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Tariff Elimination versus Tax Avoidance: Free Trade Agreements and Transfer Pricing*

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Abstract

This study explores the new roles of rules of origin (ROO) when multinational enterprises (MNEs) manipulate their transfer prices to avoid a high corporate tax. ROO of a free trade agreement (FTA) require exporters to identify the origin of exports to be eligible for a preferential tariff rate. The results suggest that a value-added criterion of ROO restricts MNEs' abusive transfer pricing. Interestingly, an FTA with ROO can induce MNEs to shift profits from a low-tax country to a high-tax country. Because ROO augment tax revenues inside FTA countries, they can transform a welfare-reducing FTA into a welfare-improving FTA.

Keywords: Rules of origin; Free trade agreement; Transfer pricing

JEL classification codes: F13; F15; F23; H26

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1 Introduction

For the past two decades, tax avoidance by multinational enterprises (MNEs) has been a controversial topic as the world has become more globalized. According to estimates by the OECD, countries lost 4-10% of the corporate income tax revenue annually because of profit shifting.[1] One way to shift profits across countries is to manipulate the price of intra-firm trade (transfer price), which is known as abusive transfer pricing. Specifically, because MNEs determine the prices of transactions between related companies, they manipulate these prices to decrease profits in high-tax countries and increase profits in low-tax countries. Some empirical research has provided evidence of transfer pricing being used to save tax payments.[2] As the taxes paid by firms are one of the main sources of government revenues, tax avoidance by MNEs has become a serious issue, as trade liberalization and the creation of global value chains increase intra-firm trade and provide MNEs with greater opportunities to redistribute their tax base to low-tax countries.

Our primary focus is on how such losses of tax revenues are linked to trade liberalization driven by trade agreements. Trade agreements among countries facilitate firms' exports and imports; however, they also influence firms' behaviors in other respects including transfer pricing and generate more complicated welfare effects. In particular, the specific rules needed to implement trade agreements complicate the effects of trade liberalization. Here, we focus on the rules of origin (ROO) of a free trade agreement (FTA), which require exporters in member countries making tariff-free exports to other member countries to prove that the exported products originated within the FTA.[3] To meet ROO, firms may change their strategies such as their input procurement. For instance, Conconi et al. (2018) concluded that the ROO of the North-American Free Trade Agreement (NAFTA) reduce imports of inputs from non-member

[1] See `http://www.oecd.org/tax/beps/`, accessed on March 11, 2020.

[2] For instance, Swenson (2001), Clausing (2003), Cristea and Nguyen (2016), and Davies et al. (2018) provided empirical evidence of transfer price manipulation. Blouin et al. (2018) found conflicting motives when MNEs use transfer pricing to lower corporate tax as well as tariff payments.

[3] Regional trade agreements in goods are classified into FTAs and customs unions. Unlike customs unions, member countries of an FTA can set their own tariff schedule against non-member countries, which provides an opportunity for firms producing outside the FTA to save tariff payments by choosing as a transit country the member country whose tariff against non-member countries is low and re-exporting from that country to other FTA member countries whose tariffs against non-member countries are higher. See, for example, Stoyanov (2012) for evidence of firms' incentive to transship a good through FTA members. To forestall firms from tariff avoidance, the WTO stipulates ROO.

countries, suggesting that such rules cause input procurement to become inefficient. From the viewpoint of tax avoidance, this also implies that ROO can be an obstacle for MNEs to shift profits within the firm because they may need to consider whether their intra-firm transactions satisfy the requirements of ROO.

One way to prove the origin is to satisfy a value-added (VA) criterion, which is closely related to transfer price manipulation.[4] The VA criterion requires firms to add a sufficient value inside FTA member countries. Specifically, let p denote the export price of the product and r denote the value of input materials, which are used per unit of final good production and do not originate in the FTA. Then, a VA criterion typically requires that the VA ratio, $(p-r)/p$, is above the specified level. This method of calculating the VA content is called the "transaction value method." The value of input materials depends on the transfer price if MNEs procure inputs from related companies outside FTA countries. Therefore, a VA criterion can be a constraint for MNEs to engage in tax avoidance via abusive transfer pricing.

Although this possibility has been overlooked in the economic literature on transfer pricing and that of FTA, it has been pointed out by some policy papers. For instance, Eden (1998) examined the ROO of NAFTA and suggested that ". . . underinvoicing parts coming outside North America and overinvoicing locally made parts would increase the North American content." Falvey and Reed (1998) indicated that the VA criterion ". . . allows room for [the] manipulation of prices as well as quantities, and may generate additional incentives for transfer pricing by multinationals." Reuter (2012) also pointed out that "most rules of origin are on a percent-of-value basis. . . . By overinvoicing the value added, the MNE can more easily meet a rule-of-origin test and qualify for duty-free entry for its products into another country in the free trade area."[5] Furthermore, the World Customs Organization suggests that one of the disadvantages of the VA criterion of ROO is possible exposure to transfer pricing.[6] As Estevadeordal

[4]Other ways to prove the origins of products include changing the tariff classification criterion and specific process criterion. Although the effects of these criteria are also important, this study focuses only on the VA criterion.

[5]Some practitioners see the link as one factor to be considered and state that "if transfer pricing changes the value of local content, then the ROO as applied may remove any FTA benefit that was previously available" (see https://www.expertguides.com/articles/oecd-beps-project-and-trade-new-perspectives/AREXIEUO , accessed on May 3, 2018).

[6]See http://www.wcoomd.org/-/media/wco/public/global/pdf/topics/origin/overview/origin-handbook/rules-of-origin-handbook.pdf, accessed on May 3, 2018

and Suominen (2003) reported that 68 of the 87 FTAs they analyzed employ a VA criterion at least in a particular product category, these statements tell us that investigating the role of ROO to restrict the abusive use of transfer pricing is important to understand the impact of FTAs on tax avoidance and welfare.

As countries have dealt with the tax avoidance problem, analyzing the anti-tax avoidance aspect of ROO is important for policymakers. In reality, different groups of policymakers, namely, customs and tax authorities, are responsible for designing trade policies and regulations on transfer pricing. Therefore, the interaction between these two authorities has been rare. According to WCO (2018), "... the WCO [World Customs Organization] is working with the OECD and World Bank Group to encourage Customs and tax administrations to establish bilateral lines of communication in order to exchange knowledge, skills and data, where possible, which will help ensure that each authority has the broadest picture of a MNE's business, its compliance record and can make informed decisions on the collect revenue liability." Thus, as the number of FTAs and volume of intra-firm trade have increased, exploring the relationship between transfer prices and ROO is an urgent issue.

