theta}$. The qualitative results are the same.

In that case, tax differences have no impact on consumer prices and firms' market shares, and the tax-adjusted marginal cost to serve the foreign market is equal to one. The unconstrained multinational chooses its prices and outputs independently from considerations of tax manipulation.

Under the CUP transfer pricing rule, in contrast, tax differentials matter for the firms' pricing and production decisions. This is because *the CUP transfer price is affected by the inefficiency existing in the arm's length relationship between exporters and distributors.* A larger inefficiency, β, translates into a higher transfer price r_i, which itself makes tax-adjusted marginal costs diverge. In particular, since $\theta_1/\theta_2 < 1$, the tax-adjusted marginal costs of serving foreign markets rank as $R_1 \geq 1 \geq R_2$, which implies that the export prices and quantities rank as $p_{12}^c > p_{ij}^* > p_{21}^c$ and $q_{12}^c < q_{ij}^* < q_{21}^c$. When compared to the benchmark, the CUP rule inflates the tax-adjusted marginal cost R_1 of serving the low-tax country 2 from the high-tax country 1. This is due to the upward bias on the transfer price as compared to marginal cost, which constrains the firms producing in the high-tax country to shift profits against their will. As a result, they reduce their domestic tax base by cutting their shipments q_{12}^c to the foreign market and increase their foreign tax base by charging a higher foreign price p_{12}^c. Conversely, the same upward bias on the transfer price helps the multinationals producing in the low-tax country to shift their foreign profits at home. Toward this aim, they expand their domestic tax base by boosting their shipments q_{21}^c to their foreign market and reduce their foreign tax base by charging a lower foreign price p_{21}^c. Hence, *the CUP transfer prices result in too little production by the multinationals producing in the high-tax country; and in too much production by the multinationals producing in the low-tax country.* Interestingly, tax differences have an impact on market shares under the CUP rule since multinationals use their production volumes to manipulate their tax liabilities.

We can summarize the foregoing results as follows:

PROPOSITION 1: *Compared to the marginal cost transfer price in the unconstrained profit shifting benchmark, under the CUP rule 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 under CUP transfer pricing results from the additional mark-up arising in the arm's length relationship between exporters and independent distributors. The transfer prices are thus above the "technological costs."[12] Observe that the inefficiency we have highlighted 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.

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[12] In Appendix A.1, we show that this result also applies to the case of the CP transfer pricing rule.

COROLLARY 1: *When products are perfect substitutes ($\sigma \to \infty$), the CUP transfer pricing rule yields the marginal cost transfer price.*

Corollary 1 provides an economic rationale for the OECD guidelines. However, it also compels us to be careful. First, transfer prices under the CUP rule only converge to the marginal cost transfer prices in the limit of a perfectly competitive industry, and yields quite different outcomes otherwise. Second, at the competitive limit, profits tend to zero so that taxation and the choice of a transfer pricing rule become essentially irrelevant. Finally, even small differences in profits under different organizational structures may lead firms to not choose the same structure under different transfer pricing rules—even when goods are very close substitutes. We now turn to this issue in more detail by examining firms' choices of organizational structure.

5. Choice of Organizational Structure

We now turn to the firms' organizational choices. On the one hand, inefficiencies in the arm's length relationship with distributors, as well as tax considerations, provide incentives for "going multinational." On the other hand, distribution cost savings push for becoming an exporter.

To isolate the pure effects of transfer pricing rules on firms' organizational choices, we abstract from compositional effects by assuming that the variety-specific efficiency parameters $\varphi_i(v)$ are distributed with the same cumulative distribution function $F(\varphi)$ in both countries. A firm v with $\varphi_i(v)$ chooses to operate a multinational structure if doing so yields higher profits than being an exporter:

$$\pi_{ii} + \pi_{ij} \geq \pi_{ii}^x + \pi_{ij}^x. \tag{17}$$

Note that the multinational's profit from 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. Comparing expressions (10) and (14) reveals that a firm chooses the multinational structure if and only if its variety-specific efficiency parameter $\varphi_i(v)$ exceeds the threshold

$$\varphi_i^c \equiv \gamma \frac{\theta_i}{\theta_j} R_i^{\sigma-1} = \gamma \frac{\theta_i}{\theta_j} \left[\beta - \frac{\theta_i}{\theta_j}(\beta - 1) \right]^{\sigma-1}. \tag{18}$$

Observe that (18) depends both on the tax differential θ_i/θ_j and the inefficiency in the arm's length relationship β. In the absence of tax differences ($\theta_i/\theta_j = 1$), firms with high marketing efficiency ($\varphi_i(v) > \varphi_i^c = \gamma$) choose a multinational structure because they prefer to avoid the foreign distributors and their associated inefficiencies. The other firms have too bad foreign marketing processes and have recourse to a foreign distribution system. However, when taxes differ, the choice of a multinational structure also

depends on profit shifting motives. One can verify that $\varphi_1^c < \gamma < \varphi_2^c$. Consequently, firms producing in the low-tax country 2 have less incentives to adopt a multinational structure. 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, $1 - F(\varphi_1^c)$.

We have established in the previous section that the CUP method reduces export shipments of the multinationals in the high-tax country 1 and increases export shipments of the multinationals in the low-tax country 2 when compared to the benchmark case of unconstrained transfer pricing. Not surprisingly, this translates into different organizational choices. When the multinational firm is unconstrained, comparing expressions (10) and (16) yields the thresholds

$$\varphi_2^* \equiv \gamma \quad \text{and} \quad \varphi_1^* \equiv \frac{\frac{\theta_1}{\theta_2}\gamma}{1 + \left(1 - \frac{\theta_1}{\theta_2}\right)\frac{I_1}{I_2}\left(\frac{\mathbb{P}_1}{\mathbb{P}_2}\right)^{\sigma-1}}. \tag{19}$$

When the multinational firms are unconstrained, multinationals and exporters producing in the low-tax country 2 are taxed at the same rate. Hence, taxation is irrelevant for their organizational choice. The threshold $\varphi_2^* \equiv \gamma$ then results solely from the trade-off between the inefficiencies in the arm's length relationship and the variety-specific marketing costs. Moreover, one can check that $\varphi_1^* < \varphi_2^*$ since $\theta_1 < \theta_2$. As a result, the mass of multinationals producing in the high-tax country, $1 - F(\varphi_1^*)$, always exceeds that in the low-tax country. The reason is that multinationals avoid the taxes that exporters must pay on the profit generated by foreign sales.

