Unilateral Tax Reform: Border Adjusted Taxes, Cash Flow Taxes, and Transfer Pricing*

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Abstract

We study the economic effects of unilateral adoption of corporate tax policies that include the choice between destination-based and source-based taxation and between cash flow and income taxes. We utilize a heterogeneous firm model in which monopolistically competitive North firms choose whether to outsource an intermediate good to an unrelated South firm or to produce in a subsidiary in the South. Standard pass through arguments no longer apply because of the income shifting behavior of multinationals and endogenous choice of organizational form. The high tax North country will prefer a destination-based tax over a source-based tax if it adopts a cash flow tax, but whether the cash flow tax is preferred to an income tax will depend on the volume of trade in the differentiated products sector. If the high tax country adopts a destination-based cash flow tax, the low tax country will prefer a destination-based income tax to capture rents from the foreign subsidiaries.

Keywords: border adjustments, destination-based taxes, source-based taxes, cash flow taxes, income taxes, transfer pricing, unilateral tax reform

JEL Classifications: F23, H21, H25, H26

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1 Introduction

As part of the debate over US corporate tax rates, the House Republicans developed a tax reform plan (Tax Reform Task Force, 2017) that proposed the unilateral change of the U.S. corporate tax law from one built around source-based income taxation (SBT) to one built around border-adjusted or destination-based cash flow taxation (DBCFT). Such a change would make two significant changes in the corporate tax system: income would be taxed based on where goods are sold rather than on where they are produced and capital expenditures would be deductible from taxable income.\(^1\) A key component of taxing on the basis of the location of sales is a border adjustment that excludes export sales from taxation, but prevents firms from deducting the cost of imported goods from taxable income.\(^2\)

Advocates of DBCFT (e.g., Auerbach et al 2017) argue that a cash flow tax will be a tax on economic rent and will not distort the international location of capital investments.\(^3\) It is also argued that the effect of the border adjustments will be similar to those of a Value Added Tax (VAT), which involve a rebate of tax on export sales and the taxation of imports and have been argued to have no effect on resource allocation by Grossman (1980) and Feldstein and Krugman (1990). Coinciding with the efficiency properties of DBCFT is the understanding that the incentive for multinational firms to shift income from high-tax into low-tax countries via transfer prices is eliminated.\(^4\) For example, Auerbach and Holtz-Eakin (2016) write in discussing the Republican plan, “Border adjustments eliminate the incentive to manipulate transfer prices in order to shift profits to lower-tax jurisdictions.”

Critics of DBCFT argue that a key assumption in this literature under which these efficiency properties and the elimination of profit-shifting incentives arise, and one not always made explicit, is

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\(^1\) Cash flow taxation can also affect the taxation of debt and interest payments. We abstract from these issues in this paper.

\(^2\) The Tax Cuts and Jobs Act (U.S. Congress, 2017) that was ultimately adopted did not convert the corporate income tax to a DBCFT. However it did move somewhat in the direction of a cash flow tax by allowing for the full expensing of intermediate duration capital purchases and by tightening the rules regarding transfer pricing. It also included some partial border adjustment in the form of the Base Erosion and Anti-Abuse Tax (BEAT), which limits the deductibility of payments by multinationals to foreign subsidiaries in low tax locations.

\(^3\) Brown (1948) and Sandmo (1979) are the classic references on cash flow taxation in a domestic context.

\(^4\) Significant income shifting behavior by multinational firms has been documented by numerous authors including recently Dowd, Landefeld, and Moore (2017), Guvenen et al (2017), and Flaen (2017) for U.S. multinationals, Cristea and Nguyen (2016) for Danish multinationals, and Chalendard (2016) for Ecuadorian firms.
that all countries adopt DBCFT. When only one country adopts DBCFT, tax distortions still exist and can affect firm behavior in very different ways relative to source-based taxation. A unilateral shift to DBCFT from SBT not only changes a multinational’s transfer price incentives, it also influences a firm’s pricing, its domestic and export sales decisions, and the organizational decision of international businesses to outsource intermediate good production or to produce intermediate goods in a foreign subsidiary. As a result of the reactions of multinational firms, a switch to DBCFT from SBT may not be neutral with regard to resource allocation. For example, if only one country adopts DBCFT, there will be an incentive to under-price imports to a high tax rate adopting country as opposed to over-pricing imports with SBT. Costinot and Werning (2019) show that the neutrality of border adjustments may not hold when there are multinational firms whose production sets are not independent across countries.

To address these issues, we provide a formal analysis of the equilibrium consequences of unilateral adoption of destination-based and/or cash flow taxes in a model with endogenous income shifting via transfer prices and endogenous choice of organizational form. We analyze a North/South model in which differentiated product firms in a high tax North country (referred to as country 1) are sourcing inputs from a low tax South country (country 2). Country 1 firms in the differentiated product sector choose whether to source through arm’s length transactions with unrelated firms in the South or through establishing a subsidiary in the South. Firms are heterogeneous in their ability to produce in the South, and must trade off their productivity advantage and transfer pricing benefits from establishing a subsidiary against the higher fixed costs they incur with a subsidiary. We focus on how the choice of the firm’s pricing and organizational form depend on two features of the North country’s tax policy: whether the North uses a corporate income tax or a cash flow tax and whether income is taxed on a destination or source basis.

We identify two channels through which the switch from a source-based tax to a destination-based tax results in a non-neutrality with regard to resource allocation. The first is the transfer pricing effect. We show that while a firm in a high tax country has an incentive to use transfer

5Shome and Schutte (1993) acknowledge this possibility in their survey on the early literature on cash flow taxes. More recently, Bond and Devereux (2002), Auerbach and Devereux (2018), and Auerbach et al (2017) all allude to this fact. Genser and Schulze (1997) derive optimal transfer prices when one country adopts a destination-based VAT and another adopts an origin-based VAT. Becker and Engelsch (2017) raise the issue of transfer price distortions in a non-technical discussion of the original U.S. tax reform proposal with regard to WTO compliance.
pricing to transfer income to the low tax rate country under a source-based system, the firm has an incentive to transfer income out of the low tax country under a destination-based system. Whether the multinational has an incentive to overprice or underprice the inputs imported from the subsidiary, the ability to raise profits by manipulating transfer exists under both systems. Therefore, the switch to a destination-based system may either raise or lower the price of goods produced by multinational firms depending on which system generates the bigger gains from transfer price manipulation. The magnitude of the gains from transfer price manipulation will also affect the firm’s decision as to whether or not to become multinational.

A second channel involves the impact of the tax system on the relative fixed capital costs incurred in the host and source country. We show that the introduction of a destination-based tax reduces the cost of fixed investments in the host country subsidiary, and thus makes integration more attractive relative to outsourcing. We also show that switching from an income tax to a cash flow tax will have the effect of expanding the output of the capital intensive differentiated product sector and shift the composition of differentiated product output from integrated firms to outsourcing firms because outsourcing firms are relatively more reliant on domestic capital.

Comparative statics results for policy changes are used to compare the welfare of the countries under the unilateral adoption of the respective tax policies. We show that for the high tax country, adopting DBCFT is superior to adopting SBCFT because DBCFT aligns the costs faced by firms with those faced by society. However, DBCFT will not necessarily dominate the use of an income tax because of the beneficial terms of trade effects that arise if export sales are sufficiently large. For the low tax country, we show that decision by the high tax country to switch to DBCFT would induce the low tax country to switch to a destination-based tax. However, the low tax country would prefer a corporate income tax over a cash flow tax in order to capture economic rents from subsidiaries located in its country. Our results highlight the role of spillover effects from policy changes to trading partners in evaluating unilateral policy changes, and also the importance of distinguishing the effects of the source/destination aspect of tax policy from the income/cash flow tax aspect.

Our work is related to several existing strands of literature. Bond and Devereux (2002) were the first to study the role of corporate taxes on the organizational choice of an international business
by focusing on the production location decision of a representative monopolist. In their model, the firm chooses to either produce in its home country and export to a foreign country or vice versa. There is no role for transfer prices and no firm heterogeneity. Auerbach and Devereux (2018) extend this model to consider both production location and resource allocation decisions in which a representative firm can produce and sell in each of two countries and engage in transfer price manipulation. We extend this literature by studying a model with firm heterogeneity where both outsourcing firms and multinationals co-exist (as is observed in practice), which allows us to analyze how tax policy and the ability to manipulate transfer prices affects both the extensive and intensive margins of outsourcing and multinational activity.

The treatment of the firm’s sourcing decision is motivated by Grossman and Helpman (2002), who analyze the choice of a firm between integration and outsourcing in monopolistically competitive markets. In this regard, our approach is similar to that of Bauer and Langenmayr (2013), who focus on transfer price issues with heterogeneous firms under source-based income taxation, and Becker (2013), who focuses on double taxation issues with heterogeneous firms. One advantage of using the monopolistic competition framework is that we can better link the recent theoretical and empirical international trade literature on the formation of multinationals with heterogeneous firms (e.g., Helpman, Melitz and Yeaple (2004) and Arkolakis et al (2018)) with the tax literature on corporate taxation.

Our work is also related to work in trade and public finance that focuses on the negative externalities on trading partners that can arise when a country adopts an optimal (unilateral) policy. In the international trade literature, Bagwell and Staiger (2002) emphasize that the role of trade agreements is to eliminate the terms of trade externalities that arise from national tariff policies. Similarly, fiscal externalities such as tax exporting can arise from a country’s taxation of capital income. In the presence of fiscal externalities from unilateral tax choices, multilateral coordination of tax policies may be required to achieve efficient outcomes. Gordon and Hines (2002) and Keen and Konrad (2013) provide surveys of the fiscal spillovers that can arise when countries or regions set policies unilaterally. Our results are related in that we show that a country may not

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6Baumann, Dieppe, and Dizioli (2017) look at the macroeconomic implications of DBCFT, but do not consider the role of multinational firms, which rules out transfer pricing behavior. Benzell, Kotlikoff, and LaGarda (2017) analyze a dynamic general equilibrium simulation of the effects of introducing the House Republican tax plan.
have an incentive to make a unilateral choice of a destination-based cash flow tax, even though global adoption might generate efficiency gains, because of the fact that some of the gains accrue to trading partners. The policy externalities in our model are similar to terms of trade and tax exporting externalities, although they differ slightly in that they arise from the presence of product variety and firm heterogeneity in a monopolistic competition model.

In section 2, we describe our model and define the tax parameters that we will use to characterize tax regimes. In section 3, we characterize the optimal decision of firms regarding price and organizational form. We use these decision rules to derive the conditions under which changes in country 1 tax policy will be neutral in their effect on resource allocation. Section 4 provides a welfare analysis of the effects of changes in country 1 tax policy on country 1 welfare. Section 5 analyzes the spillover effects of country 1 tax policy on country 2, and discusses the optimal policy of country 2 in response to the adoption of DBCFT by country 1. Section 6 offers concluding remarks.

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. Country 1 can be thought of as a “North” country: it serves as headquarters for X sector firms and has a high tax rate. Country 2 is a “South” country: it has comparative advantage in producing an input that is required by X sector firms and has a low tax rate. The decision problem for X sector firms is whether to outsource production of the intermediate good to an independent supplier in country 2 or to set up a subsidiary in country 2 as in Grossman and Helpman (2002). We focus on how the tax policies of country 1 and the ability of multinational firms to manipulate transfer prices on intra-firm transactions will influence the integration/outsourcing decision. 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 by a representative consumer in each country are given by the
quasi-linear utility function

\[ U_j = \mu_j \ln X_j + Y_j \]

for \( j = 1, 2 \), where \( X_j = \left( \int_{i \in \Omega_j} x_i^{\sigma-1} \, di \right) ^ {\frac{1}{\sigma-1}} \), \( \Omega_j \) is the set of varieties of good \( X \) offered in country \( j \), and \( \sigma > 1 \) is the elasticity of substitution. Larger values of \( \sigma \) imply a more competitive \( X \) sector. With these preferences, the demands for individual varieties and good \( Y \) in country \( j \) are given by

\[ x_j = \frac{q_j \mu_j p_j^{-\sigma}}{P_j^{1-\sigma}} \quad \text{and} \quad D_{Yj} = \frac{Z_j}{q_j} - \mu_j \]

respectively, where \( q_j \) is the price of good \( Y \), \( p_j \) is the price of the \( j^{th} \) variety of good \( X \), \( P_j = \left( \int_{i \in \Omega_j} p_j^{1-\sigma} \, di \right) ^ {\frac{1}{1-\sigma}} \) is the price index for the \( X \) good and \( Z_j \) is aggregate expenditure, all in country \( j \). The country \( j \) consumer spends \( q_j \mu_j \) on \( X \) sector goods and the remainder of its income on \( Y \) goods. We assume there are no trade costs or VATs.