Against this background, this study builds an international monopoly model to investigate an MNE's response to an FTA formation with two new elements: transfer pricing and ROO.

1.1 Preview of the model and results

The MNE produces final goods within an FTA member country and exports the goods to the other FTA member country. The MNE procures inputs from either an FTA member country or a low-tax country outside the FTA. We assume input production is efficient in the outside country. Therefore, if the MNE procures inputs from a related company in a country outside the FTA, it can exploit efficient inputs as well as shift profits across countries by manipulating the transfer price.

In the absence of ROO, the MNE always prefers to produce inputs outside the FTA by itself and engage in tax avoidance by setting a high transfer price. However, the presence of ROO restricts the manipulation of the transfer price because a high transfer price reduces the VA ratio of the final product inside the FTA. If the MNE procures inputs inside the FTA, it always

complies with the ROO and exports its product without paying a tariff, although it cannot save tax payments by transfer pricing. If the MNE locates its upstream affiliate in a country outside the FTA, it either saves corporate tax payments by setting a high transfer price or complies with the ROO to avoid a tariff burden by setting a low transfer price. Thus, the MNE chooses one of three options: (i) procuring inputs inside an FTA to comply with the ROO and eliminate tariffs, (ii) fully manipulating its transfer price to avoid tax payments at the expense of the preferential tariff of the FTA, or (iii) adjusting its transfer price to comply with the ROO to both eliminate tariffs and pursue partial tax avoidance.[7] This model exhibits the MNE's choice of "tariff elimination versus tax avoidance" via its location choice of producing inputs and/or transfer price manipulation.

The third option, adjusting the transfer price to comply with the ROO, is the optimal choice for the MNE when the stringency of the VA criterion is low and adjusting the transfer price is less costly for the MNE. However, stricter ROO induce the MNE to deviate more from the optimal abusive transfer price, which retains a part of the MNE's tax base in the high-tax country. Because of this inefficient tax avoidance, a higher VA criterion changes the MNE's optimal choice. When the tax differential is huge and the MNE purchases inputs made in an FTA country, the MNE gives up the FTA tariff but manipulates the transfer price to pursue tax avoidance. This is because the tax avoidance motive is greater than the tariff avoidance motive.

As ROO restrict the abusive use of transfer pricing by either a change in input procurement or an adjustment of the transfer price, tax revenues in a high-tax country increase. Thus, the VA criterion works as an anti-tax avoidance policy. An interesting result is that the direction of shifted profits can be from a low-tax country to a high-tax country when the MNE adjusts the transfer price to meet the VA criterion. This is because the gain from efficient input production outside FTA countries becomes greater as the tariff falls, and this outweighs the loss from more tax payments in a high-tax country. This case is possible when the tax gap is small.

We also show that ROO transform an infeasible FTA into a feasible one. In the absence of ROO, an FTA formation is harmful for member countries when the initial tariff is small and

[7] Although the MNE uses its transfer price for ROO compliance, it can still shift profits from one country to another to save tax payments when the VA requirement is less stringent and the tax gap is large. Nevertheless, the overall tax payments become larger because the transfer price is suboptimal from the viewpoint of tax savings.

the loss from the disappearance of tariff revenues exceeds consumers' gains. In the presence of ROO, FTA countries can collect tax revenues from the MNE. Although consumers' gains from the FTA are smaller than those without ROO, tax revenues from the MNE can cover the smaller consumers' gains and the loss of tariff revenues. Our results present a new role of ROO in preventing abusive transfer pricing and making the FTA an welfare-improving one for member countries.

However, the country makes little tax revenue from the MNE when the absolute level of the corporate tax in the high-tax country is low. In this case, ROO can deteriorate total welfare inside FTA countries and make an initially feasible FTA infeasible.

1.2 Relationship to the literature

The welfare effects of FTAs with ROO have previously been analyzed, but such studies focus on intermediate goods markets.[8] Krishna and Krueger (1995) showed that ROO may work as a hidden protection against input suppliers outside the FTA. Ju and Krishna (2005) showed that ROO increase the price of FTA-made inputs and reduce total output if they are not so stringent such that all firms comply with the ROO, whereas they have the opposite effects if ROO are sufficiently stringent such that some firms choose not to comply with them. In Ju and Krishna (2005), however, the output price is fixed and they did not consider how ROO affect consumers. Demidova and Krishna (2008) extended Ju and Krishna (2005) to include the productivity heterogeneity of final good producers and showed that productivity sorting ensures the negative relationship between the stringency of ROO and demand for FTA-made inputs (i.e., wages). Ishikawa et al. (2007) focused on final good markets and showed that ROO have a role to segment markets within the FTA and that both inside and outside firms producing final goods may benefit from ROO at the cost of consumers. Mukunoki (2017) showed that an FTA with ROO may harm consumers if it changes outside firms' location decisions. None of these papers, however, have considered transfer price manipulation to meet ROO. Mukunoki and Okoshi (2019) investigated a firm's export price manipulation to comply with ROO, particularly how an MNE's transfer price manipulation affects inputs imported from

[8]More broadly, many studies have investigated the welfare effects of regional trade agreements both theoretically and empirically. See Freund and Ornelas (2010) for a review of the literature on regional trade agreements.

outside FTA. Furthermore, Felbermayr et al. (2019) suggested that there is little rationale for ROO because tariff circumvention is not profitable for 86% of bilateral trade because of the small differences in external tariffs and non-negligible transport costs. This study thus provides a new rationale for ROO from the viewpoint of tax avoidance by an MNE.

Specifically, this study examines the connection between transfer pricing and trade policy. Some studies have investigated the relationship between transfer pricing and trade barriers including tariffs. Horst (1971) showed that the optimal transfer price is influenced by not only tax differentials but also tariffs. Schjelderup and Sorgard (1997) showed that if the importing country imposes an ad valorem tariff on inputs, an MNE can save tariff payments by reducing its export price.[9] Then, the optimal transfer price is influenced by both corporate tax avoidance and tariff avoidance. Kant (1988) regarded the transfer price as a tool to repatriate profits when a foreign subsidiary is not fully owned by the parent firm. With the partial ownership of the foreign affiliate, the profit shifted from the home to the foreign country is partly distributed to other owners. The study found that even when the tax rate in the home country is higher than the tax rate in the host country, an MNE has an incentive to remit all the profit earned in the low-tax host country if both the tariff and the proportion of the MNE's ownership shares in the foreign affiliate are low. This research, however, did not explicitly consider trade liberalization by forming an FTA, let alone the effects of ROO on transfer prices.

