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Transfer Pricing Regulation and Tax Competition*

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Abstract
The paper analyzes multinational enterprises' incentives to manipulate internal transfer prices to take advantage of tax differences across countries, and implications of transfer-pricing regulations as a countermeasure against such profit shifting. We find that tax-motivated foreign direct investment (FDI) may entail inefficient internal production but may benefit consumers. Thus, encouraging transfer-pricing behavior to some extent can enhance social welfare. Furthermore, we consider tax competition between two countries in order to explore the interplay with transfer-pricing regulations. We show that the FDI source country will be willing to set a higher tax rate and tolerate some profit shifting to a tax haven country if the regulation is tight enough. We also indicate a novel mechanism through which it is the larger country that undertakes tax-motivated FDI, the pattern we often observe in reality.

Keywords: Multinational enterprise; Corporate tax; Transfer pricing; Foreign direct investment; Arm's length principle; Tax competition
JEL classification: F12, F23, H21, H26, L12, L51

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1 Introduction

Corporate tax rates substantially differ across countries, and some countries adopt preferential tax measures.[1] Since multinational enterprises (MNEs) actively engage in intrafirm transactions across borders,[2] they have an incentive to manipulate internal transfer prices to save tax payments, an activity often called "transfer pricing". MNEs tend to shift their profits from high-tax countries to low-tax jurisdictions (see Hines and Rice, 1994; Huizinga and Laeven, 2008; Bauer and Langenmayr, 2013; Davies et al., 2018). For instance, inspections by the Vietnamese tax authorities have found that "the most common trick played by FDI enterprises to evade taxes was hiking up prices of input materials and lowering export prices to make losses or reduce profits in books".[3] In addition, Egger et al. (2010) find that the average subsidiary of an MNE pays about 32% less tax than similar local firms in high-tax countries. According to Goldman Sachs, the tax saving by U.S. MNEs amounts to $2 trillion, equivalent to four years' worth of U.S. corporate tax revenues (Nikkei, August 31, 2016).

If governments do not regulate transfer pricing, MNEs may shift a large proportion of their profits away from their countries to low-tax or no-tax jurisdictions, narrowing their tax bases significantly. Governments thus impose transfer-pricing rules to control transfer-price manipulation. In particular, the Organisation for Economic Co-operation and Development (OECD) proposed that internal transfer prices follow the so-called arm's length principle (ALP) in its guidelines for transfer pricing published in 1995 and revised in 2010.[4]

The basic approach of the ALP is that the headquarters and affiliates of an MNE should be treated as "operating as separate entities rather than as inseparable parts of a single unified business" and the controlled internal transfer price should mimic the market price that would be obtained in comparable uncontrolled transactions at arm's length. This kind of comparative analysis is at the heart of the application of the ALP. Currently, the ALP is the international transfer-pricing principle to which OECD member

[1]Preferential tax measures are observed in many countries. For example, Vietnam grants special or preferential tax rates to attract foreign direct investment (FDI). Thailand provides tax incentives for FDI. The Taiwanese corporate tax rate is lower by 7 percentage points for foreign firms with some fixed places of business or some business agents in Taiwan.

[2]Bernard et al. (2010) report that over 46% of U.S. imports comprised intrafirm transactions in 2000.

[3]http://vietnamlawmagazine.vn/transfer-pricing-unbridled-at-fdi-enterprises-4608.html

[4]The OECD also initiated a project in 2012 to create an action plan to address base erosion and profit shifting.

countries have agreed.

Against this background, the purpose of this study is twofold. The first purpose is to closely examine MNEs' incentive to manipulate transfer prices to avoid tax payments, and governments' regulatory responses to such practices. We specifically investigate the transfer pricing resulting from tax-motivated FDI and the implication of the ALP, when imperfect competition prevails in the final-good market. To this end, we consider a stylized set-up of two countries with different corporate tax rates, where a monopolist that produces and sells its final products in the high-tax country can set up its subsidiary, which produces intermediate goods, in the low-tax country to engage in tax-saving transfer pricing. We show that this monopolistic MNE shifts all its profits to the low-tax country by choosing the standard monopoly price as the transfer price, replicating the monopoly outcome in the market.

To counter such extreme transfer-pricing activities, the MNE's home country may tighten transfer-pricing regulation by lowering the transfer-price cap. In this study, we consider transfer-price caps to be a regulatory measure.[5] Tax authorities audit tax-avoidance behaviors by comparing the prices used in intrafirm transactions with those of similarly uncontrolled transactions between independent parties (i.e., arm's length prices); this method of the ALP is called the comparable uncontrolled price (CUP) method. In practice, however, it is often difficult to find a comparable transaction of similar products between independent enterprises. In such cases, other ALP methods such as the cost plus (CP) method, are applied.[6] The price cap which we consider in this study can be thought of as a CP method, as regulatory authorities often regard the cost plus a reasonable mark-up as a transfer price that meets the ALP.[7] The CP method is also a natural ALP in the case of monopoly, because in many monopolistic environments it is hard to find other transactions of comparable inputs.

We show that transfer pricing entails lowering what the MNE perceives as its marginal cost of production. The "perceived marginal cost" declines as a result of transfer pricing, because the marginal tax saving that arises from an additional shipment of intermediate goods serves as the marginal benefit of production for the MNE. Not surprisingly, there-

[5]This assumption has often been made to investigate transfer-pricing regulations. See Raimondos-Moler and Scharf (2002), Peralta et al. (2006), Becker and Fuest (2012), and Matsui (2012), among others.

[6]Other suggested methods include the resale price method, transactional net margin method, and transactional profit split method. See OECD (2010) for more details.

[7]Other ALP methods (except for the CUP method) indirectly regulate the ceiling of the transfer price.

fore, FDI occurs even if it is less efficient to produce the intermediate goods internally at its foreign subsidiary, because it can be used as a vehicle to lessen its tax burden with an inflated internal price. Interestingly, however, profit shifting with the regulation may also benefit consumers, because transfer pricing lowers the monopolist's perceived marginal cost, thereby leading to more production which alleviates allocative inefficiency due to market power. Thus, the MNE's home country may want to encourage its firm's tax-saving, transfer-pricing activities.

The second purpose of the paper is to identify the economic environment in which a country is indeed willing to select a higher tax rate than another country to encourage its monopolistic firm to engage in FDI and transfer pricing, hoping that the resulting alleviation of allocative inefficiency enhances its social welfare. To this end, we first investigate a sequential-move, tax-competition game (i.e., a Stackelberg tax-competition game) played by two welfare-maximizing governments within our baseline model with transfer-pricing regulation.[8] We show that the nature of tax competition can depend on the tightness of transfer-pricing regulation. In particular, the MNE's home country is willing to set a higher tax rate and tolerate some profit shifting to an endogenously-determined, tax-haven country, if the regulation is sufficiently tight. However, if regulation is too lax, tax competition leads to a "race to the bottom" that eliminates any incentives for tax-motivated FDI. Interestingly, this implies that a tax haven country does not always prefer lax transfer-pricing regulation. Thus, the incentives of the host and FDI source countries can be aligned to set up global regulatory standards for transfer pricing.

Finally, we extend the sequential-move game to a simultaneous-move, tax-competition model with multiple industries, played by two countries with different population sizes.[9] This set-up allows us to *endogenously* determine the FDI source country that selects a higher tax rate and investigate the characteristics of such countries. We show that a pure-strategy, subgame-perfect equilibrium exists if countries are sufficiently different in size. The large country sources FDI, choosing a higher tax rate than the smaller country. It is willing to create an environment in which its firm engages in FDI to save tax payments because, for the large country, the benefit of the resulting increase in the

[8]For example, Baldwin and Krugman (2004) and Stowhase (2013) also analyze tax competition in a sequential-move game.

[9]We treat transfer-pricing regulation as given in our analysis, because the ALP is agreed as the transfer-pricing regulation among OECD member countries. By contrast, Mansori and Weichenrieder (2001) and Raimondos-Moler and Scharfy (2002) focus on the strategic use of transfer-pricing rules rather than taxes when analyzing transfer pricing in a single industry. In their analyses, governments non-cooperatively choose their optimal transfer-pricing rule, taking the tax rates as given.

consumer surplus is large relative to the tax revenue that it would have earned if it hosted FDI. The smaller country, on the contrary, undercuts the large country's tax rate, because the tax revenue collected from the subsidiary of the firm operating in the large market is large. This novel result is consistent with the fact that most low-tax countries or tax havens are small countries.[10] The result also gives some justification to use a model with the Stackelberg tax-setting nature, because it is reasonable to think that in reality small tax-haven countries set their tax rates after observing large countries' tax rates. The welfare impacts of transfer pricing, which are readily obtained in the sequential-move game, can also extend to the setting of the simultaneous-move game.

Our study is thus at the intersection of international trade and public economics. Horst (1971) initiated the theory of MNEs in the presence of different tariff and tax rates across countries and explored the profit-maximizing strategy of a monopolistic firm selling to two national markets (i.e., how much it should produce in each country and what the optimal transfer price for goods exported from the parent to the subsidiary would be). Horst (1971) and subsequent studies (e.g., Itagaki, 1979) show that an MNE's optimum price would be either the highest or the lowest possible allowed by the limits of government rules and regulations, depending on tax and tariff schedules among countries. Samuelson (1982) is the first study to point out that for an MNE subject to the ALP, the arm's length reference price itself can be partially determined by the firm's activities.

Lee (1998) analyzes the effects of profit taxes on firm behaviors and shows that a monopolist engaged in tax avoidance may produce either more or less than it would in the absence of a tax.[11] The focus of his analysis is on deriving the conditions under which profit taxes are non-neutral in terms of the monopolist's output decision. It is shown that the effects of tax avoidance on the consumer surplus depend crucially on the shape of the audit probability and penalty rate. Our model identifies a different channel (i.e., transfer pricing to shift profits across jurisdictions with different tax rates) through which the consumer surplus is affected when the monopolist aims to minimize the overall tax burden.

