Tax induced transfer pricing under universal adoption of the destination-based cash-flow tax

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Tax induced transfer pricing under universal adoption of the destination-based cash-flow tax *

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Abstract

The view that the transfer pricing problem vanishes under universal destination-based cash flow taxation (DBCFT) is based on how firms behave in perfectly competitive markets. We show that the neutralizing effect DBCFT has on transfer price incentives fails once multinational firms are multi-market oligopolists. Under imperfect competition, a multinational will delegate output decisions to its affiliates. The transfer price then takes on a strategic role because it influences competitors' actions. Even if all countries adopt DBCFT, transfer prices will not equal arm's length prices, and the global efficiency implications attributed to DBCFT are lost.

Keywords: Destination-based cash-flow tax, transfer pricing, managerial delegation

JEL classification: F23, G32, H21, H25, H26

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1 Introduction

Tax base erosion by abusive transfer prices is one of the biggest challenges facing tax authorities. For example, Crivelli *et al.* (2016) estimate the revenue loss from base erosion and profit shifting by multinational enterprises (henceforth MNEs) at around one percent of gross domestic product in OECD countries.[1] The concern over abusive transfer prices has led many economists and policymakers to advocate a transition from the most commonly used system of corporate taxation, separate accounting (SA), to a destination-based cash-flow tax (DBCFT) under which firms lose the incentive to set transfer prices on cross border trade that are not equal to arm's length prices.[2] Following this advice, the United States (US) House Republican Task Force on Tax Reform in 2016 proposed a destination-based cash-flow tax to replace the current federal income tax system for corporations.

The view that the transfer pricing problem vanishes under a universal DBCFT is based on how firms behave in perfectly competitive markets. However, perfect competition is not observed in many markets. Instead, we observe various forms of imperfect competition.[3] There is a small literature that considers the economic effects of international tax rules in imperfectly competitive markets.[4] The takeaway from this literature is that the mechanisms that transmit the effects of corporate tax policies to the economy as a whole can differ between competitive economies and imperfectly competitive economies. A key reason is that tax rules can alter the ways in which multinational firms organize themselves, something that most public economics papers on DBCFT hold constant.

We show that the neutralizing effect DBCFT has on transfer price incentives fails once multinational firms are multi-market oligopolists because DBCFT prompts a profitable reorganization in which the multinational first sets it transfer prices and then delegates output decisions to its affiliates in each country.[5] Once output decisions are delegated to local affiliates, transfer prices can be used strategically to help affiliates in oligopolistic markets gain profitable market share. The ability of multinationals to profitably set transfer prices differ-

[1] Guvenen *et al.* (2017) calculates that MNEs shifted USD 280 billion in profits abroad in 2012. Clausing (2016) arrives at a similar figure using a regression-based method.

[2] For example, see Auerbach *et al.* (2017), Auerbach & Devereux (2017), and Devereux *et al.* (2021).

[3] Azar & Vives (2021) reports that Alphabet, Apple, Facebook, Amazon, and Microsoft account for almost 15% of U.S. market capitalization. Gabaix (2011) reports examples of even more extreme market concentration among a small number of firms in Finland, Japan, and Korea. The significant presence of high market concentrations is not a new phenomenon since, for close to five decades, the share of sales to GDP in the United States among the top 100 non-oil firms has been around 30%.

[4] See for example Keen & Lahiri (1998), Nielsen *et al.* (2003), Haufler & Wooton (2010), Bauer & Langenmayr (2013), Brekke *et al.* (2017) and more recently Bond & Gresik (2020).

[5] See footnote 12.

ent from arm's length prices under universal DBCFT also undermines the global efficiency properties that arise in competitive markets.

In order to clearly identify the role of transfer pricing under DBCFT with oligopolistic multinationals, we use a two-country framework with a parent company, an affiliate A located in country A, and an affiliate B located in country B. To capture how the effect of globalization and corporate tax rate differences across countries may have on the multinational firm, we allow for affiliate A or B to be the sole producer of a good that is sold in both countries. The market in country A is assumed to be monopolistic, while the market in country B is characterized by Cournot competition between the subsidiary and a local firm. Our analysis will show that these simple assumptions yield a parsimonious model of DBCFT incentives on multinationals that operate in oligopolistic markets.

It is widely recognized in economics that some decisions should be delegated to a decentralized level in corporations. The theoretical underpinnings of this so-called delegation principle are described in the industrial organization (IO) literature, where a principal may benefit from hiring an agent and giving him or her the incentive to maximize something other than the welfare of the principal.[6] Partial delegation of authority is a crucial component of corporate decision structures. It affects compensation, strategic decisions, production chains, capital allocation, performance evaluation, productivity, and research and development (R&D).[7] Delegation of decision making to national affiliates is, for example, common in the car industry, where the parent company (the producer) determines the export price (transfer price) to foreign affiliates, but leaves the task of deciding the final consumer price to the importing affiliate. Bourgeois & Eisenhardt (1988) show that delegation of decision making is not only relevant for established industries, but also for high-velocity environments, such as the microcomputer industry and R&D intensive industries.[8]

A few previous papers have recognized the multiple roles of transfer prices and their relationship with taxes under delegation. Elitzur & Mintz (1996) model the transfer price

[6]See, e.g., Vickers (1985), Fershtman & Judd (1987), Sklivas (1987), and Katz (1991). Beyond the IO-literature, different strands of the economics literature have studied how the delegation principle affects the design of policy. International trade theory, for example, has studied the implication of delegation of price or quantity setting power to managers by firm owners or headquarters (HQs) for trade policy (see e.g. Das (1997)). The literature on bureaucratic discretion has a long standing tradition of analyzing delegation of policy-making authority from legislatures to bureaucrats (see, e.g., Gailmard (2002)).