The presented model also contributes to the literature on transfer pricing policies since MNEs have been accused of tax avoidance activities and how to regulate transfer prices has been a central issue in policy debates. Several studies have examined the impacts of policies on transfer price manipulation. Elitzur and Mintz (1996) investigated the determinants of transfer prices when tax authorities use the cost-plus method to infer the appropriate transfer price. Nielsen et al. (2003) compared the use of transfer prices under two international tax systems, namely, separating account and formula apportionment.[10] Choi et al. (2018) examined the impact of the arm's length principle, under which MNEs should set the same price for intra-

[9]Given the multiple roles of transfer prices, recent work has examined MNEs' optimal strategies (Hyde and Choe, 2005; Nielsen et al., 2008; Dürr and Göx, 2011). None of them, however, link transfer pricing and ROO.

[10]The traditional international corporate tax system is the separating account system that computes MNEs' national tax base by regarding intra-firm transactions as inter-firm transactions. On the contrary, under the formula apportionment system, MNEs' tax payments to one country depend on their consolidated tax base and the proportion of activity operated in the country. See more details in Chapter XVI, Article 86 ofEuropean Commission (2011).

firm transactions as for the same transaction conducted between independent firms.[11] As their focus was on direct regulation on transfer pricing, transfer pricing for meeting ROO has been overlooked in the literature.

The rest of the paper is organized as follows. In Section 2, we set up the model and derive an equilibrium without ROO. Section 3 investigates the effect of an FTA with ROO. Section 5 discusses the robustness of the main results by relaxing some key assumptions. The last section concludes.

2 Model

There are three countries, H, F, and O; countries H and F are potential FTA members. Fig. 1 illustrates the model. A single firm, an MNE, produces a final good using inputs and sells it in country F.[12] For simplicity, the benchmark model ignores the output market in country H and focuses only on the consumers in country F.[13] The representative consumer's utility in country F is given by $U = ax - x^2/2$, where x is the consumption of the final good. By utility maximization, the inverse demand function becomes $p = a - x$.

One of the two member countries, country H, has a location advantage for final good production because of low factor prices, a large pool of skilled labor, and so on. Therefore, country H always hosts a downstream affiliate of the MNE (firm M_H). The MNE's headquarters (firm M_O) is located in country O.[14] M_O may also produce an input for final good production, as explained below.

Firm M_O has already operated in country O and makes positive profits, $\overline{\pi}$, that are exoge-

[11] Bauer and Langenmayr (2013), Choe and Matsushima (2013), and Kato and Okoshi (2019) also investigated the effect of the arm's length principle on the input procurement decision, tacit collusion, and input production location, respectively.

[12] If we consider local firms in the FTA members and oligopoly in the final good market, the fundamental properties of our results remain unchanged, although the analysis becomes more complicated. See Mukunoki and Okoshi (2019) for an oligopoly version of the model.

[13] This assumption does not qualitatively change our main results as long as the two markets are segmented in the sense that the MNE can make a separate decision in each market.

[14] This type of foreign direct investment (FDI) is known as export platform FDI, where the FDI firm exports from the host country to other countries. For example, see Tekin-Koru and Waldkirch (2010) for Mexican evidence of its increasing role as a host of export platform FDI. Tintelnot (2017) showed the share of output exported to countries outside the host country by U.S. MNEs. For instance, the share of exports located in Belgium was 63% in 2004.

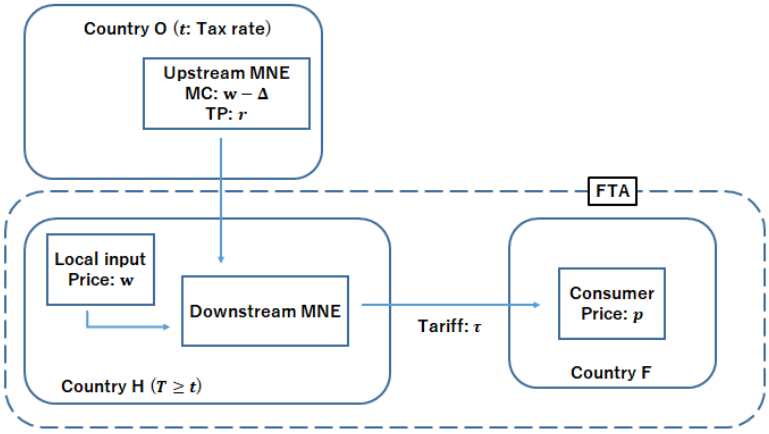

Figure 1: Model

nously given. To produce the final product, firm M_H needs to procure one unit of inputs for the production of one unit of final products.[15] Firm M_H can procure the input from a perfectly competitive input market inside FTA countries, which supply the input at the price of w. Alternatively, firm M_O located in country O can produce the input at the cost of $w - \Delta$. We assume $\Delta > 0$ and $\Delta \in [0, w]$. Therefore, input production in country O is more efficient than that in country H. This implies that the self-production of the input in country O gives the MNE not only a lower input cost but also a tax-saving opportunity via the manipulation of the transfer price, which is denoted by r. We assume away transfer pricing that realizes negative reported profits because tax authorities can audit tax avoidance.

Without the FTA, country F imposes a specific tariff, τ, on imports of the final good. We consider the case in which $\tau < a - w + \Delta$ holds to rule out negative output in the equilibrium. In addition, the governments in countries O and H respectively levy t and T as a corporate tax on reported profits.[16,17] To focus on the impact of FTA formation on the final good market, tariffs on inputs are assumed away. Hereafter, we focus on the case in which $T \geq t$ holds.[18]

[15]We can consider a more general situation in which the MNE uses a continuum of inputs and decides the extent to which it uses the intra-firm inputs for final good production. As explained in Section 5.2, this modification does not change the qualitative results of the benchmark model.

[16]We use the terms "tax rate" and "tax revenue" to represent the corporate tax rate and corporate tax revenue, respectively. Here, tax rate and tax revenue are distinguished from tariff rate and tariff revenue.

[17]In this model, we postulate that the governments in countries O and H adopt a territorial tax system instead of a worldwide one. After the United States moved from a worldwide tax system to a territorial tax system in xxxx, most OECD countries have since adopted a territorial tax system.

[18]This situation is consistent with the real-world observation. For instance, Mexico and Belgium have higher corporate taxes than other countries and these countries are major host countries of export platform FDI. See also

2.1 The equilibrium without ROO

Let us first derive the market equilibrium without ROO in each scheme of the MNE choice. In the inshoring scheme, denoted as scheme I, the MNE purchases the input from local producers. Firm M_H earns profits under the cost of inputs w and a tax rate T. In the offshoring scheme, denoted as scheme O, the MNE's headquarters in country O, firm M_O, produces the input at the production cost of $w - \Delta$. Firm M_O sells the input to firm M_H at the input price denoted by r. Thus, r is the transfer price of the MNE.