Country \( j \) has an endowment of \( L_j \) units of a productive factor, which can either be used as a “labor” input or transformed into “capital.” We assume the endowment can be converted to capital at a constant rate, which we normalize to unity, so the price of a unit of capital will equal the wage rate in country \( j \), \( w_j \). The distinction between the use of the endowment as capital and labor will be important in the application of tax policy discussed below, because the cost of the capital input will be deductible from corporate income under a cash flow tax, but not under an income tax. Since our focus is on the taxation of capital income, we assume throughout that labor is deductible from taxation.

Good \( Y \) is produced using only labor in each country under conditions of constant returns to scale and perfect competition and is tradable. We simplify by assuming that the labor input requirement is unity in each country. Choosing good \( Y \) in country 2 as the numeraire, the pre-tax cost of a unit of good \( Y \) is \( w_1 \) in country 1 and 1 in country 2. Under the assumption that labor income is not subject to tax, the zero profit condition for sector \( Y \) ensures that \( q_1 = w_1 \) and \( q_2 = 1 \).

A variety of good \( X \) is produced using capital for headquarter services in country 1 and one unit of an intermediate good \( M \) per unit of output. To simplify the discussion and focus on the choice of organizational form, we assume that the cost of production of \( M \) in country 1 is sufficiently high.
relative to that in country 2 that local production of the intermediate is not an option. If the firm chooses to outsource the good to an unrelated foreign firm, it incurs a cost of $f^O$ units of capital for the headquarters in country 1 and purchases good $M$ at a price of $r$ per unit. Country 2 firms producing intermediate good $M$ are assumed to use one unit of labor per unit of the intermediate, but we allow for $r \geq 1$ to cover the possibility of markup pricing by country 2 firms. The pre-tax cost of producing $m$ units of output for an outsourcing firm will be $C^O(m) = w_1f^O + rm$.7

If an $X$ firm establishes a foreign subsidiary, it requires a capital investment $f_1$ to maintain a headquarters in country 1 and a capital investment $f_2$ in country 2 to organize production. Although we do not restrict the values of the individual fixed cost investments, we assume that the communication and coordination costs associated with organizing production in a subsidiary result in a greater total fixed cost for integrated firms than for outsourcing firms, $f_1 + f_2 > f^O$. We assume that production in a subsidiary by an integrated firm requires $a$ units of country 2 labor per unit of output labor, where $a$ is distributed in the population of potential entrants according to the distribution function $G(a)$ for $a \in [a, \infty)$. The cost of producing $m$ units of output for an integrated firm is $C^I(m) = w_1f_1 + f_2 + am$.8

Firms are assumed to know their productivity at the time of entry, so they will choose between producing as an outsourcing firm or as an integrated firm. The fixed cost disadvantage of an integrated firm can be offset by the fact that the firm may have a lower variable cost of producing $M$ than the country 2 firms, $a < r$. We will establish below that firm heterogeneity in the value of $a$ will lead to the most productive firms choosing to integrate. This sorting is consistent with the observation that the largest firms are the ones that become multinational.

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7To simplify notation, we assume that there are no variable labor costs incurred in country 1 to turn the intermediate input into a unit of final good. The results of section 3 are unaffected if sector $X$ firms have a common unit labor requirement of $b$ per unit of output in country 1 for outsourcing and integrated firms. We discuss the role of variable capital costs in Appendix B.

8Note that the assumption of fixed capital costs in the headquarters and the subsidiary play a key role in the theoretical and empirical analysis of the decision of firms between exporting and FDI by Helpman, Melitz, and Yeaple (2004). The evidence shows that the fixed costs result in the selection of the most productive firms into FDI. Their results mirror our results concerning selection between importing and FDI.
2.2 Tax Policy Parameters

Our objective is to analyze the allocation and welfare effects of a change in the corporate tax system by country 1, where country 1 is a high tax country relative to country 2. To that end, we will define two tax policy parameters to focus on two features of the corporate tax system: whether income is taxed at the source and whether capital costs are deductible from income. In addition to comparing the current SBT with DBCFT, we also allow for the choice of a cash flow tax that taxes income at its source (SBCFT) and a corporate income tax that taxes income on a destination basis (DBT). While we most often will refer to these four policy options, our analysis is more general and allows us to consider intermediate options.

The low tax country 2 is assumed to tax income on a source basis at a rate $t_2$ and not to allow the deduction of capital costs from taxable income. We hold country 2 tax policy constant through most of our analysis, since these features characterize the existing tax system in most countries and our primary focus is on a unilateral tax policy change by country 1. We also assume that country 1 taxes income on a territorial basis, and that taxes in each country are rebated to domestic households in a lump sum fashion.\footnote{Our approach to modelling a distinction between income and cash flow taxes is equivalent to that in Auerbach and Devereux (2018), in which the consumer has a unit of an endowment good that can be converted on a one-to-one basis into a private consumption good similar to good $Y$, a public good, or capital. Our model does not include a public good but this difference is not driving our results.}

For country 1, we define $t_{1j}$ as the tax rate imposed on sales in market $j$. Under a source-based tax system, income produced from firms located in country 1 will be taxed at a common rate $t_{11} = t_{12} = t_1$. Under a destination-based tax system, income produced from export sales will not be taxed, so $t_{11} = t_1$ and $t_{12} = 0$. In addition, a destination-based tax does not allow the deductibility of purchases of imported inputs. Changes in the parameter $t_{12}$ between $t_1$ and 0 will be used to capture the border adjustments associated with a change by country 1 from a source-based tax to either a partial or full destination-based tax.

The difference between a corporate income tax and a cash flow tax is captured by the parameter $\lambda$, which is the after-tax cost of capital in country 1. A cash flow tax is reflected by $\lambda = 1 - t_1$, since the cash flow tax allows full deductibility of capital costs. Under a capital income tax, capital expenses are not deductible and $\lambda = 1$. Changes in $\lambda$ between 1 and $1 - t_1$ can be used to determine
the effect of a change by country 1 from a capital income tax towards a cash flow tax. Finally, we will also examine the role of changes in $t_1$ under the respective systems.\textsuperscript{10}

3 Firm Pricing and Pass-Through of Border Adjustments

In this section we focus on the effects of tax policy changes on resource allocation, and derive conditions for the neutrality of border adjustments and changes in country 1’s base tax rate, $t_1$. We show that border adjustments are fully passed through to domestic prices for $Y$ sector firms and $X$ sector firms that outsource. For integrated firms, we identify two factors that will lead to departures from complete pass through: the potential for manipulation of transfer prices on intra-firm trade and the existence of fixed costs in the host country. We also examine the effect of changes in tax parameters on the choice of organizational form.

3.1 $Y$ Sector Firms

As noted above, the zero profit conditions and deductibility of labor costs means that the price of good $Y$ will equal unit labor costs in each country, $q_i = w_i$. The linkage between wage rates in the two countries will be determined by the tax system adopted by country 1 when both countries are producing good $Y$. A producer in country 1 receives an after-tax return of $q_1(1 - t_1)$ per unit sold in country 1 and an after-tax return of $q_2(1 - t_{12})$ per unit sold in country 2. In order to make domestic firms indifferent between exporting and selling in the domestic market, we must have

$$q_1 = w_1 = \frac{1 - t_{12}}{1 - t_1} \tag{2}$$

in equilibrium. Eq.\,(2) also makes country 1 firms indifferent between importing and domestic production. Good $Y$ prices and wages will be equalized between countries with a source-based tax, but they will be higher in country 1 by a factor of $\frac{1}{1 - t_1}$ in the case of a destination-based tax.

Condition \,(2) establishes that border adjustments of the capital tax policy will be fully passed

\textsuperscript{10}In our analysis we treat $\lambda$ and $t_{12}$ as continuous variables in order to determine if partial adjustments can be optimal. Footnote 2 provides examples of how the Tax Cuts and Jobs Act provided partial movements in the direction of cash flow taxation and border adjustments. Adjustments in the degree of deductibility of capital expenses are a fairly common policy instrument. Also, China’s use of partial refunds of VAT payments on exports (Chandra and Long (2013)) provides an example of the use of partial border adjustments in a destination-based VAT system.
through to consumers of good Y in country 1. Since a unit of the capital good has the same labor requirement as good Y, the price of a unit of capital in country j will equal $q_j$ as well.

### 3.2 X Sector Outsourcing Firms

For X sector firms that outsource production to unrelated foreign firms, after-tax profits will be

$$\Pi^O = (1 - t_{11})R_1^O + (1 - t_{12}) (R_2^O - rm^O) - \lambda w_1 f^O$$

(3)

where $R_j^O = q_j \mu_j \left( \frac{x_j}{X_j} \right)^{\frac{2-\sigma}{\sigma}}$ is the revenue a final goods producer earns from sales in market $j$.

If a final good producer purchases $m^O$ units of the intermediate good, it will produce an output of $x^O = m^O$. Under our assumption that there are no trade costs, marginal costs will be the same for sales in each market and the firm’s profit maximizing policy will allocate output across markets to maximize revenue. The maximum after-tax revenue from selling $x$ units is

$$\Psi(x) = \max_{x_2} (1 - t_{11}) R_1(x - x_2) + (1 - t_{12}) R_2(x_2)$$

(4)

$$= \kappa(t_{11}, t_{12}) x^{\frac{\sigma - 1}{\sigma}}$$

where $\kappa(t_{11}, t_{12}) \equiv (k_1^{\sigma} + k_2^{\sigma})^{\frac{1}{\sigma}}$ and $k_j = (1 - t_{1j}) q_j \mu_j \frac{1 - \sigma}{\sigma}$. The parameter $k_j$ captures the profitability of the $j$ market, reflecting both the tax rate and intensity of competition in that market, and $\kappa$ 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,

$$x^O_j = \frac{k_j^{\sigma} m^O}{k_1^{\sigma} + k_2^{\sigma}}.$$  

(5)

Each firm will treat the parameters $k_j$ as exogenously given when making sales decisions. The $k_j$ will be endogenously determined in a free entry equilibrium because the measure and composition of entrants will determine the $X_j$.

Solving for the profit-maximizing output level and then solving for the corresponding prices yields the following result for pass-through for outsourcing firms. (See Appendix A for proofs of all results.)
Proposition 1 For an outsourcing firm,

(a) the switch from a source-based tax to a destination-based tax raises the cost of the intermediate input and capital costs by a factor of $\frac{1}{1-t_1}$, and

(b) the prices of the final goods in market $j$ will be

$$p^O_j = \frac{(1-t_{12})}{1-t_{1j}} \frac{\sigma r}{\sigma - 1}. \tag{6}$$

Under a source-based tax, prices in each country will be equalized and will reflect a markup of $\frac{\sigma}{\sigma - 1}$ over marginal cost. If a switch is made to a destination-based tax, all costs for an outsourcing firm rise by a factor of $\frac{1}{1-t_1}$ reflecting the inability to deduct the input cost and the rise in the domestic cost of the capital good. The final good price in country 1 will rise by the same proportion as the increase in marginal cost, while the price in country 2 is unaffected due to the exemption of export sales from North taxation. The effect on the country 1 price is identical to that obtained for sector $Y$ firms, which means that $\frac{p^O_1}{q_1} = \frac{\sigma r}{\sigma - 1}$ under either tax system.\footnote{Our analysis abstracts from a potential holdup problem where the intermediate goods are specialized to the final good producers, as analyzed by Antràs and Helpman (2004). They use Nash bargaining to determine the price of the intermediate good, $r = \frac{\sigma}{\sigma - 1}$, which is consistent with our assumption of a constant fixed price. The outcome under the holdup problem differs from the one we consider in that the output decision in Antràs and Helpman (2004) with a holdup problem will not be one that maximizes the final goods producer’s profits at $r$. It can be shown that the full pass through result applies in this case as well.}

3.3 Payoffs for $X$ Sector Integrated Firms

We now turn to the case in which a country 1 firm has chosen to produce the intermediate good in a wholly owned subsidiary. For the integrated firm, the division of taxable income between the subsidiary and the parent firm will be determined by the transfer price on intra-firm trade, $\rho \geq 0$. 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 $\rho(1-t_{12})$. We assume that country 1 exempts foreign source income from taxation, and that the firm chooses policies to maximize global profits. Global after-tax profits will be increasing in $\rho$ if, and only if, $t_{12} > t_2$. 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 $t_{12} < t_2$.