In our model, the welfare of the high-tax country can improve because the consumers there benefit from regulated transfer-pricing activities. In particular, welfare can improve even if intermediate-good production is less efficient with FDI than without FDI. Matsui (2012) is closely related to our study in that he considers internal transfer prices in MNEs

[10]These countries include Ireland, Luxembourg, Singapore, Switzerland and the Netherlands.

[11]We thank an anonymous referee for directing our attention to this study.

as the channel for tax avoidance and shows that an MNE's transfer pricing can benefit consumers through an increase in its output. In a Dixit–Stiglitz model of monopolistic competition, he shows that tax authorities face a trade-off between consumer welfare and tax revenue.[12] However, he deals with neither tax-motivated FDI nor tax competition. We also show that the relationship between the transfer-price cap and consumer price is not monotonic.

Tax competition between countries of different size has been explored extensively (Bucovetsky, 1991; Wilson, 1991; Haufler and Wooton, 1999; Stowhase, 2005, 2010). The literature also shows that the smaller country is likely to set a lower tax rate in various settings. Stowhase (2005, 2010) is related to our analysis in the sense that profit shifting is explicitly taken into account in a tax-setting game between two tax-revenue-maximizing governments. In our analysis, however, the governments maximize social welfare, caring about not only tax revenue but also profits and consumer welfare. Moreover, Stowhase (2005, 2010) does not deal with transfer-pricing regulation. We identify an aforementioned novel logic of an equilibrium outcome that the larger country is willing to set a higher corporate tax rate than the smaller country in the presence of transfer-pricing regulation.

Although tax competition has been examined in the presence of profit shifting (Stowhase, 2005, 2010; Bucovetsky and Haufler, 2008; Slemrod and Wilson, 2009; Johannesen, 2010; Marceau et al., 2010), only a few theoretical studies take transfer-pricing regulation into consideration. Elitzur and Mintz (1996) study tax competition between the MNE's home country and its host country, both of which try to maximize individual tax revenues. The MNE operates under rigid transfer-pricing regulation along the lines of the CP method. In their model, however, there is no consideration of whether the firm sets up a subsidiary in the host country. Hence, they are unable to discuss the possible inefficiency caused by tax-motivated FDI to a high-cost country. Moreover, in their model, transfer pricing is used not only for profit shifting but also for an incentive scheme to improve the subsidiary's efficiency. Peralta et al. (2006) identify an interesting role of transfer-pricing regulation in the context of bidding for a firm: loosening the control of profit shifting can mitigate tax competition so that winning becomes more beneficial in the presence of indigenous firms that also pay corporate taxes.[13] In some cases, therefore, the winning country does not strictly enforce the regulation even though it entails tax revenue leak-

[12] Matsui (2012) focuses on the long-run equilibrium in which the MNE's post-tax profits are zero.

[13] Becker and Fuest (2012) introduce a model that does not require the presence of indigenous firms and obtain qualitatively the same result as Peralta et al. (2006).

age. Hosting a firm (or the headquarters of a firm in our context) is different from getting hold of its profits. Because of its reduced-form structure of the model, however, they are unable to examine the effect of transfer pricing on the firm's output and its welfare consequences through the effect on the consumer surplus. In our study, this channel is crucial to identifying the importance of market size in the endogenous determination of the FDI source country and a tax haven that hosts FDI.

The rest of the paper is organized as follows. Section 2 introduces the basic set-up of a monopoly model with transfer pricing. In the model in which the monopolist has already set up a subsidiary in the foreign country, we examine this monopolistic MNE's transfer-pricing behavior when its home tax rate is exogenously given at a higher rate than the foreign rate. In particular, we show that the MNE increases its output from the monopolistic production level when its home country imposes a binding cap on the transfer price. In Section 3, we model a sequential-move, tax-competition game, played by two countries, still assuming that only one firm, in the first-mover country, sources inputs from the foreign country. We show that the home country selects a higher tax rate than the foreign country if and only if transfer-pricing regulation is sufficiently tight. Section 4 extends the tax-competition game to a simultaneous-move game with a monopoly in each country operating in each of the two industries. Moreover, we allow the two countries to differ in size. Then, we show that there is a pure-strategy equilibrium in which the larger country sets a higher tax rate than the smaller one to become the source country of tax-motivated FDI. Section 5 concludes.

2 Monopoly Model with FDI: Transfer Pricing and Regulations

2.1 Baseline Model

There are two countries, Country 1 and Country 2, with possibly different corporate tax rates, t_1 and t_2. In Country 1, there is a monopolistic final-good producer, which we often call the MNE. The MNE's headquarters that produces the final good is immobile and tied to Country 1, while its intermediate input can be procured either from the open market at a price of ω or from its subsidiary in Country 2.[14] We assume that one unit of the input is converted into one unit of the final good without incurring any additional costs and that input production is subject to constant-returns-to-scale technology. We also assume

[14] Alternatively, we can assume that ω is the headquarters' constant marginal production cost of the intermediate input.

away the costs associated with FDI.[15] The subsidiary's unit cost of input production (i.e., the marginal production cost) is given by c. The final good is consumed only in Country 1.

The MNE can choose an internal transfer price of γ, when its foreign subsidiary supplies its input to the headquarters. Without any tax rate differential between the two countries, the MNE's optimal internal transaction price for the input is simply its marginal cost, c, to eliminate the double marginalization problem. However, as the two countries have different tax rates, the MNE can engage in transfer pricing such that it chooses γ to optimally allocate its profits between its headquarters and subsidiary and thus minimize its tax burden.

In this section, we assume that the two countries' corporate tax rates are exogenously given such as $t_1 > t_2$, meaning that the MNE in Country 1 has an incentive to manipulate its internal transfer price to avoid tax payments. We also assume throughout this section that the MNE has already set up its subsidiary in Country 2 to procure intermediate goods, thereby focusing the analysis on the MNE's transfer-pricing strategy and its home country's regulatory response.

2.2 The Benchmark Case: No Regulation

As a benchmark case, we first consider the choice of transfer price by the MNE without any transfer-pricing regulation. In this case, the MNE selects its transfer price, γ, and output, q, to maximize the following global profits after tax:

$$\Pi = (1 - t_1) \underbrace{[P(q) - \gamma]q}_{\text{Downstream Profits}} + (1 - t_2) \underbrace{(\gamma - c)q}_{\text{Upstream Profits}}, \tag{1}$$

where $P(q)$ is the downward-sloping inverse demand function faced by the monopolist (with the corresponding demand function $q = D(p)$). Decision making is assumed to be centralized. That is, with the firm's objective function above, the headquarters producing the final good makes an output decision that maximizes the overall profit of the firm, not only the profit of the downstream division.

We can rewrite the objective function of the monopolist, expressed by (1), as

$$\Pi = (1 - t_1)[P(q) - \xi]q, \tag{2}$$

[15] If a fixed cost of setting up the subsidiary exists, FDI becomes less likely. However, the essence of our results would not change.

where

$$\xi \equiv \frac{(1-t_2)c - (t_1 - t_2)\gamma}{1-t_1}. \tag{3}$$

That is, the MNE facing different tax rates across countries behaves as if its marginal production cost were ξ, which can be considered as its perceived marginal cost of production. Since the MNE's profit decreases as ξ increases, the monopolist's optimal choice of γ is to minimize ξ regardless of its output level. Note that ξ is decreasing in its transfer price γ because it can be used as a vehicle to shift profit from the high-tax country (Country 1) to the low-tax country (Country 2).

As pointed out by Horst (1971), it immediately follows that the optimal choice is to set γ as high as possible with the constraint that the downstream profit is non-negative. This would imply that all profits from a high-tax country are shifted toward to a low-tax country in the absence of any regulation. This simple model illustrates the need for regulations to counter such MNE's profit-shifting motives to reduce the tax burden.

To show this rigorously, we first derive $q^*(\gamma)$, which we define as the MNE's optimal output when its transfer price is set at γ. Let $q^m(\xi)$ denote the optimal monopoly quantity that maximizes the monopolist's profits when its perceived marginal cost is ξ. Since $q^m(\xi(\gamma))$ is increasing in γ and hence $P(q^*(\gamma))$ is decreasing in γ, there is a unique $\gamma = \gamma^0$ such that $P(q^*(\gamma^0)) = \gamma^0$. In other words, if $\gamma < \gamma^0$, the optimal output by the MNE is given by $q^*(\gamma) = q^m(\xi(\gamma))$ with the downstream division in the high-tax Country 1 making a positive profit. However, if $\gamma > \gamma^0$, the non-negative profit constraint for the headquarters is binding because $P(q(\gamma)) < \gamma$. Therefore, the MNE's optimal output $q^*(\gamma)$ cannot be $q^m(\xi(\gamma))$. The maximum output that can be used to transfer profit is capped by $P^{-1}(\gamma)$. That is, if $\gamma > \gamma^0$, we have $q^*(\gamma) = P^{-1}(\gamma) = D(\gamma)$, which is decreasing in γ. We can conclude that

$$q^*(\gamma) = \begin{cases} q^m(\xi(\gamma)) & \text{if } \gamma < \gamma^0 \\ P^{-1}(\gamma) = D(\gamma) & \text{if } \gamma \geq \gamma^0. \end{cases}$$

The following lemma helps us determine the MNE's optimal choice of γ.