The post-tax profits under the inshoring scheme are given by

$$\Pi^I = (1-T)\underbrace{\left(\frac{a-w-\lambda\tau}{2}\right)^2}_{\pi_H^I} + (1-t)\underbrace{\overline{\pi}}_{\pi_O^I}, \tag{1}$$

where λ is a state variable that takes zero if the MNE qualifies for an FTA tariff rate and unity otherwise. π_i^s represents the reported profits of firm M_i under scheme $s \in [I, O]$.

In the offshoring scheme, the MNE maximizes

$$\Pi^O = (1-T)\underbrace{(p-r-\lambda\tau)x}_{\pi_H^O} + (1-t)\underbrace{[\{r-(w-\Delta)\}x + \overline{\pi}]}_{\pi_O^O}$$

with respect to r and x, subject to $\pi_H^O \geq 0$ and $\pi_O^O \geq 0$. Since $\frac{\partial \Pi_O}{\partial r} = (T-t)x > 0$ always holds, the MNE is willing to set the optimal transfer price as high as possible. Therefore, the optimal abusive transfer price is set at the level that transfers all the profits earned in a high-tax country to a low-tax country, $r = p - \lambda\tau$.[19] Thus, the post-tax profits under the offshoring scheme are given by

$$\Pi^O = (1-t)\left(\frac{a-w+\Delta-\lambda\tau}{2}\right)^2 + (1-t)\overline{\pi}. \tag{2}$$

Irrespective of the formation of an FTA, the MNE always prefers the offshoring scheme to

footnote 14.

[19]We assume there is no cost of shifting profits across countries. This is a conventional way of determining the optimal transfer price in the literature, when cost-for-profit shifting is absent. We relax this assumption by introducing a standard convex concealment cost in Section 5.3.

the inshoring scheme as

$$\Pi^O - \Pi^I = (1-t)\left(\frac{a-w+\Delta-\lambda\tau}{2}\right)^2 - (1-T)\left(\frac{a-w-\lambda\tau}{2}\right)^2 \geq 0 \tag{3}$$

holds. Intuitively, procurement from its upstream affiliate provides the MNE with both efficient input production and the opportunity to shift profits.

For notational convenience, we use the superscript "$*$" for the variables in the pre-FTA case and "$\widehat{\ }$" for the variables for post-FTA without ROO hereafter.

2.2 The welfare effects of FTA formation without ROO

To explore the welfare effects of FTAs, we focus on the total welfare of FTA countries. If the redistribution of gains from the FTA is possible between member countries, the FTA is feasible if total welfare increases. The total welfare of FTA countries is the sum of the consumer surplus in country F (CS^s), tax revenues of country H paid by the MNE (TR^s_H), and tariff revenues in country F (TR^s_F):

$$W^s = CS^s + TR^s_H + TR^s_F = \frac{(x^s)^2}{2} + T\pi^s_H + \lambda\tau x^s. \tag{4}$$

Total welfare does not include the post-tax profits of the MNE because it is owned by residents outside the FTA.

Since member countries cannot collect tax revenues when the MNE chooses offshoring, total welfare under offshoring becomes

$$\begin{aligned}\widetilde{W} - W_{O*} &= \widehat{CS} - CS_{O*} - TR^{O*}_F \\ &= \frac{-2(a-w+\Delta)+3\tau}{8} \gtreqless 0 \iff \tau \gtreqless \frac{2(a-w+\Delta)}{3} \equiv \tau^W.\end{aligned} \tag{5}$$

As equation (5) shows, an FTA without ROO generates a trade-off between an increase in the consumer surplus and disappearance of tariff revenues. When the initial tariff rate is high, the consumers' gains exceed tariff revenues and the FTA formation increases the total welfare of member countries. This section concludes with the following proposition.

Proposition 1. In the absence of ROO, the MNE always procures inputs from its upstream affiliate outside FTA countries. Forming an FTA benefits member countries when the initial tariff rate is high ($\tau > \tau^W$) and hurts them when it is low ($\tau < \tau^W$).

3 Equilibrium with ROO

In this section, we consider FTA formation with ROO. As stated in the Introduction, our focus is on the VA criterion of ROO. Specifically, a VA criterion is applied to exports of the final good in the FTA. For notational convenience, we use "$\widetilde{\ }$" as a circumflex for the variables in the presence of ROO.

3.1 The MNE's decisions in each scheme

After an FTA is formed, firm M_H needs to meet the VA criterion to be eligible for the elimination of τ. Specifically, ROO require firm M_H to add a proportion of at least $\underline{\alpha}(\in [0, 1])$ of the values of exported goods within the FTA. There are three cases, which we explain sequentially below.

If firm M_H chooses the offshoring of input production and sets an abusive transfer price, $\widehat{r} = p$, the VA ratio is always zero, which fails to meet the requirement of the ROO. Hence, the final good exports of the MNE incur the tariff, τ, even after the formation of the FTA. We call this case scheme N (non-compliance).[20] The equilibrium outcomes of this scheme are obtained by setting $\lambda = 1$ in equations (2) and (4), as well as in the other corresponding welfare components.

For firm M_H to utilize the FTA tariff, it has to comply with the ROO by either (i) inshoring the input procurement (scheme I) or (ii) setting r such that

$$\alpha \equiv \frac{p^O - r}{p^O} \geq \underline{\alpha} \tag{6}$$

is satisfied. We call this case scheme B (binding ROO). It is apparent that $(p^O - r)/p^O$ is decreasing in r and thereby the VA ratio, α, is more likely to exceed $\underline{\alpha}$ as the MNE sets a lower

[20]Some empirical evidence shows that not all firms use FTA tariffs because of the existence of ROO, which means the impacts of FTA formation are heterogeneous across firms. See, for example, Takahashi and Urata (2010) and Hayakawa et al. (2013).

r. Remember that $\frac{\partial \Pi_O}{\partial r} > 0$ holds. Then, the optimal transfer price is set such that it binds equation (6), which is calculated as

$$\widetilde{r}^B = (1 - \underline{\alpha})p. \tag{7}$$

As the ROO become stricter, the MNE needs to add more VA inside the FTA and thus the optimal transfer price must decrease by $\underline{\alpha}p$, which is regarded as the adjustment factor for meeting the ROO. We can easily see that $\widetilde{r}^B$ is decreasing in $\underline{\alpha}$ and is equivalent to $\widehat{r}$ with $\underline{\alpha} = 0$.