Firms' organizational choices are summarized in Figure 1, which depicts the loci of the thresholds under unconstrained profit shifting ($*$) and CUP transfer pricing rules (c). The vertical distance of φ from the x-axis measures (up to a monotonically increasing transformation) the mass of exporters, $F(\varphi)$, whereas the vertical distance between φ and the top of the figure measures the mass of multinationals, $1 - F(\varphi)$.

Using the foregoing results, the various thresholds are ranked as follows (see Appendix A.3 for additional details):

$$\varphi_1^* < \varphi_1^c < \varphi_2^* < \varphi_2^c. \tag{20}$$

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 with the distributors and the variety-specific marketing costs. When tax differentials are larger (θ_1/θ_2 decreases), the firms producing in the high-tax country 1 have stronger incentives to choose the multinational structure, whereas those producing in the low-tax country 2 have strong incentives to choose the exporter structure. Hence, under CUP, firms' organizational incentives diverge across countries as tax differences grow larger.
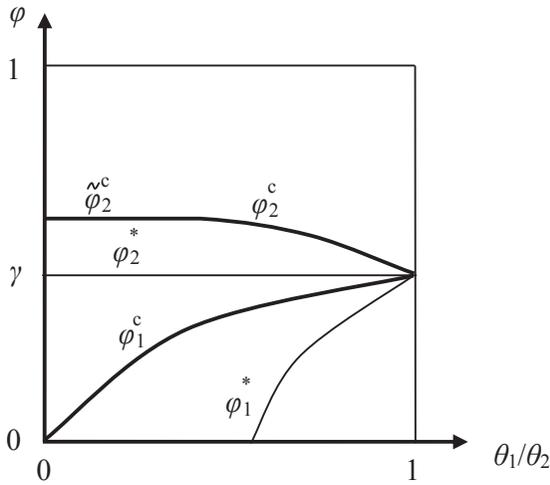
Figure 1: Choice of production structure.

We can summarize the foregoing results as follows (see Appendix A.3 for the proof):

PROPOSITION 2:   *(i) Incentives to choose a multinational structure are always stronger in the high-tax country ($\varphi_1^k < \varphi_2^k$, for $k = c, *$). (ii) Incentives to choose a multinational structure are always weaker under CUP than under unconstrained profit shifting ($\varphi_i^* < \varphi_i^c$, $i = 1, 2$). (iii) Under CUP, incentives across countries diverge as tax differences increase (i.e., as θ_1/θ_2 decreases). (iv) Under unconstrained profit shifting, incentives across countries diverge as tax differences increase provided that $\mathbb{P}_1/\mathbb{P}_2$ does not fall too much, which is true for small tax differences.*

Note that the foregoing results also hold when products are 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 different transfer pricing rules are not the same, so that firms are not indifferent as to their organizational structure. We can summarize this result as follows (see Appendix A.4):

COROLLARY 2:   *When products are close to perfect substitutes ($\sigma \to \infty$), the mass of multinational firms under CUP does not converge to the mass of multinational firms under unconstrained profit shifting. The ranking (20) continues to apply.*

One comment is in order. For simplicity, we abstract from concealment costs in this paper. Yet, much of the literature on transfer pricing embeds

concealment costs, which is one of the most important business areas of the world's biggest accounting firms. Observe that our foregoing results can be extended to the case with such costs. First, in the absence of concealment costs, firms are free to use the multinational structure to avoid taxation, hence their behavior is congruent to that under unconstrained profit shifting. Second, if the OECD transfer pricing rule is the international standard, firms must apply that rule when the concealment cost is infinite. The prices and organizational structure are then given by the above results. Finally, we can readily infer the firms' prices and organizational structure when concealment costs take intermediate values. In that case, firms will choose transfer prices and organizational structures between those prevailing under unconstrained profit shifting and the CUP rule. The mass of multinational firms producing in country i will lie between the curves φ_i^* and φ_i^c in Figure 1. Higher concealment costs will, therefore, naturally decrease the mass of multinationals producing in both countries by making transfer pricing more costly.

6. Welfare

We now investigate the impact of pricing decisions and organizational choices on consumers' utility, an aspect that is usually disregarded in the discussion on the design of transfer pricing rules. The OECD transfer pricing rules have a dual objective: (i) help tax authorities and multinationals to find mutually satisfying solutions to transfer pricing disputes, thereby minimizing conflict and costly litigation; and (ii) as a means to achieve the OECD's objectives, i.e., to promote a high standard of living and the efficient use of economic resources.

Our analysis shows so far that transfer pricing rules create distortions in imperfectly competitive markets. This is bound to harm some consumers and to benefit others. The literature on transfer pricing has predominantly focused on tax revenue and production efficiency. Less attention has been paid to how transfer pricing rules affect the "standard of living," i.e., consumers' utility. This is the focus of this section. We first analyze the consumer surplus by sterilizing income differences among consumers, and we then examine the impact of transfer pricing when tax revenues are redistributed to consumers.

6.1. Intensive and Extensive Margins

We first discuss the impact of transfer prices on the price indices, $\mathbb{P}_i$, by assuming that $I_1 = I_2$. This is the case in our model when consumers neither receive profits nor tax proceeds. Alternatively, it also holds when consumers have identical claims to global profits. This setup can be seen as a first approximation of the total welfare effects because the proceeds

from the taxation of multinationals usually represent only a small share of GDP.

