Border Adjusted Prices and Transfer Pricing

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The tax reform plan advanced by U.S. Congressional Republicans beginning in 2016 (Tax Reform Task Force, 2017) has stimulated recent research on destination-based cash flow taxes (DBCFT). Although the current outline for tax reform as of the Fall 2017 no longer includes for DBCFT, there remains much discussion about the impact of such taxes. DBCFT have two main components: a cash flow tax and border adjustments. The first component defines a firm's taxable income as its revenues minus all it expenditures (including capital expenses) while the second component adjusts this definition of taxable income by exempting export income from taxation and denying a tax deduction for the cost of imported inputs. A common claim in the literature is that adoption of DBCFT would eliminate the incentive for multinational firms to shift income from high-tax into low-tax countries via transfer prices and they would eliminate the associated production distortions. These claims seem to have their origins going back to the foundational papers on cash flow taxes (e.g., Brown (1948) and Sandmo (1979)) in which it was assumed that all countries would adopt a cash flow tax.

In this paper, we analyze the after-tax profit-maximizing transfer prices a multinational firm sets for both exported and imported intermediate goods when only the firm's home country adopts border adjusted taxes. From the perspective of the initial U.S. House Republican plans, this unilateral adoption case most accurately reflects the situation that was being considered. While border adjusted taxes do change a firm's transfer pricing incentives, we find that these incentives are not eliminated. Our finding directly contradicts statements made by Auerbach and Holtz-Eakin (2017) that "Border adjustments eliminate the incentive to manipulate transfer prices in order to shift profits to lower-tax jurisdictions" and "Border adjustments eliminate the incentive to shift profitable production activities abroad simply to take advantage of lower foreign tax rates."

Our reason for focusing attention on the border-adjustment component of DBCFT is because this is the component that bears most directly on the transfer price incentives firms operating in a border adjustment regime face. In order to analyze the production and transfer pricing incentives created by unilateral adoption of border adjustments, we begin with a two-country economy in which both countries use a source-based corporate income tax system (SBT). One country (country 1) is home to multinational firms and a final good market. The other country (country 2) hosts intermediate good production as well as a final good market. Using an Antràs and Helpman (2004) model with heterogeneous multinational firms, each multinational firm must choose either to outsource the production of a required intermediate good to an independent country 2 producer and to produce the intermediate good in a subsidiary located in country 2 and thus operate as an integrated firm. Firms differ in their marginal cost of producing the intermediate good through a subsidiary. As one would expect, more efficient country 1 firms will choose to integrate and less efficient country 1 firms will choose to outsource. All units of the intermediate good are shipped to the parent firm in country 1, where final good production takes place. The final goods can then be sold to consumers in country 1 and exported to consumers in country 2. We then analyze the case in which country 1 adopts a destination-based corporate income tax system (DBT). Because our model includes both import and export behavior, our analysis can capture both margins that can be influenced by border adjusted taxes. While an additional change to a cash flow tax will change the intensive and extensive choices of country 1 multinationals, it will not eliminate the transfer pricing incentives that persist under a DBT.

The transfer price incentives are influenced by the corporate income tax rates of both countries, t_1 and t_2. Consistent with the typical U.S. scenario, if $t_1 > t_2$, then an integrated country 1 parent under a SBT has the incentive to shift income into country 2 by setting its transfer price below the arm's-length price country 1 tax authorities would like it pay. Imperfect transfer price auditing results in a transfer price below the arm's-length price as each country 1 parent will trade off its marginal tax savings of $t_1 - t_2$ against its marginal country 1 auditing penalties. Under a DBT, an integrated country 1 parent loses the tax deduction for what it pays its subsidiary for the each unit of the intermediate good so it will set its transfer price to trade off marginal tax savings of $0 - t_2$ against marginal country 2 auditing penalties. In other words, the integrated country 1 parent now faces the incentive to set its transfer price above the arm's-length price. The switch to a DBT does not eliminate transfer price incentives but reverses them! Many authors have argued that a switch to a DBT by a major country such as the United States would neutralize these new transfer price incentives through exchange rate adjustments. However, while exchange rate adjustments have the potential to change the arm's-length price, they cannot neutralize tax differential effects across heterogeneous firms.

The unilateral adoption of a DBT can also change final good prices and sales quantities in each country as well as the choice of each country 1 firms to outsource its intermediate good production or to produce it in a subsidiary. The Antràs and Helpman (2004) type model we analyze allows us to identify these effects as well. To do this we need to adapt the Antràs and Helpman (2004) model by introducing the specifics of corporate income taxation under both an SBT and a DBT. In this regard we follow the approach of Bauer and Langenmayr (2013).

In the absence of exchange rate effects, outsourcing country 1 firms will pay the same price for the intermediate good but will buy fewer units under a DBT. They will also charge the same final good price in country 2. Their country 1 final good price will increase in order to offset the higher after-tax cost of the intermediate good. The price and output responses of integrated firms is slightly different as unilateral adoption of a DBT has both marginal revenue effects (through the tax advantage afforded export sales) and marginal cost effects (through transfer pricing). With a DBT, integrated firms will charge a higher final good prices in country 1 than in country 2. Their country 1 prices will also be higher under DBT relative to SBT. But, the country 2 (export) prices can fall under DBT as the change in the relevant transfer price tax differentials from $|t_1 - t_2|$ to $|0 - t_2|$ will affect the change in an integrated firms effective after-tax marginal cost of production. Not surprisingly then, the total final good output of integrated firms can also increase or decrease following a change to a DBT. Moreover, the identity of the marginal integrated firm can change under a DBT. However, if we eliminate transfer price incentives by assuming perfect auditing then a change to a DBT will have no effect on the decision of a country 1 firm to outsource or integrate. We believe this last result emphasizes the importance of transfer price incentives in evaluating the economic impact of the unilateral adoption of a DBT.