[7]See Baldenius & Ziv (2003) for an evaluation of performance in firms with delegated decision making and Bloom *et al.* (2010) for low profitability in firms without delegated decision making. Graham *et al.* (2015) provide a survey of decision making authority within firms.

[8]There exists a large literature that both documents and explains the extent of decentralization that takes place within MNEs, see e.g., Grandstand & Sjolander (1992), Almeida (1996), Papanastasiou & Pearce (2005).

both as a tax-minimizing instrument and as an instrument to influence decisions of a self-interested manager in a subsidiary. Under oligopoly, it has been shown by Schjelderup & Sørgard (1997) that transfer prices trade off income tax incentives against strategic incentives under separate accounting (i.e., each unit of a multinational calculates its taxable income separately). Nielsen *et al.* (2003) compares the effects of taxing oligopolistic multinational firms under standard separate accounting rules versus under formula apportionment rules (i.e., a formula divides up a multinational's global taxable income among countries for tax purposes). Advocates of the formula apportionment approach argue that the negative welfare effects of income shifting strategies can be mitigated by formula apportionment relative to separate accounting. Nielsen *et al.* (2003) shows that in oligopolies the income shifting incentives can actually be stronger under formula apportionment. Finally, Nielsen *et al.* (2008) show that sufficiently large corporate tax differences affect how multinationals organize their decision-making.

Our analysis is also related to a small but expanding literature on tax reform and DBCFT. Auerbach *et al.* (2017) consider implications of the DBCFT for three common ways of shifting taxable profits between countries. They conclude that manipulation of transfer prices, use of debt, and locating intangible assets in low-taxed jurisdictions are no longer viable options for MNEs under a DBCFT system, if adopted universally. Shome & Schutte (1993) and Auerbach & Devereux (2017) suggest that income shifting incentives via transfer prices persist under unilateral adoption of the DBCFT. Becker & Englisch (2019) study how the DBCFT works under unilateral adoption. Recently, Bond & Gresik (2020) study the economic effects of unilateral adoption of corporate tax policies that include destination-based taxes and/or cash-flow taxes in a heterogeneous agent model in which multinational firms can endogenously shift income between countries by using transfer prices. They find that welfare in the adopting country can decrease both with adoption of destination-based taxes and adoption of cash-flow taxes, and that profit shifting incentives remain under unilateral adoption of the DBCFT. Hebous *et al.* (2020) estimate the revenue implications of a destination-based cash-flow tax (DBCFT) for 80 countries. They find that on a global average, DBCFT revenues under unchanged tax rates would remain similar to the existing corporate income tax (CIT) revenue, but with sizable redistribution of revenue across countries. However, their estimates assume that DBCFT adopton eliminates transfer price distortions.

In section 2, we study how universal adoption of the DBCFT affects transfer pricing incentives under delegation when production occurs in country A. Section 3 undertakes the same analysis when production occurs in country B. Finally, section 4 offers some discussion and concluding remarks.

2 Transfer Pricing Under Universal DBCFT

Consider an MNE that operates in two countries: country A, where the parent firm and affiliate A are located, and country B, where affiliate B is located. Affiliate A produces a product Q where quantity Q_A is sold directly to the consumers in country A, and quantity Q_B is sold to the consumers in country B through affiliate B, which here takes the form of a retailer. We initially assume that affiliate A produces $Q = Q_A + Q_B$ units at a cost $c(Q)$, where $\frac{\partial c}{\partial Q_i} = \frac{dc}{dQ} \equiv c' \geq 0$, $i = A, B$, and $c'' \geq 0$.[9] We will later relax this assumption and study transfer pricing incentives when affiliate B is the sole producer.

Similar to Bulow *et al.* (1985), the market in country A is assumed to be monopolistic, while the market in country B is characterized by Cournot competition between affiliate B and a local firm. Different from Bulow *et al.* (1985) is the modeling of taxes, and the fact that there is transfer pricing across countries.

In the continuation, an asterisk $(*)$ denotes variables for the local competitor in country B. It is assumed that quantity is the strategic variable in market B, but the qualitative insights of our analysis do not depend on this, as we shall see later on. The local competitor called firm B^*, sells Q_B^* units and the revenue functions of affiliate B and its competitor are $r_B(Q_B, Q_B^*)$ and $r_B^*(Q_B^*, Q_B)$. Affiliate A has revenues $r_A(Q_A)$ from selling directly to consumers in country A plus export revenue from selling to affiliate B at the transfer price, q.[10] All three revenue functions are strictly concave in the firm's own output.[11]

Country A levies a profit tax of t_A. Country B levies a profit tax of t_B. Both countries operate under DBCFT rules. Under DBCFT, affiliate A is exempt from the country A tax on its export revenue qQ_B. Affiliate B faces a tax on its revenues but does not receive a tax deduction for its import cost qQ_B. The profit functions of affiliate A, affiliate B, and the competitor are given by

$$\pi_A = (1 - t_A)[r_A(Q_A) - c(Q)] + qQ_B, \quad \text{and} \quad \pi_B = (1 - t_B)r_B(Q_B, Q_B^*) - qQ_B, \qquad (1)$$

[9] One could interpret the cost function as exhibiting dis-economies of scope as it would be more efficient for two firms to produce separately since the merged cost per unit is higher than the sum of stand-alone costs.