The consumers' utility (5) is an increasing function of the CES price index, given by

$$\mathbb{P}_i^{1-\sigma} \equiv \left(p_{ii}^r\right)^{1-\sigma} + \left(1 - m_j\right)\left(p_{ji}^d\right)^{1-\sigma} + m_j\left(p_{ji}^r\right)^{1-\sigma}$$

$$= \left[\left(p_{ii}^r\right)^{1-\sigma} + \left(p_{ji}^d\right)^{1-\sigma}\right] + m_j\left[\left(p_{ji}^r\right)^{1-\sigma} - \left(p_{ji}^d\right)^{1-\sigma}\right], \qquad (21)$$

for a transfer pricing rule $r = c, *$. Using our foregoing results, we know that $p_{ii}^r = \sigma/(\sigma - 1)$ and that $p_{ji}^d = \beta\sigma/(\sigma - 1)$, both of which are independent of the transfer pricing rules, the location of multinationals, and the location of consumers. Hence, the first term in expression (21) is constant. Transfer pricing rules only affect the second term of (21). They have an effect on the *intensive margin* through foreign multinationals' prices p_{ji}^r for serving market i, and on the *extensive margin* through the mass of foreign multinationals m_j. We study each of those effects in turn.

Expressions (9), (12), and (15) allow us to rank the sales prices in the foreign markets as follows:

$$p_{21}^c < p_{ij}^* < p_{12}^c < p_{ij}^d, \quad \forall i, j \quad \text{and} \quad i \neq j. \qquad (22)$$

The highest prices, p_{ij}^d, are always set by the independent distributors. This is because of the double marginalization arising in the arm's lenght relationship. Under the CUP rule, the transfer price entices the multinational firms producing in the high-tax country 1 to shift their domestic tax base to the low-tax country 2 by setting a higher export price p_{12}^c and by underproducing for their export market. As the tax differential widens (θ_1/θ_2 falls), the gap in multinationals' sales prices also widens across countries and strengthens the consumption advantage in the high-tax country because imports get cheaper there. Hence, conditional on both countries having the same industry structure, the high-tax country has access to cheaper products under the CUP rule. To summarize, the intensive margin is larger in the high-tax country and offers a consumption advantage to the consumers there. By contrast, in the case of unconstrained profit shifting there is no intensive margin as prices are unaffected by profit tax differentials.

It is worth noticing the market power, arm's lenght relationship, and profit shifting create economic distortions that may operate in different directions. Market power entices firms to set their prices with a positive markup over their marginal costs while the arm's length relationship with distributors obliges them to distort their prices further up. However, profit shifting motives create distortions in both directions. On the one hand, profit shifting entices the firms producing in the high-tax country to raise their foreign prices p_{12}^c at an intermediate level. In this respect, tax motives generate less distortion than the arm's length relationship. On the other hand, profit shifting gives incentives to the firms producing in the low-tax country to set

their prices p_{21}^c closer to their true marginal cost. Profit shifting then mitigates market power in the high-tax country. One can finally readily check that higher tax discrepancies mitigate the price inefficiencies in the high-tax country whereas they amplify them in the other country.

In addition to intensive margin effects, transfer pricing rules do have extensive margin effects because they affect firms' organizational choices. Since the mass of multinationals, m_i^r, is equal to $1 - F(\varphi_i^r)$, we can make use of (20) to derive the following ranking:

$$m_2^c < m_2^* < m_1^c < m_1^*. \tag{23}$$

Under either CUP rules or unconstrained profit shifting, the high-tax country 1 hosts more multinationals and the low-tax country 2 more exporters. Consequently, imports in the high-tax country are more often done by exporters contracting with independent distributors. Consumers in the high-tax country thus purchase a larger share of products at the higher prices set by the distributors. Firms' organizational choices hence give a consumption disadvantage to consumers residing in the high-tax country. This extensive margin effect is stronger for larger tax differentials because the shares of multinationals in the two countries diverge with increasing tax differences.

Because the intensive and the extensive margin effects go in opposite directions, we have to check their combined effect on consumers' utility. For the CUP rule, we have

$$U_1^c > U_2^c \iff \frac{m_2^c}{m_1^c} = \frac{1 - F\left(\gamma R_2^{\sigma-1}\theta_2/\theta_1\right)}{1 - F\left(\gamma R_1^{\sigma-1}\theta_1/\theta_2\right)} > \frac{(\beta/R_1)^{\sigma-1} - 1}{(\beta/R_2)^{\sigma-1} - 1}. \tag{24}$$

Since the two sides of condition (24) are smaller than one, the overall effect is *a priori* ambiguous. Nevertheless, we shown in Appendix A.5 that (24) is always satisfied when tax differentials are small ($\theta_1/\theta_2 \to 1$) and/or when the distribution F is uniform. When these conditions hold, the intensive margin effect dominates the extensive margin effect: consumers are then better off in the high-tax country 1 because they benefit more from the cheaper imports of foreign multinationals than they lose from the increased presence of distributors who charge higher prices. Let us summarize these results in the following proposition:

PROPOSITION 3:   *Assume that consumers have the same income, and that tax differences are small and/or the distribution of φ_i is uniform. Then, under the CUP transfer pricing rule, consumers' utility in the high-tax country exceeds that in the low-tax country. Moreover, the cross-country gap in utility widens as tax differentials increase.*

Note that this conclusion differs from the one in the benchmark case of unconstrained profit shifting. Because the latter features only extensive margin effects the consumers in the high-tax country are worse off as they

are served by a larger mass of independent distributors: $U_1^* < U_2^*$ since $m_1^* > m_2^*$. It is also worth pointing out that this result is the same as in Devereux and Keuschnigg (2009): the CUP rule benefits the high-tax country at the expense of the low-tax one. Our mechanism and our model are, as pointed out before, however quite different from theirs.

The distortions arising from imposing the arm's length principle upon multinational firms imply a transfer of welfare from the low-tax country 2 to the high-tax country 1. An important question is then the extent to which the gains in country 1 are offset by the losses in country 2. As we show in the next proposition, imposing the CUP rule on otherwise unconstrained multinationals actually worsens *global* welfare (see also Devereux and Keuschnigg 2009).