To return to the Tax Reform Task Force proposal, we note that it was dropped due to considerable opposition from large U.S. retailers that made considerable investments to move their supply chains offshore. Free entry of country 1 firms into outsourcing implies that outsourcing firms earn zero economic profit under SBT and DBT. The choice of a tax system will affect the equilibrium profits of integrated firms, with the marginal integrated firm earning zero economic profit. As noted above, whether the measure of integrated firms increases or decreases from a shift to a DBT will depend on how the identity of the marginal firm changes, which it turn depends on tax rate differences. However, the Tax Reform Task Force proposal included a reduction in the country 1 tax rate. One could argue that any negative profit consequences of a shift to a DBT can be offset by a reduction in the corporate tax rate. In our model, a change in the country 1 tax rate does not change equilibrium profit for any integrated firm. Free entry or exit of outsourcing firms absorbs any benefits from a lower tax rate and thus has no effect on the identity of the marginal integrated firm.

2 The Model

We consider a two country model with two final goods: a perfectly competitive production sector (good Y) and differentiated good sector (good X) characterized by monopolistic competition. Good X is produced by combining headquarter services in country 1 with an intermediate good produced in country 2, and we focus on the choice of the X firms in country whether to outsource production of the intermediate good to an independent supplier in country 2 or to set up a subsidiary in production country 1. We model country 1 has a high corporate tax country relative to country 2, and examine how tax policy affects the choice between outsourcing and integration. Production of the competitive good is assumed to take place in each country.

2.1 Consumer Preferences and Production Structure

Preferences over the two goods are given by the quasi-linear preference function

$$U_j = \mu_j \ln X_j + Y_j \text{ for } j = 1, 2,$$

where $X_j = \left(\int_{i\in\Omega_j} x_i^{\frac{\sigma-1}{\sigma}} di\right)^{\frac{\sigma}{\sigma-1}}$, Ω_j is the set of varieties of good X offered in country j, and $\sigma > 1$.The demand functions for the individual varieties in country j will be given by

$$x_j = \frac{\mu_j p_j^{-\sigma}}{P^{1-\sigma}}, \tag{1}$$

where $P_j = \left(\int_{i\in\Omega_j} p^{1-\sigma}\right)^{\frac{1}{1-\sigma}}$ is the price index in country j.

Good Y is produced using only labor in each country under conditions of constant returns to scale and perfect competition. We choose good Y to be the numeraire, and assume for simplicity that the productivity of labor in production in good 2 is the same in each country. We abstract from trade costs and tariffs, so that the wage rate in each country will equal 1 under the assumption that labor is sufficiently abundant that good Y is produced in both countries in equilibrium.

A variety of good X is produced using a unit of headquarter services in the home country and one unit of an intermediate good, M, per unit of output. We assume that the cost of production of the intermediate in country 1 is sufficiently high to that in country 2 that local production of the intermediate is not an option for X firms. Headquarter services require a fixed investment of c units of labor in the home country. If the firm chooses to outsource the intermediate good to the foreign country, it requires one unit of labor in the foreign country. If the firm produces the intermediate in a foreign subsidiary, it incurs a fixed cost of f units of home labor and a variable cost of a units of foreign country labor per unit of output.

Firm heterogeneity is introduced by assuming that firms differ in their efficiency of producing in the foreign subsidiary. Specifically, we assume that productivity in the foreign subsidiary is a random variable with distribution function $G(a)$ with $a \in [\underline{a}, \infty)$, so that a firm's choice between outsourcing and integration will depend on its value of a. Potential entrants are assumed to know their value of a prior to entry, so that they make their entry decision based on the knowledge of their decision on supply of the intermediate.

2.1.1 Tax Policy and Transfer Pricing

Let t_j denote the rate at which corporate income is taxed in country j. We assume that country 2 is a low tax rate country relative to country 1, so that $t_2 < t_1$. We will compare two different tax systems for country 1: a source based tax system (SBT) and a destination based tax system (DBT) with border adjustments. Under an SBT, taxable income of an X sector firm in country 1 consists of revenues earned from sales in the two markets less the cost of intermediates purchased from county 2. If the firm outsources the product to a country 2 firm, the cost of inputs purchased is determined by the sales price that is negotiated between the final good producer in country 1 and the intermediate producer in country 2. If the firm produces in a subsidiary, the allocation of taxable income is determined by a transfer price that is set by the firm for intrafirm trade.

Under a DBT, taxable income of an X sector firm consists of revenues from sales in market 1. Under the assumption of border adjustments in the DBT, the imported intermediate goods are not deductible from taxes in country 1. We assume that the fixed costs of headquarters services, c, and of subsidiary services, f, are not deductible from country 1 taxes under either system. [1]. Taxable income in country 2, whether for unrelated supplier or subsidiary, is the difference between revenue from sales of the intermediate good to the X producer in country 1 and labor costs.

[1] The issues we address are related to the debate over whether to change the US corporate income tax, which is analogous to our SBT, to a destination based cash flow tax (DBCFT) with border adjustments as advocated by Auerbach et al (). The proposal for a DBCFT also differs from the US corporate income tax in that it allows immediate deductions for capital investments. We abstract from this difference in the two tax systems because we treat the deductility of home country input expenses as symmetric under the two systems.