Given the optimal transfer price, the post-tax profits of the MNE are given by

$$\begin{aligned}\Pi^B &= (1-T)\underbrace{(p - \widetilde{r}^B)x^B}_{\pi_H^B} + (1-t)\underbrace{[\{\widetilde{r}^B - (w-\Delta)\}x^B + \overline{\pi}]}_{\pi_O^B} \\ &= \{1 - t - \underline{\alpha}(T-t)\}(p - c_M)x^B + (1-t)\overline{\pi},\end{aligned} \tag{8}$$

where $c_M = \frac{(1-t)(w-\Delta)}{\{1-t-\underline{\alpha}(T-t)\}} (\geq w - \Delta)$ represents the "perceived marginal cost" of producing the final good.[21] The perceived marginal cost is higher than the physical marginal cost, $w - \Delta$, as long as $\underline{\alpha}$ is positive and $T > t$. Given the level of t, both an increase in the stringency of the ROO ($\underline{\alpha}$) and that in the tax differential ($T - t$) increase the perceived marginal cost.

We can interpret the perceived marginal cost as follows. Without any ROO, the MNE shifts all the profits to a low-tax country by setting $\widetilde{r} = p$. From $\widetilde{r} = p$, the introduction of the ROO decreases the transfer price by as much as $\underline{\alpha}p$ and increases the per-unit tax payments of the MNE by as much as $\underline{\alpha}(T-t)p > 0$. This means that the ROO decrease the MNE's post-tax profits of selling the final good and makes it less aggressive in the product market under scheme B. The lower incentive to sell the final good is reflected in the perceived marginal cost.

The output decision of the MNE is made with c_M instead of $w - \Delta$, generating the following equilibrium profit:

$$\widetilde{\Pi}^B = \frac{\{(1-t)(a - w + \Delta) - \underline{\alpha}(T-t)a\}^2}{4\{1 - t - \underline{\alpha}(T-t)\}} + (1-t)\overline{\pi}. \tag{9}$$

[21] The terminology "perceived marginal cost" is often used in the analysis of vertically related industries in the context of industrial organization. See Choi et al. (2018) for an application of this terminology in the tax avoidance literature.

The post-tax profits under scheme B are a decreasing function of $\underline{\alpha}$ because an increase in $\underline{\alpha}$ induces the MNE to set a transfer price that deviates more from the level at which it avoids tax payments in the high-tax country.

3.2 The MNE's choice of scheme

Among the three possible schemes (I, N, and B), the MNE chooses the one that maximizes its profits. Let us first compare $\widetilde{\Pi}^I$ with $\widetilde{\Pi}^N$. Since both profits are independent of the VA threshold, $\underline{\alpha}$, the tariff level and tax differential determine which profit is larger. The MNE faces a trade-off between tax avoidance and tariff avoidance. If the tax differential is large, the MNE prefers scheme N to scheme I because of the stronger incentive to avoid tax payments in country H. If the tax differential is small, scheme I is more preferable for the MNE. Thus, there exists a unique threshold of T, $\widetilde{T}$, such that $\widetilde{\Pi}^I = \widetilde{\Pi}^N$ holds. As a larger tariff discourages the MNE from choosing scheme N, $\frac{\partial \widetilde{T}}{\partial \tau} > 0$ holds.[22]

Let us next compare the profits in scheme B with those in schemes N and I. Since $\widetilde{\Pi}^B = \widehat{\Pi}$ holds at $\underline{\alpha} = 0$, which is larger than $\widetilde{\Pi}^N$ and $\widetilde{\Pi}^I$, and $\widetilde{\Pi}^B$ is decreasing in $\underline{\alpha}$, we can derive a unique threshold, $\underline{\alpha}^N$ (resp. $\underline{\alpha}^I$), above which the MNE prefers scheme N (resp. scheme I) to scheme B. Intuitively, under less strict ROO, the MNE prefers scheme B to schemes N and I because adjusting the transfer price to comply with those ROO becomes less costly as the VA criterion becomes less stringent.[23] In other words, the MNE's gains from tariff elimination by adjusting the transfer price become smaller as the FTA is attached to more stringent ROO.

Putting the above comparisons together, we characterize the equilibrium outcomes as follows, which is illustrated in Figure 2.

Proposition 2. After an FTA with ROO is formed, the MNE chooses (i) inshoring if $T \leq \widetilde{T}$ and $\alpha > \underline{\alpha}^I$ hold, (ii) offshoring and its exports incur a tariff if $\widetilde{T} < T$ and $\alpha > \underline{\alpha}^N$ hold, and (iii) offshoring and it adjusts its transfer price to meet The ROO if $\underline{\alpha} \leq \min\{\underline{\alpha}^I, \underline{\alpha}^N\}$ holds.

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[22] Formally, the threshold is calculated as $\widetilde{T} = 1 - (1-t)\left(\frac{a-w+\Delta-\tau}{a-w}\right)^2 < 1$. We can confirm that $\widetilde{T}$ is greater than t if and only if $\Delta < \tau$ holds. To secure the existence of the equilibrium with scheme I, we additionally assume $\Delta < \tau$ hereafter.

[23] Here, the MNE meets the ROO by changing its transaction input price. An offshoring firm may also adjust its export price p to meet the VA criterion. This possibility is analyzed by Mukunoki and Okoshi (2019).

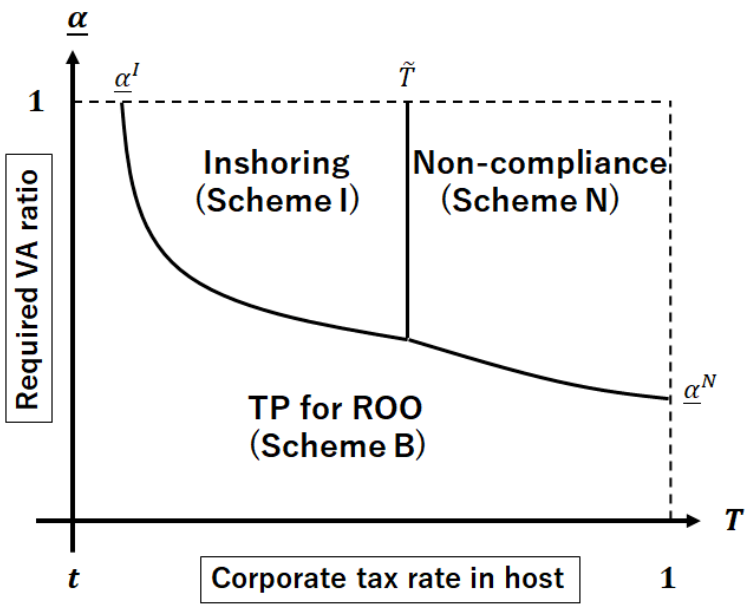

Figure 2: The equilibrium MNE's choice

Proof. See Appendix A.1.