PROPOSITION 4:   *Assume that consumers have the same income and that the distribution of φ_i is uniform. Then, if tax differences are small, the total consumer surplus is lower under the CUP transfer pricing rule than when multinationals are unconstrained.*

To understand this result, the proof of which is given in Appendix A.6, suppose that both countries initially have the same tax rate.[13] In that case, pricing decisions and organizational choices under CUP coincide with those in the unconstrained case, and the two scenarios yield the same welfare. Now let country 1 increase its tax rate. In the unconstrained case, the consumer surplus in the high-tax country does not change, since both the export prices and the organizational choices in country 2 are unaffected by the tax change. However, the increase in the number of multinationals operating in country 1 benefits the consumers in country 2. Hence, total welfare increases. When CUP is applied, by contrast, both prices and organizational choices change in both countries, but the change is exactly symmetric (as is clear from Figure 1). Hence, global welfare does not change.

In order to fully assess the consequences of the CUP rule, it is important to compare tax revenue. One of the main motivations of the OECD in the design of the transfer pricing rules is precisely to prevent fiscal erosion. We can show the following result (see Appendix A.7):

PROPOSITION 5:   *Assume that consumers have the same income and that the distribution of φ_i is uniform. Then, if tax differences are small, the total tax revenue is higher under the CUP transfer pricing rule than when multinationals are unconstrained.*

The foregoing result is another consequence of the symmetric price changes under CUP, which translate into symmetric changes in the

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[13] Nielsen *et al.* (2010) and Devereux and Keuschnigg (2009) also perform welfare comparisons around the symmetric tax setting.

number of firms that decide to go multinational. The intensive and extensive margin effects of a change in country 1's tax rate cancel out, and only the positive first-order impact of the tax increase on tax revenue remains. This is no longer the case when transfer pricing is unconstrained, as the firms' choice of organizational structure leads them to decrease their overall tax liabilities. This second-order effect adds to the first-order one, making for a lower overall tax revenue. This result provides a justification for the arm's length principle: it allows for greater tax revenue. Yet, at the same time, this higher revenue comes at the expense of a lower consumer surplus. In the end, the global desirability of CUP thus strongly depends on the use that national governments make of the fiscal revenue.[14]

6.2. Income and Tax Redistribution Effects

Proposition 3 states that, when consumer incomes are the same, the high-tax country gains from the OECD's CUP guidelines, whereas the low-tax country loses from it. We now use numerical simulations to check the robustness of this conclusion when a more comprehensive measure of income is used. To this end, we endow each consumer with half of the global portfolio of firms and let him receive the associated net profits. We subsequently integrate the government into the analysis by letting the tax proceeds of each country be distributed to the country's consumers. In this latter scenario, the income naturally becomes asymmetric across countries.

Figure 2 plots individual utility levels as a function of the distributor's bargaining power for $\sigma = 5$, $\mu = 1/2$, and $L = 1$.[15] The top and bottom panels depict the configurations with CUP and unconstrained transfer pricing, respectively. The left-hand panels depict configurations where the countries set the same tax rates $t_1 = t_2 = 25.5\%$, which corresponds to the average tax rate of the OECD countries.[16] The thick curves are those associated with the case where consumers earn only their wage ($I_1 = I_2 = 1$). The medium-thick curves represent the case where individuals earn their wages plus an identical share of global net profits. Finally, the thin curves are plotted for the case

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[14] Our results contrast with those of Devereux and Keuschnigg (2009, p. 3) who focus on the sum of global net profits and fiscal revenue. This difference stems from the fact that, in our model, transfer prices are pure profit shifting devices, whereas in Devereux and Keuschnigg (2009) they serve strategic purposes. As acknowledged by the authors, their result hinges on the fact that "tax authorities, when observing arm's length prices, tend to misinterpret high transfer prices and low royalties as a result of tax induced profit shifting while, in fact, these choices reflect an efficient organization of worldwide production by multinational firms."

[15] This amounts to assuming that multinational prices are 25% above marginal cost. The results are invariant to L and qualitatively invariant to μ. A lower μ reduces the multinationals' profits and their effect on individuals' incomes. Changes in tax rates do not qualitatively alter the results either.

[16] These figures and subsequent ones are computed from the OECD official data on nominal corporate income tax rates for the year 2011, combining both central and local government taxes.
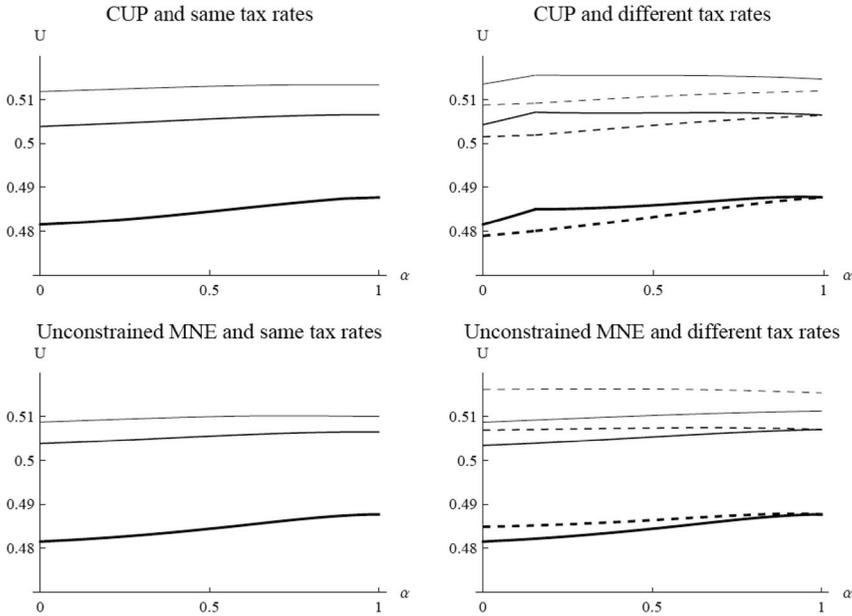
Figure 2: Utility levels.

where consumers receive an identical share of local tax proceeds in addition to their other earnings (wages and net profits).