To limit firms from reducing taxable income by manipulating transfer prices, tax authorities define the arm’s length price a firm should charge on intra-firm transactions, and audit firms for
compliance. We assume that the arm’s length price is the subsidiary’s marginal cost of producing the input, $a$. Due to the heterogeneity of marginal costs across firms, it will be difficult for tax authorities to identify the appropriate arm’s length price for each firm. Therefore, we adopt the traditional formulation of Allingham and Sandmo (1972) by assuming a firm can choose a transfer price different from its arm’s length price by incurring a labor cost of $C_j(\rho, a) = \alpha_j (\rho - a)^2$ per unit of the intermediate good if country $j$ chooses to audit the firm, where $\alpha_j > 0$. This function combines the idea of a probability of detection with a penalty for under-reporting earnings, both of which are increasing in the deviation between a firm’s transfer price and its arm’s length price. The probability of detection is also proportional to $\alpha_j$ as it reflects the ability of country $j$ to identify the appropriate arm’s length price for the firm. For simplicity, we assume that transfer prices are monitored only in the country that stands to lose tax revenue from transfer price manipulation, and that the firm’s cost of monitoring is incurred in the country where the monitoring takes place.13

An output of $m^I(a)$ units of the intermediate good by a firm with unit labor requirement $a$ in the subsidiary will result in an output $x^I(a) = m^I(a)$ of the final good. As in the case of the outsourcing firm, this output will be allocated across markets to maximize revenue. Using (4) and (5), the after-tax global profits of an integrated firm with unit labor requirement $a$ will be

$$
\Pi^I(m, \rho; a) = \Psi(m) - ((1 - t_{11})\delta_1 w_1 C_1(\rho, a) + (1 - t_{12})\rho) m + (1 - t_2)(\rho - a - (1 - \delta_1)C_2(\rho, a))m - w_1 \lambda f_1 - f_2
$$

where $\delta_1$ is an indicator variable that is equal to 1 if country 1 will lose revenue from transfer price manipulation (i.e., $t_{12} > t_2$) and 0 otherwise. The objective of the firm is to choose $m$ and $\rho$ to maximize (7).

Integrated firm profit is concave in $\rho$, so the necessary condition for the choice of $\rho$ at an interior solution yields the optimal transfer pricing formula,

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

12Our results can be extended to allow for an arm’s length price that adds a markup above marginal cost by choosing the arm’s length price to be $\theta a$, where $\theta \geq 1$. This formulation substantially complicates the analysis, but does not alter the basic results.

13The results for the case in which both countries audit is similar.
The firm will have an incentive to transfer income to the low tax location, with the magnitude of the deviation from the arm’s 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 arm’s length case is obtained when tax authorities have perfect monitoring, which makes evasion arbitrarily costly (i.e. $\alpha_j \to \infty$). With imperfect monitoring, the transfer price will exceed the arms length price under source-based taxation and will be less than the arm’s length price under destination-based taxation.

Using (8), the after-tax marginal cost of an integrated firm will be

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

(9)

The first term in (9), $(1 - t_{12})a$, is the after-tax cost of the input when the transfer price is evaluated at marginal cost, the arm’s length transfer price. A change from source-based to destination-based taxation increases this after-tax arm’s length price due to the loss in the tax deduction for imported inputs. The second term reflects the reduction in after-tax marginal cost resulting from the transfer pricing policy of the firm. The ability to use transfer pricing to reduce tax liabilities reduces the marginal cost of output below what it would be otherwise. The gain from transfer price manipulation is increasing in the difference in tax rates between the two locations, $|t_{12} - t_2|$, and decreasing in the after-tax cost of transfer price manipulation, $\alpha_1 \delta_1 (1 - t_{12}) + \alpha_2 (1 - \delta_1)(1 - t_2)$.

Letting $\Delta^S(a) = \Delta(a, t_1, t_2)$ be marginal cost under a source-based system and $\Delta^D(a) = \Delta(a, 0, t_2)$ be the marginal cost under a destination-based system, it can be shown that $\Delta^D(a) > \Delta^S(a)$ for $t_1 > t_2$. The fact that the imported inputs are not deductible under a destination-based system means that the after-tax marginal cost of inputs rises under a destination-based system. However, we have established that for $Y$ sector firms and outsourcing firms a switch to a destination-based system raises the cost of variable and fixed inputs by a factor of $\frac{1}{1-\delta_1}$. Therefore, full pass through of the border adjustment to the costs of integrated firms requires that fixed and variable costs increase by a factor of $\frac{1}{1-\delta_1}$.

Using (7) and (9), we obtain the following conditions on pass through for integrated firms.

---

14It follows from (9) that $\Delta^D(a) - \Delta^S(a)$ is an increasing function of $t_1$. The zero lower bound on the transfer price ensures that the difference is non-negative at $t_1 = t_2$. 

---
Lemma 1 For an integrated firm, the switch from a source-based tax to a destination-based tax will

(a) raise the after-tax cost of inputs by more than a factor of \( \frac{1}{1-t_1} \) if, and only if,

\[
\Gamma(a) \equiv \Delta^D(a) - \frac{\Delta^S(a)}{(1-t_1)} = \left[ \frac{(t_1 - t_2)^2}{4\alpha_1(1-t_1)^2} - \frac{t_2^2}{4\alpha_2(1-t_2)} \right] > 0,
\]

and

(b) raise the fixed costs of an integrated firm by a factor of \( \frac{1}{1-t_1} \left( \frac{\lambda f_1 + f_2(1-t_1)}{\lambda f_1 + f_2} \right) \leq \frac{1}{1-t_1} \).

The switch from source-based taxation to destination-based taxation causes the firm to change from over-pricing inputs to under-pricing of inputs in order to reduce the global tax burden. Observe however that the degree of pass through is determined by the change in the after-tax marginal cost of inputs, so that there will be more than full pass through from the change to a destination-based system if the tax savings from transfer price manipulation are lower under the destination-based system. \( \Gamma(a) \) reflects the difference in the gains from transfer price manipulation between the source-based and destination-based tax systems. \( \Gamma(a) > 0 \) occurs when transfer price manipulation yields greater gains to the firm under source-based taxation than under destination-based taxation. Since country 1 is the one losing revenue from transfer price manipulation under a source-based tax, \( \Gamma(a) > 0 \) is more likely to arise when country 2 is more effective at monitoring transfer prices, \( \alpha_1 < \alpha_2 \), and when the tax differential from transfer pricing under a source-based tax, \( t_1 - t_2 \), is large relative to that under a destination-based tax, \( t_2 \). Similarly, we say that transfer price manipulation yields greater gains under a destination-based tax when \( \Gamma(a) < 0 \). If the transfer price equals marginal cost under each tax regime (i.e. \( \alpha_j \to \infty \) for \( i = 1, 2 \)), then \( \Gamma(a) = 0 \) and there is full pass through of the change to a destination-based tax for an integrated firm.

Part (b) shows that the fixed capital cost of the integrated firm will rise by a factor of less than \( \frac{1}{1-t_1} \) if \( f_2 > 0 \). The fixed capital costs incurred by an integrated firm in country 1 rise by a factor of \( \frac{1}{1-t_1} \), but the fixed capital costs in country 2 are unaffected. The ability of integrated firms to purchase inputs in the host country, combined with the fact that foreign income is exempted from source country taxes on capital income, means that the border adjustment is not neutral with respect to an \( X \) sector firm’s incentive to become integrated. It is shown in Appendix B that this
result continues to hold if fixed costs have a labor cost component as well. Thus, it is the existence of fixed costs in the subsidiary per se, and not their composition between capital and labor, that creates an incentive to integrate with a switch to a destination-based tax.\footnote{Costinot and Werning (2019) show that the neutrality of border adjustments can break down when the firm’s production set in each country is linked. In our case, the linkage in production decisions results from the existence of transfer price manipulation, leading to the possibility that $\Gamma(a) \neq 0$.}

Solving the integrated firm’s optimization problem yields the following result:

\textbf{Proposition 2} \textit{For an integrated firm, the price in market $j$ will be}

\[ p_j^I(a, t_1, t_{12}, t_2) = \frac{\Delta(a, t_{12}, t_2)}{1 - t_{1j}} \frac{\sigma}{\sigma - 1}. \] \hfill (11)

Consumers in country 1 will face more than full pass through of the change from source-based to destination-based taxation and the price to consumers in country 2 will increase if, and only if, $\Gamma(a) > 0$.

The switch to a destination-based tax will raise (lower) the price of integrated firm output relative to that of other goods in cases where transfer price manipulation is more (less) profitable under a source-based tax than under a destination-based tax. The switch to a destination-based tax will have no effect on relative prices in countries 1 or 2 when there is arm’s length pricing by integrated firms, $\Gamma(a) = 0$.

\section*{3.4 Equilibrium Entry and Selection}

The previous section examined the extent to which a change from a source-based to a destination-based tax is passed through to consumers for a given organizational form. In this section we solve for the equilibrium firm outputs and selection of organizational form in a free entry equilibrium.

The goal is to show how tax rate changes and changes in the tax base affect both the intensive and extensive margins for sector $X$ firms. In particular, we show that changes in the selection between integration and outsourcing will occur even in the case where there is complete pass through of tax rate changes to prices in country 1 when $f_2 > 0$.

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 $\Pi^I(a) \geq \Pi^O$. Profits of an integrated firm are decreasing in $a$, $\frac{d\Pi^I(a)}{da} = -(1 - t_{12})m^I(a) < 0$. Letting $a^*$ denote the value of $a$ at which $\Pi^I(a) = \max[0, \Pi^O]$, all potential firms with $a \in [a, a^*]$ will enter as integrated firms. Entry will increase the outputs $X_j$ until $\kappa$ adjusts sufficiently that the profit of a potential entrant is 0. We assume an interior equilibrium in which there are both outsourcing and integrated firms.\textsuperscript{16}

Outsourcing firms are the marginal firms in an interior equilibrium, so the homogeneous outsourcing firms will enter/exit until $\kappa$ adjusts so that $\Pi^O = \kappa(m^O)^{\frac{\sigma - 1}{\sigma}} - (1 - t_{12})r m^O - \lambda w_1 f^O = 0$. Solving the zero profit condition for outsourcing firms yields

$$\bar{\kappa} = (1 - t_{12}) \left( \frac{\lambda f^O}{1 - t_1} \right)^{\frac{1}{\sigma}} \left( \frac{\sigma r}{\sigma - 1} \right)^{\frac{\sigma - 1}{\sigma}}.$$ (12)

$\bar{\kappa}$ is an increasing function of the after-tax cost of capital, $\lambda w_1 f^O$, and the after-tax cost of the intermediate good, $(1 - t_{12})r$. An increase in either cost requires an increase in $\bar{\kappa}$ through exit to restore zero profits for outsourcing firms.

Solving for the output levels of the respective firm types when evaluated at $\bar{\kappa}$ yields

$$\bar{m}^O = \frac{\lambda w_1 f^O (\sigma - 1)}{(1 - t_{12})r} = \frac{\lambda f^O (\sigma - 1)}{(1 - t_1)r}$$

and

$$\bar{m}^I(a) = \bar{m}^O \left( \frac{\Delta(a, t_{12}, t_2)}{(1 - t_{12})r} \right)^{-\sigma}.$$ (13)

The size of outsourcing firms in a zero profit equilibrium is an increasing function of the magnitude of the after-tax fixed (capital) cost, $\lambda f^O w_1$ relative to variable (labor) costs of the input, $(1 - t_{12})r$. The size of integrated firms relative to outsourcing firms is determined by the relative after-tax marginal costs of their inputs.

Equations (13) can be used to illustrate the effect of changes in the tax policy parameters on the output levels of $X$ sector firms. A change in $t_{12}$ will have no effect on equilibrium output.

\textsuperscript{16}There are three types of possible equilibria. If the fixed costs of forming a subsidiary are sufficiently high that $\Pi^O = 0 > \Pi^I(a)$, 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 $a^* > a$. 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.
of outsourcing firms, which reflects the full pass through of border adjustments to the costs of outsourcing firms. The higher prices of the products under destination-based taxation are offset by the increase in the wage so the equilibrium output level of these firms is unchanged from a change in the tax system. For integrated firms, the change from a source-based to a destination-based tax will raise (reduce) output if \( \Gamma(a) < 0(> 0) \). Thus, the output of integrated firms will rise if, and only if, transfer pricing is more profitable under a destination-based tax system. A reduction in \( \lambda \), which allows firms to deduct more of their capital costs, will induce entry of outsourcing firms while having no effect on their output price. The resulting decline in \( \pi \) yields a smaller equilibrium firm size due to the incentive to substitute capital for labor in both outsourcing and integrated firms.

We now turn to the effect of the tax policy parameters on the choice of an \( X \) sector firm between integration and outsourcing. Substituting (12) and (13) into the expression for integrated firm profits yields

\[
\Pi'(a) = \frac{\lambda(1 - t_{12})}{1 - t_1} \left[ \left( \frac{\Delta(a, t_{12}, t_2)}{(1 - t_{12})r} \right)^{1-\sigma} f^O - f_1 \right] - f_2.
\]

Evaluating the effect of the effect of a change in \( t_{12} \) on profits yields the following result:

**Proposition 3** (a) If transfer price manipulation is not more profitable under source-based taxation than under destination-based taxation (i.e. \( \Gamma(a) \leq 0 \)), the switch from source-based to destination-based taxation will raise the profit of an integrated firm.

(b) A necessary, but not sufficient, condition for the switch from a source-based to destination-based tax system to reduce the profit of an integrated firm is that transfer price manipulation be more profitable under the source-based system, \( \Gamma(a) > 0 \).