[10] In line with the literature and in order to bring forward the tax incentives in the simplest possible way, we assume that the MNE is able to price discriminate between the two markets.

[11] We assume there exists a value of Q_A for which marginal revenue from direct sales in country A is equal to zero, for each value of Q_B^*, there exists a value of Q_B for which the subsidiary's marginal revenue is equal to zero, and for each value of Q_B, there exists a value of Q_B^* for which the competitor's marginal revenue is equal to zero.

and the profit function of the competitor is given by

$$\pi_B^* = (1 - t_B) r_B^*(Q_B^*, Q_B).$$

It is assumed for simplicity that the competitor has constant marginal costs that are normalized to zero.

As a baseline case, consider the game in which the parent first chooses q and then having observed q the parent chooses Q_A and Q_B to maximize its global after-tax profit while the competitor simultaneously chooses Q_B^* to maximize its after-tax profit. The affiliates make no decisions in this scenario. Under universal adoption of the DBCFT, the multinational's global after-tax profit function is

$$\Pi = (1 - t_A)[r_A(Q_A) - c(Q_A + Q_B)] + (1 - t_B) r_B(Q_B, Q_B^*) \tag{2}$$

It is clear from the global-after tax profit function that the terms with the transfer price in (1) cancel each other out. Any profit shifting motive due to differences in the countries' tax rates is eliminated, so the choice of q is moot.

Denote the equilibrium quantities when the multinational chooses to make centralized decisions by (Q_A^c, Q_B^c, Q_B^{*c}). These equilibrium quantities are defined by each firm equating its after-tax marginal revenue with its after-tax marginal cost:

$$\begin{aligned} r_A' &= c', \\ (1 - t_B)\frac{\partial r_B}{\partial Q_B} &= (1 - t_A)c', \quad \text{and} \\ \frac{\partial r_B^*}{\partial Q_B^*} &= 0. \end{aligned} \tag{3}$$

Now consider an alternative game in which the parent first publicly announces its transfer price and then delegates authority to affiliate A to choose Q_A and authority to affiliate B to choose Q_B. It is well known from the International Organization literature arising from the work of Bulow *et al.* (1985) and Fudenberg & Tirole (1991) that when a multi-market company faces competition in some markets, adopting a commitment strategy can allow the firm to influence its competitor's actions in a favorable way. In this model, we will show that delegating sales output decisions to the local affiliates will introduce a strategic role for transfer pricing even under universal DBCFT. When the parent delegates decisions about quantities to its affiliates in national markets, the parent takes into account that the transfer price will affect the outcome of competition in market B. A high transfer price, for example,

will increase the marginal cost of the affiliate in B, while a low transfer price will have the opposite effect.

Each affiliate seeks to maximize its respective profit as defined in (1). The affiliates choose their quantities simultaneously with the competitor in country B. To solve for the subgame perfect Nash equilibrium of this two-stage game, we first solve for the equilibrium quantities following any transfer price, q. Denote these quantities by $Q_i = Q_i(q)$ and $Q_B^* = Q_B^*(q)$ where $i = A, B$.[12] We then calculate the the transfer price that maximizes the multinational's global after-tax profit taking account of the influence of its transfer price on the quantities of its affiliates and the competitor.

Solving the game backwards, the first order conditions of the affiliates and the competitor at stage 2 are

$$\begin{aligned} r_A' &= c', \\ (1-t_B)\frac{\partial r_B}{\partial Q_B} &= q, \quad \text{and} \\ \frac{\partial r_B^*}{\partial Q_B^*} &= 0. \end{aligned} \tag{4}$$

Notice that if the parent sets $q = (1-t_A)c'(Q_A^c + Q_B^c)$, then the first-order conditions in (3) and (4) have the same solutions. This means the parent can replicate the equilibrium quantities achieved under centralization if it chooses to do so. At stage 1, the parent sets the optimal transfer price by totally differentiating the global after-tax profit function (2), taking into account how q affects the stage 2 competition. Totally differentiating the global after-tax profit function with respect to q, and using the Envelope Theorem yields

$$\frac{d\Pi}{dq} = [(1-t_B)\frac{\partial r_B}{\partial Q_B} - (1-t_A)c']\frac{dQ_B}{dq} + (1-t_B)\frac{\partial r_B}{\partial Q_B^*}\frac{dQ_B^*}{dq} = 0. \tag{5}$$

The comparative statics, dQ_B/dq and dQ_B^*/dq, can be calculated by totally differentiating (4). Using the first order condition $(1-t_B)\frac{\partial r_B}{\partial Q_B} = q$ in (4), (5) reduces to

$$q - (1-t_A)c' = (1-t_B)\frac{\partial r_B}{\partial Q_B^*} \cdot \frac{\partial^2 r_B^*}{\partial Q_B^* \partial Q_B} \Big/ \frac{\partial^2 r_B^*}{\partial Q_B^{*2}}. \tag{6}$$

The left-hand side of (6) is the difference between the multinational firm's transfer price

[12] Since the affiliates and the local rival set their strategic choice (quantity) simultaneously, the local rival cannot observe either affiliate's output before making it's own choice. But by observing the transfer price, it can infer how affiliate B will behave. In many countries import prices are public knowledge due to the calculation of tariff payments, and in some industries such as the car industry, import prices are often announced (Schjelderup & Sørgard (1997)).

and what is called the arm's length price, or the price at which two independent firms in separate countries would carry out the same transaction in a competitive market. If this difference equals zero, the multinational firm will be indifferent between making centralized or decentralized output decisions. Note that for any $t_B < 1$, the right-hand side of equation (6) must be non-zero as long as there is a strategic link between the firms operating in country B. Regardless of the strategic relationship between the firms in country B, it will be optimal for the multinational to choose a transfer price that differs from the multinational's after-tax marginal cost of producing in country A. In particular, the transfer price that would implement the equilibrium quantities achieved under centralized management is not optimal under decentralized management. Thus, the adoption of decentralized management results in a transfer price that differs from after-tax marginal cost and improves the multinational's equilibrium profit despite the adoption of DBCFT by both countries.