The two panels depict a number of interesting findings. In the absence of tax differences in the two left-hand panels, utility increases with the distributors' bargaining power α. When $\alpha = 1$, the distributors claim the full share of their sales revenues so that the inefficiencies of double marginalization under CUP vanish. Exporters then set their external transfer prices to their marginal cost and distributors set the same prices as multinationals. Consumers benefit at the intensive margin through lower prices, and thus consumer surplus increases with α. Utility also increases whenever profits and tax revenues are redistributed to consumers. Profits and tax revenues fall because of double marginalization and transfer pricing under CUP, but this fall does not outweigh the gains in consumer surplus. Comparing the top-left and bottom-left panels of Figure 2, we indeed see that welfare is higher under CUP than under unconstrained multinationals.

The two right-hand panels depict countries with two different tax rates. Those tax rates are equal to the averages of the above-median and below-median tax rates of OECD countries, respectively ($t_1 = 31\%$ and $t_2 = 21\%$). The solid lines depict utility in the high-tax country 1, and the dashed lines utility in the low-tax country 2. The thick solid and dashed curves confirm our previous findings: under the CUP rule, consumers in the high-tax country benefit from a higher consumption surplus than those in the low-tax country 2, whereas the opposite conclusion holds in the case of

unconstrained multinationals. Note that consumers achieve the same utility in both countries when the distributors' bargaining power is maximal ($\alpha = 1$). In that case, double marginalization and CUP transfer pricing induce no price distortions. When α is close to zero, however, multinationals repatriate the whole profits from the high to the low-tax country even under the CUP pricing rule (see condition (13) in the above). This explains the discontinuity in the slope of utility around $\alpha = 0.15$ in the top-right panel. The medium-thick curves lead to the same conclusion when profits are redistributed to consumers. A uniform redistribution of profits indeed uniformly increases consumers' purchasing power, maintaining the existing consumer surplus differences. Finally, the thin curves show the effect of tax proceeds on individuals' utility levels. As one expects, under CUP transfer pricing, the high-tax country collects more taxes and redistributes more to local consumers. By contrast, the low-tax country collects more taxes when multinationals are unconstrained.

To conclude, under CUP transfer pricing, welfare in the high-tax country is higher than in the low-tax country, *irrespective of the definition of income.* This suggests that the CUP rule serves the interests of the high-tax country both in terms of consumer surplus and in terms of tax revenue. The opposite conclusion is true when multinational firms are unconstrained. These findings suggest that agreeing on transfer pricing principles may be difficult when tax rates differ across countries.

7. Conclusions

We have developed a monopolistic competition model to analyze the impacts of OECD transfer pricing rules on firms' pricing decisions, their organizational choices, consumers' utility, and tax revenues. 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.

We compare the CUP rule, as suggested by the OECD, with the benchmark case of unconstrained profit shifting where all profits can be repatriated to the low-tax country. In the high-tax country, the incentives to operate a multinational with fully owned and controlled affiliates are lower under CUP transfer pricing than under unconstrained profit shifting. Firms are thus more likely to adopt an exporter structure using independent distributors, which affects the market outcome because of inefficient double marginalization. The same holds true in the low-tax country. Hence, higher tax revenues when profit shifting is restricted may be more than offset by higher prices as firms switch to less efficient organizational structures and rely more on inefficient arm's length transactions.

When markets are not competitive, transfer prices are not guaranteed 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 the high-tax country has a higher consumer utility than the low-tax country, which is in sharp contrast to the outcome under the unconstrained benchmark. 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 are largest in the unconstrained benchmark. By contrast, 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. We show that OECD rules reduce overall consumer surplus, although it allows the countries to increase their fiscal revenue.

By means of simulations, we examine the general equilibrium of our analysis by including tax revenue and firm dividends in consumer income. The simulations show that, as expected, increasing income has a positive effect on welfare. It also confirms that the high-tax country gains from the introduction of the OECD rules when compared to a previously unregulated world, whereas the low-tax country looses from it. This suggests that mutual agreement on transfer pricing rules may be a complicated issue, and that the way tax revenue is spent is crucial in assessing the overall welfare effects of transfer pricing regulations.

Appendix

A.1. Cost-Plus Transfer Pricing

In this appendix, we show that our results are robustness to the choice of another transfer pricing rule recommended by the OECD, namely, 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.

We now show that in our model the CP rule has the same properties as the CUP rule. Let the tax authorities in country i define the "appropriate" margin using the aggregate measure

$$\eta_i \equiv s_i \frac{r_i - 1}{1} + (1 - s_i) \frac{r_i^x - 1}{1}, \tag{A1}$$

where the mark-ups contain the transfer prices r_i and the unit production cost borne by the multinational producer established in country i; and

where $s_i \in (0, 1)$ and $1 - s_i$ are the weights put on multinationals' and exporters' mark-ups, respectively. Different weighting schemes are possible. For example, the weight on multinationals' mark-ups could be defined as $s_i = m_i/(m_i + x_i)$ if the tax authorities weight mark-ups by the mass of firms; but it could also be $s_i = m_i q_i^c/(m_i q_i^c + x_i q_i^x)$ if the tax authorities weight mark-ups by output volumes.

We first consider multinationals that produce in the high-tax country 1 and that want to shift profits to the low-tax country 2 by using a low transfer price r_1. Since the low-tax country always gains from multinationals' tax evasion, this country does not impose restrictions on the multinationals' transfer prices. Hence, we can limit the study to 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:

$$\eta_1 \leq \frac{r_1 - 1}{1} \quad \Longleftrightarrow \quad r_1 \geq 1 + \eta_1. \tag{A2}$$

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

$$\eta_2 \geq \frac{r_2 - 1}{1} \quad \Longleftrightarrow \quad r_2 \leq 1 + \eta_2. \tag{A3}$$

We now compute the equilibrium "appropriate" margins η_1 and η_2. These margins depend on transfer prices, which themselves depend on the constraints on the "appropriate" margins. In equilibrium, those constraints must be consistent with the transfer prices. Assume that multinationals have no incentives to declare perpetual losses. They set their transfer prices so that the constraints (A2) and (A3) are binding. The equilibrium can be computed by replacing $(r_i - 1)/1$ by η_i in expression (A1) and by using r_i^x as defined by (9). We then get

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

which reduces to $\eta_i = \beta - 1$. Observe that the weighting scheme used for computing the "appropriate" margin is immaterial for the equilibrium value of this margin. Furthermore, making use of the fact that the constraints (A2) and (A3) are binding, we obtain the transfer price under CP as follows: $r_i = \beta$. Hence, *tax authorities impose the same transfer price under CP than under CUP.* Thus, all result pertaining to CUP apply to CP. In particular, 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.