Proposition 3 shows that the effect of border adjustments on the profits of an integrated firm depends on the magnitude of the two pass through effects on costs identified in Lemma 1. Consider first the case in which transfer prices are equal to marginal costs, \( \Gamma(a) = 0 \), which results in full pass through of the tax rate change to costs and prices in country 1 and no change in output levels. Firm revenues and variable cost will rise by a factor of \( \frac{1}{1-t_1} \), but fixed costs will rise less than proportionally by Lemma 1 (b) if \( f_2 > 0 \). If \( \Gamma(a) < 0 \), the fixed cost advantage under a destination-based tax is reinforced by the fact that transfer price manipulation also leads to higher revenues.
under the destination-based tax (i.e., the bracketed term in (14) increases). Thus, \( \Gamma(a) \leq 0 \) is sufficient for profits to increase from the switch to a destination-based tax.

If \( \Gamma(a) > 0 \), there are two conflicting effects on profits from the switch to a destination-based tax. The reduction in \( t_{12} \) will raise the after-tax marginal cost of the inputs from the subsidiary by Lemma 1, but will also reduce after-tax fixed costs in country 2 relative to those in country 1. Profits from integration will decrease if the former effect is sufficiently large, which requires \( \Delta^S(a) \leq (1 - t_1) \frac{\sigma}{\sigma - 1} \Delta^D(a) \).

Using (14), the identity of the marginal integrated firm is determined by the condition

\[
\frac{\Delta(a^*, t_{12}, t_2)}{1 - t_{12}} = r \left( \frac{f_1 + f_2/(\lambda w_1)}{f^O} \right)^{\frac{1}{1 - \sigma}}.
\]

(15)

The condition for the marginal integrated firm, (15), equates the relative saving in profits from the reduction in variable costs to the increase in fixed costs associated with organizing production in country 2. A reduction in the capital costs of integration relative to headquarter costs, \( \frac{f_1 + f_2/(\lambda w_1)}{f^O} \), will make integration more attractive and increase \( a^* \). Similarly, a reduction in \( \Delta(a, t_{12}, t_2) \) due to a reduction in the cost of transfer price manipulation will increase \( a^* \).

Proposition 3 and the results on pass-through illustrate how the effect of a change in \( t_{12} \) on resource allocation is affected by the existence of multinational activity. If all \( X \) sector firms engage in outsourcing, then changes in \( t_{12} \) will have no effect on resource allocation because relative prices will be unaffected in each country. When \( X \) sector firms can invest in foreign countries, changes in \( t_{12} \) can affect both relative prices of \( X \) sector goods and the extent of integration activity. The resource allocation effects of a switch from a source-based to a destination-based tax results from differences in the profitability of transfer price manipulation under the two regimes, \( \Gamma(a) \neq 0 \), and from the presence of fixed costs of subsidiaries in country 2, \( f_2 > 0 \). We then have:

**Corollary 1** The only case in which the switch to a destination-based tax will have no impact on resource allocation with multinational activity is if there is no differential benefit from transfer price manipulation, \( \Gamma(a) = 0 \), and integrated firms incur no capital costs in country 2, \( f_2 = 0 \).

We can also examine the impact of a switch from an income tax to a cash flow tax, which is captured by a reduction in \( \lambda \). A reduction in \( \lambda \) reduces the after-tax cost of capital to the firm,
which will result in a decline in the importance of fixed costs relative to variable costs. The following proposition summarizes the effect of a reduction in $\lambda$ on the aggregate output and composition of output in the $X$ sector.

**Proposition 4** An increase in the tax-deductibility of capital costs (lower $\lambda$) will

(a) increase the consumption of $X$ in each country, where

$$X_j = \left(\frac{1 - t_1}{\lambda f O \sigma}\right)^{\frac{1}{\sigma}} \mu_j (\mu_1 + \mu_2)^{\frac{1}{\sigma-1}} \left(\frac{\sigma - 1}{\sigma r}\right) \quad j = 1, 2, \quad (16)$$

(b) reduce the profits of integrated firms and reduce integrated firm output at both the intensive and extensive margins, and

(c) raise the measure of outsourcing firms, $N^O$, and reduce the output of outsourcing firms, where

$$N^O = \left(\frac{1 - t_1}{\lambda f^O O \sigma}\right) (\mu_1 + \mu_2) - \int_a^{a^*} \left(\frac{\Delta}{(1 - t_{12})r}\right)^{1-\sigma} g(a) da. \quad (17)$$

Part (a) shows that an increase in the deductibility of capital costs in country 1 reduces the cost of capital in country 1, which results in an expansion of the capital intensive $X$ sector output. The increased value of $X_2$ is a spillover benefit to country 2, and can be thought of as a favorable terms of trade effect resulting from the reduction in the cost of capital in country 1. The increased value of consumption of the differentiated product comes in the form of an increase in product variety rather than an increase in output, since output per firm will fall with a reduction in $\lambda$ by (13).

Part (b) shows that a reduction in country 1 capital costs benefits outsourcing firms at the expense of integrated firms, because outsourcing firms incur a larger fraction (100%) of their capital costs in country 1 than do integrated firms ($\frac{f_1}{f_1 + f_2}$)\(^{17}\). Part (c) shows that there will then be a shift in the composition of $X$ sector firms toward more outsourcing firms and fewer integrated firms.

### 3.5 Changes in country 1’s base tax rate, $t_1$

We conclude the comparative statics analysis of tax policy changes by establishing conditions under which a change in country 1’s base tax rate, $t_1$, will be neutral. In the equilibrium solutions derived

\[^{17}\text{We show in Appendix B that the result that a reduction in capital costs will benefit outsourcing firms relative to integrated firms continues to hold when firms incur variable capital costs in country 1 as long as integrated firms are not more intensive in their use of country 1 capital than are outsourcing firms.}\]
previously, country 1’s tax rate affects the equilibrium through its effect on the relative price of capital to labor, \( \frac{\lambda}{1-t_1} \), the relative marginal cost of inputs to an integrated firm, \( \frac{\Delta(a,t_{12},t_2)}{1-t_{12}} \), and the cost of country 1 capital, \( w_1 \lambda \). Since \( \lambda = 1 - t_1 \) under DBCFT, the price of labor to capital is unity, the after-tax marginal cost to the integrated firm is \( a - \frac{t_2}{\alpha_2(1-t_2)} \), and the cost of capital in country 1 is unity. Each of these margins is unaffected by a change in \( t_1 \) under DBCFT, so the decisions of firms are unaffected by changes in \( t_1 \). We thus have:

**Proposition 5** A change in country 1’s base tax rate, \( t_1 \), will have no effect on resource allocation if country 1 adopts DBCFT.

Since DBCFT has no effect on resource allocation, it will be a tax on pure profits. This result for unilateral adoption of DBCFT is similar to that obtained by Auerbach and Devereux (2018) for the case of multilateral adoption.

The neutrality result for \( t_1 \) does not extend to the case of SBCFT if transfer pricing is not prohibitively expensive, since \( \frac{\Delta(a,t_{12},t_2)}{1-t_{12}} = a - \frac{(t_1-t_2)^2}{4\alpha_1(1-t_1)^2} \) is decreasing in \( t_1 \) due to the greater gain from transfer price manipulation. Under income taxation, neither DBT or SBT will be neutral because in both cases changes in \( t_1 \) will affect the relative cost of capital to labor, \( \frac{\lambda}{1-t_1} = \frac{1}{1-t} \).

### 4 Country 1 Welfare

We now turn to an analysis of the effect of a change in the tax policy parameters, \( \lambda \) and \( t_{12} \), on national welfare of country 1. The indirect utility function of country 1 can be written as

\[
W_1(t_{12}, \lambda) = \mu_1(\ln X_1(\lambda) - 1) + Z_1/q_1 \tag{18}
\]

where sector \( X \) consumption in country 1, \( X_1(\lambda) \), is defined by (16), and \( Z_1 \) is country 1 income.

Country 1 income consists of endowment income, tax revenues, and \( X \) sector firm profit. Substituting the endowment market clearing condition into the expression for national income yields
the following expression for real income of country 1 in terms of good $Y$,

$$
\frac{Z_1}{q_1} = L_1 + \mu_1 + \mu_2 - (f^O + rm^O)N^O - (f_1 + f_2)G(a^*) - \int_a^{a^*(t_1,\lambda)} \hat{\Delta}(a, t_{12})m^I(a)g(a)da
$$

where $N^O$, the measure of outsourcing firms, is defined by (17), and

$$
\hat{\Delta}(a, t_{12}) = (1 - t_2)(a + \delta_2 C_2) + t_2 \rho^*(a) + \delta_1 C_1 = \Delta + t_{12}(\rho^* + \delta_1 C_1)
$$

denotes the cost of inputs before country 1 taxes for integrated firm production. National income is equal to endowment income plus the difference between revenue from the sale of good $X$ and the pre-tax cost of inputs required to produce good $X$.

Substituting for $N^O$ from (17) into (19) and using (13), we obtain

$$
\frac{Z_1}{q_1} = L_1 + \frac{\mu_1 + \mu_2}{\sigma} \left( 1 - \frac{1 - t_1}{\lambda} \right) + f^O \left[ \int_a^{a^*(t_{12},\lambda)} \left( \frac{\Delta(a)}{(1 - t_{12})^r} - f_1 + f_2 \right) g(a)da \right]
$$

$$
+ \left[ \int_a^{a^*} \left( \frac{\Delta(a)}{1 - t_{12}} - \hat{\Delta}(a) \right) m^I(a)g(a)da \right].
$$

The first two terms in (21) represent the income that would be earned if all the output in sector $X$ was produced by outsourcing firms. The remaining two terms capture the cost savings realized by replacing some outsourcing firms with integrated firms whose productivities lie on $[a, a^*]$.

The expression for national income in (21) can be used to identify three margins for firm decision making at which the difference between the firm’s cost of inputs and the pre-country 1 tax cost of inputs may affect resource allocation. The first margin is the labor-capital margin in country 1. Labor can be converted to capital at a physical cost of 1 unit of labor per unit of capital, but the after-tax cost of capital to the firms is $\frac{\lambda}{1 - t_1}$ units of labor per unit of capital. This differential is relevant to the equilibrium size of outsourcing firms, $m^O$. If $\frac{\lambda}{1 - t_1} > 1$, outsourcing firms will be too large because the relative private cost of capital exceeds the pre-tax cost. The second margin arises from any difference between the after-tax cost of capital in country 1, $\lambda w_1 = \frac{\lambda(1 - t_{12})}{1 - t_1}$, and the after-tax cost of capital in country 2 to the firm, which is 1. The integration decision for the
marginal firm in (15) depends on the after-tax fixed capital costs in the two countries, \( f_1 + \frac{f_2}{\lambda w_1} \), whereas the pre-tax cost is \( f_1 + f_2 \). If \( \lambda w_1 > 1 \), too many subsidiaries will be formed because a firm’s cost of integration is too low relative to the pre-tax costs. The third margin arises from any difference between the pre-country 1 tax cost of inputs to the integrated firm, \( \hat{\Delta}(a) \), and the private cost, \( \frac{\Delta(a)}{1-t_{12}} \). If \( \frac{\Delta(a)}{1-t_{12}} < \hat{\Delta}(a) \), output at integrated firms will be too large and, given (15), there will be too many integrated firms. Thus, this input cost difference affects both the intensive and extensive margins for integrated firms.

DBCFT aligns the private cost of firms with the pre-country 1 tax cost at each of these margins, since \( \frac{\lambda}{1-t_{11}} = \frac{\lambda(1-t_{12})}{1-t_{11}} = 1 \) and \( \hat{\Delta}(a) = \frac{\Delta(a)}{1-t_{12}} \). This observation is related to the result of Proposition 5 that resource allocation is independent of \( t_1 \), because both indicate that firm decisions are not influenced by country 1’s tax rate. However, the fact that DBCFT gets each of these margins “right” does not necessarily mean that unilateral adoption of DBCFT will maximize national welfare. The reason is that tax policy also affects the variety of goods that are provided by the \( X \) sector and the terms at which country 1 trades the intermediate good and the final good with the foreign country. Since the aggregate output of the capital intensive \( X \) sector and the degree of product variety is affected by the relative price of labor to capital, tax policies that result in departures of the firm’s cost of inputs from their pre-tax values could be welfare improving for country 1.

To illustrate the role of the aggregate output of sector \( X \) on national welfare, we first examine the case where there are no integrated firms. This case eliminates substitution between integrated and outsourcing firms and transfer pricing issues, so the welfare effects of tax policy changes result from changes in the aggregate output of \( X \). We then introduce integrated firms and study the welfare effect of tax price changes operating through the fixed cost channel and the transfer pricing channel separately. This approach allows us to identify how the fixed capital costs of integrated firms in the host country and transfer price manipulation affect the attractiveness of the various tax systems to country 1.