Proposition 1 *The adoption of DBCFT by both countries does not eliminate the incentive for an oligopolistic multinational that produces in country A to shift profits through its transfer price. Joint DBCFT adoption creates an incentive for the multinational to adopt a decentralized management structure under which profit shifting induces a beneficial strategic effect for the affiliate in country B.*

The strategic role of the transfer price identified in Proposition 1 emerges because the multinational can use the transfer price as an instrument to capture market shares in local markets and thereby increase its profits. Using the terminology from Bulow *et al.* (1985), the sign of the term, $\partial r_B/\partial Q_B^*$, will depend on whether Q_B and Q_B^* are economic substitutes (< 0) or economic complements (> 0). The sign of the term, $\partial^2 r_B^*/\partial Q_B^* \partial Q_B$, will depend on whether Q_B and Q_B^* are strategic substitutes (< 0) or strategic complements (> 0). Because of the strict concavity of r_B^*, the sign of the term, $\partial^2 r_B^*/\partial Q_B^{*2}$ is negative. Therefore, if Q_B and Q_B^* are both economic and strategic substitutes or if they are both economic and strategic complements, the parent will set the transfer price below the arm's length price in order to make affiliate B behave more aggressively and sell a larger quantity. The competitor anticipates this, and its best response is to limit its own sales. As a result, profits are increased for affiliate B and the MNE as a whole.

It is worth pointing out that if affiliates A and B were unrelated companies, affiliate A's relevant marginal cost would now be its after-tax marginal cost because of the differential tax treatment of domestic costs and export revenues. Because of this differential treatment, whether affiliate A under- or over-prices its exports to affiliate B depends on strategic factors and not on the difference in the countries' tax rates. For example, in a standard income tax

framework affiliate A would want to underprice its exports if country B has the lower tax rate. From equation (6), under-pricing is the optimal decision if, and only if, Q_B and Q_B^* are both economic and strategic substitutes or both economic and strategic complements.

Even though the parent distorts the transfer price for strategic reasons as opposed to the standard income shifting reasons, its optimal transfer price can respond to changes in the countries' tax rates in ways that would make it difficult for one to distinguish empirically between the two motives. To understand how tax rates influence the multinational's transfer price, denote the equilibrium transfer price by $q*$. All comparative statics calculations are provided in the Appendix. There we show that

$$\frac{dq^*}{dt_A} = \frac{-c' \frac{dQ_B}{dq}}{\frac{\partial^2 \Pi}{\partial q^2}} < 0 \tag{7}$$

and

$$\frac{dq^*}{dt_B} = -\frac{q^*}{1-t_B} + \frac{(1-t_A)c'}{1-t_B} \frac{\partial Q_B}{\partial q} \frac{1}{d^2\Pi/dq^2}. \tag{8}$$

Independent of the relative size of tax rates across the two countries, an increase in t_A lowers the after-tax marginal cost of acquiring market share and results in a lower transfer price. The optimal transfer price of a single firm not engaged in strategic output behavior under source-based income taxation responds in the same way to a change in t_A. An increase in t_B can have an ambiguous effect on the optimal transfer price. An increase in t_B does lower the marginal profitability of winning market share in country B (leading the multinational to set a lower transfer price) but it also creates an incentive to lower sales of the B affiliate in order to decrease its after-tax cost of production by setting a higher transfer price.

We can also examine how the mis-pricing, defined by $\Delta_A(t_A, t_B) \equiv q^* - (1-t_A)c'(Q_A(q^*) + Q_B(q^*))$, is affected by the tax rates. Direct calculation shows that

$$\frac{\partial \Delta_A}{\partial t_A} = c' + \beta_A \cdot \frac{dq^*}{dt_A}, \qquad \frac{\partial \Delta_A}{\partial t_B} = \beta_A \cdot \frac{dq^*}{dt_B} > 0, \quad \text{and} \quad \beta_A \equiv [1-(1-t_A)c'' \cdot \frac{d(Q_A+Q_B)}{dq}] > 0, \tag{9}$$

since comparative statics calculations in the Appendix yield

$$\frac{d(Q_A+Q_B)}{dq} = \frac{r_A''}{|E|} \cdot \frac{\partial^2 r_B^*}{\partial Q_B^{*2}} < 0. \tag{10}$$

A change in t_A has a direct effect (c') and an indirect effect ($\beta_A \cdot \frac{dq^*}{dt_A}$) on the amount of mis-pricing. The direct effect is positive leading to more mis-pricing because an increase in

t_A lowers the A affiliate's after-tax marginal cost for any values of Q_A and Q_B. The indirect effect is the strategic effect of transfer pricing and is made up of two components. Holding t_A fixed, an increase in q^* decreases $Q_A + Q_B$. The reduction in multinational production lowers the multinational's marginal cost and increases the amount of mis-pricing ($\beta_A > 0$). The second indirect effect is negative ($\frac{dq^*}{dt_A} < 0$) since an increase in t_A lowers marginal cost holding all quantities fixed and thus leads to a lower transfer price. These effects combined means that the sign of $\partial\Delta_A/\partial t_A$ is ambiguous. In contrast, a change in t_B has only a strategic effect on mis-pricing. As noted above, the sign of the effect of t_B on q^* is ambiguous, so the effect of t_B on the amount of mis-pricing is also ambiguous.