2.2 Payoffs for an Outsourcing Firm

We first analyze the payoff if the firm chooses to outsource the production of the intermediate good to a firm in country 2. We assume that the intermediate input produced for a final producer i is specialized to that firm, so that there is a holdup problem associated with its production. Once the intermediate good has been produced by the supplier in country 2, the supplier engages in Nash bargaining with the producer of the final good in country 1.

The after-tax profit of a supplier of good M in country 2 will be

$$\Pi_S^O = (1 - t_2)(r - 1)m^O,$$

where r is the price negotiated with the multinational and m^O is the quantity of the good produced by the intermediate producer. The after-tax profit of the X producer is the after-tax revenue from sales in the respective markets less after-tax costs of variable and fixed inputs. Letting t_{1j} denote the tax rate imposed by country 1 on sales in market j, the after-tax profits of the final goods producer will be

$$\Pi^O = (1 - t_{11})R_1^O + (1 - t_{12})\left(R_2^O - rm^O\right) - c \tag{2}$$

where R_j^O is the revenue that the final goods producer earns from sales in market j. In the case of the SBT, the firm faces the same tax rate in each market and can deduct the cost of intermediates, so $t_{11} = t_{12} = t_1$. Under the DBT the firm pays no tax on sales in market 2 but cannot deduct the cost of the imported input, so $t_{11} = t_1$ and $t_{12} = 0$. Since all firms face the same payoffs from outsourcing, Π^O is independent of the firm's unit labor requirement if it chooses to outsource.

If the final good producer i purchases m^O of the intermediate good, it will produce an output of $x^O = m^O$ and will allocate the outputs across markets to maximize after-tax revenue. The revenue of a representative final goods producer from selling x_j units in market j,given the outputs of all other firms in market j, will be

$$R_j = \mu_j \left(\frac{x_j}{X_j}\right)^{\frac{\sigma-1}{\sigma}} \tag{3}$$

Letting $k_i = (1 - t_{1i})\mu_i X_i^{\frac{1-\sigma}{\sigma}}$, the maximum after-tax revenue from an output of x can be written as

$$\begin{aligned} \Psi(x) &= \max_{x_2}(1 - t_{11})R_1(x - x_2) + (1 - t_{12})R(x_2) \\ &= \kappa(t_{11}, t_{12})x^{\frac{\sigma-1}{\sigma}} \end{aligned} \tag{4}$$

where $\kappa(t_{11}, t_{12}) \equiv (k_1^{\sigma} + k_2^{\sigma})^{\frac{1}{\sigma}}$.

The parameter k_j captures the profitability of the j market, reflecting both the tax rate and intensity of competition in that market, and κ is a measure of the overall profitability of the two markets. The share of output allocated to market j is determined by its relative profitability,

$$x_j^O = \frac{k_j^{\sigma} m^O}{k_1^{\sigma} + k_2^{\sigma}}. \tag{5}$$

Observe that each firm will treat the parameters k_j as exogenously given when making sales decisions. However, the k_j will be endogenously determined in a free entry equilibrium because the measure and composition of entrants will determine the X_j.

We assume no outside market for the firm-specific version of the intermediate, so in the absence of an agreement the seller in country 2 loses its wage costs, m^O, and the buyer in country 1 loses the fixed cost, c. Letting β denote the relative bargaining power power of the firm in country 1, we can express the solution to the Nash bargaining problem as choosing r to maximize $\left(\Pi^O + c\right)^{\beta} \left(\Pi_S^O + (1 - t_2)m^O\right)^{1-\beta}$, which yields

$$r = \left(\frac{1-\beta}{1-t_{12}}\right) \frac{\Psi(m^O)}{m^O} \tag{6}$$

With a SBT where the tax rate on revenue is t_1 across both markets, the supplier earns a share $(1 - \beta)$ of the final good producer's pre-tax revenue. In the case of a DBT where $t_{12} = 0$, the supplier earns a share $(1 - \beta)$ of the post-tax revenue.

Substituting (6) into (2), the profits of the firm will be a share $\beta\Psi(m)$ in either case. Since $\Psi(m)$ is strictly increasing in m, the value of m^0 will be determined by the supplier to to maximize its after-tax profits. The necessary condition for maximizing after-tax profits is $\partial(rm^O)/\partial m^O = 1$, which yields

$$m^O = \left[\frac{(1-\beta)\kappa}{1-t_{12}}\frac{\sigma-1}{\sigma}\right]^{\sigma} \tag{7}$$

The quantity of intermediate good will be increasing in the profitability of the markets for final goods, κ and increasing in the tax rate on the final good producer's sales in market 2. The latter effect reflects the extent to which the imported inputs are deductible from taxes in country 1.

Substituting (7) into (6) and using (1) yields solutions for the prices of the intermediate and final goods when the firm outsources, which gives: (see Appendix for Proofs)

Proposition 1 *The prices of the intermediate input and final good under outsourcing will be*

$$\begin{aligned} r^O &= \frac{\sigma}{\sigma-1} \\ p_j^O &= \left(\frac{1-t_{12}}{1-t_{1j}}\right)\frac{\sigma}{(1-\beta)(\sigma-1)} \end{aligned}$$

Outsourcing firms under a destination based tax will charge a higher final goods price in their home market than under a destination based tax, but will charge the same price in the export market. Producers of the intermediate good receive the same price under either regime.