If all output is produced in outsourcing firms, it follows from Proposition 1 that changes in \( t_{12} \) will be fully passed through to consumers and thus have no effect on resource allocation. Whether country 1 adopts a destination-based or sourced-based tax system would make no difference in this
case. Using the equilibrium output of \( X \) from (16), national welfare of country 1 can be written as

\[
W_1 = -\frac{\mu_1 \ln \lambda}{\sigma - 1} + \frac{\mu_1 + \mu_2}{\sigma} \left( 1 - \frac{1 - t_1}{\lambda} \right) + A,
\]

(22)

where \( A \) consists of terms independent of \( \lambda \). Increases in \( \lambda \) result in a trade-off between price and product variety: the higher cost of capital results in fewer but larger outsourcing firms.

Solving for the optimal tax treatment of capital yields

\[
\frac{1 - t_1}{\lambda} = \left( \frac{\mu_1}{\mu_1 + \mu_2} \right) \left( \frac{\sigma}{\sigma - 1} \right).
\]

(23)

Welfare in (22) is quasi-concave in \( \lambda \), so the solution for \( \lambda \) in (23) will be unique and decreasing in the relative size of the domestic market, \( \frac{\mu_1}{\mu_1 + \mu_2} \). In a closed economy, which occurs with \( \mu_2 = 0 \), the optimal policy sets \( \frac{\lambda}{1 - t_1} = \frac{\sigma - 1}{\sigma} < 1 \). Since the pre-tax cost of capital is unity, the optimal policy requires a choice of \( \lambda \) that reduces the private cost of capital below its pre-tax cost. The monopoly markup in the \( X \) sector leads to less than the socially optimal output of good \( X \). A cash flow tax would be preferred to an income tax in this case, because the cash flow tax provides greater product variety and a value of \( \frac{1 - t_1}{\lambda} \) closer to the optimal value, \( \frac{\sigma}{\sigma - 1} \). Specifically, under an income tax we have \( \frac{1 - t_1}{\lambda} = 1 - t_1 < 1 < \frac{\sigma}{\sigma - 1} \). However, the cash flow tax would be dominated by a subsidy to capital that satisfies \( \frac{1 - t_1}{\lambda} = \frac{\sigma}{\sigma - 1} \).

In an open economy, increases in product variety spill over to benefit country 2. This is analogous to a deterioration in the terms of trade of country 1 when capital is subsidized, since the expanded product variety is a benefit to country 2. Note however that since goods prices are unaffected in country 2 by Proposition 1, the terms of trade effect operates through an increase in product variety rather than through a reduction in the price of exports. Whether a cash flow tax is preferred to an income tax in the open economy will depend on the relative size of the export market.

Note also that by constraining \( \frac{1 - t_1}{\lambda} = 1 \), a cash flow tax takes away the use of \( t_1 \) to influence the price of capital. However, in general, both \( \lambda \) and \( t_1 \) can be used to satisfy the optimal policy condition in (23).

We now turn to the question of how the presence of integrated firms affects the welfare of tax policy changes for country 1. We begin by assuming that transfer price manipulation is prohibitively
costly, which occurs if $\alpha_1, \alpha_2 \to \infty$, and there are no fixed capital costs incurred in country 2 for integrated firms, $f_2 = 0$. These parameter values satisfy the conditions of Corollary 1, so that there is full pass through of costs to integrated firms. We refer to this as the benchmark case, and show that the outcome is the same as obtained in the case with no integrated firms.

**Proposition 6 (Benchmark Case)** If transfer price manipulation is prohibitively costly and integrated firms incur no capital costs in country 2, $f_2 = 0$, border adjustments will have no effect on resource allocation. Country 1 will be indifferent between SBT and DBT, and also between SBCFT and DBCFT. Country 1 will prefer income taxation to cash flow taxation when the export market is sufficiently large relative to the domestic market.

Under the benchmark assumptions, either DBCFT or SBCFT will be a tax on pure profits, and thus will not affect the firm’s choice of capital. Since $\frac{\lambda}{1-t_1} = 1$ under the cash flow tax, it results in the optimal capital tax policy only in the case where $\frac{\mu_1}{\mu_1+\mu_2} = \frac{\sigma-1}{\sigma}$. The cash flow tax prevents country 1 from using its domestic tax rate, $t_1$, to influence the output of good 1. In general, country 1 could do better than the cash flow tax by having the flexibility to choose values of $\lambda$ and $t_1$ to satisfy (23).\(^{18}\) We now consider how introducing the fixed capital cost and transfer price channels affects the ranking of unilateral country 1 tax policies.

### 4.1 Selection Effects from Subsidiary Fixed Costs

To illustrate the role of fixed capital costs in country 2, we consider the effect of modifying the level of $f_2$ while holding the pre-tax cost required for integration constant at $f_1 + f_2 = \bar{f}$. We hold the total fixed costs of integration constant so that the effect of increasing $f_2$ has the effect of increasing the share of fixed costs that are incurred in country 2. We maintain the assumptions that $\alpha_1, \alpha_2 \to \infty$ so that transfer price manipulation is prohibitively expensive and $\Gamma(a) = 0$.

The after-tax fixed cost of an integrated firm can be written as $\lambda w_1(\bar{f} - f_2) + f_2$, so that increases in $f_2$ will make integration more attractive to an $X$ sector firm if the after-tax cost of capital is

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\(^{18}\)In this benchmark case, the non-neutrality of $t_1$ can be shown to imply that country 1 will prefer SBT with an optimally chosen $t_1$ to DBCFT due to the terms of trade effect country 1’s tax rate can generate with an income tax.
lower in country 2, $\lambda w_1 > 1$. Differentiating condition (15) for the marginal integrated firm yields

$$\frac{\partial a^*}{\partial f_2} = \frac{a^*}{\sigma - 1} \bar{f} - f_2 + \frac{1}{\lambda w_1 - 1} \left( \frac{1}{\lambda w_1 - 1} \right).$$

(24)

An increase in the share of fixed costs of integration that are incurred in country 2 reduces $a^*$ if, and only if, $\lambda w_1 < 1$.

How does the change in the extensive margin of integrated firms affect the welfare of country 1? First, consider the case of a cash flow tax. Under DBCFT, the after-tax cost of capital at home is $\lambda w_1 = 1$, which is equal to the pre-tax cost. A switch to SBCFT will result in $\lambda w_1 = 1 - t_1 < 1$, which causes a decrease in $a^*$ by (24). This decrease in the extensive margin of integrated firms reduces $Z_1/q_1$ because firms are making a choice of organizational form based on a cost of country 1 capital that is below the pre-tax cost.

Recall from Proposition 6 that DBCFT and SBCFT provide equal welfare with $f_2 = 0$. Since we have shown that welfare is decreasing in $f_2$ for $t_{12} > 0$ and unaffected by a change in $f_2$ for $t_{12} = 0$, it follows that welfare under DBCFT must dominate that under any cash flow tax with $t_{12} > 0$. Therefore, we have the additional result that DBCFT will be preferred to SBCFT for $f_2 > 0$.

For an income tax, on the other we hand, we have $\lambda w_1 = 1$ in the case of SBT. A switch to DBT will result in $\lambda w_1 = \frac{1}{1-t_1} > 1$ and an increase in $a^*$ by (24). This increase in $a^*$ reduces $Z_1/q_1$ because the cost of country 1 capital to the firm is below the pre-tax cost, so $X$ sector firms over-invest in integration relative to the welfare maximizing level.

Proposition 6 established that DBT and SBT provide equal welfare with $f_2 = 0$. The fact that welfare is increasing in $f_2$ for $t_{12} > 0$ and independent of $f_2$ for $t_{12} = 0$ means that the SBT will be preferred to any income tax with $t_{12} < 1$ if $f_2 > 0$.

The next proposition summarizes these results.

**Proposition 7** Assume the costs of transfer pricing are prohibitive for $X$ sector firms to engage in income shifting and consider an increase in $f_2$ holding $f_1 + f_2$ constant.

(a) Under cash flow taxation, country 1 welfare is unchanged by a change in $f_2$ if $t_{12} = 0$ and it decreases for all $t_{12} > 0$. Since welfare is independent of $t_{12}$ when $f_2 = 0$, the comparative statics...
result on \( f_2 \) implies for \( f_2 > 0 \) that country 1 strictly prefers DBCFT to cash flow taxation with partial or no border adjustment.

(b) Under income taxation, country 1 welfare is unchanged by a change in \( f_2 \) if \( t_{12} = t_1 \) and it decreases for all \( t_{12} < t_1 \). Since welfare is independent of \( t_{12} \) when \( f_2 = 0 \), the comparative static result on \( f_2 \) implies for \( f_2 > 0 \) that country 1 strictly prefers SBT to income taxation with any border adjustment.

### 4.2 Transfer Pricing Effects

We now examine how transfer price manipulation influences the welfare effects of tax policy changes. We allow for firms to manipulate transfer prices by assuming \( \alpha_1, \alpha_2 < \infty \), but set \( f_2 = 0 \) to neutralize the fixed capital cost effect analyzed in the previous section. The effect of transfer pricing on the efficiency of firm selection decisions will depend on the direction of the income shifting. When \( t_{12} > t_2 \), the firm uses transfer pricing to shift income out of country 1, resulting in \( \frac{\Delta(a)}{1-t_{12}} < \hat{\Delta} \). The integrated firm’s cost of inputs is less than the cost to country 1 because it does not take into account the government’s loss of tax revenue from the partial deductibility of imported inputs. On the other hand, if \( t_{12} < t_2 \), the firm uses transfer pricing to shift income into country 1, yielding \( \frac{\Delta(a)}{1-t_{12}} \geq \hat{\Delta} \) with strict equality for \( t_{12} = 0 \). If \( t_2 > t_{12} > 0 \), the firm’s cost of inputs exceeds that to country 1 because the firm does not take into account the tax revenue the government collects from the partial border adjustment. When \( t_{12} = 0 \), the firm’s cost of inputs coincides with that of country 1.

Under these assumptions, we can use the comparative static effect of a change in \( \alpha_i \) to capture the effect of transfer pricing by integrated firms on national welfare. We can also examine the optimal choice of \( t_{12} \) under income taxation and cash flow taxation.

**Proposition 8** Assume transfer price manipulation is not prohibitively expensive for \( X \) sector firms, \( \alpha_1, \alpha_2 < \infty \), and integrated firms incur no capital costs in country 2, \( f_2 = 0 \).

(a) Under income and cash flow taxation, a decrease in country 1 auditing costs via \( \alpha_1 \) decreases country 1 welfare when \( t_{12} > t_2 \) and a decrease in country 2 auditing costs via \( \alpha_2 \) increases country 1 welfare when \( t_{12} < t_2 \).
(b) Under cash flow taxation, country 1 prefers full border adjustment to partial border adjustment with any $t_{12} > 0$.

(c) Under income taxation, country 1 strictly prefers partial border adjustment to full border adjustment.

Part (a) establishes the intuitive result that lowering the cost to an integrated firm of using transfer pricing to shift income between countries is welfare reducing for country 1 when income is being shifted out of the country, but is welfare increasing when transfer pricing is being used to shift income into country 1.

Part (b) of the Proposition establishes a sense in which cash flow taxation and border adjustments are complements. This result follows from our earlier observation that DBCFT aligns the firm’s cost of inputs with the pre-country 1 tax cost of inputs, combined with the fact that border adjustments have no terms of trade effects for country 1. Recalling from (16) that $X_i$ is independent of $t_{12}$ for $i = 1, 2$, we have that the effect of border adjustments is to alter the composition of differentiated sector output between outsourcing and integrated firms. Therefore, country 1 welfare is maximized if $Z_1/q_1$ is maximized. Increases in $t_{12}$ have the effect of raising the cost of inputs above their pre-tax costs, leading to inefficient choices by firms and a reduction in country 1 income and welfare when country 1 adopts a cash flow tax.

Under an income tax, in contrast, the price of capital faced by firms with a full border adjustment, $1 - t_i$, exceeds the pre-tax cost of capital and the allocation of resources between outsourcing and integrated firms is not efficient with $t_{12} = 0$. In particular, there will be too many integrated firms in equilibrium. An increase in $t_{12}$ will also have the countervailing effect of increasing the cost of inputs to integrated firms, which will reduce the share of output provided by integrated firms. As a result, an increase in $t_{12}$ reallocates resources to mitigate the distortion created by the capital tax, but it introduces a distortion between the integrated firm’s cost of inputs and the pre-tax cost. The proof of part (c) establishes that the former effect will dominate in the neighborhood of $t_{12} = 0$, so a full border adjustment cannot be optimal. Therefore, a strictly positive value of $t_{12}$ will be optimal if country 1 adopts an income tax.