Proposition 2 *If Q_B and Q_B^* are economic and strategic substitutes or economic and strategic complements, then the multinational sets the transfer price below the arm's length price when all production occurs in country A. An increase in t_A results in a lower optimal transfer price. An increase in t_B can result in either a higher or lower transfer price.*

Despite the ambiguous effect of a change in country B's tax rate on the optimal transfer price and the amount of mis-pricing, the following example identifies a class of economies in which country B's tax rate generates transfer pricing behavior consistent with standard income shifting incentives.

Example. Suppose that the firms in country B sell perfect substitutes with identical choke-off prices, affiliate A and the B firms both face linear demand, and marginal cost is constant. The choke-off prices and marginal cost imply strictly positive sales quantities. Under these assumptions $\partial q^*/\partial t_B > 0$, $\partial\Delta_A/\partial t_A < 0$, and $\partial\Delta_A/\partial t_B > 0$. In this example, even though the multinational will always set its transfer price below the arm's-length price for strategic purposes, its optimal transfer price will respond to changes in each country's tax rate the same way it would in a standard model in which the multinational responds only to income shifting incentives.

3 Affiliate B produces the good

In order to examine how results may depend on the location of production, we shall let affiliate B instead of affiliate A be the sole producer of the good sold in both countries. Affiliate B produces quantities Q_A and Q_B at a cost $c(Q_A + Q_B)$ and exports Q_A at a price q to affiliate A who sells the good in country A without adding value to it. The model is otherwise unchanged.

The profit functions of affiliate A and B, and the competitor are given by

$$\pi_A = (1-t_A)r_A(Q_A) - qQ_A, \quad \text{and} \quad \pi_B = (1-t_B)[r_B(Q_B, Q_B^*) - c(Q_A+Q_B)] + qQ_A, \quad (11)$$

and the profit function of the competitor is as before given by

$$\pi_B^* = (1-t_B)r_B^*(Q_B^*, Q_B).$$

At stage 2, affiliate A and B, and the competitor in country B set their optimal quantities, taking the transfer price as given. The first order conditions are

$$\begin{aligned} (1-t_A)r_A' &= q, \\ \frac{\partial r_B}{\partial Q_B} &= c', \quad \text{and} \\ \frac{\partial r_B^*}{\partial Q_B^*} &= 0. \end{aligned} \quad (12)$$

The multinational's global after-tax profit function is

$$\Pi = (1-t_A)r_A(Q_A) + (1-t_B)[r_B(Q_B, Q_B^*) - c(Q_A+Q_B)] \quad (13)$$

At stage 1, the parent sets the transfer price to maximize its global after-tax profit function (13), taking account of the stage 2 quantities. Totally differentiating the global after-tax profit function with respect to q, and using the Envelope Theorem yields

$$\frac{d\Pi}{dq} = [(1-t_A)r_A' - (1-t_B)c']\frac{dQ_A}{dq} + (1-t_B)\frac{\partial r_B}{\partial Q_B^*}\frac{dQ_B^*}{dq} = 0. \quad (14)$$

The comparative statics dQ_A/dq, dQ_B/dq, and dQ_B^*/dq are calculated in the Appendix by totally differentiating (12). Using $(1-t_A)r_A' = q$ from (12), (14) can be rewritten as

$$q - (1-t_B)c' = (1-t_B)c''\frac{\partial r_B}{\partial Q_B^*} \cdot \frac{\partial^2 r_B^*}{\partial Q_B^* \partial Q_B} \cdot \frac{(1-t_A)r_A''}{|E|}, \quad (15)$$

where $|E| < 0$ at any locally-stable stage-2 equilibrium. Changing the location of production alters the conclusions in Proposition 1 in only one way. If the marginal cost of production is a constant, then there is no transmission of strategic effects via q. According to the first-order conditions in (12), the choice of q affects the equilibrium sales of affiliate B only if a change

in Q_A changes affiliate B's marginal cost of production. If $c'' = 0$, affiliate B's marginal cost of production does not depend on the quantity produced for the A market.

As before, the left-hand side of (15) is the difference between the multinational firm's transfer price and the arm's length price, where the latter is the marginal after-tax cost of production by affiliate B. As was the case when affiliate A was the sole producer, underpricing or overpricing depends on whether Q_B and Q_B^* are economic substitutes or complements and whether they are strategic substitutes or complements. It is seen from equation (15) that overpricing ($q > (1 - t_B)c'$) is the optimal decision if, and only if, Q_B and Q_B^* are both economic and strategic substitutes or both economic and strategic complements. This result is the opposite of what was the case when affiliate A was the sole producer. When affiliate B produces the good, overpricing reduces the quantity exported to affiliate A and thus reduces production costs in affiliate B thereby making affiliate B into a lower cost firm that behaves more aggressively. The competitor anticipates this, and its best response is to limit its own sales. This response benefits affiliate B and the multinational firm as a whole.