Lemma 1. *Without any transfer-pricing regulation, the MNE's optimal choice of γ cannot be less than γ^0. This implies that all the downstream profits are transferred to the subsidiary located in the country with a lower tax rate, that is, $P(q^*(\gamma)) = \gamma$.*

Proof. Suppose, on the contrary, that $\gamma < \gamma^0$. Then, the optimal output by the MNE is given by $q^*(\gamma) = q^m(\xi(\gamma))$ With an infinitesimal increase in γ, the new transfer price is still less than γ^0 while reducing ξ. As a result, the MNE's profit increases, resulting in a contradiction. $\square$

Given Lemma 1, we can rewrite the optimal choice of γ by the MNE as

$$\max_{\gamma} \, (1 - t_2)(\gamma - c)D(\gamma). \tag{4}$$

This is mathematically equivalent to the standard monopoly pricing problem where γ can be considered as the monopolist's price. This implies that the MNE chooses a monopoly price equal to $P(q^m(c))$. Proposition 1 summarizes our discussion in the case of no regulation and calls for regulations to counter the MNE's profit-shifting motives to reduce the tax burden.

Proposition 1. *(Full Profit Shifting with the Monopoly Outcome under No Regulation) In the absence of any transfer-pricing regulation, the MNE shifts all its profits to the country with the lower tax rate by choosing the transfer price at the standard monopoly price, replicating the monopoly outcome in the market.*

2.3 Transfer-pricing Regulation and the MNE's Decisions

In reality, regulations would prevent the choice from being a corner solution and limit the MNE's profit-shifting motives. The most-widely adopted and agreed-upon standard practice is the ALP, which requires intrafirm transfer prices to mimic the market prices that would be obtained in comparable uncontrolled transactions at arm's length, as discussed in the Introduction. Although this principle is conceptually sound and straightforward, its implementation as a regulatory policy may be difficult and subject to different interpretations. For instance, in the monopoly context, such a comparative analysis is unlikely to be feasible, simply because there is no comparable transactions as it is the only firm that produces the final good; no other firms acquire similar inputs. Even if similar inputs are transacted in the market by other firms for different purposes, a firm may argue that the available inputs are not suitable to meet its specifications, which explains why they are engaged in its production in the first place. In other words, what constitutes a similar input may not be clear-cut and could be subject to disputes unless comparable inputs are identical.

In our analysis, we simply model Country 1's transfer-pricing regulation as a price cap for the transfer price to limit the extent to which the MNE can shift its profits to the

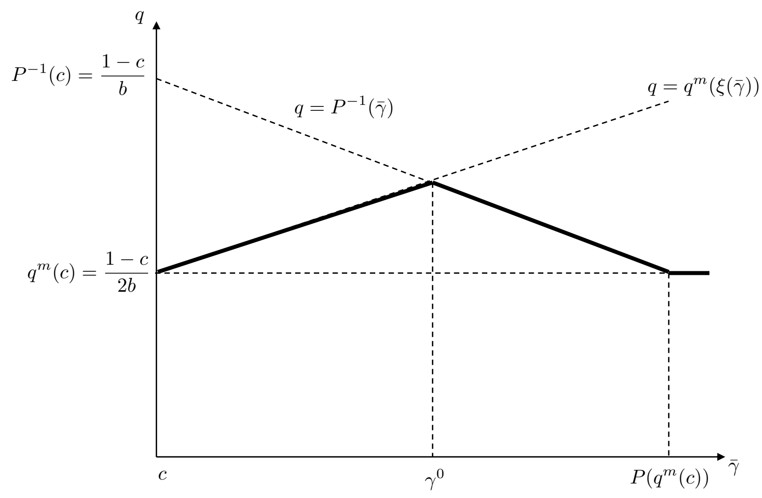

Figure 1: MNE's optimal output level

low-tax country. Country 1 caps the transfer price at $\bar{\gamma}$. Under this regulation, the MNE can only select γ that is less than or equal to $\bar{\gamma}$.

We derive the MNE's optimal choice of γ under the restriction and its optimal output level as a function of $\bar{\gamma}$. As shown in the previous subsection, the MNE raises γ as much as it can, all the way up to the monopoly price $P(q^m(c))$ if possible. If $\gamma < \gamma^0$, for example, the MNE can raise its profit by increasing γ, thereby decreasing the perceived marginal cost ξ. If $\gamma \geq \gamma^0$, it can also raise its profit by increasing γ because γ here serves as the price of the products and increasing γ is equivalent to bringing the price closer to the monopoly price $P(q^m(c))$, as shown in (4). Therefore, the MNE chooses the largest possible γ under the price cap of $\bar{\gamma}$, as long as this regulation is binding, that is, as long as $\bar{\gamma} \leq P(q^m(c))$. If $\bar{\gamma} > P(q^m(c))$, the MNE simply chooses γ at the monopoly price and produces $q^m(c)$ units of the good in such a case. Figure 1 illustrates the MNE's optimal output level as a function of the price cap $\bar{\gamma}$ (in the case of linear demand, as given by (5)-(7) below). An increase in $\bar{\gamma}$ increases the optimal output if $c \leq \bar{\gamma} \leq \gamma^0$ but decreases it if $\gamma^0 < \bar{\gamma} \leq P(q^m(c))$.

Lemma 2. *With the given transfer-price cap $\bar{\gamma}$, the MNE chooses $\gamma = \bar{\gamma}$ if $\bar{\gamma} \leq P(q^m(c))$, and $\gamma = P(q^m(c))$ if $\bar{\gamma} > P(q^m(c))$. The optimal output level is given by*

$$q^*(\bar{\gamma}) = \begin{cases} q^m(\xi(\bar{\gamma})) & \text{if } c \leq \bar{\gamma} \leq \gamma^0, \\ P^{-1}(\bar{\gamma}) & \text{if } \gamma^0 < \bar{\gamma} \leq P(q^m(c)), \\ q^m(c) & \text{if } \bar{\gamma} > P(q^m(c)). \end{cases}$$

As an illustration and for later purposes, we explicitly derive some of the above key functions and variables in the case of linear demand, such that $P(q) = 1 - bq$:

$$q^m(\xi(\bar{\gamma})) = \frac{1-c}{2b} + \frac{(t_1 - t_2)(\bar{\gamma} - c)}{2b(1-t_1)}, \tag{5}$$

$$P^{-1}(\bar{\gamma}) = \frac{1-\bar{\gamma}}{b}, \tag{6}$$

$$\gamma^0 = \frac{(1-t_1) + (1-t_2)c}{(1-t_1) + (1-t_2)}. \tag{7}$$

2.4 Optimal Taxation and Transfer-pricing Regulation

Figure 1 shows the possibility that Country 1, the home country of the MNE, can mitigate the monopoly distortion by relaxing transfer-pricing regulation and hence inducing the MNE to produce more. Here, we investigate whether Country 1 can indeed enhance its social welfare by optimally adjusting the transfer-price cap. In addition, we derive its optimal policy when both the transfer price cap and the corporate tax rate can be freely chosen, for the given tax rate in Country 2 (i.e., the country that hosts the MNE's subsidiary).

Country 1's social welfare is defined as the sum of the consumer surplus (CS), producer surplus (PS), and tax revenue (TR). It follows from

$$CS = \int_0^{q^*(\bar{\gamma})} P(q)dq - P(q^*(\bar{\gamma}))q^*(\bar{\gamma}),$$
$$PS = \Pi_1 = (1-t_1)[P(q^*(\bar{\gamma})) - \xi(\bar{\gamma})]q^*(\bar{\gamma}),$$
$$TR = t_1[P(q^*(\bar{\gamma})) - \bar{\gamma}]q^*(\bar{\gamma})$$

that Country 1's social welfare can be written as

$$W_1 = \int_0^{q^*(\bar{\gamma})} [P(q) - \xi^s(\bar{\gamma})]dq, \tag{8}$$

where the social marginal cost ξ^s is defined and can be written with the use of (3) as

$$\begin{aligned} \xi^s(\bar{\gamma}) &= (1-t_1)\xi(\bar{\gamma}) + t_1\bar{\gamma} \\ &= (1-t_2)c + t_2\bar{\gamma}. \end{aligned} \tag{9}$$

Obviously, W_1 increases with the MNE's output level, $q^*(\bar{\gamma})$, and decreases with the social marginal cost, $\xi^s(\bar{\gamma})$.

Lemma 3. *The optimal transfer price cap for Country 1 is greater than γ^0. It equals γ^0 if t_2 is small, while it is less than γ^0 if t_2 is sufficiently large to be close to t_1.*

Proof. As Figure 1 shows, $q^*(\bar{\gamma})$ increases by lowering $\bar{\gamma}$ when $\bar{\gamma} > \gamma^0$. Because a decrease in $\bar{\gamma}$ also decreases $\xi^s(\bar{\gamma})$ as (9) shows, W_1 increases by lowering $\bar{\gamma}$ in this range of $\bar{\gamma}$. Thus, the optimal $\bar{\gamma}$ is greater than γ^0.