A remaining question is whether the welfare under DBCFT exceeds that under the optimal
border adjustment for an income tax. One might assume that DBCFT would always dominate because it involves an efficient allocation of resources between integrated and outsourcing firms, whereas the income tax involves distortions in capital costs and integrated firm input costs. Observe however that from (16) the $X_i$ will be lower under an income tax system than under a cash flow tax system due to the higher cost of capital. Therefore, as in the result of Proposition 6 it is possible that country 1 prefers the income tax because it results in a more favorable terms of trade with country 2 by taxing the capital intensive good. Figure 1 illustrates an example in which the optimal policy is an income tax with partial border adjustment, with the further observation that the cash flow tax yields higher welfare at both $t_{12} = 0$ and $t_{12} = t_1$. As in the case of Proposition 6, this example requires a sufficiently large export market for the differentiated good in country 2. This case again illustrates how the welfare effect of a policy depends on both the efficiency of internal resource allocation and the impact on the terms of trade for sales to country 2.

Combining Proposition 8 with Proposition 7(b), we see that both the transfer pricing effect and the capital cost effect make the use of a destination-based tax system more attractive when country 1 chooses a cash flow tax. DBCFT has the advantage over SBCFT in that it equates the private and pre-tax costs for both the transfer pricing and and fixed cost channels. In particular, the welfare of country 1 is decreasing in $t_{12}$ for both channels. For the case of an income tax, DBT is dominated by SBT due to the fixed cost channel because SBT equates private and pre-tax costs. The full border adjustment of DBT is also dominated by partial border adjustment for the transfer pricing channel. However, DBT could still be preferred to SBT when the resource loss from transfer pricing is large at $t_{12} = t_1$. Thus, for the income tax, whether SBT is preferred to DBT will depend on the relative importance of the transfer price effect to the fixed capital cost effect.

5 Country 2 Welfare

We conclude our analysis with a brief discussion of how changes in country 1 tax policy will affect country 2. National welfare of country 2 is $W_2 = \mu_2 (\ln X_2 - 1) + Z_2$, where $Z_2$ is country 2 income measured in terms of the numeraire (labor in 2). Assuming that the producers of good $M$ in country 2 are competitive firms selling at marginal cost, country 2’s income is the sum of labor income and
Figure 1: Country 1 welfare as a function of $t_{12}$ under cash flow and income taxation with transfer pricing and $f_2 = 0$ when $c = f_1 = 1$, $t_1 = 0.35$, $\sigma = 4$, and $\mu_1 = 1$. $\mu_2$ is set equal to 0.641 so that at $t_{12} = 0$ welfare under cash flow taxation is slightly larger than under income taxation. Firm productivity, $1/a$, is distributed according to a Type II Pareto distribution on $[0,2]$.

tax revenues from outsourcing firms,

$$Z_2 = L_2 + t_2 \int_a^{a^*} (\rho^* - a - \delta_2 C_2) m_I(a) g(a) da. \quad (25)$$

Changes in country 1 tax policy affect country 2 welfare through two channels: a consumption effect and a tax revenue effect.\(^{19}\) In any case where transfer price manipulation is prohibitively costly, tax revenue will be zero and country 2 welfare depends only on the consumption effect. Therefore, we divide the analysis of the spillover effect of country 1 tax policy on country 2 into two cases, depending on whether integrated firms engage in transfer price manipulation.

**Proposition 9** (a) If transfer price manipulation is prohibitively costly, country 2 welfare is increasing in the tax deductibility of capital costs in country 1 (lower $\lambda$) and independent of country 1’s border adjustment tax, $t_{12}$.

(b) If firms engage in transfer price manipulation, country 2 welfare increases with the border adjustment tax in country 1, $t_{12}$. Increases in the tax deductibility of capital costs in country 1 will improve country 2 welfare if $t_{12} \leq t_2$, but will have an ambiguous effect on country 2 welfare for $t_{12} > t_2$.

Part (a) of Proposition 9 shows that if transfer price manipulation is prohibitively expensive,

\(^{19}\)If the producers of $M$ in country 2 have some market power so that price exceeds marginal cost, there will also be a profit-shifting effect. Increases in the output of $M$ by integrated firms will reduce profits of unrelated country 2 firms, which has a negative effect on country 2 welfare. We abstract from this effect to simplify the welfare discussion.
then country 2 is indifferent between country 1 adopting DBCFT and SBCFT and between DBT and SBT. Country 2 prefers the cash flow tax to the income tax in country 1 because of the favorable effect of the cash flow tax on the output of X.\footnote{The welfare expression in (25) implies that for $t_{12} < t_2$, the tax revenue of the government from subsidiaries of integrated firms is negative. It can be shown that if we define an arm’s length price that includes a markup above marginal cost to ensure positive tax payments, part (a) of Proposition 9 continues to hold. Part (b) is modified to reflect the fact that the reduction in the number of integrated firms resulting from an increase in $\lambda$ will raise, rather than reduce, tax revenue.}

Part (b) establishes that when integrated firms find it profitable to manipulate transfer prices, country 2 prefers country 1 adopt SBCFT to DBCFT and prefers SBT to DBT because of the favorable tax revenue effects that arise when country 1 raises $t_{12}$. An increase in $\lambda$ will have the effect of expanding the number of integrated firms and raising their output, which harms country 2 when the transfer price is below marginal cost but helps it when the transfer price is above marginal cost. Thus, country 2 prefers that country 1 use DBCFT to DBT as $t_{12} = 0$. Whether the best country 1 policy for country 2 is SBT or SBCFT depends on the relative magnitude of consumption effects and the tax revenue effects.

Another question is whether the unilateral adoption of DBCFT by country 1 would induce country 2 to respond by also changing its tax policy to DBCFT. A full treatment of this question requires analysis of the equilibrium of a non-cooperative game, which is beyond the scope of this paper. However, we can address a simpler question. Suppose that country 1 adopts DBCFT. What would be the best choice of tax policy (destination- vs. source-based and cash flow vs. income tax) for country 2?

To address this question, we let country 2 choose the tax rate on export sales of the integrated firm, $t_{21}$ and the after-tax cost of capital to the subsidiary of integrated firms, $\lambda_2$. The income of country 2 in this case will be

$$Z_2 = L_2 + \int_{\rho}^{a^*} (t_{21}(\rho^* - a - \delta_2 C_2) m^I(a) - (1 - \lambda_2) f_2) g(a) da. \tag{26}$$

The key difference between (25) and (26) is that the reduction of $\lambda_2$ below 1 results in a loss of tax revenue on the capital invested by subsidiaries of integrated firms in country 2.

We obtain the following result from differentiation of (26).
Proposition 10 Suppose that country 1 adopts DBCFT, so that $t_{12} = 0$ and $\lambda = 1 - t_1$.

(a) Country 2 welfare is decreasing in country 2’s border adjustment tax, $t_{21}$.

(b) Country 2 welfare is decreasing in country 2’s tax deductibility of capital costs incurred in country 2 (lower $\lambda_2$).

If country 1 adopts DBCFT, country 2 has an incentive to adopt a destination-based tax to avoid the loss of tax revenue resulting from the underpricing of export sales that exists under a source-based tax. However, country 2 does not have an incentive to adopt a cash flow tax because it will lose revenue that it collects from the capital invested in North subsidiaries.

6 Conclusion

In this paper, we focus on the economic effects that arise when a country unilaterally adopts destination-based and/or cash flow taxes in an economy in which intermediate goods are sourced from a country that employs a traditional source-based income tax. We analyze a North-South type trade model that incorporates monopolistic competition with heterogeneous firms and fixed costs of forming subsidiaries. These two features have been used in empirical analyses of firm exporting and foreign direct investment decisions, and we think the model captures the concerns of U.S. firms with extensive supply chains located outside the United States, who were a major source of opposition to the DBCFT proposals during the 2017 tax reform debates.

Our model shows how the manipulation of transfer prices and the existence of fixed costs of forming a subsidiary affect the pass through of border adjustments of taxes to local prices and the incentive of firms to form subsidiaries. A major result of our paper is that although DBCFT has the desirable effect of aligning a firm’s cost of inputs with its pre-tax costs to the North country, the unilateral adoption of DBCFT need not maximize welfare because income taxation gives a North country the ability to affect the relative price of capital in order to shift some tax burden onto South countries. Moreover, the fact that capital is used in the fixed costs of heterogeneous firms in a monopolistically competitive industry means the impact on the foreign country operates primarily through changes in the variety of goods available. A similar effect would operate through changes in price and variety in cases where capital is a variable input. All of our welfare results...
will also hold for any $\sigma > 1$ as long as integrated and outsourcing firms co-exist in equilibrium.

We also show that if country 1 unilaterally adopts DBCFT, it will not be optimal for country 2 to respond by adopting DBCFT. In our model, country 2 benefits from adopting a border adjustment, since the firm has an incentive to manipulate transfer prices to transfer income out of country 2. However, country 2 will prefer income taxation in order to shift tax burden onto the multinational firms when their subsidiaries have fixed capital investments in country 2.

Our results suggest that spillovers from changes in tax policy will prevent countries from unilaterally adopting policies that may be efficient from a global point of view, so that cooperative agreements would be required to achieve the efficient outcome. We have made this point in a model that assumes vertical investments by multinational firms with specific production technologies. Future work can address how these results extend to a North/North model where firms are choosing between exporting and subsidiary production of final goods between similar countries.

Appendix A: Proofs

Proof of Proposition 1: Choosing $m^O$ to maximize (3) yields

$$m^O = \left[ \frac{\kappa \sigma - 1}{1 - t_{12} \sigma r} \right]^{\sigma}.$$  \hspace{1cm} (27)

Substituting (27) into (5) yields

$$x^O_j = (1 - t_{1j})^\sigma (q_j \mu_j)^\sigma X_j^{1-\sigma} \left[ \frac{\sigma - 1}{(1 - t_{12})\sigma r} \right]^{\sigma}.$$  

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

$$x^O_j = \left( \frac{q_j \mu_j}{p^O_j} \right)^\sigma X_j^{1-\sigma}.$$  

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 the necessary condition for choice of $m$ from (7). The argument then proceeds as in Proposition 1. To obtain $x^I_j$ substitute
\( m^f \) into (5). Combining this with \( x_j^f = \left( \frac{\mu_j}{\mu_f} \right)^{\sigma} X_j^{1-\sigma} \), from the expenditure relationship yields the solution for \( p_j^f \).

**Proof of Proposition 3:** For source-based taxation (with either income or cash flow taxation), integrated firm profit becomes

\[
\Pi^{IS}(a) = \lambda f^O \left( \frac{\Delta^S(a)}{1-t_1} \right)^{1-\sigma} r^{\sigma-1} - \lambda f_1 - f_2.
\]

For destination-based taxation,

\[
\Pi^{ID}(a) = \frac{1}{1-t_1} \left[ \lambda f^O \Delta^D(a)^{1-\sigma} r^{\sigma-1} \right] - f_2 = \Pi^{IS}(a) + \frac{t_1 f_2}{1-t_1} > \Pi^{IS}.
\]

(a) Suppose \( \Delta^D(a) \leq \Delta^S(a) \frac{1}{(1-t_1)} \). Since integrated firm profit is decreasing in \( \Delta(a) \), we have

\[
\Pi^{ID}(a) \geq \frac{1}{1-t_1} \left[ \lambda f^O \left( \frac{\Delta^S(a)}{1-t_1} \right)^{1-\sigma} r^{\sigma-1} \right] - f_2 = \Pi^{IS}(a) + \frac{t_1 f_2}{1-t_1} > \Pi^{IS}.
\]

This is a sufficient condition for integration to be more attractive under destination-based taxation, and for the extensive margin of integration to be expanded when it holds at \( a^{*S} \).

(b) Next suppose \( \Delta^D(a) \geq \Delta^S(a) (1-t_1)^{\frac{\sigma}{\sigma-1}} \), which is equivalent to \( \Delta^D(a)(1-t_1) \frac{1}{\sigma-1} \geq \Delta^S(a) \frac{1}{(1-t_1)} \).

Substituting into the expression for integrated firm profits under source-based taxation yields

\[
\Pi^{IS}(a) \geq \frac{\lambda f^O}{1-t_1} \Delta^D(a)^{1-\sigma} r^{\sigma-1} - \lambda f_1 - f_2 = \Pi^{ID}(a) + \frac{t_1 \lambda (c + f_1)}{1-t_1}.
\]

This is a sufficient condition for integration to be more attractive under source-based taxation, and for the extensive margin of integration to be reduced when it applies at \( a^{*D} \).

**Proof of Proposition 4:**

(a) The share of output allocated to the respective markets will be the same for all \( X \) sector firms, so \( X_2 = \frac{\mu_2 X_1}{\mu_1} \). Substituting this result into the definition of \( \kappa \) and using (12) yields the aggregate equilibrium output levels for each market in (16).

(b) We have from (13) that \( m^f(a) \) is homogeneous of degree 1 in \( \lambda \). The right hand side of (15) is increasing in \( \lambda \), so an increase in \( \lambda \) requires an increase in \( a^* \) to restore equality. Therefore, both
the extensive and intensive margins of integrated firms will be decline when $\lambda$ decreases.