Denoting the equilibrium transfer price again by q^*, we show in the Appendix that when Q_B and Q_B^* are economic and strategic substitutes or economic and strategic complements, the sign of dq^*/dt_A is ambiguous but

$$\frac{dq^*}{dt_B} = \frac{\left(c' \cdot \frac{dQ_A}{dq} - \frac{\partial r_B}{\partial Q_B^*} \cdot \frac{dQ_B^*}{dq}\right)}{\frac{\partial^2 \Pi}{\partial q^2}} \leq 0. \tag{16}$$

Independent of the tax differential, an increase in t_B will result in a higher transfer price.

Defining the amount of mis-pricing by $\Delta_B(t_A, t_B) \equiv q^* - (1 - t_B)c'(Q_A(q^*) + Q_B(q^*))$, direct calculation yields

$$\frac{\partial \Delta_B}{\partial t_A} = \beta_B \cdot \frac{dq^*}{dt_A} \quad \text{and} \quad \frac{\partial \Delta_B}{\partial t_B} = c' + \beta_B \cdot \frac{dq^*}{dt_B} \tag{17}$$

where

$$\beta_B \equiv 1 - (1 - t_B)c'' \cdot \frac{d(Q_A + Q_B)}{dq} \cdot \frac{dq^*}{dt_A}$$

and where

$$\frac{d(Q_A + Q_B)}{dq} = \frac{1}{(1 - t_A)r_A''} + c'' \frac{\partial^2 r_B^*}{\partial Q_B^{*2}} / |E|. \tag{18}$$

There is only a direct effect following a change in t_A whereas there is a direct and an indirect effect following a change in t_B. Different from when A was the sole producer, the signs of $\partial \Delta_B / \partial t_A$ and $\partial \Delta_B / \partial t_B$ are ambiguous since we cannot sign $\frac{d(Q_A + Q_B)}{dq}$. The reason is the complicated incentives that arise when the producer (affiliate B) is also facing a competitor.

The parent, when setting the transfer price, must balance the loss in after-tax revenue by affiliate A (first term in 18, which is negative) against the effect a change in the transfer price on revenues by affiliate B due to higher costs of production (second term in 18, which is positive). These effects go against each other and the outcome depends on the curvatures of the cost function and the revenue function of affiliate B.

Proposition 3 *If Q_B and Q_B^* are economic and strategic substitutes or economic and strategic complements, then the multinational sets the transfer price above the arm's length price when all production occurs in country B. An increase in t_B results in a weakly lower optimal transfer price. An increase in t_A can result in either a higher or lower transfer price.*

4 Concluding Remarks

In this paper we find that the mechanisms that transmit the effects of corporate tax policies to the economy as a whole in imperfectly competitive economies alter the ways in which multinational firms organize themselves, something that most public economics papers on DBCFT hold constant. We show that the neutralizing effect DBCFT has on transfer price incentives fails once multinational firms are multi-market oligopolists. The reason is that DBCFT prompts a profitable reorganization in which the neutralizing effects and the subsequent global efficiency implications are lost. This holds true irrespective of which affiliate produces the good. Consequently, oligopoly markets undermine the efficiency benefits of universal DBCFT, and may affect the ability of universal DBCFT adoption to arise in an equilibrium.

Our analysis also shows that the location of production does determine whether a multinational underprices or overprices its affiliate trade under universal DBCFT adoption. Even though the multinational distorts its transfer price for strategic reasons, because the standard income shifting reasons do not exist under universal DBCFT, we show that its optimal transfer price can respond to changes in the countries' tax rates in ways that mimic the tax-induced transfer price changes that arise under tax policies with income shifting incentives.

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5 Appendix: Comparative statics

A. Comparative statics with respect to q on stage-2 quantities when affiliate A is the producer

Totally differentiating first-order conditions (4) yields

$$\begin{pmatrix} r_A'' - c'' & -c'' & 0 \\ 0 & (1-t_B)\frac{\partial^2 r_B}{\partial Q_B^2} & (1-t_B)\frac{\partial^2 r_B}{\partial Q_B^* \partial Q_B} \\ 0 & \frac{\partial^2 r_B^*}{\partial Q_B \partial Q_B^*} & \frac{\partial^2 r_B^*}{\partial Q_B^{*2}} \end{pmatrix} \cdot \begin{pmatrix} dQ_A \\ dQ_B \\ dQ_B^* \end{pmatrix} = \begin{pmatrix} 0 \\ dq \\ 0 \end{pmatrix}. \tag{19}$$

Let E denote the 3x3 matrix in (19). $|E| < 0$ at any locally-stable stage-2 equilibrium. Solving (19) yields

$$\begin{aligned} \frac{dQ_A}{dq} &= c'' \cdot \frac{\partial^2 r_B^*}{\partial Q_B^{*2}} / |E| \geq 0 \\ \frac{dQ_B}{dq} &= \frac{r_A'' - c''}{|E|} \cdot \frac{\partial^2 r_B^*}{\partial Q_B^{*2}} \leq 0, \text{and} \\ \frac{dQ_B^*}{dq} &= \frac{-dQ_B}{dq} \cdot \frac{\partial^2 r_B^* / \partial Q_B \partial Q_B^*}{\partial^2 r_B^* / \partial Q_B^{*2}}. \end{aligned} \tag{20}$$

Similar analysis shows that $dQ_i/dt_A = 0$ and $dQ_i/dt_B = (q^*/(1-t_B)) \cdot dQ_i/dq$ for $Q_i \in \{Q_A, Q_B, Q_B^*\}$.