Remember that the MNE always chooses the self-production of inputs before an FTA is formed. After an FTA is formed, this proposition suggests that the MNE may change its input procurement from self-production to the purchase of local inputs, even though the production cost is higher. As Conconi et al. (2018) showed, ROO lower the likelihood of input procurement from non-FTA countries. This "input trade diversion" corresponds to the area of scheme I in Figure 2.

Further, as Takahashi and Urata (2010) and Hayakawa et al. (2013) pointed out, some firms may not utilize FTA tariffs because of the burden of the ROO. This possibility corresponds to the areas $\widetilde{T} \leq T$ and $\underline{\alpha}^N \leq \underline{\alpha}$ in Figure 2. A standard explanation of the non-use of an FTA is that export firms must incur additional costs to meet the ROO. Our model suggests another burden of meeting the ROO: it increases tax payments by restricting the MNE's freedom to adjust its transfer price.

4 Welfare effects with ROO

In this section, we explore the welfare effect of the FTA with ROO. As the FTA has no effect if the post-FTA equilibrium scheme is scheme N, we investigate the welfare effects in schemes I and B. Hereafter, we discuss the effect on each component of welfare and the total welfare of member countries. We also discuss the optimal level of the ROO that maximizes members' joint welfare.

4.1 Consumer surplus

Let us begin with the effect on consumers. Under scheme I, FTA formation increases the marginal cost of production from $w - \Delta$ to w because the MNE changes the location of its input procurement. However, the FTA formation also eliminates the tariff, τ, faced by the MNE. We can easily confirm that the MNE chooses scheme I only if $\Delta < \tau$ holds (see footnote 22). Therefore, the FTA always decreases the MNE's marginal cost of exports whenever scheme I becomes the equilibrium outcome and it always increases the exports of the MNE.[24]

Under scheme B, the MNE also faces a higher marginal cost because the perceived marginal cost is higher than $w - \Delta$. As in scheme I, however, the MNE chooses scheme B only if the cost reduction from tariff elimination dominates the increase in the marginal cost of production (see the Appendix for details). Therefore, the FTA always increases the exports of the MNE whenever scheme B becomes the equilibrium outcome. Putting the two cases together, we have the following proposition.

Proposition 3. An FTA formation with ROO always benefits consumers if the MNE utilizes an FTA tariff and has no effect on consumers otherwise. The presence of ROO decreases consumers' gains.

Proof. See Appendix A.2.

Although FTA formation is beneficial for consumers, ROO decrease consumers' gains because of the increase in the production cost due to the inefficient procurement of inputs (scheme I) or increase in the perceived marginal cost (scheme B). Hence, ROO have no effect

[24]Specifically, the change in exports becomes $\Delta x^{I*} = \widetilde{x}^{I} - x^{O*} = (\tau - \Delta)/2$, which is positive if $\Delta < \tau$ holds.

on consumers' gains in scheme B because the tariff is eliminated and the MNE continues to produce the efficient input by itself. However, they actually diminish the increase in exports and consumers' gains because giving up full tax avoidance increases the MNE's perceived marginal cost. We should recognize this export-decreasing effect of ROO driven by the change in the MNE's transfer pricing.

4.2 Tax revenue

When the MNE engages in transfer pricing, an FTA with ROO enables member countries to recover some of the MNE's tax base. When the MNE procures the input from the local input market (scheme I), there are no opportunities to shift profits and all the tax base is retained in country H. When the MNE adjusts its transfer price to meet the VA criterion of ROO, a part of the tax base is retained in country H because of the limited use of abusive transfer pricing.

Notably, we can confirm that ROO reverse the direction of profit shifting across countries. To see this point more clearly, it is useful to decompose the optimal transfer prices into the "tax avoidance motive" and "tariff elimination motive." In the pre-FTA equilibrium, the optimal transfer price is always above the marginal cost of input production:

$$r = w - \Delta + \underbrace{\frac{a - w + \Delta - \lambda\tau}{2}}_{\text{Tax avoidance motive}}. \tag{10}$$

The second term of equation (10) represents the tax avoidance motive, which makes the transfer price as high as making the profit of the downstream affiliate of the MNE zero.

In scheme B of the post-FTA equilibrium, the tariff elimination motive counters the tax avoidance motive and the optimal transfer price is expressed as

$$\widetilde{r}^{B} = w - \Delta + \underbrace{\frac{a - w + \Delta}{2}}_{\text{Tax avoidance motive}} - \underbrace{\frac{\underline{\alpha}\{(1-t)a + (1-T)(w-\Delta) - \underline{\alpha}(T-t)a\}}{2\{1 - t - (T-t)\underline{\alpha}\}}}_{\text{Tariff eliminative motive}}. \tag{11}$$

The third term of equation (11) captures the tariff elimination motive, which is zero at $\underline{\alpha} = 0$ and increasing in $\underline{\alpha}$. If the Tariff elimination motive is sufficiently large such that $\widetilde{r}^{B}$ is lower

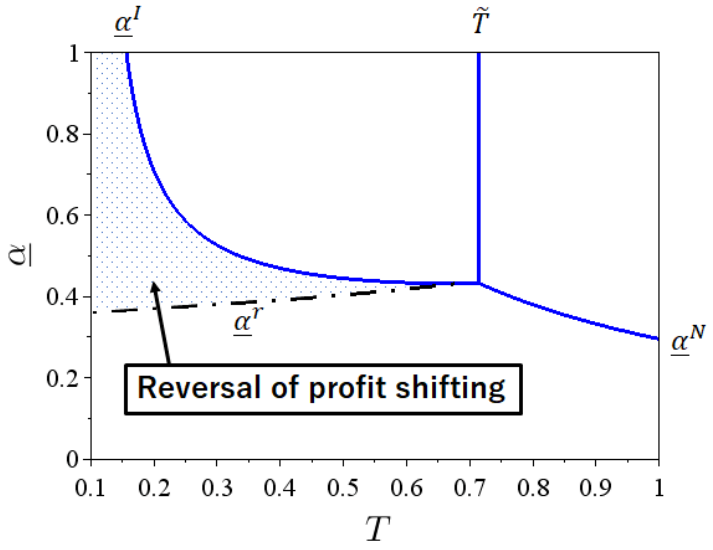

Figure 3: The direction of the MNE's shifted profits

than $w - \Delta$, the profits of the MNE are shifted from the low-tax country to the high-tax country, which is in sharp contrast to the conventional effect of transfer pricing.