(c) The output of outsourcing firms is homogeneous of degree 1 in $\lambda$ from (13). To solve for the measure of outsourcing firms, observe that the we can use (16) and the allocation of output across markets given by (5) to obtain

$$X_1 + X_2 = \left[ N^O (m^O)^{\sigma-1}/\sigma + \int_a^{a^*} (m^I(a))^{\sigma-1}/\sigma g(a)da \right]^{\sigma/(\sigma-1)}.$$

Substituting for $X_1 + X_2$ and using $X_2 = \frac{\mu_2 X_1}{\mu_1}$ yields (17). $N^O$ will be decreasing in $\lambda$ because the first term in (17) is decreasing in $\lambda$ and $a^*$ is increasing in $\lambda$ by (b).

**Proof of Proposition 5:**

Neutrality of changes in $t_1$ requires that $a^*, m^I(a), m^O$ and $X_j$ be unaffected by changes in $t_1$, since it ensures the intensive and extensive margins of outsourcing and integration are unaffected. By (13) and (16), $m^O$ and $X_j$ will be independent of $t_1$ if, and only if, $\lambda = 1 - t_1$. For $m^I(a)$ to be independent of $t_1$ also requires $\frac{\Delta(a,t_{12},t_2)}{1-t_{12}}$ to be independent of $t_1$, which will be satisfied for $t_{12} < t_1$. Finally, for $a^*$ to be independent of $t_1$ also requires $\lambda w_1$ to be independent of $t_1$ from (15). These 3 conditions will be satisfied if, and only if, $\lambda = 1 - t_1$ and $t_{12} = 0$.

**Proof of Proposition 6:**

The assumption that $\alpha_1, \alpha_2 \to \infty$ ensures that $\Delta(a) = a(1 - t_{12})$ and hence $\Gamma(a) = 0$ for all $a$. It then follows from Proposition 2 and (13) that relative prices and outputs of integrated firms are unaffected by changes in $t_{12}$. From (15), the condition for the marginal integrated firm in this case will be $\frac{a^*}{r} = \left( \frac{f_1}{f_2} \right)$. Since the solution for $a^*$ is independent of $t_{12}$ and $\lambda$, tax policy changes will not affect the intensive margin or extensive margin of integrated firms. The optimal choice of $\lambda$ will be given by (23).

Evaluating the change in welfare as a share of expenditure on good $X$ due to the switch from a cash flow tax to an income tax in the benchmark case yields

$$\frac{W(t_1,1) - W(t_1,1-t_1)}{\mu_1 + \mu_2} = \frac{\mu_1}{\mu_1 + \mu_2} \ln(1-t_1) + \frac{t_1}{\sigma}.$$  (28)

**Proof of Proposition 7:**
Differentiating (21) with respect to $f_2$ holding $\bar{f} = f_1 + f_2$ constant, and using (13) implies that

$$\frac{\partial Z_1/q_1}{\partial f_2} \bigg|_f = \left[ f^O \left( \frac{r}{a^*} \right)^{\sigma - 1} - \bar{f} \right] g(a^*) \frac{\partial a^*}{\partial f_2}. \tag{29}$$

Using the formula for $a^*$ from (15) to substitute for $r/a^*$ implies that (29) simplifies to

$$\frac{\partial Z_1/q_1}{\partial f_2} \bigg|_f = -\left( \frac{a^*}{\sigma - 1} \right) f_2 \left( \frac{1 - t_1}{\lambda(1 - t_{12})} - 1 \right)^2 g(a^*). \tag{30}$$

With cash flow taxation, (30) is negative for all $f_2 > 0$ and all $t_{12} > 0$. It is zero if $f_2 = 0$ or if $t_{12} = 0$. This means country 1 welfare under DBCFT is unchanged by shifting some fixed costs to country 2 while it declines for any positive value of $t_{12}$. Thus, with $f_2 > 0$ while holding $f_1 + f_2$ constant, country 1 will prefer DBCFT over SBCFT. With income taxation, (30) is negative for all $f_2 > 0$ and all $t_{12} < t_1$. It is zero if $f_2 = 0$ or $t_{12} = t_1$. This means country 1 welfare under SBT is unchanged by shifting some fixed costs to country 2 while it declines for any $t_{12} < t_1$. Thus, with $f_2 > 0$ while holding $f_1 + f_2$ constant, country 1 will prefer SBT over DBT.

**Proof of Proposition 8:**

Preliminaries. First, to simplify some of the expressions, define $\alpha = \alpha_1$ when $t_{12} > t_2$ and define $\alpha = \alpha_2$ when $t_{12} < t_2$. Any derivative with respect to $\alpha$ will be understood to denote a derivative with respect to either $\alpha_1$ or $\alpha_2$, depending on which transfer price cost parameter is operative given $t_{12}$ and $t_2$. Second, direct calculation shows that $\hat{\Delta}(a) > \Delta(a)/(1 - t_{12})$ for $t_{12} > t_2$ and $\hat{\Delta}(a) \leq \Delta(a)/(1 - t_{12})$ for $t_{12} < t_2$ with equality for $t_{12} = 0$. Third, when $t_{12} = t_2$, $W_1$ is unaffected by a change in $\alpha$. Fourth, given (21) and using the definition of $a^*$ from (15) to substitute out $f_1 + f_2 / f_2$ for $f_2 = 0$ yields

$$W_1 = \mu_1 (\ln X_1 - 1) + L_1 + \frac{\mu_1 + \mu_2}{\sigma} \left( 1 - \frac{1 - t_1}{\lambda} \right)$$

$$+ f^O \int_a^{a^*} \left[ \left( \frac{1 - t_{12}}{\Delta(a)} \right)^{\sigma - 1} - \left( \frac{1 - t_{12}}{\Delta(a^*)} \right)^{\sigma - 1} \right] g(a) da \tag{31}$$

$$+ \frac{\lambda f^O (\sigma - 1)}{1 - t_1} \int_a^{a^*} \left( \frac{1 - t_{12}}{\Delta(a)} \right)^{\sigma - 1} \left[ 1 - \frac{1 - t_{12}}{\Delta(a)} \frac{\hat{\Delta}(a)}{\Delta(a)} \right] g(a) da.$$
Because $\hat{\Delta}(a) > \Delta(a)/(1 - t_{12})$ for $t_{12} > t_2$,

$$\frac{\partial W_1}{\partial \alpha} > f^O(\sigma - 1) \left(1 - \frac{\lambda}{1 - t_1} \right) \int_0^{a^*} \left( \frac{(1 - t_{12})r}{\Delta(a)} \right)^{\sigma - 2} \frac{\partial}{\partial \alpha} \left( \frac{(1 - t_{12})r}{\Delta(a)} \right) g(a)da$$

$$+ \frac{\lambda(\sigma - 1)f^O}{1 - t_1} \int_0^{a^*} (\sigma - 1) \left( \frac{(1 - t_{12})r}{\Delta(a)} \right)^{\sigma - 2} \frac{\partial}{\partial \alpha} \left( \frac{(1 - t_{12})r}{\Delta(a)} \right) \left[ 1 - \frac{(1 - t_{12})\hat{\Delta}(a)}{\Delta(a)} \right] g(a)da$$

$$- \frac{\lambda(\sigma - 1)f^O}{1 - (t_{12})r} \int_0^{a^*} \left( \frac{(1 - t_{12})r}{\Delta(a)} \right) \sigma \frac{\partial\hat{\Delta}(a)}{\partial \alpha} g(a)da$$

$$+ \frac{\lambda(\sigma - 1)f^O}{1 - t_1} \left( \frac{(1 - t_{12})r}{\Delta(a^*)} \right)^{\sigma - 1} \left[ 1 - \frac{(1 - t_{12})\hat{\Delta}(a^*)}{\Delta(a^*)} \right] g(a^*) \frac{\partial a^*}{\partial \alpha} > 0. \quad (33)$$

Line 1 in (33) between the inequalities is non-negative and the other lines are strictly positive because $\Delta(a)$ is increasing in $\alpha$, $\hat{\Delta}(a)$ is decreasing in $\alpha$ (with $t_{12} > t_2$), and $a^*$ is decreasing in $\alpha$. Thus, the entire expression is strictly positive for $t_{12} > t_2$ so a lower cost of transfer pricing lowers country 1 welfare.

Next, we analyze the case in which $t_{12} < t_2$. Because $\hat{\Delta}(a) \leq \Delta(a)/(1 - t_{12})$ for $t_{12} < t_2$ and $
\Delta(a) - \hat{\Delta}(a)(1 - t_{12})$ is non-negative and independent of $a$, one can write (31) as

$$W_1 = \mu_1(\ln X_1 - 1) + L_1 + \frac{\mu_1 + \mu_2}{\sigma} \left( 1 - \frac{1 - t_1}{\lambda} \right)$$

$$+ f^O \int_0^{a^*} \left[ \left( \frac{(1 - t_{12})r}{\Delta(a)} \right)^{\sigma - 1} - \left( \frac{(1 - t_{12})r}{\Delta(a^*)} \right)^{\sigma - 1} \right] g(a)da$$

$$+ \frac{\lambda f^O(\sigma - 1)}{1 - t_1} \left( \frac{\Delta(a) - \hat{\Delta}(a)(1 - t_{12})}{(1 - t_{12})r} \right) \int_0^{a^*} \left( \frac{(1 - t_{12})r}{\Delta(a)} \right)^{\sigma} g(a)da. \quad (34)$$
Differentiating (34) with respect to \( \alpha \) then implies that

\[
\frac{\partial W_1}{\partial \alpha} = f^O \int_a^{a^*} (\sigma - 1) \left( \frac{(1-t_{12})r}{\Delta(a)} \right)^{\sigma-2} \frac{\partial}{\partial \alpha} \left( \frac{(1-t_{12})r}{\Delta(a)} \right) g(a) da \\
+ \frac{\lambda (\sigma - 1) f^O}{1-t_1} \frac{\partial}{\partial \alpha} \left( \frac{\Delta(a) - \Delta(a)(1-t_{12})}{(1-t_{12})r} \right) \int_a^{a^*} \left( \frac{(1-t_{12})r}{\Delta(a)} \right)^\sigma g(a) da \\
+ \frac{\lambda (\sigma - 1) f^O}{1-t_1} \left( \frac{\Delta(a) - \Delta(a)(1-t_{12})}{(1-t_{12})r} \right) \int_a^{a^*} \sigma \left( \frac{(1-t_{12})r}{\Delta(a)} \right)^{\sigma-1} \frac{\partial}{\partial \alpha} \left( \frac{(1-t_{12})r}{\Delta(a)} \right) g(a) da \\
+ \frac{\lambda (\sigma - 1) f^O}{1-t_1} \left( \frac{\Delta(a) - \Delta(a)(1-t_{12})}{(1-t_{12})r} \right) \left( \frac{(1-t_{12})r}{\Delta(a^*)} \right)^\sigma g(a^*) \frac{\partial a^*}{\partial \alpha}.
\]

(35)

The first line in (35) is negative because \( \Delta(a) \) is increasing in \( \alpha \) and the second is negative because \( \Delta(a) - \hat{\Delta}(a)(1-t_{12}) \) is strictly decreasing in \( \alpha \). The remaining lines are non-positive because \( \Delta(a) \geq \hat{\Delta}(a)(1-t_{12}) \) and \( a^* \) is strictly decreasing in \( \alpha \). Thus, a lower cost of transfer pricing increases country 1 welfare.

Proof of parts (b) and (c). Differentiating \( W_1 \) with respect to \( t_{12} \) and noting that \( d((1-t_{12})/\Delta(a^*))/dt_{12} = 0 \) when \( f_2 = 0 \) yields

\[
\frac{\partial W_1}{\partial t_{12}} = f^O \int_a^{a^*} (\sigma - 1) \left( \frac{(1-t_{12})r}{\Delta(a)} \right)^{\sigma-2} \frac{\partial}{\partial t_{12}} \left( \frac{(1-t_{12})r}{\Delta(a)} \right) g(a) da \\
+ \frac{\lambda f^O (\sigma - 1)}{1-t_1} \int_a^{a^*} \left( \sigma - 1 \right) \left( \frac{(1-t_{12})r}{\Delta(a)} \right)^{\sigma-2} \frac{\partial}{\partial t_{12}} \left( \frac{(1-t_{12})r}{\Delta(a)} \right) \left[ 1 - \frac{\Delta(a)(1-t_{12})}{\Delta(a)} \right] \\
- \left( \frac{(1-t_{12})r}{\Delta(a)} \right)^{\sigma-1} \frac{\partial}{\partial t_{12}} \left( \frac{(1-t_{12})\hat{\Delta}(a)}{\Delta(a)} \right) g(a) da \\
+ \frac{\lambda f^O (\sigma - 1)}{1-t_1} \left( \frac{(1-t_{12})r}{\Delta(a^*)} \right)^{\sigma-1} \left[ 1 - \frac{\Delta(a^*)(1-t_{12})}{\Delta(a^*)} \right] g(a^*) \frac{\partial a^*}{\partial t_{12}}.
\]

(36)

At \( t_{12} = 0, \hat{\Delta}(a) = \Delta(a)/(1-t_{12}) \) and \( \partial \hat{\Delta}(a)/\partial t_{12} = 0 \) for all \( a \) so

\[
\frac{\partial W_1}{\partial t_{12}} \bigg|_{t_{12}=0} = f^O (\sigma - 1) \left( 1 - \frac{\lambda}{1-t_1} \right) \int_a^{a^*} \left( \frac{(1-t_{12})r}{\Delta(a)} \right)^{\sigma-2} \frac{\partial}{\partial t_{12}} \left( \frac{(1-t_{12})r}{\Delta(a)} \right) g(a) da.
\]

(37)

To evaluate the sign of (37), note that for \( t_{12} < t_2 \),

\[
\frac{\partial}{\partial t_{12}} \left( \frac{\Delta(a)}{1-t_{12}} \right) = -\frac{(t_{12} - t_2)(2 - t_{12} - t_2)}{4a_2(1-t_2)(1-t_{12})^2} > 0
\]

(38)
so
\[
\frac{\partial}{\partial t_{12}} \left( \frac{1 - t_{12}}{\Delta} \right) < 0. 
\] (39)

With income taxation, (37) is strictly positive and the optimal value of \(t_{12} > 0\).