In the range that $c \leq \bar{\gamma} \leq \gamma^0$, a reduction in $\bar{\gamma}$ involves a trade-off between the beneficial effect of lowering $\xi^s(\bar{\gamma})$ and adverse effect of decreasing $q^*(\bar{\gamma})$. If t_2 is small, the latter adverse effect outweighs the former effect. Indeed, if $t_2 = 0$ at the extreme, (9) shows that $\xi^s(\bar{\gamma}) = c$, and hence decreasing $\bar{\gamma}$ from γ^0 only reduces $q^*(\bar{\gamma})$ leaving $\xi^s(\bar{\gamma})$ as it is. Hence, it is optimal for Country 1 to set $\bar{\gamma} = \gamma^0$. However, if t_2 is not so small, the beneficial effect of lowering $\xi^s(\bar{\gamma})$ outweighs the adverse effect at $\bar{\gamma} = \gamma^0$, making it optimal for Country 1 to set $\bar{\gamma}$ below γ^0. At the extreme where t_2 is so large to be equal to t_1, we know from (3) that $\xi(\bar{\gamma}) = c$ and thus $q^*(\bar{\gamma}) = q^m(c)$. Hence, the optimal $\bar{\gamma}$ is as small as c to minimize $\xi^s(\bar{\gamma})$. □

What if Country 1 can adjust t_1, for the given t_2, as well as choose an arbitrary $\bar{\gamma}$? Redefining ξ as a function of t_1 as well as $\bar{\gamma}$ (i.e., $\xi(\bar{\gamma}, t_1)$), we obtain from (3) that $\partial\xi/\partial t_1 = -(\bar{\gamma} - c)(1 - t_2)/(1 - t_1)^2 < 0$. Since q^m is decreasing in ξ, this means that q^m increases as t_1 rises, except at $\bar{\gamma} = c$. This relationship is easily verified from (5) in the linear demand case, as illustrated by the counterclockwise rotation of the q^m line in Figure 2. As this figure shows, an increase in t_1 coupled with a decrease in $\bar{\gamma}$ (from γ^0 to $\gamma^{0\prime}$) enables Country 1 to increase $q^*(\bar{\gamma})$ and decrease $\xi^s(\bar{\gamma})$ at the same time.

Proposition 2. *The MNE's home country can enhance its social welfare by increasing its corporate tax rate and tightening transfer-pricing regulation simultaneously. The monopoly distortion is completely eliminated, meaning social welfare is maximized at the limit where the tax rate approaches 1, whereas the transfer-price cap approaches the marginal cost of the intermediate good.*

Proof. As t_1 increases, so does $q^m(\xi(\bar{\gamma}, t_1))$ for any $\bar{\gamma}$. It also follows from $\gamma^0 = P(q^m(\gamma^0, t_1))$, the definition of γ^0, that γ^0 decreases accordingly, as Figure 2 illustrates. Thus, Country 1 can induce the MNE to produce more and lower the social marginal cost, as seen in (9), by raising t_1 and simultaneously lowering $\bar{\gamma}$ to keep $\bar{\gamma} = \gamma^0$. That is, Country 1 can increase its social welfare by raising t_1 and lowering $\bar{\gamma}$, while keeping $P^{-1}(\bar{\gamma}) = q^m(\xi(\bar{\gamma}, t_1))$. As

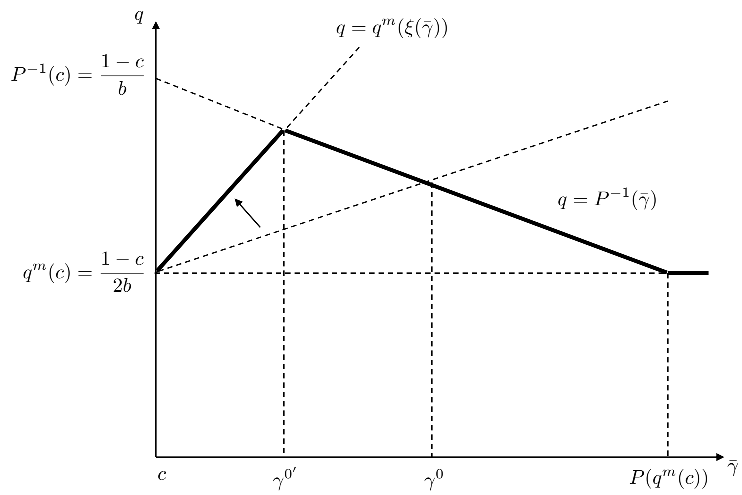

Figure 2: The effect of an increase in the source country's tax rate

shown in (3), at the limit where t_1 approaches 1, $\bar{\gamma}$ approaches c, meaning that ξ remains finite to satisfy the above equality. Noting that $\xi^s(\bar{\gamma})$ also approaches c, we conclude that Country 1 can maximize its social welfare by raising t_1 and lowering $\bar{\gamma}$, thereby attaining a market outcome equivalent to that under perfect competition at the limit where $t_1 = 1$ and $\bar{\gamma} = c$. □

In the current scenario in which the MNE's home country has two policy tools, namely the transfer-price cap and corporate tax rate, it can manage to increase the MNE's output and minimize tax leakage at the same time. Even though the country lowers $\bar{\gamma}$, which dampens the MNE's incentive to produce more, it can increase t_1 sufficiently large to more than offset the incentive; hence the MNE is induced to increase its output because of the increased incentive to save tax payments. This benefits the country because it can increase the MNE's output while reducing tax leakage. Indeed, this proposition indicates that the country can lower the price of the good all the way to the MNE's actual marginal cost of production by tailoring its tax rate and price-cap.

3 Tax Competition between the MNE's Home Country and the Host Country

We have thus far analyzed how the MNE reacts to transfer-pricing regulation and corporate taxation in its home country, and discussed the optimal policy for the home county.

Proposition 2 reveals that the home country can completely eliminate the monopoly distortion through extreme transfer-pricing regulation and taxation. In reality, however, the transfer price is regulated by the ALP, which suggests that it should be set at the level that provides reasonable markups to the marginal production cost of intermediate goods. On the contrary, sovereign countries have more freedom to set their individual corporate tax rates. In this section, therefore, we fix $\bar{\gamma}$, and discuss how the tax rates are determined between the MNE's home government and host government.

We consider a sequential-move game in which Country 1 (the MNE's home country) first sets its tax rate, and then Country 2 tries to undercut Country 1's tax rate to attract FDI, given the transfer-pricing regulation represented by the price cap of $\bar{\gamma}$. We show that the nature of tax competition can depend on the tightness of transfer-pricing regulation. In particular, if $\bar{\gamma}$ is not too large, Country 1 selects a relatively high tax rate to allow Country 2 to undercut its tax rate in a unique subgame perfect equilibrium. The monopolist in Country 1 sets up a subsidiary in Country 2 and engages in transfer pricing to save tax payments. Country 1 is willing to let its own firm do so, because it leads to an expansion of production and helps increase its social welfare. If regulation is too lax, (i.e., $\bar{\gamma}$ is sufficiently large), however, tax competition leads to the "race to the bottom" and eliminates any incentive for tax-motivated FDI.

The next section considers a simultaneous-move game between the two countries, where the direction of FDI is endogenously determined. Although the model setting in the next section may be considered as more general than the one here, it entails multiple equilibria in some cases and no pure-strategy equilibrium in other cases. Thus, it is meaningful to consider a sequential-move game that pins down a unique equilibrium, to gain insights into the tax competition when a monopolistic firm may engage in transfer pricing. Moreover, the timing assumption seems rather realistic, especially when Country 2 merely acts as a tax haven.

Here, we relax the assumption that the MNE has already set up its subsidiary in Country 2. That is, we now explicitly incorporate the firm's choice of FDI for intermediate-goods procurement, while maintaining the assumption that the firm's headquarters and its production facility for the final goods is located in Country 1.

Social welfare for either country depends on whether the firm engages in FDI. In the case where the firm engages in FDI, Country 1's social welfare can be written as

$$W_1 = \int_0^{q^*(t_1,t_2)} [P(q) - \xi^s(t_2)]dq, \tag{10}$$

where $\xi^s(t_2) = c + t_2(\bar{\gamma} - c)$, and the MNE's output is now written as a function of t_1 and t_2. When the firm does not engage in FDI, then it loses the opportunity of tax avoidance while its marginal cost is ω. Country 1's social welfare in this case is given by

$$W_1 = \int_0^{q^m(\omega)} [P(q) - \omega] dq = \frac{3(1-\omega)^2}{8}.$$

Country 2's social welfare, by contrast, only consists of the tax revenue from the MNE's subsidiary, and can be written as

$$W_2 = t_2(\bar{\gamma} - c) q^*(t_1, t_2), \tag{11}$$

if the firm engages in FDI, whereas it equals 0 otherwise.

With sequential moves, Country 1 maximizes W_1 subject to

$$t_2 \in BR_2(t_1) \equiv \arg\max_{t_2} t_2(\bar{\gamma} - c) q^*(t_1, t_2),$$

taking into account that Country 2 will undercut its tax rate to obtain tax revenue. We solve this problem by backward induction as usual.

For the sake of concreteness, we henceforth assume that the demand for the final good is linear such that $P(q) = 1 - bq$.