Therefore, the direction of profit shifting relies on the size of the two motives. Indeed, we can derive a unique threshold of $\underline{\alpha}$, $\underline{\alpha}^r$, such that $\widetilde{r}^B < w - \Delta$ holds and profits shift from a high-tax country to a low-tax country if $\underline{\alpha} > \underline{\alpha}^r$ holds. Figure 3 illustrates the reversal of profit shifting.[25] The dotted line represents $\underline{\alpha}^r$ and the dotted area in the figure is the case in which profits flow from a low-tax country to a high-tax country. The following proposition summarizes the effect on tax revenue.

Proposition 4. An FTA formation with ROO reduces the profits of the MNE shifted from a high-tax country to a low-tax country if the MNE utilizes an FTA tariff. The MNE rather shifts its profits from a low-tax country to a high-tax country if tariff elimination motive of transfer pricing is sufficiently large.

Proof. See Appendix A.3.

This proposition sheds new light on the role of ROO that has been overlooked in policy debates. As Proposition 2 shows, an FTA formation with ROO can induce the MNE to give up

[25]We use the following parameters for the figure: $a = 1$, $w = 1/2$, $\Delta = 1/32$, $\tau = 1/4$, and $t = 1/10$.

the self-production of inputs as well as the opportunity to avoid tax.[26] This result suggests that a VA criterion provides another channel to keep MNEs away from tax avoidance by restricting the extent of abusive transfer pricing. Thus, although the main purpose of imposing ROO is to prevent trade circumvention, ROO also play a role in preventing tax avoidance.

Furthermore, Proposition 4 provides a new empirical implication for estimating transfer pricing. As our model shows, the optimal transfer price depends on the stringency of the VA criterion, suggesting that the observed transfer prices can reflect not only the tax avoidance motive but also the tariff elimination motive.[27]

4.3 Total welfare of member countries

Let us discuss how the presence of ROO changes the effect of FTA formation on the total welfare of member countries. Remember that Proposition 1 suggests that an FTA without ROO is feasible in the sense that it increases the total welfare of member countries if and only if the initial tariff is sufficiently large ($\tau > \tau^W$).

As seen in this section, ROO reduce consumers' gains from an FTA formation in country F. However, ROO also help generate tax revenues in country H if the MNE changes its input procurement or adjusts its transfer price to comply with the ROO. This indicates that ROO can make an infeasible FTA without ROO feasible and they can also make an initially feasible FTA without ROO infeasible.

Let us first discuss the welfare effect of an FTA formation in schemes I and B. In the case of scheme I, total welfare is sum of the consumer surplus and tax revenue from the MNE:

$$\widetilde{W}^I = \frac{(a-w)^2}{8} + T\frac{(a-w)^2}{4}. \tag{12}$$

By comparing $\widetilde{W}^I$ with W_{O*}, we obtain the threshold of T, $\widetilde{T}^W$, such that $\widetilde{W}^I = W_{O*}$ holds at

[26]This effect would be observed in the other two criteria of ROO, that is, the tariff classification criterion and specific process criterion.

[27]Although there are other ways of shifting profits such as using internal debt and making royalty payments, the tariff elimination motive behind the transfer pricing of tangible assets remains.

$T = \widetilde{T}^W$, which is given by

$$\widetilde{T}^W = \frac{2(a-w)(\Delta+\tau) - (\tau-\Delta)(\Delta+3\tau)}{2(a-w)^2}. \tag{13}$$

We have $\widetilde{W}^I > W_{O*}$ for $T > \widetilde{T}^W$ and $\widetilde{W}^I > W_{O*}$ holds for $T < \widetilde{T}^W$. An FTA with ROO improves total welfare when the corporate tax in country H is sufficiently large and the tariff revenue gains from the ROO dominate the loss of the consumer surplus.

Total welfare under scheme B also includes tax revenue from the MNE, given by

$$\begin{aligned}\widetilde{W}^B =& \frac{\{(1-t)(a-w+\Delta) - \underline{\alpha}a(T-t)\}^2}{8\{1-t-\underline{\alpha}(T-t)\}^2} \\ &+ T\underline{\alpha}\left(\frac{\{(1-t)(a+w-\Delta) - \underline{\alpha}a(T-t)\}\{(1-t)(a-w+\Delta) - \underline{\alpha}a(T-t)\}}{4\{1-t-\underline{\alpha}(T-t)\}^2}\right).\end{aligned} \tag{14}$$

At $\underline{\alpha} = 0$, regime B is identical to the post-FTA equilibrium without ROO ($\widetilde{W}^B = \widehat{W}$). Starting from $\underline{\alpha} = 0$, an increase in the stringency of ROO has two opposite effects on $\widetilde{W}^B$. On the one hand, a stricter VA requirement reduces the transfer price and thereby increases the tax revenue that country H collects. On the other hand, it diminishes consumers' gains from an FTA formation by increasing the MNE's perceived marginal cost and reducing the amount of exports. There is thus an inverted U-shaped relationship between $\widetilde{W}^B$ and $\underline{\alpha}$. Specifically, the former effect dominates the latter and $\frac{\partial \widetilde{W}^B}{\partial \underline{\alpha}} > 0$ holds when $\underline{\alpha}$ is small, whereas the latter effect dominates the former and $\frac{\partial \widetilde{W}^B}{\partial \underline{\alpha}} < 0$ holds when $\underline{\alpha}$ is large.[28]

Because of the increased tax revenue, ROO can make an initially infeasible FTA feasible. Suppose $\tau < \tau_W$, with which an FTA without ROO reduces total welfare (see Proposition 1). Since stricter ROO improve post-FTA welfare in scheme B, post-FTA welfare can be larger than pre-FTA welfare even with $\tau < \tau_W$. Specifically, we can specify a threshold of $\underline{\alpha}$, $\underline{\alpha}^W$, at which $\widetilde{W}^B = W^{O*}$ holds.[29] When $\underline{\alpha}^W < \min[\underline{\alpha}^I, \underline{\alpha}^N]$ holds, an FTA formation improves

[28] Let $\underline{\alpha}^x$ be the threshold of $\underline{\alpha}$ such that the amount of exports is constant before and after the FTA is formed, $\widetilde{x}^B = x_{O*}$. Since we have $\frac{\partial \widetilde{W}^B}{\partial \underline{\alpha}}|_{\underline{\alpha}=0} > 0$, $\frac{\partial^2 \widetilde{W}^B}{\partial \underline{\alpha}^2} < 0$, and $\frac{\widetilde{W}^B}{\partial \underline{\alpha}}|_{\underline{\alpha}=\underline{\alpha}^x} < 0$, there exists a unique threshold, $\underline{\alpha}_0^W \in [0, \underline{\alpha}^x)$, such that $\frac{\widetilde{W}^B}{\partial \underline{\alpha}}|_{\underline{\alpha}=\underline{\alpha}_0^W} = 0$ holds.