With cash flow taxation, (37) is equal to zero. However, by expanding line 3 of (36),
\[
\frac{\partial W_1}{\partial t_{12}} = f^O(\sigma - 1) \int_2^{a^*} \left( \frac{1 - t_{12}}{\Delta(a)} \right)^{\sigma - 2} \frac{\partial}{\partial t_{12}} \left( \frac{1 - t_{12}}{\Delta(a)} \right) g(a) da 
\]
\[
+ f^O(\sigma - 1) \int_2^{a^*} (\sigma - 1) \left( \frac{1 - t_{12}}{\Delta(a)} \right)^{\sigma - 2} \frac{\partial}{\partial t_{12}} \left( \frac{1 - t_{12}}{\Delta(a)} \right) \left[ 1 - \hat{\Delta}(a)(1 - t_{12}) \right] g(a) da 
\]
\[
- f^O(\sigma - 1) \int_2^{a^*} \left( \frac{1 - t_{12}}{\Delta(a)} \right)^{\sigma - 2} \hat{\Delta}(a)(1 - t_{12}) \frac{\partial}{\partial t_{12}} \left( \frac{1 - t_{12}}{\Delta(a)} \right) g(a) da 
\]
\[
- f^O(\sigma - 1) \int_2^{a^*} \left( \frac{1 - t_{12}}{\Delta(a)} \right)^{\sigma} \frac{\partial}{\partial t_{12}} \hat{\Delta}(a) g(a) da 
\]
\[
+ f^O(\sigma - 1) \left( \frac{1 - t_{12}}{\Delta(a^*)} \right)^{\sigma - 1} \left[ 1 - \hat{\Delta}(a^*)(1 - t_{12}) \right] g(a^*) \frac{\partial}{\partial t_{12}} a^*. 
\] (40)

For \(0 < t_{12} < t_2\), \((1 - t_{12})r/\Delta(a)\) and \(a^*\) are decreasing in \(t_{12}\), \(\Delta(a) > (1 - t_{12})\hat{\Delta}(a)\), and \(\hat{\Delta}(a)\) is increasing in \(t_{12}\). Because \(\Delta(a) > (1 - t_{12})\hat{\Delta}(a)\), the sum of lines 1 and 3 in (40) is negative while lines 2, 4, and 5 are each negative. Thus, (36) is strictly negative for all \(0 < t_{12} < t_2\). For \(t_{12} > t_2\), \((1 - t_{12})r/\Delta(a)\), \(a^*\), and \(\hat{\Delta}(a)\) are all increasing in \(t_{12}\) while \(\Delta(a) < (1 - t_{12})\hat{\Delta}(a)\). At \(t_{12} = t_2\), \(\hat{\Delta}(a)\) is strictly increasing. Now because \(\Delta(a) < (1 - t_{12})\hat{\Delta}(a)\), the sum of lines 1 and 3 in (40) is still negative and lines 2, 4, and 5 also remain negative. Thus, (36) is also strictly negative for all \(t_{12} \geq t_2\).

**Proof of Proposition 9:** (a) \(X_2\) is decreasing in \(\lambda\) and independent of \(t_{12}\). Since \(Z_2\) is independent of \(\lambda\) and \(t_{12}\), the welfare of country 2 depends only on consumption effects.

(b) The change in country 2 income from an increase in \(t_{12}\) is given by
\[
\frac{dZ_2}{dt_{12}} = t_2 \int_2^{a^*} \left[ \frac{\partial (\rho^* - a - \delta_2 C_2)}{\partial t_{12}} m^I(a) + (\rho^* - a - \delta_2 C_2) \frac{\partial m^I(a)}{\partial t_{12}} \right] g(a) da 
\]
\[
+ t_2(\rho^* - a^* - \delta_2 C_2) m^I(a^*) g(a^*) \frac{\partial a^*}{\partial t_{12}}. 
\] (41)
We consider two cases, depending on whether $t_{12}$ is greater or less than $t_2$. For $t_{12} > t_2$, the first term is positive since $\frac{\partial (\rho^* - a - \delta_2 C_2)}{\partial t_{12}} = \frac{1-t_2}{2a_1(1-t_{12})} > 0$. The fact that $\frac{\partial^2 (a, t_{12}, t_2)/(1-t_{12})}{\partial t_{12}} = \frac{(t_2-t_{12})/2-t_2}{2a_1(1-t_{12})^2} < 0$ ensures that $\frac{\partial m^I(a)}{\partial t_{12}} > 0$ and $\frac{\partial a^*}{\partial t_{12}} > 0$. Since $(\rho^* - a - \delta_2 C_2) > 0$, the second and third terms will also be positive.

For $t_{12} < t_2$, the first term is positive because $\frac{\partial (\rho^* - a - \delta_2 C_2)}{\partial t_{12}} = \frac{1-t_2}{2a_1(1-t_{12})} > 0$. The fact that $\frac{\partial^2 (a, t_{12}, t_2)/(1-t_{12})}{\partial t_{12}} = \frac{(t_2-t_{12})(2-t_2-t_{12})}{2a_2(1-t_{12})^2(1-t_2)} > 0$ ensures that $\frac{\partial m^I(a)}{\partial t_{12}} < 0$ and $\frac{\partial a^*}{\partial t_{12}} < 0$. We also have $(\rho^* - a - \delta_2 C_2) < 0$, so the second and third terms will also be positive.

The change in income from an increase in $\lambda$ is given by

$$\frac{dZ_2}{d\lambda} = t_2 \left( \int_a^{a^*} (\rho^* - a - \delta_2 C_2) \frac{\partial m^I(a)}{\partial \lambda} g(a) da + (\rho^* - a^* - \delta_2 C_2) m^I(a^*) g(a^*) \frac{\partial a^*}{\partial \lambda} \right). \quad (42)$$

We have $\frac{\partial m^I(a)}{\partial \lambda} > 0$ from (13) and $\frac{\partial a^*}{\partial \lambda} > 0$ from (15). For $t_{12} < t_2$, we have $(\rho^* - a - \delta_2 C_2) < 0$, $\frac{dZ_2}{d\lambda} < 0$, and $\frac{\partial W_2}{\partial \lambda} < 0$. For $t_{12} > t_2$, $(\rho^* - a - \delta_2 C_2) > 0$ and $\frac{dZ_2}{d\lambda} > 0$. Since the effect of an increase in $\lambda$ on consumption is negative, the sign of $\frac{\partial W_2}{\partial \lambda}$ is ambiguous for $t_{12} > t_2$.

**Proof of Proposition 10:**

The analysis for this case is obtained by replacing $t_2$ by $t_{21}$ in the equilibrium conditions and setting the after-tax of capital in country 2 for integrated firms to $\lambda_2 f_2$ in (14). The condition for the marginal integrated firm becomes

$$\frac{\Delta(a, t_{12}, t_2)}{1-t_{12}} = r \left( \frac{f_1 + \lambda_2 f_2/(\lambda w_1)}{f_0} \right)^{\frac{1}{\gamma}}, \quad (43)$$

where $\frac{da^*}{dt_{21}} < 0$ and $\frac{da^*}{dt_{21}} = \frac{(t_{12} - t_{21})(2-t_{21} - t_{12})}{4a_2(1-t_{21})^2} > 0$ for $t_{12} > t_{21}$.

The effect of an increase in $t_{21}$ on country 2 income is given by

$$\frac{dZ_2}{dt_{21}} = t_{21} \int_a^{a^*} \left[ \frac{\partial (\rho^* - a - \delta_2 C_2)}{\partial t_{21}} m^I(a) + (\rho^* - a - \delta_2 C_2) \frac{\partial m^I(a)}{\partial t_{21}} \right] g(a) da$$

$$+ \left( t_{21}(\rho^* - a - \delta_2 C_2)m^I(a^*) - (1-\lambda_2)f_2 \right) g(a^*) \frac{\partial a^*}{\partial t_{12}} + \int_a^{a^*} (\rho^* - a - \delta_2 C_2) m^I(a) g(a) da. \quad (44)$$

If $t_{12} = 0$, then $(\rho^* - a - \delta_2 C_2) < 0$ for all $a$ because $\rho^*(a) < a$. The fact that the transfer pricing
profits of an integrated firm are increasing in $t_{21}$ means that $\frac{d\ell(t)}{dt_{21}} > 0$ and $\frac{d\omega^*}{dt_{21}} > 0$. All terms will be negative when $t_{12} = 0$. https://www.overleaf.com/project/5a0f2b37487ce235299a7763 The effect of an increase in $\lambda_2$ on country 2 income is

$$\frac{dZ_2}{d\lambda_2} = (t_{21}(\rho^* - a^* - \delta_2C_2)m^t(a^*)g(a^*) - (1 - \lambda_2)f_2g(a^*)) \frac{da^*}{d\lambda_2} + f_2G(a^*).$$

The second term will be positive for $f_2 > 0$. We have $\frac{da^*}{d\lambda_2} < 0$ because an increase in $\lambda_2$ raises the cost of capital for integrated firms. The first term will also be positive for $t_{12} = 0$.

**Appendix B: Generalizing the Technology**

We simplified the analysis of firm behavior by assuming that outsourcing and integrated firms use capital only as a fixed input. In this section, we examine how the results are affected if capital is also a variable input in either the subsidiary in country 2 or the headquarters in country 1.\(^{21}\)

Suppose the technology of an integrated firm subsidiary requires the use of labor and capital as both variable and fixed inputs. The results on pass through of border adjustments to consumer price in Proposition 2 and Lemma 1(a) will continue to hold, where marginal cost (and hence the arm’s length price) is the sum of the cost of variable labor and capital inputs. Furthermore, it is straightforward to show that the result of Lemma 1(b) continues to hold: a switch from a source-based tax to a destination-based tax will raise the fixed cost of the integrated firm by less than a factor of $\frac{1}{1-t_{12}}$ as long as there are fixed costs (in terms of either capital or labor) in the subsidiary.

Similarly, assuming that the headquarters facilities for integrated and outsourcing firms in country 1 require a per unit input of capital in addition to the fixed input has no effect on the pass through results of prices in response to changes in $t_{12}$. The pricing formulas of Propositions 1 and 2 continue to hold once marginal cost is modified to include the per unit capital cost in country 1.

A reduction in the after-tax cost of capital will reduce both the marginal costs and the fixed costs of $X$ sector firms. Proposition 4, which deals with the effect of $\lambda$, will be affected in two ways.

\(^{21}\)We can also examine the effect of an increase in the competitiveness of the market by considering an increase in $\sigma$. Increased $\sigma$ will lower prices and increase firm size. The share of firms that are integrated will increase if $f_1 + f_2/(w_1\lambda) > f^O$. Under our assumption of constant marginal costs, the limit as $\sigma \to \infty$ is not particularly interesting, because only an arbitrarily large firm of the most efficient type would survive.
First, the increase in X sector consumption resulting from a reduction in \( \lambda \) will occur through both a reduction in price and an increase in product variety. This effect is minor, in that it changes the composition but not the direction of the spillover. The second effect is the extent to which a reduction in \( \lambda \) favors outsourcing firms as opposed to integrated firms. Now the effect of an increase in \( \lambda \) on the decision to integrate depends on both relative variable costs and relative fixed costs of integrated firms to outsourcing firms. The result that a decrease in \( \lambda \) favors outsourcing firms could be reversed if integrated firms are sufficiently capital intensive relative to outsourcing firms in the variable cost component.

Finally, DBCFT is still a tax on pure profits when there are variable capital costs.
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