The price of the intermediate good is a markup over marginal cost reflecting the demand elasticity for the final good. The price of the final good is a markup over the price of the intermediate good that reflects the tax treatment of the intermediate relative to the final good and the inverse of the bargaining power of the intermediate supplier. In the case of an SBT, $t_{12} = t_{11}$ and the price in each market will be $\frac{\sigma}{(1-\beta)(\sigma-1)}$. The tax treatment of intermediate and final goods is symmetric in this case, so the final good's producer's markup over the cost of the intermediate reflects its relative bargaining power. In the case of a DBT, the prices will be $p_1 = \left(\frac{1}{1-t_{11}}\right)\frac{\sigma}{(1-\beta)(\sigma-1)} > p_2 = \frac{\sigma}{(1-\beta)(\sigma-1)}$. The price of the final good is higher under a DBT than under an SBT because the purchase of the intermediate good is not deductible from taxable income. However, the price under a DBT is the same in the export market as under the SBT because the lack of deductibility of intermediate costs is offset by the exemption of export sales from taxation. A switch to a DBT will thus result in a higher price for the good in the home market.

2.3 Integrated Firm Optimization

We now turn to the case in which the country 1 firm chooses to produce the intermediate good in a wholly owned subsidiary. An integrated firm can produce the intermediate good at a lower resource cost than an outsourcing firm if it draws a unit labor requirement of $a < 1$ for producing the intermediate good in a subsidiary. We also assume that that an integrated firm is able to avoid the holdup problem, and thus avoids the double marginalization associated with outsourcing. However, producing a subsidiary requires the firm to incur a fixed cost of f to operate the subsidiary.

In addition to the potential to reduce unit labor costs, the integrated firm also has the potential to use transfer prices to reduce taxable income. With an integrated firm, the allocation of taxable income between the parent and the subsidiary will be determined by the transfer price, ρ, that the firm chooses for intra-firm trade. The after-tax contribution to revenue in country 2 of a unit of the intermediate will be $\rho(1-t_2)$, while the after-tax cost of the input in country 1 of a unit is $\rho(1-t_{12})$. Global after-tax profits will be increasing in ρ iff $t_{12} > t_2$, so the firm will have an incentive to set the transfer price as high as possible if $t_{12} > t_2$ and as low as possible if $t_{12} < t_2$.

In order to prevent firms from manipulating transfer prices to reduce taxable income, tax authorities define an arms length transfer that the firm should charge on intra-firm transactions prices. The CUP method allows firms to make adjustments for firm-specific differences, so we allow the arms length price to differ with a and denote by $\tilde{\rho}(a)$. We assume that the arms length price is common across countries. There are several possible approaches to determining an arms length price. One option would be to define the arms length price as the marginal cost to the firm, which in this case would be the labor cost of the subsidiary, a. Another option would be to use the observed market price between unrelated firms, which is the value $r^O = \frac{\sigma}{\sigma-1}$ paid by firms that outsource. Finally, the tax authority might choose marginal cost plus a markup. For the main results we will assume that the arms length price satisfies $\tilde{\rho}(a) \geq a$ and $\frac{d\tilde{\rho}(a)}{da} \geq 0$, which allows for any of these cases.

Since inputs are firm specific and heterogeneous in cost, it will be difficult for tax authorities to identify the appropriate arms length price for a given firm. Therefore, we assume that the firm can deviate from the appropriate arms length price by incurring a cost $C_i(\rho, \tilde{\rho}(a)) = \alpha_i(\rho - \tilde{\rho}(a))^2$ per unit of the intermediate good, where $\alpha_i > 0$. This function captures the notion that the firm faces increasing marginal costs of raising the transfer cost, with the magnitude of α_i reflecting the ability of country i to identify the appropriate arms length price for the firm. Since the high tax country will have the strongest incentive to monitor transfer prices to avoid the loss of revenue, we allow for country specific transfer pricing costs. The change in tax systems will affect which country is the high tax country, because country 1 will be the high tax country under the SBT ($t_{12} = t_1$) and country 2 will be the high tax country under the DBT ($t_{12} = 0$).

Given a quantity m of intermediate inputs produced by the subsidiary, an integrated firm will have output $m = x_1 + x_2$ to allocate between markets in a profit maximizing way. after-tax revenue can be expressed as $\Psi(m)$ as in the case of the outsourcing firm. With these assumptions, the after-tax global profits of a representative firm with unit labor requirement a will be

$$\begin{aligned} \Pi^I(m, \rho; a) &= \Psi(m) - (1 - t_{12})(\rho + \delta_1 C_1(\rho, \tilde{\rho}(a)))m \\ &\quad + (1 - t_2)(\rho - a - (1 - \delta_1)C_2(\rho, \tilde{\rho}(a)))m \end{aligned} \tag{8}$$

where δ_1 is an indicator variable that is equal to 1 if country 1 is the high tax country and 0 otherwise. We assume that the transfer pricing costs are tax deductible in the country in which they are incurred and that only the high tax country monitors the transfer price.[2] The objective of the firm is to choose m and ρ to

[2] We focus in the text on the case where only the high tax countries monitor. However, the results for the case where both

maximize (8).

The necessary condition for choice of ρ yields the optimal transfer pricing formula,

$$\rho^*(a) = \tilde{\rho}(a) + \frac{t_{12} - t_2}{2(\alpha_1\delta_1(1 - t_{12}) + \alpha_2(1 - \delta_1)(1 - t_2)}. \tag{9}$$

The firm will have an incentive to transfer income to the low tax location, with the magnitude of the deviation from the arms length price positively related to the magnitude of the tax differential and inversely related to the effectiveness of the monitoring by the tax authority. The arms length case is obtained when tax authorities have perfect monitoring, so evasion becomes arbitrarily costly (i.e.$\alpha_i \to \infty$).[3] With imperfect monitoring, the transfer price will exceed the arms length price under an SBT and will be less than the arms length price with a DBT.