A.2. Unconstrained Multinationals

An unconstrained multinational producing in country i sets a transfer price r_i, as well as local and export prices p_{ii} and p_{ij}, to maximize its total profit given by

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

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

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

$$\pi_{ij}^{\text{for}} = (p_{ij} - r_i) q_{ij}\varphi_i \geq 0.$$

A small increase in r_i increases total profit if and only if $d\Pi_i/dr_i = (\theta_i - \theta_j) q_{ij}\varphi_i \geq 0$, 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 above 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 $r_1^* = 1 - (p_{11} - 1)(q_{11}/q_{12})$. Plugging r_1^* into the total profit yields $\Pi_1 = \pi_{12}^{\text{for}} = \theta_2 \left[(p_{11} - 1) q_{11} + (p_{12} - 1) q_{12}\right]\varphi_1$. The optimal prices are thus equal to $p_{11}^* = p_{12}^* = \sigma/(\sigma - 1)$, as given in Section 4. 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 $r_2^* = p_{21}$. The firm's total profit becomes $\Pi_2 = \pi_{22} + \pi_{21}^{\text{dom}} = \theta_2 \left[(p_{22} - 1) q_{22} + (p_{21} - 1) q_{21}\right]\varphi_2$. The optimal prices are thus also equal to $p_{22}^* = p_{21}^* = \sigma/(\sigma - 1)$.

A.3. Threshold Rankings and Proof of Proposition 2

We rank the thresholds φ_i and 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: $\varphi_1^* = (\theta\gamma)/[1 + (1 - \theta)(\mathbb{P}_1/\mathbb{P}_2)^{\sigma-1}(I_1/I_2)]$, $\varphi_2^* = \gamma$, $\varphi_1^c = \gamma\theta\left[\beta - \theta(\beta - 1)\right]^{\sigma-1}$ and $\varphi_2^c = \gamma\theta^{-1}[\beta - \theta^{-1}(\beta - 1)]^{\sigma-1}$.

(i)   We first show how φ_i^* varies with θ. On the one hand, we have $d\varphi_2^*/d\theta = 0$. On the other hand, using the implicit function theorem on (19), we have

$$\frac{d\varphi_1^*}{d\theta} = \frac{\gamma\left[1 + (1 - \theta)\frac{I_1}{I_2}\left(\frac{\mathbb{P}_1}{\mathbb{P}_2}\right)^{\sigma-1}\right] + \theta\gamma\frac{I_1}{I_2}\left(\frac{\mathbb{P}_1}{\mathbb{P}_2}\right)^{\sigma-1}}{\left[1 + (1 - \theta)\frac{I_1}{I_2}\left(\frac{\mathbb{P}_1}{\mathbb{P}_2}\right)^{\sigma-1}\right]^2 + \theta\gamma(1 - \theta)\frac{I_1}{I_2}\frac{d(\mathbb{P}_1/\mathbb{P}_2)^{\sigma-1}}{d\theta}}. \quad \text{(A4)}$$

The numerator is clearly positive while the denominator is ambiguous since

$$\frac{d(\mathbb{P}_1/\mathbb{P}_2)^{\sigma-1}}{d\theta}$$

$$= \frac{-f(\varphi_1^*)\left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma}\left(1-\beta^{1-\sigma}\right)}{\left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma}\left(1+\beta^{1-\sigma}\right)+(1-F(\varphi_2^*))\left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma}\left(1-\beta^{1-\sigma}\right)} \leq 0.$$

If the indirect impact of changes in φ_1^* on the price indices is small, or if $\theta \approx 1$, we have $d\varphi_1^*/d\theta > 0$. In addition, with a uniform distribution $F(\varphi) = \varphi$, we have

$$\varphi_1^* = \frac{\theta\gamma}{1+(1-\theta)\frac{1+\beta^{1-\sigma}+(1-\varphi_1^*)(1-\beta^{1-\sigma})}{1+\beta^{1-\sigma}+(1-\gamma)(1-\beta^{1-\sigma})}},$$

so that $d\varphi_1^*/d\theta > 0$.

Note also that $d\varphi_1^c/d\theta = \gamma \ [\beta-\theta(\beta-1)]^{\sigma-2} \ [\beta-\theta\sigma(\beta-1)]$, which is positive because $\beta-\theta(\beta-1) \geq 1$ and $\beta-\theta\sigma(\beta-1) \geq \beta - \sigma(\beta-1) = \alpha > 0$. Finally, $d\varphi_2^c/d\theta = -\gamma\theta^{-2} \ [\beta-\theta^{-1}(\beta-1)]^{\sigma-2} [\beta-\theta^{-1}\sigma(\beta-1)]$, which is negative for any θ exceeding $\widehat{\theta} \equiv \sigma(\beta-1)/\beta$.

(ii) We have the ranking $\varphi_1^r < \gamma \leq \varphi_2^r$, for $r = c, *$ 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 $r = c, *$.

(iii) We further obtain the ranking $\varphi_1^* < \varphi_1^c$ because $\varphi_1^c = \theta\gamma \ [\beta-\theta(\beta-1)]^{\sigma-1} > \theta\gamma$ since $\beta-\theta(\beta-1) \geq 1$.

(iv) Finally, we get the ranking $\varphi_2^* < \varphi_2^c$ because $d\varphi_2^*/d\theta = 0 > d\varphi_2^c/d\theta$.