3.1 Country 2's Best Response

Let us first consider the best response for Country 2, whose social welfare is given by (11). Now, we see from (5) that q^m decreases with t_2. Therefore, if t_2 is smaller than the threshold given by (7), the firm's output is constant at $P^{-1}(\bar{\gamma})$. Hence, Country 2 is better off by increasing t_2 up to the threshold. If t_2 is sufficiently large that $q^m(\xi(t_1, t_2)) \leq P^{-1}(\bar{\gamma})$, we have $q^*(t_1, t_2) = q^m(\xi(t_1, t_2))$. Therefore, we can use (5) to write (11) as

$$W_2 = t_2(\bar{\gamma} - c) \left[\frac{1-c}{2b} + \frac{(t_1 - t_2)(\bar{\gamma} - c)}{2b(1-t_1)} \right].$$

It is readily verified that the t_2 that maximizes W_2 in this case is given by

$$t_2 = \frac{1 - c - (1 - \bar{\gamma}) t_1}{2(\bar{\gamma} - c)}. \tag{12}$$

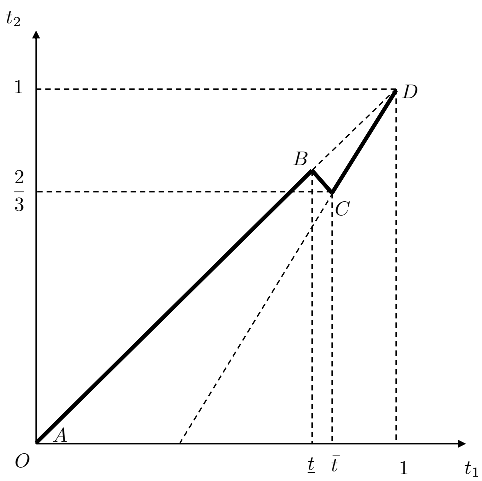

Figure 3: Country 2's reaction curve

This t_2 is a valid best response only if the resulting γ^0 is greater than or equal to $\bar{\gamma}$. To see the condition for this requirement, we substitute (12) into (7) and find that $\gamma^0 \geq \bar{\gamma}$ if and only if

$$t_1 < \bar{t} \equiv \frac{3(1-\bar{\gamma}) - (\bar{\gamma} - c)}{3(1-\bar{\gamma})}.$$

If this condition is violated, t_2 is chosen to satisfy $\gamma^0 = \bar{\gamma}$, i.e.,

$$t_2 = 1 - \frac{1-\bar{\gamma}}{\bar{\gamma} - c}(1 - t_1).$$

Another condition that is required for the t_2 in (12) to be the best response is $t_2 \leq t_1$, which reduces to

$$t_1 \geq \underline{t} \equiv \frac{1-c}{2(\bar{\gamma}-c) + (1-\bar{\gamma})}.$$

Consequently, Country 2's best response function is given by

$$B_2(t_1) = \begin{cases} t_1 & \text{if } t_1 \leq \underline{t}, \\ \frac{1-c-(1-\bar{\gamma})t_1}{2(\bar{\gamma}-c)} & \text{if } \underline{t} < t_1 \leq \bar{t}, \\ 1 - \frac{1-\bar{\gamma}}{\bar{\gamma}-c}(1-t_1) & \text{if } \bar{t} < t_1 < 1, \end{cases} \tag{13}$$

where it is readily verified that $\underline{t} < \bar{t}$. Figure 3 depicts Country 2's best response function.

The intuition for this result is as follows. When t_1 is low (more precisely, when $t_1 \leq \underline{t}$), it is optimal for Country 2 to just undercut Country 1's tax rate, as reducing the tax rate further and inducing more output does not raise tax revenue. Thus, in this range, Country 2's tax rate is a strategic complement to Country 1's tax rate. However, if t_1 becomes moderately large (i.e., $\underline{t} < t_1 \leq \bar{t}$), then it can be optimal for Country 2 to lower the tax rate to induce more output and hence tax revenue in response to an increase in Country 1's tax rate. In this case, Country 2's tax rate is a strategic substitute to Country 1's tax rate. Finally, if the tax rate in Country 1 becomes sufficiently large (i.e., $\bar{t} < t_1 < 1$), the incentive to shift profit by raising production becomes too large, while the zero profit condition for the MNE's headquarters is binding. As the output is capped and cannot increase any more, Country 2 follows suit as Country 1 increases its tax rate. Once again, Country 2's tax rate becomes a strategic complement to Country 1's tax rate.

3.2 Country 1's Optimal Tax Rate

Now, we analyze Country 1's optimal tax rate when it considers the undercutting threat by Country 2. To avoid unnecessary complication in the exposition, we assume henceforth $(1-c)^2/2b > 3(1-\omega)^2/8b$, which means that the highest social welfare Country 1 can achieve through regulation and tax policies in the presence of FDI, which is the same as welfare under perfect competition as Proposition 2 shows, is greater than its social welfare without FDI. If this condition is violated, Country 1 will never set a higher tax rate than Country 2. In the subgame perfect equilibrium, both countries thus set their tax rates to 0, whereas the monopolist engages in FDI if and only if $c < \omega$. Here, we make the following assumption

$$(1-c)^2 > \frac{3}{4}(1-\omega)^2, \tag{14}$$

which is equivalent to $(1-c)^2/2 > 3(1-\omega)^2/8$ to focus on the interesting and meaningful case.

As Country 2 will always choose a point on its reaction curve, Country 1's optimal choice can be considered as the choice of a point on Country 2's reaction curve, as shown in Figure 3. Then, we have the following proposition.

Proposition 3. *The subgame perfect equilibrium of tax competition can be summarized as follows. There is a critical level of $\bar{\gamma}$, denoted by $\bar{\gamma}^*(< (1+c)/2)$, such that (i) the equilibrium tax profile is $(t_1, t_2) = (\bar{t}, 2/3)$ if $\bar{\gamma} < \bar{\gamma}^*$ and (ii) $(t_1, t_2) = (0, 0)$ otherwise.*

Proof. We consider three segments on Country 2's reaction curve: the segments between $A = (0, 0)$ and $B = (\underline{t}, \underline{t})$, B and $C = (\bar{t}, 2/3)$, and C and $D = (1, 1)$ (Figure 3). First, we argue that Country 1 prefers point A to any other points in the segment AB because along this segment, $\xi = [(1-t_2)c-(t_1-t_2)\gamma]/(1-t_1) = c$. Thus, the monopolist's output is fixed at $q^*(t_1, t_2) = q^m(c) = (1+c)/2$. By contrast, $\xi^s = c+t_2(\bar{\gamma}-c)$ is increasing as we move from A to B as t_2 increases with t_1. Thus, point A is preferred to any other points in the segment AB. Moreover, point C is preferred to any other points in the segment BC. Along the BC segment, output is increasing from $q^m(c)$ to $P^{-1}(\bar{\gamma})$. In addition, Country 2 responds by decreasing its tax rate as t_1 increases. Thus, on both accounts, Country 1 is better off, and hence it prefers point C to any other points in the segment BC. Finally, in the segment CD, output is once again fixed at the level of $P^{-1}(\bar{\gamma})$. Thus, as in the segment AB, $\xi^s = c+t_2(\bar{\gamma}-c)$ increases as we move from C to D as t_2 increases with t_1.

This leaves us two candidate equilibrium points, A and C. When point A is chosen, Country 1's welfare is given by

$$W_1(A) = W_1(0,0) = \max\left\{\frac{3(1-\omega)^2}{8b}, \frac{3(1-c)^2}{8b}\right\}.$$

In this case, the monopolist's FDI decision is always efficient from the viewpoint of global production efficiency. When point C is chosen by the monopolist, it can be easily verified that

$$W_1(C) = W_1(\bar{t}, 2/3) = \frac{(3-2c-\bar{\gamma})(1-\bar{\gamma})}{6b}. \tag{15}$$

Observe that $W_1(C)$ is decreasing in $\bar{\gamma}$, while $W_1(C)|_{\bar{\gamma}=c} = (1-c)^2/2b > W_1(A)$ under the assumption expressed by (14), and $W_1(C)|_{\bar{\gamma}=\frac{1+c}{2}} = 5(1-c)^2/24b < W_1(A)$. Therefore, there is a unique $\bar{\gamma}^*$ such that $W_1(C)|_{\bar{\gamma}=\bar{\gamma}^*} = W_1(A)$. This implies that in the subgame perfect equilibrium, (i) $(t_1, t_2) = (\bar{t}, 2/3)$ if $\bar{\gamma} < \bar{\gamma}^*$ and (ii) $(t_1, t_2) = (0, 0)$ otherwise. $\square$

Proposition 3 reveals that Country 2 will undercut Country 1's tax rate so that the firm in Country 1 establishes a foreign subsidiary to engage in transfer pricing, if and only if transfer-pricing regulation is tight. Otherwise, the two countries race to the bottom in tax competition, and the firm undertakes FDI if and only if $c < \omega$ (i.e., no tax-motivated FDI occurs). It is rather counter-intuitive that loosening regulation deters transfer pricing. If the price cap is high, however, so is the resulting price for the final good. Then, Country 1 would obtain an insufficient benefit from allowing its firm to engage in transfer pricing. Consequently, it selects zero tax rate to prevent Country 2 from undercutting the tax rate; then the firm has no incentive to engage in FDI to avoid tax.

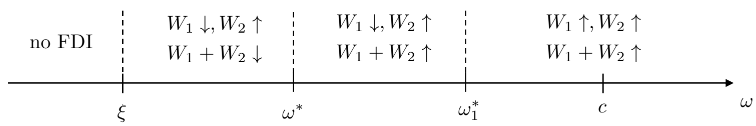

Figure 4: Welfare impacts

3.3 Welfare Impacts

Next, we assess the welfare impacts of opening the possibility of the firm's FDI. We examine the impact on world welfare, $W_1 + W_2$, as well as on each country. It follows from (10) and (11) as well as $t_2(\bar{\gamma} - c) - \xi^s = -c$ that world welfare can be written as

$$W_1 + W_2 = \int_0^{q^*(t_1,t_2)} [P(q) - c]dq, \tag{16}$$

when the firm engages in FDI. As the expression in (16) indicates, there is a trade-off between enhancing *allocative efficiency*, namely, the efficiency attained by increasing quantity from the monopolistic production level, and sacrificing *production efficiency*, namely, the cost-minimizing production location. As we have seen, Country 1 can induce the firm to produce more, only by encouraging it to engage in FDI in Country 2, which may have a higher cost of production. It is readily shown, on the contrary, that $W_2 = 0$ and hence world welfare equals $W_1 = 3(1-\omega)^2/8$, if the firm does not undertake FDI.

Let us first consider the case in which $\bar{\gamma} < \bar{\gamma}^*$. In this case, the firm engages in FDI if and only if $\omega > \xi$, as illustrated in Figure 4. Since Country 2 enjoys a positive welfare level if and only if the firm sets up its subsidiary there, Country 2's welfare improves if and only if $\omega > \xi$. As Figure 4 illustrates, Country 1's welfare increases if and only if $\omega > \omega_1^*$, and world welfare enhances if and only if $\omega > \omega^*$.