The necessary condition for optimal level of imports requires that after-tax marginal revenue equal the after-tax marginal cost,

$$\left(\frac{\sigma - 1}{\sigma}\right)\kappa m^{-\frac{1}{\sigma}} = \Delta(a, t_{12}, t_2) \tag{10}$$

where after-tax marginal cost can be written using (9) as

$$\Delta(a, t_{12}, t_2) = (1 - t_{12})a + (t_2 - t_{12})(\tilde{\rho}(a) - a) - \frac{(t_{12} - t_2)^2}{4(\alpha_1\delta_1(1 - t_{12}) + \alpha_2(1 - \delta_1)(1 - t_2)} \tag{11}$$

The sum of the first two terms is the marginal cost when the transfer price is evaluated at the arms length price as defined by tax authorities. The last term reflects the reduction in marginal cost resulting from the transfer pricing policy of the firm. The ability to use transfer pricing to reduce tax liabilities reduces the marignal cost of output below what it would be otherwise.

Using (10) and the firm's demand, we obtain the following results on the optimal price and quantity for an integrated firm.

monitor is similar, and will be discussed in footnotes.

[3]If monitoring occurs in both countries, then the denominator in (9) becomes $2(\alpha_1(1-t_{12})+\alpha_2(1-t_2)$, so that the marginal cost of deviating from the arms legnth price is the sum of the marginal evasion costs across the two markets.

Proposition 2 *For an integrated firm, the optimal price and quantity will be*

$$\begin{aligned} m^I(a, t_{12}, t_2) &= \left(\frac{\kappa}{\Delta(a, t_{12}, t_2)} \frac{\sigma - 1}{\sigma}\right)^{\sigma} \\ p_j^I(a, t_{12}, t_2) &= \frac{\Delta(a, t_{12}, t_2)}{1 - t_{1j}} \frac{\sigma}{\sigma - 1} \end{aligned} \tag{12}$$

(a) Under an SBT, integrated firms will charge the same final goods price in each market.

(b) Under a DBT, integrated firms will charge a higher price in their home market than in the export market.

(c) The price in the home market will be higher under a DBT than under an SBT..

(d) The price in the export market will be higher under a DBT than under an SBT if and only if $\Delta(a, t_1, t_2) < (1 - t_1)\Delta(a, 0, t_2)$.

The effect of the tax policy on pricing for integrated firms in parts (a) and (b) is the same as for outsourcing firms. The tax treatment of domestic sales and export sales is the same under a source based tax, so the firm will choose the same price in each market. For a destination based tax, the price will be lower in the export market than in the domestic market due to the more favorable treatment of export earnings.

The optimal price of an integrated firm is a product of the relative after-tax cost of the input to the final good in market j, $\frac{\Delta(a,t_{12},t_2)}{1-t_{1j}}$, and a markup reflecting the demand elasticity for the final good. Observe that there are two differences between the optimal pricing formula for an outsourcing firm derived in Proposition 1 and that for an integrated firm. One is due to the fact that there is double marginalization due to the holdup problem when the firm outsources, which adds a markup factor of $\frac{1}{1-\beta}$. The other is that the after-tax cost of the input in the case of the outsourcing firm, $1 - t_{12}$, differs from that of the integrated firm, $\Delta(a, t_{12}, t_2)$. The difference in input costs is due to differences in labor productivity of the subsidiary and the potential for tax avoidance due to transfer pricing.

3 Equilibrium Entry and Selection

Since firms are assumed to know their value of a prior to entry, a firm with productivity a will enter the industry if $\max[\Pi^O, \Pi^I(a)] \geq 0$. If this condition is satisfied, the firm will enter as an integrated firm if $\Pi^I(a) \geq \Pi^O$. By the Envelope Theorem, $\frac{d\Pi^{*I}(a)}{da} = -\left((1-t_2) + (t_2 - t_{12})\frac{d\tilde{\rho}(a)}{da}\right) m^*(a)$, which must be negative for an DBT and will be negative for a SBT as long as $\frac{d\tilde{\rho}(a)}{da} < \frac{1-t_2}{t_1-t_2}$.We assume this condition is satisfied.[4] Letting a^* denote the value of a at which $\Pi^I(a) = \max[0, \Pi^O]$, all potential firms with $a \in [\underline{a}, a^*]$ will enter as integrated firms.

Entry will increase the outputs X_j until κ falls sufficiently that there is no additional incentive for firms to enter. There are three types of possible equilibria. If the fixed costs of forming a subsidiary are sufficiently high that $\Pi^O = 0 > \Pi^I(\underline{a})$, then all firms will outsource in a free entry equilibrium. If high productivity firms are sufficiently abundant that $\Pi^I(a^*) > \Pi^O$, then all firms will be vertically integrated in equilibrium. Finally, there will be a mixed equilibrium with both outsourcing and integration if $\Pi^I(a^*) = \Pi^O = 0$ for $a^* > \underline{a}$. Since outsourcing and integration typically coexist in manufacturing industries, we will focus on parameter values for which there is an interior equilibrium with both outsourcing and integration.

Since some firms are assumed to be outsourcing in equilibrium, (homogeneous) outsourcing firms will enter until κ falls sufficiently that $\Pi^O = \kappa m^{\frac{\sigma-1}{\sigma}} - \frac{\sigma}{\sigma-1}m - c = 0$, which yields

$$\kappa = \left(\frac{c}{\beta}\right)^{\frac{1}{\sigma}} \left(\frac{1-t_{12}}{1-\beta}\frac{\sigma}{\sigma-1}\right)^{\frac{\sigma-1}{\sigma}} \tag{13}$$

Since κ is a measure of the after-tax profitability of the final goods sector, (13) indicates that with free entry of outsourcing firms the after-tax profitability of the final goods sector will be an increasing function of c and a decreasing function of t_{12}. The term $(1-t_{12})$ reflects the after-tax cost of inputs to the final good producer under outsourcing. Larger values of c and lower values of t_{12} increase the costs of outsourcing firms, so that profitability must be higher in equilibrium to offset the higher costs.