A.4. Proof of Corollary 2

We compute the limits of the thresholds when $\sigma \to \infty$. First, we have $\lim_{\sigma\to\infty} \gamma \equiv (1-\alpha)e^{-(1-\alpha)}$ where e denotes Euler's number. It is then immediate to verify that $\lim_{\sigma\to\infty} \varphi_1^c = (1-\alpha)\theta e^{-(1-\alpha)\theta}$. Furthermore, $\lim_{\sigma\to\infty} \varphi_2^c = (1-\alpha)\theta^{-1}e^{-(1-\alpha)\theta^{-1}}$ if $\theta \geq \widehat{\theta}$ (or, equivalently, $\theta \geq (1-\alpha)$). Next, using $\theta < 1$, we successively have $\lim_{\sigma\to\infty} \varphi_1^* = \theta(1-\alpha)e^{-(1-\alpha)}/ [1+(1-\theta)\lim_{\sigma\to\infty}(\mathbb{P}_1/\mathbb{P}_2)^{\sigma-1}] < \theta(1-\alpha)e^{-(1-\alpha)} <\theta(1-\alpha)e^{-(1-\alpha)\theta}$. We also have from the foregoing $\lim_{\sigma\to\infty} \varphi_2^* = (1-\alpha)e^{-(1-\alpha)}$. We then finally have $\lim_{\sigma\to\infty} \varphi_1^* < \lim_{\sigma\to\infty} \varphi_2^r$, $r = c, *$, whereas $\lim_{\sigma\to\infty} \varphi_1^* < \lim_{\sigma\to\infty} \varphi_1^c$ and $\lim_{\sigma\to\infty} \varphi_2^* < \lim_{\sigma\to\infty} \varphi_2^c$. ∎

A.5. Proof of Proposition 3

Let $\theta \equiv \theta_1/\theta_2 < 1$ and assume that $I_1 = I_2$. Given a transfer pricing rule ($r = c, *$), consumers' utility in country i exceeds that in country j if and only 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 (24) for the CUP rule. We now provide sufficient conditions under which (24) is satisfied. First, note that it is satisfied for small tax differences. To see this, let

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

and

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

Note that $G(1) = H(1) = 0$ since $R_1 = R_2 = 1$ in that case. Condition (24) 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 then readily obtain $G'(1) = 2\gamma(\beta - 1)(\sigma - 1)\left[-F'(\gamma)\right]/\left[1 - F(\gamma)\right]$ and $H'(1) = 2\beta^{\sigma-1}(\sigma - 1)(\beta - 1)/\left(\beta^{\sigma-1} - 1\right)$, 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 $0 < F'(\gamma) \leq 1$ and $\beta \geq 1$.

We next show that condition (24) is satisfied for the uniform distribution $F(x) = x$. Indeed, given that assumption and using the definition of β, we see 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 all numerators and denominators are positive. Letting $Z(y) \equiv \ln[1 - y(\sigma - 1)(1 - y)^{\sigma-1}] + \ln[(1 - y)^{1-\sigma} - 1]$, 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 $\theta > \hat{\theta}$ by assumption, 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

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

The numerator and the denominator are positive because $y < 1/\sigma < 1$, and because $(1 - y)^{1-\sigma} - y(\sigma - 1)$ is an increasing function for $y > 0$ that is equal to 1 at $y = 0$.

A.6. Proof of Proposition 4

With symmetric taxes ($\theta_1 = \theta_2$) and a uniform distribution of φ, we have $m_1^c = m_2^c = m_1^* = m_2^* = 1 - \gamma$. Moreover, $p_{ij}^* = p_{ij}^c = \sigma/(\sigma - 1)$. Hence at

the symmetric equilibrium, $U_1^c = U_2^c = U_1^* = U_2^*$. Let country 1 marginally increase its tax rate, i.e., θ_1 and hence $\theta = \theta_1/\theta_2$ decrease marginally. We show that global welfare is unchanged under CUP, and increases when multinationals are unconstrained. From (21), we have

$$\frac{\mathrm{d}\mathbb{P}_i^{1-\sigma}}{\mathrm{d}\theta} = \frac{\mathrm{d}m_j}{\mathrm{d}\theta}\left[\left(p_{ji}^r\right)^{1-\sigma} - \left(p_{ji}^d\right)^{1-\sigma}\right] + m_j\frac{\mathrm{d}}{\mathrm{d}\theta}\left(p_{ji}^r\right)^{1-\sigma}. \tag{A5}$$

Some algebraic manipulations and (A4) allow us to write

$$\frac{\mathrm{d}m_2^*}{\mathrm{d}\theta} = 0, \quad \frac{\mathrm{d}m_1^*}{\mathrm{d}\theta} = -2\gamma, \quad \frac{\mathrm{d}m_1^c}{\mathrm{d}\theta} = -\frac{\mathrm{d}m_2^c}{\mathrm{d}\theta} = -\gamma\alpha, \quad \frac{\mathrm{d}p_{ij}^*}{\mathrm{d}\theta} = 0,$$

$$\text{and } \frac{\mathrm{d}p_{ij}^c}{\mathrm{d}\theta} = -\frac{\sigma}{\sigma-1}(\beta - 1), \tag{A6}$$

where all derivatives are evaluated at the symmetric equilibrium. Combining (A5) and (A6), we finally obtain

$$\frac{\mathrm{d}\mathbb{P}_1^{*1-\sigma}}{\mathrm{d}\theta} = 0, \quad \frac{\mathrm{d}\mathbb{P}_2^{*1-\sigma}}{\mathrm{d}\theta} = -2\gamma\left(\tfrac{\sigma}{\sigma-1}\right)^{1-\sigma}(1 - \beta^{1-\sigma}) > 0,$$

$$\frac{\mathrm{d}\mathbb{P}_1^{c\,1-\sigma}}{\mathrm{d}\theta} = -\frac{\mathrm{d}\mathbb{P}_2^{c\,1-\sigma}}{\mathrm{d}\theta} = \left(\tfrac{\sigma}{\sigma-1}\right)^{1-\sigma}\left[\gamma\alpha(1 - \beta^{1-\sigma}) + (1 - \gamma)(1 - \alpha)\right] > 0.$$

Recalling that consumer utility is inversely related to $\mathbb{P}_i^{1-\sigma}$, the result follows.