Country 1's welfare increases, if and only if $W_1(C) > 3(1-\omega)^2/8$, which is readily shown to be equivalent to $\omega > \omega_1^*$, where

$$\omega_1^* \equiv 1 - \frac{2}{3}\sqrt{(1-\bar{\gamma})(3-\bar{\gamma}-2c)}.$$

The threshold ω_1^* lies between ξ and c. We know from the definition of $\bar{\gamma}^*$ that if $\omega = c$, then $W_1(C) > 3(1-\omega)^2/8$. That is, under tight transfer-pricing regulation, Country 1 prefers an equilibrium with FDI because of the increase in allocative efficiency, and this is particularly so in the absence of production inefficiency when $\omega \geq c$. As ω falls and hence $c - \omega$ rises, the gain in allocative efficiency decreases, while the loss in production efficiency increases. The open-market marginal cost ω reaches the threshold before it reaches ξ, where the gain in allocative efficiency disappears.

Similarly, world welfare increases, if and only if $W_1(C) + W_2(C) > 3(1-\omega)^2/8$, where $W_1(C) + W_2(C)$ is calculated from (16) with $C = (\bar{t}, 2/3)$. Deriving the threshold

$$\omega^* \equiv 1 - \frac{2}{\sqrt{3}}\sqrt{(1-\bar{\gamma})(1+\bar{\gamma}-2c)}$$

from

$$W_1(C) + W_2(C) \equiv \frac{(1-\bar{\gamma})(1+\bar{\gamma}-2c)}{2b} = \frac{3(1-\omega^*)^2}{8b},$$

it is readily shown that $\omega^* < \omega_1^*$, and $W_1(C)+W_2(C) > 3(1-\omega)^2/8$ if and only if $\omega > \omega^*$. Now, both Country 1 and Country 2 enjoy gains from allocative efficiency. Consequently, the threshold for world welfare is less than that for Country 1's welfare.

Under tight transfer-pricing regulation, both countries benefit from the firm's FDI and transfer pricing, even though it involves a loss of production efficiency. However, these gains diminish as foreign production costs c rise above home production costs ω.

In the case where $\bar{\gamma} > \bar{\gamma}^*$, $(t_1, t_2) = (0, 0)$ in the equilibrium, and the firm engages in FDI, if and only if $c < \omega$. Production efficiency is guaranteed with FDI. The countries, however, do not enjoy gains from allocative efficiency with FDI because the firm sets $\gamma = c$ and the standard monopoly equilibrium is realized.

The above analysis is summarized in the following proposition.

Proposition 4. *(i) Suppose $\bar{\gamma} < \bar{\gamma}^*$. Then, there are three welfare level thresholds: $\xi < \omega^* < \omega_1^*$. FDI arises and Country 2's welfare improves if and only if $\omega > \xi$, Country 1's welfare increases if and only if $\omega > \omega_1^*$, and the world welfare increases if and only if $\omega > \omega^*$. (ii) Suppose $\bar{\gamma} > \bar{\gamma}^*$. Then, FDI arises if and only if $\omega > c$. FDI improves Country 1's welfare but does not affect Country 2's welfare.*

Before closing this section, we should mention an interesting, counter-intuitive effect of transfer-pricing regulation on Country 2. Since Country 2, as a tax haven, can generate tax revenue from the MNE only when $\bar{\gamma} < \bar{\gamma}^*$, it does not always prefer laxer transfer-pricing regulation, once we take into consideration that Country 1's willingness to allow transfer pricing depends on the tightness of such regulation. Thus, there is some room for harmonizing and setting up global regulatory standards in transfer pricing. As Figure 4 indicates, tighter transfer-pricing regulation benefits both countries as long as the loss in production efficiency is small.

4 Endogenous Selection of the FDI Source Country

We have thus far assumed that the MNE's headquarters is located in Country 1 and thus Country 1 always sources FDI. What characteristics does the FDI source country have? Does it always have an incentive to select a higher tax rate to become an FDI source country? To answer these questions, we consider here a simultaneous-move, tax-competition game, played by two countries, either of which can be an FDI source country. Each country has its own industry: Industry 1 in Country 1 and Industry 2 in Country 2.[16] In Country 1, a monopolist, Firm 1, sells its products only in Country 1. Similarly, in Country 2, Firm 2 in Industry 2 produces goods and sells them only in Country 2. Each firm, however, can set up its subsidiary in the other country to produce intermediate goods, which are shipped to its headquarters for final-goods production. Demand for Firm 1's final goods is characterized by the inverse demand function $P_1(q_1) = 1 - q_1/L_1$, whereas that for Firm 2's goods is given by $P_2(q_2) = 1 - q_2/L_2$, where L_1 and L_2 represent the two countries' populations, respectively.[17]

We suppose $L_1 \geq L_2$, and show that otherwise symmetric countries have different tax strategies in the equilibrium when L_1 is sufficiently larger than L_2: the larger country, Country 1, will select a tax rate higher than Country 2's, to deliberately allow its own firm to engage in transfer pricing to save tax payments. Thus, this section provides a theoretical foundation for the commonly observed phenomenon that tax-haven countries tend to be small and that firms in large countries set up subsidiaries there to engage in transfer pricing.

Let us first derive Country 1's best response function. If Country 1 chooses a higher tax rate than Country 2, it becomes an FDI source country that maximizes its social welfare, given by (10), for the given t_2. We find immediately that t_1 can affect W_1 only through $q^*(t_1, t_2)$. As shown in Figure 1, if t_1 is sufficiently large that $\gamma^0 \leq \bar{\gamma}$, Firm 1 selects $q^* = P^{-1}(\bar{\gamma})$, which is independent of t_1. On the contrary, if t_1 is so small that $\gamma^0 > \bar{\gamma}$, Firm 1 chooses $q^m(\xi(\bar{\gamma}))$, which is smaller than $P^{-1}(\bar{\gamma})$ and hence less favorable for Country 1. Thus, Country 1 chooses any t_1 that yields $\gamma^0 \leq \bar{\gamma}$. It follows from (7)

[16] We thank Arnaud Costinot (the co-editor of this journal) for suggesting this extended model.

[17] The specified linear demand functions can be derived if we assume that consumers' valuations are uniformly distributed on [0,1] in each country.

that the threshold t_1 that yields $\gamma^0 = \bar{\gamma}$ should satisfy

$$1 - t_1 = \frac{\bar{\gamma} - c}{1 - \bar{\gamma}}(1 - t_2), \tag{17}$$

so that Country 1's best response function as an FDI source country is a correspondence given by

$$B_1^s(t_2) = \left\{ t_1 \,\middle|\, 1 - \frac{\bar{\gamma} - c}{1 - \bar{\gamma}}(1 - t_2) \le t_1 < 1 \right\}. \tag{18}$$

Any effective price cap must satisfy $\bar{\gamma} < (1 + c)/2 = P(q^m(c))$, which directly means that $(\bar{\gamma} - c)/(1 - \bar{\gamma}) < 1$. Thus, we have $B_1^s(t_2) > t_2$ for any $t_2 < 1$.

If Country 1 chooses a lower tax rate than Country 2, on the contrary, it becomes an FDI host country and its best response is given by

$$B_1^h(t_2) = \begin{cases} t_2 & \text{if } t_2 \le \underline{t}, \\ \frac{\bar{\gamma} - c + (1-\bar{\gamma})(1-t_2)}{2(\bar{\gamma} - c)} & \text{if } \underline{t} < t_2 \le \bar{t}, \\ 1 - \frac{1-\bar{\gamma}}{\bar{\gamma}-c}(1 - t_2) & \text{if } \bar{t} < t_2 < 1, \end{cases} \tag{19}$$

as it was derived as a best response function for Country 2, shown in (13), in the last section.

The following lemma shows the two countries' individual best response functions.

Lemma 4. *For the given L_1/L_2, there is a threshold $\tilde{t}_2$ such that Country 1's best response function is*

$$B_1(t_2) = \begin{cases} B_1^s(t_2) & \textit{if } t_2 < \tilde{t}_2, \\ B_1^h(t_2) & \textit{otherwise}, \end{cases} \tag{20}$$

and $\tilde{t}_2$ is increasing in L_1/L_2. Country 2's best response function is symmetric to Country 1's. The only substantial difference is that the threshold $\tilde{t}_1$ decreases with L_1/L_2.

Proof. See the Appendix. □

Figure 5 illustrates Country 1's reaction curve, which is characterized by (20).