[4] Since $\frac{1-t_2}{t_1-t_2} > 1$, a sufficient condition is that $\frac{d\tilde{\rho}(a)}{da} \leq 1$. If the arms length price is a markup over the marginal cost, λa for $\lambda > 1$, the condition becomes $\frac{1-t_2}{t_1-t_2} > \lambda$,

Substituting (13) into (7) and (12) , we obtain the equilibrium level of output for the respective types of final goods producers in a free entry equilibrium,

$$
\begin{aligned}
\bar{m}^O &= \frac{c(1-\beta)}{1-t_{12}}\frac{\sigma-1}{\sigma} \\
\bar{m}^I(a) &= \frac{c}{\beta}\frac{\sigma-1}{\sigma}\left(\frac{1-t_{12}}{1-\beta}\right)^{\sigma-1}\Delta(a,t_{12},t_2)^{-\sigma}
\end{aligned}
\tag{14}
$$

Equation (14) reflects the effects of variable costs as opposed to fixed costs on the size of size of firms in the zero profit equilibrium. For outsourcing firms, the size of the firm in a zero profit equilibrium is an increasing function of the fixed costs, c, and a decreasing function of the after-tax cost of inputs, $r(1-t_{12})$. A switch to a DBT will reduce the size of outsourcing firms because it increases the after-tax cost of inputs.

For an integrated firm, output is increasing in $\frac{\kappa}{\Delta(a,t_{12},t_2)}$ from (12). An increase in fixed costs, c, will raise output of integrated firms in the free entry equilibrium because it requires an increase in the profitability of firms, κ, in order to restore zero profits for outsourcing firms. A change from an SBT to a DBT will have conflicting effects, because it raises both κ and $\Delta(a,t_{12},t_2)$. We thus have the following result on the effect of a change in the tax system on outputs.

Proposition 3 *A change from a SBT to a DBT will*

(a) reduce the quantity produced by outsourcing firms in the free entry equilibrium

(b) reduce the output of integrated firms in the free entry equilibrium if and only if $\Delta(a,t_1,t_2) < (1-t_1)^{\frac{\sigma-1}{\sigma}}\Delta(a,0,t_2)$.

Proposition 3 shows the effect of the shift in tax system on the output of individual firms. We can also establish the effect on overall output in the two markets. The relative profitability of the two markets is the same for all firm types, so all firms sell in the two markets in the same proportion. The relative aggregate outputs in the two markets will satisfy

$$X_2 = \frac{(1-t_{12})\mu_2 X_1}{(1-t_{11})\mu_1}. \tag{15}$$

A switch from an SBT to a DBT will raise the relative sales in market 2, since the firm's sales in market 2 are not subject to tax. Substituting this result into the definition of κ and using (13) yields the aggregate equilibrium output levels for each market.

$$X_j = \left(\frac{\beta}{c}\right)^{\frac{1}{\sigma-1}} \frac{(1-t_{1j})\mu_j}{((1-t_{11})\mu_1 + (1-t_{12})\mu_2)^{\frac{1}{1-\sigma}}} \frac{1-\beta}{1-t_{12}} \frac{\sigma-1}{\sigma} \tag{16}$$

A switch from an SBT to a DBT raises the after-tax cost of inputs to an outsourcing firm, but raises the attractiveness of selling in the foreign market. The following result follows immediately from (16):

Proposition 4 *The aggregate output levels under a DBT relative to an SBT are given by*

$$\begin{aligned} X_1^D &= (1-t_1)\left(\frac{\mu_1 + \mu_2/(1-t_1)}{\mu_1+\mu_2}\right)^{\frac{1}{\sigma-1}} X_1^S \\ X_2^D &= \left(\frac{\mu_1 + \mu_2/(1-t_1)}{\mu_1+\mu_2}\right)^{\frac{1}{\sigma-1}} X_2^S \end{aligned}$$

If there is no demand in country 2, a shift to a destination based tax will reduce aggregate consumption and welfare in country 1. If there is positive demand in country 2, a shift to a destination based tax will increase aggregate consumption in country 2, but can either increase or decrease aggregate consumption in country 1.

We can also compare the revenues earned in each country under an SBT to that under a DBT.

Proposition 5 *Integrated firms will earn less revenue from each country under a DBT than under an SBT if and only if*

$$\left(\frac{(1-t_1)\Delta(a,0,t_2)}{\Delta(a,t_1,t_2)}\right)^{\sigma-1} > \frac{\mu_1+\mu_2}{\mu_1+\mu_2/(1-t_1)} \tag{17}$$

Because the right hand side of (17) is less than or equal to 1, a sufficient condition for the revenue to fall following a switch from SBT to DBT is $(1 - t_1)\Delta(a, 0, t_2) > \Delta(a, t_1, t_2)$. From Proposition 2(d), this is the case in which integrated firms will charge a lower price in country 2 under a DBT.

3.1 Choice between Integration and Outsourcing

An integrated firm will enter as long as they earn sufficient revenue to cover the fixed costs of entry, c,and the fixed cost of forming the subsidiary, f. We assume that a potential entrant of an integrated firm knows its productivity in a subsidiary, a, prior to entry. Denoting the profit of an integrated firm with productivity a when evaluated at profit maximizing prices by $\Pi^{*I}(a)$, entry of an integrated firm will occur if $\Pi^{*I}(a) \geq 0$. We denote the marginal integrated firm by a^*, which is the solution to $\Pi^{*I}(a^*) = 0$.