B. Comparative statics with respect to the tax rates on q^* when affiliate A is the sole producer

Totally differentiating (5), with all expressions evaluated at q^*, yields

$$\frac{d^2\Pi}{dq^2} dq^* + c' \cdot \frac{dQ_B}{dq} dt_A + \frac{d^2\Pi}{dt_B dq} dt_B = 0, \tag{21}$$

where

$$\frac{d^2\Pi}{dq^2} = \frac{\partial^2\Pi}{\partial Q_A \partial q} \cdot \frac{dQ_A}{dq} + \frac{\partial^2\Pi}{\partial Q_B \partial q} \cdot \frac{dQ_B}{dq} + \frac{\partial^2\Pi}{\partial Q_B^* \partial q} \cdot \frac{dQ_B^*}{dq} + \frac{\partial^2\Pi}{\partial q^2} \tag{22}$$

and

$$\frac{d^2\Pi}{dt_B dq} = \frac{\partial^2\Pi}{\partial Q_A \partial q} \cdot \frac{dQ_A}{dt_B} + \frac{\partial^2\Pi}{\partial Q_B \partial q} \cdot \frac{dQ_B}{dt_B} + \frac{\partial^2\Pi}{\partial Q_B^* \partial q} \cdot \frac{dQ_B^*}{dt_B} + \frac{\partial^2\Pi}{\partial t_B \partial q}. \tag{23}$$

The dt_A term in (21) consists only of the direct effect of a change in t_A on (5) because $dQ_A/dt_A = 0$. The dt_B term in (21) includes indirect terms because $dQ_i/dt_B \neq 0$ and $\partial^2 Q_i/\partial t_B \partial q \neq 0$, where $Q_i \in \{Q_A, Q_B, Q_B^*\}$. From part A of this appendix, we know that

$dQ_i/dt_B = (q/(1-t_B))dQ_i/dq$ which also implies that

$$\frac{\partial^2 Q_i}{\partial t_B \partial q} = \frac{q}{1-t_B}\frac{\partial^2 Q_i}{\partial q^2} + \frac{1}{1-t_B}\frac{\partial Q_i}{\partial q}. \tag{24}$$

Substituting (24) into (23) then implies

$$\frac{d^2\Pi}{dt_B dq} = \frac{q}{1-t_B}\frac{d^2\Pi}{dq^2} - \frac{(1-t_A)c'}{1-t_B}\frac{\partial Q_B}{\partial q}. \tag{25}$$

According to (25), an increase in t_B generates two opposing effects on the marginal profitability of transfer pricing. The first effect reflects a decrease in the marginal benefits of using the transfer price to influence the B affiliate's market share while the second effect reflects a cost savings for the B affiliate from lowering its output in response to a higher transfer price.

Solving equation (21) we obtain

$$\frac{dq^*}{dt_A} = \frac{-c' \cdot \frac{dQ_B}{dq}}{\partial^2\Pi/\partial q^2} < 0 \tag{26}$$

and

$$\frac{dq^*}{dt_B} = -\frac{q^*}{1-t_B} + \frac{(1-t_A)c'}{1-t_B}\frac{\partial Q_B}{\partial q}\frac{1}{d^2\Pi/dq^2}. \tag{27}$$

Because of the opposing effects identified in (25), the sign of dq^*/dt_B is ambiguous.

C. Comparative statics with respect to the tax rates on the amount of mis-pricing when affiliate A is the producer

Equation (6) defines not only the equilibrium transfer price but the amount of mis-pricing. We denote the amount of mis-pricing by $\Delta(t_A, t_B) \equiv q^* - (1-t_A)c'(Q_A(q^*) + Q_B(q^*))$.

Direct calculation shows that

$$\frac{\partial \Delta_A}{\partial t_A} = c' + \frac{dq^*}{dt_A} - (1-t_A)c'' \cdot \frac{d(Q_A+Q_B)}{dq} \cdot \frac{dq^*}{dt_A} \tag{28}$$

and

$$\frac{\partial \Delta}{\partial t_B} = \frac{dq^*}{dt_B} - (1-t_A)c'' \cdot \frac{d(Q_A+Q_B)}{dq} \cdot \frac{dq^*}{dt_B}. \tag{29}$$

From (20),

$$\frac{d(Q_A+Q_B)}{dq} = \frac{r_A''}{|E|} \cdot \frac{\partial^2 r_B^*}{\partial Q_B^{*2}} < 0. \tag{30}$$

Inequality (30) implies that the strategic effect on the amount of mis-pricing has the same

sign as dq^*/dt_x for $x \in \{A, B\}$. Holding t_A fixed, an increase in q^* decreases $Q_A + Q_B$. The reduction in multinational production lowers the multinational's marginal cost and increases the amount of mis-pricing. However, an increase in t_A reduces the optimal transfer price and creates a negative strategic effect. At the same time, the direct effect of an increase in t_A increases the amount of mis-pricing as it lowers marginal cost holding all quantities fixed. Thus, the sign of $\partial\Delta_A/\partial t_A$ is ambiguous. An increase in t_B only generates a strategic effect. The effect on the amount of mis-pricing will be ambiguous given the ambiguous effect of t_B on q^*.