Given the above lemma, we are ready to derive the Nash equilibrium of the simultaneous-move, tax-competition game played by the two countries. We consider two cases. In the first case, $\bar{\gamma}$ is sufficiently small that $\tilde{t}_1 = \tilde{t}_2 \ge 2/3$ holds when $L_1 = L_2$. In the second case, $\bar{\gamma}$ is large, meaning that $\tilde{t}_1 = \tilde{t}_2 < 2/3$ when $L_1 = L_2$. The threshold of 2/3 here is derived from $B_i^h(\bar{t}) = 2/3$ for $i = 1, 2$. As a preliminary investigation, consider the

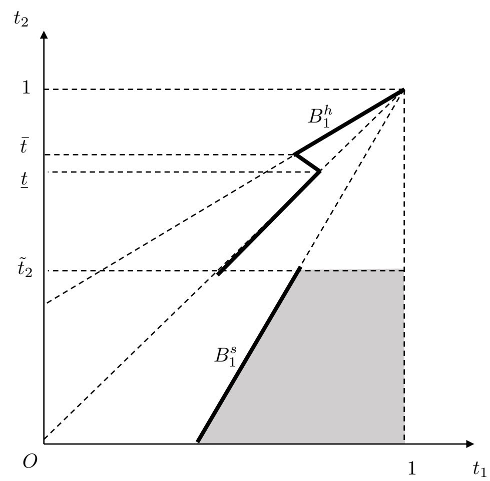

Figure 5: Country 1's reaction curve

knife-edge case where $\tilde{t}_1 = \tilde{t}_2 = 2/3$ holds when $L_1 = L_2$. The two countries are perfectly symmetric when $L_1 = L_2$. If $t_2 = \tilde{t}_2 = 2/3$, one of Country 1's best responses to $t_2 = 2/3$ is to select $t_1 = \bar{t}$ to become the FDI source country, as Figure 6 shows, while Country 2's best response to $t_1 = \bar{t}$ is to select $t_2 = 2/3$. Similarly, if $t_1 = \tilde{t}_1 = 2/3$, one of Country 2's best response is to select $t_2 = \bar{t}$, while Country 1's best response to $t_2 = \bar{t}$ is to select $t_1 = 2/3$. Consequently, as Figure 6 illustrates, there are two Nash equilibria $(t_1, t_2) = (\bar{t}, 2/3), (2/3, \bar{t})$.

When $\tilde{t}_1 = \tilde{t}_2 \geq 2/3$ holds with $L_1 = L_2$, there is a continuum of equilibria; however, when $\tilde{t}_1 = \tilde{t}_2 = 2/3$, as shown above, Country 1 becomes the source country and the host in each of the cases. As illustrated in Figure 7, the Nash equilibrium set is then given by

$$\begin{aligned} &\left\{(t_1, t_2) | 1 - t_2 = \frac{1-\bar{\gamma}}{\bar{\gamma} - c}(1 - t_1), t_1 \geq \tilde{t}_1, t_2 \leq \tilde{t}_2\right\} \\ \cup &\left\{(t_1, t_2) | 1 - t_1 = \frac{1-\bar{\gamma}}{\bar{\gamma} - c}(1 - t_2), t_2 \geq \tilde{t}_2, t_1 \leq \tilde{t}_1\right\}. \end{aligned} \tag{21}$$

In the first equilibrium set, Country 1 plays the role of the source country, whereas Country 2 plays the role of the host. The roles are switched in the second equilibrium set. In this case, each country is willing to be the source because $\bar{\gamma}$ is so small that the tax leakage to the host country is small. Each country also has an incentive to be the host country because the source country's tax rate is so high that it can maintain a relatively high tax rate while undercutting the other country's.

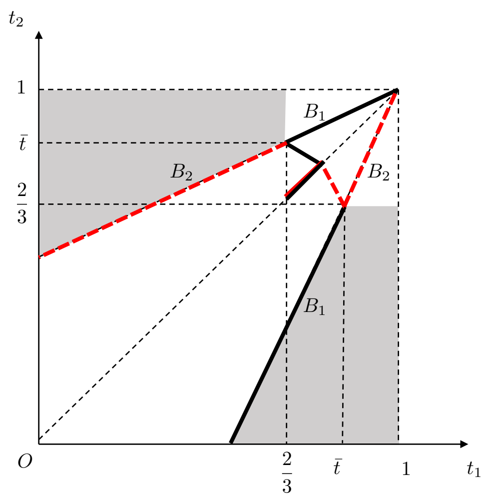

Figure 6: Nash equilibrium when $L_1 = L_2$ and $\tilde{t}_1 = \tilde{t}_2 = \frac{2}{3}$

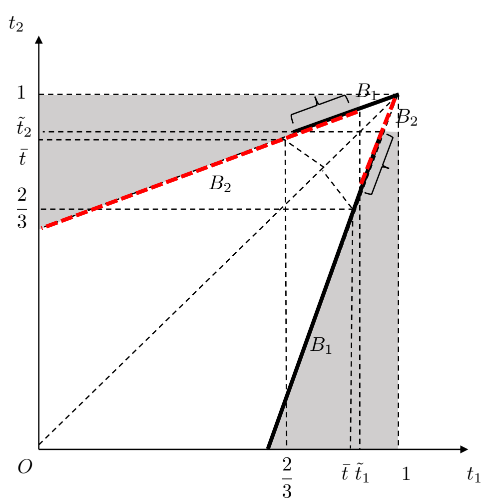

Figure 7: Nash equilibrium when $L_1 = L_2$ and $\tilde{t}_1 = \tilde{t}_2 > \frac{2}{3}$

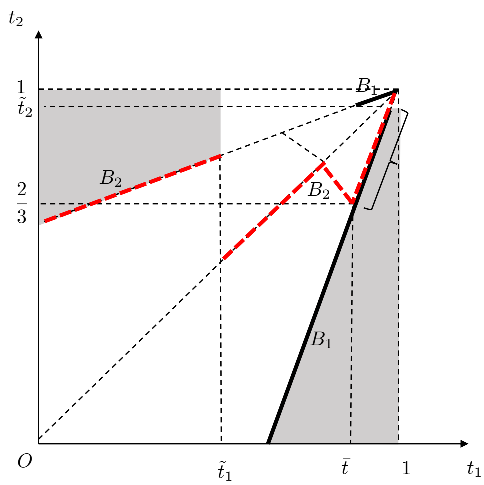

Figure 8: Nash equilibrium when $L_1 > L_2$

As L_1/L_2 increases, however, the equilibrium set under which Country 1 is the host shrinks and eventually disappears. As Figure 8 depicts, $\tilde{t}_1$ decreases and $\tilde{t}_2$ increases as L_1/L_2 rises. Consequently, the first equilibrium set in (21) expands, whereas the second set shrinks. The second equilibrium set eventually disappears when $\tilde{t}_1$ becomes smaller than 2/3. In this asymmetric case, the equilibrium set is

$$\left\{(t_1, t_2) | 1 - t_2 = \frac{1 - \bar{\gamma}}{\bar{\gamma} - c}(1 - t_1), t_1 \geq \bar{t}_1, t_2 \leq \tilde{t}_2\right\}. \tag{22}$$

In the second case where $\tilde{t}_1 = \tilde{t}_2 < 2/3$ holds with $L_1 = L_2$, there is no pure-strategy Nash equilibrium as long as the two countries are completely symmetric. As L_1/L_2 rises, however, the Nash equilibrium set, as described by (22) and graphically represented in Figure 8, will appear.

We summarize the above results as a proposition.

Proposition 5. *If Country 1 is sufficiently large relative to Country 2, there is a Nash equilibrium set of the tax-competition game, in which Country 1 sets a higher tax rate than Country 2 so that the firm in Country 1 sets up a subsidiary in Country 2 and engages in transfer pricing. If the two countries are of a similar size and regulation is so tight that the transfer-price cap is low, then in addition to this Nash equilibrium set, there is a Nash equilibrium set in which Country 2, the smaller country, selects a higher tax rate to become the FDI source country.*

Since the transfer pricing caused by tax-motivated FDI shifts profits from the FDI source country to the FDI host country, tax revenue decreases in the former country but increases in the latter country. This tax-revenue increase becomes larger as the FDI source country becomes larger. Furthermore, transfer pricing with regulation increases output in the FDI source country, implying that the consumers in this country gain. This gain also becomes larger as the country becomes larger. Thus, the larger country has an incentive to be the FDI source country, whereas the smaller country has an incentive to be the FDI host country. Hence, as was discussed in the sequential-move game, it may not be optimal for the smaller country (i.e., the FDI host country) to "just" undercut the tax rate of the large country (i.e., the FDI source country), because the tax revenue may not be maximized for the smaller country.

5 Concluding Remarks

We have analyzed MNE's incentives to manipulate an internal transfer price to take advantage of tax differences across countries and discussed implications of transfer-pricing regulation as a countermeasure against such profit shifting. We found that tax-motivated FDI may entail inefficient internal production but could benefit consumers. Thus, encouraging transfer-pricing behavior to some extent can enhance social welfare.

We have also considered tax competition between (exogenously determined) source and host countries to explore the interplay between tax competition and transfer-pricing regulation. In tax competition, each government non-cooperatively sets the tax rate to maximize its social welfare. We showed that the nature of tax competition can depend on the tightness of transfer-pricing regulation. In particular, the source country is willing to set a higher tax rate and tolerate profit shifting to a tax-haven country under sufficiently tight regulation. However, if regulation is too lax, tax competition leads to a "race to the bottom" and eliminates any incentives for tax-motivated FDI. This finding implies that a tax-haven country does not always prefer lax transfer-pricing regulation. Thus, the incentives of the host and FDI source country can be aligned to set up global regulatory standards for transfer pricing.

Finally, we have extended our tax competition model to *endogenously* determine the identity of the source country in a set-up with multiple industries. This extended set-up allows us to rationalize our basic model by deriving an equilibrium outcome that the larger country is willing to set a higher corporate tax rate than the smaller country in the presence of transfer-pricing regulation. We often observe in reality that firms in large countries establish subsidiaries in small tax-haven countries and engage in transfer pricing. The result that the large country sources FDI also provides some justification for using a model with the Stackelberg tax-setting nature because it is reasonable to think that in reality small tax-haven countries set their tax rates after observing large countries' tax rates. The welfare impacts of transfer pricing obtained in the sequential-move game can also be extended to the setting of the simultaneous-move game.