The shift from an SBT to a DBT will have two effects on the profits of an integrated firm: it raises the cost of inputs to the firm due to the loss in deductibility of imported inputs, but it also raises the equilbrium value of κ from (13) to restore zero profits to outsourcing firms. The following result establishes the condition under which the latter effect dominates, so that profits of integrated firms rise and some firms switch from outsourcing to integration.

Proposition 6 *A shift from a SBT to a DBT increases equilibrium profit for integrated firms and results in a larger measure of integrated firms iff* $(1 - t_1)\Delta(a, 0, t_2) < \Delta(a, t_1, t_2)$.

One factor that influences the impact of a switch to DBT on the incentive to integrate is the relationship between the arms length price and the marginal cost of the intermediate. If the tax authorities define the arms length price to be marginal cost, $\tilde{\rho}(a) = a$, and there is no transfer price manipulation by the firm, then $(1-t_1)\Delta(a, 0, t_2) = \Delta(a, t_1, t_2)$ and the change in the tax system has no effect on the incentives to integrate. If there is perfect monitoring of a transfer price that exceeds *marginal cost, $\tilde{\rho}(a) > a$, then a shift to the DBT will reduce the measure of integrated firms. The SBT provides a greater benefit when the arms length price exceeds marginal cost because the markup above marginal cost is deductible in the high tax country.

A second factor that affects the incentive to integrate is the gain from transfer price manipulation. Under a SBT, the reduction in marginal cost due to transfer price manipulation is $\frac{(t_1-t_2)^2}{4\alpha_1(1-t_1)}$, which is greater the larger the tax differential between the countries and the laxer is enforcement in country 1. For a DBT, the reduction in marginal cost due to transfer price manipulation is $\frac{t_2^2}{4\alpha_2(1-t_2)}$, which is greater the higher is the tax rate in country 2 and the laxer is enforcement in country 2. The tax manipulation component will lead to an expansion of integrated firms with a switch from SBT to DBT if

$$\alpha_1(1-t_1)^2 t_2^2 > \alpha_2(1-t_2)(t_1-t_2)^2$$

If $t_1 = .35$ and $t_2 = .2$ and $\tilde{\rho}(a) = a$, then all integrated firms earn larger profits under the DBT if $\alpha_1 > 1.065\alpha_2$. That is, if transfer pricing is approximately 6.5% more expensive in country 1 than country 2, a shift to the destination based tax will benefit all integrated firms.[5]

4 Tax Rates and Tax Revenues

We can use the equilibrium conditions derived the previous section to analyze the effect of a change in tax rates under a DBT and to compare tax revenues under the two types of systems.

4.1 Effect of a Tax Rate Reduction

In addition to proposals for a change to a switch to a destination based system, there have been calls for a reduction in tax rates. By the envelope theorem, the effect of a change in country 1's tax rate under a dBT on the profits of an integrated firm will be

$$\frac{d\Pi^{*I}(a)}{dt_1} = \frac{d\kappa}{dt_1}\left(m^I\right)^{\frac{\sigma-1}{\sigma}}$$

The zero profit condition for outsourcing firms in (13) shows that the equilibrium value of κ is independent of t_1 under a DBT, so a change in country 1's tax rate will have not impact on the profits of an outsourcing

[5] If both countries are auditing the transfer price, then the condition in the proposition implies $t_1 < t_2(2-t_2)$.

or integrated firm under a DBT.

By Proposition 2, an increase in t_1 will raise the price charged in the home market but has no effect on the equilibrium level of output of an integrated firm. Since the share of output sold in the home market is $\frac{(1-t_1)\mu_1}{(1-t_1)\mu_1+(1-t_{12})\mu_2}$, an increase in t_1 results in a reallocation in the firm's sales from country 1 to country 2.

Proposition 7 *A change in t_1 has no effect on the profits of integrated or outsourcing firms under a DBT.*

4.1.1 Tax Revenues

The switch from an SBT to a DBT by country 1 has two effects on tax revenues: it reduces the revenue collected from export sales but raises eliminates the deductibility of import purchase. We consider the effect of these changes on a representative outsourcing firm and integrated firm in turn.

For an outsourcing firm, country 1 tax revenue equals $T_1^O(t_1, t_{12}) = \beta\left(t_1 R_1^O + t_{12} R_2^O\right)$. Using the fact that

$\frac{k_j^\sigma}{k_1^\sigma+k_2^\sigma} = \frac{(1-t_{1j})\mu_j}{(1-t_1)\mu_1+(1-t_{12})\mu_2}$, tax revenue from the outsourcing firm will be

$$T_1^O = \beta\left(\mu_1 t_1\left(\frac{(1-t_1)\mu_1}{(1-t_1)\mu_1+(1-t_{12})\mu_2}\frac{m^O}{X_1}\right)^{\frac{\sigma-1}{\sigma}} + t_{12}\mu_2\left(\frac{(1-t_{12})\mu_2}{(1-t_1)\mu_1+(1-t_{12})\mu_2}\frac{m^O}{X_2}\right)^{\frac{\sigma-1}{\sigma}}\right) \tag{18}$$

Substituting in (18) for X_2 using (15) and for $\frac{m^O}{X_1}$ using (14) and (16) yields

$$T_1^O = \frac{c\left(\mu_1 t_1 + t_{12}\mu_2\right)}{(1-t_1)\mu_1+(1-t_{12})\mu_2} \tag{19}$$

Since T_1^O is increasing in t_{12} for $\mu_2 > 0$, a shift from an SBT to a DBT must reduce the tax revenue collected from outsourcing firms if the firm sells in the export market. Note that in the case where X firms sell only in the home country market, it follows from (14) and 1 that revenue from market 1 is independent of t_{12}.