A.7. Proof of Proposition 5

Letting $I_1 = I_2 = 1$ and using the properties of the uniform distribution, we can write total tax revenue of country i, T_i^r for $r = *, c$, as follows:

$$T_1^* = (1 - \theta_1)\kappa\left[\mathbb{P}_1^{*\sigma-1}\frac{\varphi_1^{*2}}{2} + \mathbb{P}_2^{*\sigma-1}\gamma\varphi_1^* + \mathbb{P}_1^{*\sigma-1}\beta^{1-\sigma}\frac{\varphi_2^{*2}}{2}\right],$$

$$T_2^* = (1 - \theta_2)\kappa\left[\mathbb{P}_2^{*\sigma-1}\frac{\varphi_2^{*2}}{2} + \mathbb{P}_1^{*\sigma-1}\gamma\varphi_2^* + \mathbb{P}_2^{*\sigma-1}\beta^{1-\sigma}\frac{\varphi_1^{*2}}{2} + \mathbb{P}_2^{*\sigma-1}\frac{1 - \varphi_2^{*2}}{2}\right.$$

$$\left. + \mathbb{P}_2^{*\sigma-1}\frac{1 - \varphi_1^{*2}}{2} + \mathbb{P}_1^{*\sigma-1}\frac{1 - \varphi_1^{*2}}{2} + \mathbb{P}_1^{*\sigma-1}\frac{1 - \varphi_2^{*2}}{2}\right],$$

$$T_1^c = (1 - \theta_1)\kappa\left[\mathbb{P}_1^{c\,\sigma-1}\frac{\varphi_1^{c2}}{2} + \mathbb{P}_2^{c\,\sigma-1}\gamma\varphi_1^c + \mathbb{P}_1^{c\,\sigma-1}\beta^{1-\sigma}\frac{\varphi_2^{c2}}{2} + \mathbb{P}_1^{c\,\sigma-1}\frac{1 - \varphi_1^{c2}}{2}\right.$$

$$\left. + \mathbb{P}_1^{c\,\sigma-1}R_2^{1-\sigma}\frac{1 - \varphi_2^{c2}}{2}\right],$$

$$T_2^c = (1 - \theta_2)\kappa \left[\mathbb{P}_2^{c\,\sigma-1} \frac{\varphi_2^{c\,2}}{2} + \mathbb{P}_1^{c\,\sigma-1} \gamma \varphi_2^c + \mathbb{P}_2^{c\,\sigma-1} \beta^{1-\sigma} \frac{\varphi_1^{c\,2}}{2} + \mathbb{P}_2^{c\,\sigma-1} \frac{1 - \varphi_2^{c\,2}}{2} \right.$$

$$\left. + \mathbb{P}_2^{c\,\sigma-1} R_1^{1-\sigma} \frac{1 - \varphi_1^{c\,2}}{2} \right],$$

where the first two (respectively, the last two) terms pertain to the profits realized by exporters (respectively, by multinationals) in the home and foreign markets, respectively. The third term denotes the exporters' tax bill. In the unconstrained case, country 2 gets all the tax revenue from multinationals. In the symmetric tax equilibrium ($\theta_1 = \theta_2$), so that $\varphi_1^c = \varphi_2^c = \varphi_1^* = \varphi_2^* = \gamma$. Moreover, $p_{ij}^* = p_{ij}^c = \sigma/(\sigma - 1)$. Hence at the symmetric equilibrium, $T^c \equiv T_1^c + T_2^c = T^* \equiv T_1^* + T_2^*$. The impact of a change in θ_1 is given by

$$\frac{dT^r}{d\theta_1} = \frac{\partial T^r}{\partial \theta_1} + \frac{\partial T^r}{\partial \mathbb{P}_1^r} \frac{d\mathbb{P}_1^r}{d\theta_1} + \frac{\partial T^r}{\partial \mathbb{P}_2^r} \frac{d\mathbb{P}_2^r}{d\theta_1} + \frac{\partial T^r}{\partial \varphi_1^r} \frac{d\varphi_1^r}{d\theta_1} + \frac{\partial T^r}{\partial \varphi_2^r} \frac{d\varphi_2^r}{d\theta_1}, \quad \text{for} \quad r = *, c.$$

Using (A5) and (A6) above, as well as $d\varphi_i^r/d\theta = -dm_i^r/d\theta$, for $i = 1, 2$ and $r = *, c$, together with the fact that $\partial T^c/\partial \mathbb{P}_1^c = \partial T^c/\partial \mathbb{P}_2^c$, and $\partial T^c/\partial \varphi_1^c = \partial T^c/\partial \varphi_2^c$ when $\theta = 1$, we obtain

$$\frac{dT^c}{d\theta_1} = -\kappa \mathbb{P}_1^{c\,\sigma-1} \left(\frac{\gamma^2}{2} + 1 + \beta^{1-\sigma} \frac{\gamma^2}{2} \right) < 0.$$

When multinationals are unconstrained, we can use (A5) and (A6), as well as some longer algebra, to obtain

$$\frac{dT^*}{d\theta_1} = -\kappa \mathbb{P}_1^{*\,\sigma-1} \left(\frac{\gamma^2}{2} + \gamma^2 + \beta^{1-\sigma} \frac{\gamma^2}{2} \right) + 2\kappa \gamma \mathbb{P}_1^{*\,\sigma-1} \frac{1 - \theta_2}{\theta_2}$$

$$\left[\gamma \beta^{1-\sigma} + \mathbb{P}_1^{*\,\sigma-1} \left(\frac{\sigma}{\sigma - 1} \right)^{1-\sigma} \left(1 - \beta^{1-\sigma} \right) \left(\frac{\gamma^2}{2} + 1 + \beta^{1-\sigma} \frac{\gamma^2}{2} \right) \right].$$

Hence, $dT^c/d\theta_1 < dT^*/d\theta_1$, which implies the result (recalling that, around the symmetric equilibrium, $d\theta_1 < 0$).

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