Our study has mainly focused on a simple the monopoly setting. With oligopolistic market competition, additional issues could arise, however. For instance, with oligopolistic competition in the final-good market of the FDI source country, the internal transfer price has additional strategic effects that further strengthen the incentive to inflate the transfer price at the expense of rivals' profits. Tax-motivated FDI by the MNE has spillover effects that reduce tax revenue from other final-good producers as well as the MNE. Moreover, with the presence of competitors that use *similar* inputs, the CUP method may be adopted as an application of the ALP. In such a case, we can also uncover a novel mechanism for input foreclosure when the input market is also imperfectly competitive. The MNE may have an incentive for input foreclosure even if it is a more efficient input producer. The new mechanism stems from the dependence of the transfer price on the market price of a "comparable" input, which is endogenously determined. Some of these issues are analyzed by Choi et al. (2018). In addition, with oligopolistic competition, each firm's FDI decision may depend on other firms' FDI decisions. These issues represent potential areas for future research.

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Appendix: Proof of Lemma 4

To show that Country 1's best response is given by (20), we derive Country 1's social welfare when it sources and hosts FDI, respectively.

When County 1 sources FDI, it chooses t_1 so that the price equals $\bar{\gamma}$ regardless of t_2 as we have seen. Country 1's social welfare in this case consists only of the total surplus in Industry 1. Thus, it follows from $q^* = L_1(1-\bar{\gamma})$ and $\xi^s = c + (\bar{\gamma} - c)t_2$ that its social welfare as a source country is given by

$$\begin{aligned} W_1^s &= \frac{L_1}{2}(1-\bar{\gamma})^2 + (\bar{\gamma} - \xi^s)L_1(1-\bar{\gamma}) \\ &= \frac{L_1}{2}(1-\bar{\gamma})^2 + L_1(\bar{\gamma} - c)(1-\bar{\gamma})(1-t_2), \end{aligned}$$

for any t_2. It is readily verified that W_1^s is decreasing in $\bar{\gamma}$, meaning that W_1^s takes the largest value of $L_1(1-c)^2/2$ when $\bar{\gamma} = c$.

Country 1 compares this welfare W_1^s with that when it selects a lower tax rate than Country 2 and hence hosts a subsidiary of Firm 2. Social welfare as an FDI host country consists of the total surplus in Industry 1 and that in Industry 2, and it thus takes a different form depending on the level of t_2 as (19) suggests.

When $t_2 \leq \underline{t}$, the best response of Country 1 is to slightly undercut t_2, or t_1 is set equal to t_2 while Country 1 hosts FDI. In this case, Firm 2's perceived marginal cost becomes $\xi_2 = c$ and hence $q_2^* = L_2(1-c)/2$, meaning that we have

$$W_1^h = \frac{3L_1(1-\omega)^2}{8} + t_2(\bar{\gamma} - c)\frac{L_2(1-c)}{2}.$$

Consequently, we have $W_1^s \geq W_1^h$ if and only if

$$\frac{L_1}{L_2}\left[\frac{(1-\bar{\gamma})^2}{2} + (\bar{\gamma} - c)(1-\bar{\gamma})(1-t_2) - \frac{3(1-\omega)^2}{8}\right] \geq \frac{t_2(\bar{\gamma} - c)(1-c)}{2}. \qquad (23)$$

It follows from the assumption expressed by (14) that as $\bar{\gamma}$ decreases to c, the left-hand side of this inequality approaches to a positive number, while the right-hand side converges to 0. Thus, this inequality is satisfied for any t_2 if $\bar{\gamma}$ is sufficiently small. If $\bar{\gamma}$ is not that small, there exists a $\tilde{t}_2$ such that $W_1^s \geq W_1^h$ if and only if $t_2 \leq \tilde{t}_2$. It is easy to see that the threshold $\tilde{t}_2$ increases with L_1/L_2.

We obtain a similar result when $\underline{t} < t_2 < \bar{t}$. In this case, we have $t_1 = [1 - c + (1 -$

$\bar{\gamma})(1-t_2)]/[2(\bar{\gamma}-c)]$ as indicated in (19). Then, we have

$$\xi_2 = \frac{(1-t_1)c-(t_2-t_1)\bar{\gamma}}{1-t_2} = \bar{\gamma} - \frac{\bar{\gamma}-c-(1-\bar{\gamma})(1-t_2)}{2(1-t_2)},$$

and hence

$$q_2^* = \frac{L_2(1-\xi_2)}{2} = \frac{L_2[\bar{\gamma}-c+(1-\bar{\gamma})(1-t_2)]}{4(1-t_2)}.$$

Country 1 obtains a tax revenue of

$$t_1(\bar{\gamma}-c)q_2^* = \frac{L_2[\bar{\gamma}-c+(1-\bar{\gamma})(1-t_2)]^2}{8(1-t_2)},$$

meaning that social welfare as an FDI host country is given by

$$W_1^h = \frac{3L_1(1-\omega)^2}{8} + \frac{L_2[\bar{\gamma}-c+(1-\bar{\gamma})(1-t_2)]^2}{8(1-t_2)}.$$

Thus, we have $W_1^s \geq W_1^h$ if and only if

$$\frac{L_1}{L_2}\left[\frac{(1-\bar{\gamma})^2}{2} + (\bar{\gamma}-c)(1-\bar{\gamma})(1-t_2) - \frac{3(1-\omega)^2}{8}\right] \geq \frac{L_2[\bar{\gamma}-c+(1-\bar{\gamma})(1-t_2)]^2}{8(1-t_2)}. \tag{24}$$

As $\bar{\gamma}$ falls to c, the right-hand side of this inequality converges to $L_2(1-c)^2(1-t_2)/8$. However, we have

$$\frac{L_2(1-c)^2(1-t_2)}{8} < \frac{L_2(1-c)^2(\bar{\gamma}-c)}{8[2(\bar{\gamma}-c)+(1-\bar{\gamma})]}$$

under $t_2 > \underline{t}$, while the right-hand side of this inequality converges to 0 as $\bar{\gamma}$ falls to c. This implies that $W_1^s > W_1^h$ for any t_2 if $\bar{\gamma}$ is small enough. In addition, the right-hand side of (24) is increasing in t_2 if and only if $1-t_2 < (\bar{\gamma}-c)/(1-\bar{\gamma})$, which is true when $t_2 > \underline{t}$ since $1-t_2 < (\bar{\gamma}-c)/[2(\bar{\gamma}-c)+(1-\bar{\gamma})] < (\bar{\gamma}-c)/(1-\bar{\gamma})$. This implies that when the threshold $\tilde{t}_2$ falls in this range, $\tilde{t}_2$ rises with L_1/L_2.

We also obtain a similar result in the final case where $t_2 \geq \bar{t}$. In this case, we have $t_1 = [\bar{\gamma}-c-(1-\bar{\gamma})(1-t_2)]/(\bar{\gamma}-c)$ and $q_2^* = L_2(1-\bar{\gamma})$. Thus, we have

$$\begin{aligned} W_1^h &= \frac{3L_1(1-\omega)^2}{8} + t_1(\bar{\gamma}-c)L_2(1-\bar{\gamma}) \\ &= \frac{3L_1(1-\omega)^2}{8} + L_2(1-\bar{\gamma})[\bar{\gamma}-c-(1-\bar{\gamma})(1-t_2)]. \end{aligned}$$

We have $W_1^s \geq W_1^h$ if and only if

$$\frac{L_1}{L_2}\left[\frac{(1-\bar{\gamma})^2}{2}+(\bar{\gamma}-c)(1-\bar{\gamma})(1-t_2)-\frac{3(1-\omega)^2}{8}\right] \geq (1-\bar{\gamma})[\bar{\gamma}-c-(1-\bar{\gamma})(1-t_2)].$$

It is readily verified that this inequality is satisfied if $\bar{\gamma}$ is sufficiently small, and that if $\tilde{t}_2$ falls in this region it increases with L_1/L_2.

Before turning to Country 2's best response, we show the relationship between $\bar{\gamma}$ and $\tilde{t}_2$ more rigorously. We restrict $\bar{\gamma}$ to the range $(c,(1+c)/2)$, that is, the transfer price lies between the marginal cost and monopoly price. As we have shown, if $\bar{\gamma}$ is sufficiently close to c, we have $W_1^s > W_1^h$ under the assumption (14), meaning that $\tilde{t}_2 = 1$. As $\bar{\gamma}$ increases, W_1^s decreases while W_1^h increases. At a certain level of $\bar{\gamma}$, these two payoffs become equal, and $\tilde{t}_2$ starts to decrease as $\bar{\gamma}$ further increases. Tentatively assuming that $\tilde{t}_2$ becomes smaller than $\underline{t}$ when $\bar{\gamma}$ reaches its upper bound, the equation $W_1^s = W_1^h$, which is characterized by (23) with equality when $t_2 = \tilde{t}_2$ and $\bar{\gamma} = (1+c)/2$, can be written as

$$\frac{L_1}{L_2}\left[\frac{3(1-c)^2}{8}-\frac{3(1-\omega)^2}{8}-\frac{\tilde{t}_2(1-c)^2}{4}\right] = \frac{\tilde{t}_2(1-c)^2}{8}.$$

If $c<\omega$, the $\tilde{t}_2$ that satisfies this equation is positive and thus the threshold $\tilde{t}_2$ is positive even at the limit. This is because FDI itself is beneficial for the source country, because of the gains in production efficiency. We may rather focus on the more interesting case where $c \geq \omega$, while satisfying the assumption (14). In that case, $\tilde{t}_2$ reaches 0 before $\bar{\gamma}$ reaches its upper bound: the assumption that $\tilde{t}_2 < \underline{t}$ is thus satisfied in this case.

Country 2's best response is similarly derived. Recall that B_1^s and B_1^h do not depend on L_1/L_2, as (18) and (19) show, and that L_1/L_2 only affects Country 1's best response function B_1 through $\tilde{t}_2$, as (20) shows. Country 2's best response function is therefore symmetric to Country 1's. The only substantial difference is that the threshold $\tilde{t}_1$ decreases with L_1/L_2, whereas $\tilde{t}_2$ increases.