For an integrated firm, country 1 tax revenue is $T_1^I = t_1 R_1^I + t_{12}(R_2^I - \rho^* - C_1)m^I$. From Proposition 5, country 1 will collect fewer taxes under the DBT from country 1 sales if and only if the inequality in (17) is satisfied. If (17) is satisfied and $(R_2^I - \rho^* - C_1)$ is non-negative under an SBT, a shift from an SBT to a

DBT will cause country 1 to lose tax revenue from earnings in both markets. Note however that m^I reflects worldwide output while R_2^I is revenue from sales in country 2 only. If demand in country 2 is sufficiently close to zero, taxable income from operations in country 2 is negative. In this case the tax revenue effects from not taxing export income and from eliminating the deduction for imported inputs work in opposite directions. Country 1 tax revenues will unambiguously increase when $\mu_2 = 0$ and (17) is violated. However, if (17) is satisfied when $\mu_2 = 0$, tax revenues under a DBT will exceed those under an SBT if and only if

$$R_1^{IS} - R_1^{ID} < (\rho^* + C_1)m^I(a, t_1, t_2) \tag{20}$$

If (20) holds, the lost revenues from dropping the tax on export revenues are less than the gain in tax revenues from eliminating the deduction on imported inputs.

Appendix

Proof of Proposition 1: Substituting (7) into (5) yields

$$x_j^O = (1-t_{1j})^\sigma \mu_j^\sigma X_j^{1-\sigma}\left[\frac{(1-\beta)}{1-t_{12}}\frac{\sigma-1}{\sigma}\right]^\sigma$$

Using the fact that $P_j X_j = \mu_j$ in the demand function (1), we have

$$x_j^O = \left(\frac{\mu_j}{p_j^O}\right)^\sigma X_j^{1-\sigma}$$

Combining these two results yields the profit-maximizing prices in the respective markets.||

Proof of Proposition 2: The solution for m^I is obtained by inverting (10). The argument then proceeds as in Proposition 1. Substitute for from m^I into (5) to obtain x_j^I. Combining this with $x_j^I = \left(\frac{\mu_j}{p_j^I}\right)^\sigma X_j^{1-\sigma}$ from the expenditure relationship yields the solution for p_j^I.

Proof of Proposition 6: Using (4) and , the profit of an integrated firm can be written as $\Pi^I(a) = \kappa m^{\frac{\sigma-1}{\sigma}} - \Delta m - c - f$. Substituting from (15 into the definition of κ yields

$$\kappa = \kappa(t_{11}, t_{12}) = \left(\frac{(1-t_{11})\,\mu_1}{X_1}\right)^{\frac{\sigma-1}{\sigma}}\left[(1-t_{11})\mu_1 + (1-t_{12})\mu_2\right]^{\frac{1}{\sigma}} \tag{21}$$

$$\Pi^I(a) = \frac{\kappa(t_{11}, t_{12})^\sigma}{\Delta(a, t_{12}, t_2)^{\sigma-1}}\frac{1}{\sigma}\left(\frac{\sigma}{\sigma-1}\right)^{\sigma-1} - f - c$$

The profits of an integrated firm under the SBT will be less than the profits of the same integrated firm under the DBT if and only if

$$\frac{\kappa(t_1, t_1)^\sigma}{\Delta(a, t_1, t_2)^{\sigma-1}} < \frac{\kappa(t_1, 0)^\sigma}{\Delta(a, 0, t_2)^{\sigma-1}}$$

Using (21), we have $\kappa(t_1, t_1) = (1-t_1)^{\frac{\sigma-1}{\sigma}}\kappa(t_1, 0)$, so profits will be lower under the SBT if and only if $(1-t_1)\Delta(a, 0, t_2) < \Delta(a, t_1, t_2)$.||

Proof of Proposition 5: Substituting from (15) into (5)

$$x_j^I = \frac{(1-t_{1j})\mu_j m^I}{(1-t_{11})\mu_1 + (1-t_{12})\mu_2}$$

Then from (3),

$$R_j^I = \mu_j \left(\frac{(1-t_{1j})\mu_j}{(1-t_{11})\mu_1 + (1-t_{12})\mu_2} \right)^{\frac{\sigma-1}{\sigma}} \left(\frac{m^I}{X_j} \right)^{\frac{\sigma-1}{\sigma}}$$

Substituting the equilibrium expressions for m^I and X_j yields

$$R_j^I = \mu_j \left(\frac{(1-t_{1j})\mu_j}{(1-t_{11})\mu_1 + (1-t_{12})\mu_2} \right) \left(\frac{c}{\beta} \right) \left(\frac{1-t_{12}}{\Delta(1-\beta)} \right)^{\sigma-1} \tag{22}$$

Denoting integrated firm revenues in country j under regime x by R_j^{Ix},equation (**??**) implies that

$$\frac{R_j^{IS}}{R_j^{ID}} = \left(\frac{(1-t_1)\Delta(a,0,t_2)}{\Delta(a,t_1,t_2)} \right)^{\sigma-1} \left(\frac{\mu_1 + \mu_2/(1-t_1)}{\mu_1 + \mu_2} \right)$$

The right hand side will be greater than 1 if and only if the condition of the proposition is satisfied. ||

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