D. Comparative statics with respect to q^* on stage-2 quantities when affiliate B is the producer

Totally differentiating first-order conditions (4) yields

$$\begin{pmatrix} (1-t_A)r_A'' & 0 & 0 \\ -c'' & \frac{\partial^2 r_B}{\partial Q_B^2} - c'' & \frac{\partial^2 r_B}{\partial Q_B^* \partial Q_B} \\ 0 & \frac{\partial^2 r_B^*}{\partial Q_B \partial Q_B^*} & \frac{\partial^2 r_B^*}{\partial Q_B^{*2}} \end{pmatrix} \cdot \begin{pmatrix} dQ_A \\ dQ_B \\ dQ_B^* \end{pmatrix} = \begin{pmatrix} dq \\ 0 \\ 0 \end{pmatrix}. \tag{31}$$

Let E denote the 3x3 matrix in (31). $|E| < 0$ at any locally-stable stage-2 equilibrium. Solving (31) yields

$$\begin{aligned} \frac{dQ_A}{dq} &= \left(\left[\frac{\partial^2 r_B}{\partial Q_B^2} - c'' \right] \frac{\partial^2 r_B^*}{\partial Q_B^{*2}} - \frac{\partial^2 r_B}{\partial Q_B^* \partial Q_B} \frac{\partial^2 r_B^*}{\partial Q_B \partial Q_B^*} \right) / |E| = \frac{1}{(1-t_A)r_A''} < 0 \\ \frac{dQ_B}{dq} &= c'' \frac{\partial^2 r_B^*}{\partial Q_B^{*2}} / |E| \geq 0, \text{and} \\ \frac{dQ_B^*}{dq} &= -c'' \frac{\partial^2 r_B^*}{\partial Q_B \partial Q_B^*} / |E| \leq 0 \quad \text{if } Q_B \text{ and } Q_B^* \text{ are strategic substitutes} \end{aligned} \tag{32}$$

Furthermore, we have

$$\frac{d(Q_A + Q_B)}{dq} = \left(\frac{\partial^2 r_B}{\partial Q_B^2} \frac{\partial^2 r_B^*}{\partial Q_B^{*2}} - \frac{\partial^2 r_B}{\partial Q_B^* \partial Q_B} \frac{\partial^2 r_B^*}{\partial Q_B \partial Q_B^*} \right) / |E|. \tag{33}$$

Because the term in parentheses in (33) can be positive or negative, the sign of $d(Q_A + Q_B)/dq$ is ambiguous. A larger transfer price will result in the multinational selling less in country B. At the same time, the diseconomies of scope between Q_A and Q_B will result in the multinational selling more in country A.

Similar analysis shows that $dQ_i/dt_B = 0$ and $dQ_i/dt_A = (q^*/(1-t_A)) \cdot dQ_i/dq$ for $Q_i \in \{Q_A, Q_B, Q_B^*\}$.

E. Comparative statics with respect to the tax rates on q^* when affiliate B is the sole producer

Totally differentiating (14), with all expressions evaluated at the equilibrium transfer price q^*, yields

$$\frac{d^2\Pi}{dq^2}dq^* + \frac{d^2\Pi}{dt_A dq}dt_A + \frac{d^2\Pi}{dt_B dq}dt_B = 0 \tag{34}$$

where

$$\frac{d^2\Pi}{dt_B dq} = c' \cdot \frac{\partial Q_A}{\partial q} - \frac{\partial r_B}{\partial Q_B^*} \cdot \frac{\partial Q_B^*}{\partial q} \tag{35}$$

and

$$\frac{d^2\Pi}{dt_A dq} = \frac{q}{1-t_A}\frac{d^2\Pi}{dq^2} - \frac{(1-t_B)}{1-t_A}\frac{d^2\Pi}{dt_B dq}. \tag{36}$$

When Q_B and Q_B^* are economic and strategic substitutes or economic and strategic complements, $d^2\Pi/dt_B dq < 0$ and (34) implies

$$\frac{dq^*}{dt_B} = \frac{-d^2\Pi/dt_B dq}{d^2\Pi/dq^2} < 0 \tag{37}$$

and

$$\frac{dq^*}{dt_A} = \frac{-d^2\Pi/dt_A dq}{d^2\Pi/dq^2}. \tag{38}$$

Defining the amount of mis-pricing by $\Delta_B(t_A, t_B) \equiv q^* - (1-t_B)c'(Q_A(q^*) + Q_B(q^*))$, direct calculation yields

$$\frac{\partial \Delta_B}{\partial t_A} = \frac{dq^*}{dt_A} - (1-t_B)c'' \cdot \frac{d(Q_A+Q_B)}{dq} \cdot \frac{dq^*}{dt_A}. \tag{39}$$

$$\frac{\partial \Delta_B}{\partial t_B} = c' + \frac{dq^*}{dt_B} - (1-t_A)c'' \cdot \frac{d(Q_A+Q_B)}{dq} \cdot \frac{dq^*}{dt_B} \tag{40}$$

We can rewrite these equations as

$$\frac{\partial \Delta_B}{\partial t_A} = \beta_B \cdot \frac{dq^*}{dt_A} \quad \text{and} \quad \frac{\partial \Delta_B}{\partial t_B} = c' + \beta_B \cdot \frac{dq^*}{dt_B} \tag{41}$$

where

$$\beta_B \equiv 1 - (1-t_B)c'' \cdot \frac{d(Q_A+Q_B)}{dq} \cdot \frac{dq^*}{dt_A}. \tag{42}$$

There is only a direct effect following a change in t_A whereas there is a direct and an indirect effect following a change in t_B.

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