[29] At $\underline{\alpha} = \underline{\alpha}^x$, an FTA formation does not change the MNE's exports of the final good or the consumer surplus. We can simplify the change in total welfare to the sum of tax revenue and the loss of tariff revenue, $\widetilde{W}^B - W_{O*}|_{\underline{\alpha}=\underline{\alpha}^x} = T\underline{\alpha}^x\widetilde{\pi}_H^B - \tau x^{O*} = \tau x^{O*}\left\{\left(\frac{T(1-t)}{T-t}\right)\left(\frac{a+w-\Delta+\tau}{2(w-\Delta+\tau)}\right) - 1\right\} > 0$. This means that a threshold $\underline{\alpha}^W \in [0, \underline{\alpha}^x)$ exists that satisfies $\widetilde{W}^B = W^{O*}$.

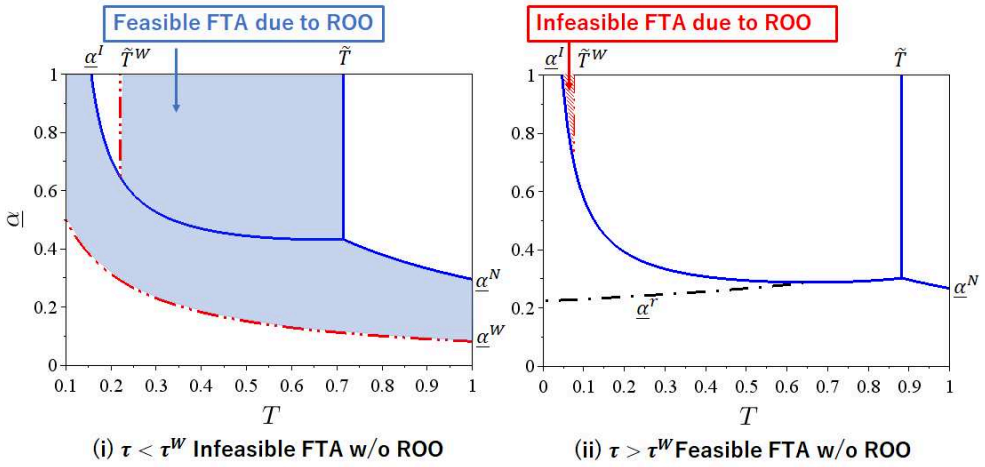

Figure 4: ROO and the feasibility of an FTA formation

the total welfare of member countries in scheme B for $\underline{\alpha} > \underline{\alpha}^W$.[30] The left figure of Figure 4 provides a numerical example that $\underline{\alpha}^W < \min[\underline{\alpha}^I, \underline{\alpha}^N]$ holds.[31] In the shaded area in scheme B, an FTA formation improves total welfare. Further, an FTA formation can improve total welfare in scheme I. As shown above, an FTA formation improves total welfare in scheme I if $T > \widetilde{T}^W$ holds. Therefore, ROO can transform an infeasible FTA into a feasible one because the increased tax revenue from the MNE compensates for the tariff revenue loss.

Proposition 5. When $\tau < \tau^W$ holds and an FTA formation is infeasible without ROO, an FTA formation with ROO improves the total welfare of member countries if the MNE adjusts its transfer price to comply with the ROO and $\underline{\alpha}^W < \underline{\alpha} < \min[\underline{\alpha}^I, \underline{\alpha}^N]$ hold or if the MNE purchases local inputs and $T < \widetilde{T}^W$ holds. In these cases, ROO make an initially infeasible FTA feasible.

However, ROO may negatively affect total welfare and make an initially feasible FTA formation infeasible. The right figure of Figure 4 corresponds to the case with $\tau > \tau^W$, where the formation of an FTA without ROO is beneficial for member countries. The dotted curve in scheme B represents $\underline{\alpha}^r$, above which we see the reversal of profit shifting discussed in the previous section. The figure shows that an FTA stays feasible even if we take ROO into account, so that ROO increase the gains of forming an FTA under scheme B in the equilibrium because

[30] Although $\widetilde{W}^B$ is an inverted U-shaped curve in $\underline{\alpha}$, we always have $\widetilde{W}^B > W^{O*}$ at $\underline{\alpha} = \min[\underline{\alpha}^I, \underline{\alpha}^N]$ because $\min[\underline{\alpha}^I, \underline{\alpha}^N] < \underline{\alpha}^x$ holds. This means that an FTA formation always improves total welfare for $\underline{\alpha}^W < \underline{\alpha} \leq \min[\underline{\alpha}^I, \underline{\alpha}^N]$.

[31] The parameters are set as follows: $a = 1$, $\Delta = 1/32$, and $\tau = 1/4$. The left figure is drawn with $w = 1/2$ and $t = 1/10$, whereas the right figure uses $w = 2/3$ and $t = 0$.

$\frac{\partial \widetilde{W}^B}{\partial \underline{\alpha}} > 0|_{\underline{\alpha}=0}$ holds. If both $\underline{\alpha}$ and T are high so that scheme N is the equilibrium outcome, there is no welfare change from an FTA formation. Moreover, if the equilibrium outcome is scheme I and $T \leq \widetilde{T}^W$ holds, the gains from increased tax revenue are smaller than the loss from the lower consumer surplus. In this case, ROO transform a welfare-improving FTA formation into a welfare-reducing one.

The next proposition summarizes these results.

Proposition 6. When $\tau \geq \tau^W$ holds and an FTA formation is feasible without ROO, an FTA formation with ROO deteriorates total welfare if it induces the MNE to purchase local inputs to meet the ROO and $T \leq \widetilde{T}^W$ holds. In this case, ROO can make an initially feasible FTA infeasible.

From Propositions 3 and 4, we know that an FTA with ROO benefits consumers and makes profit shifting difficult. Proposition 5 suggests that ROO with a certain level of $\underline{\alpha}$ can be necessary for FTA formation. A formation of an FTA with ROO works as an effective policy not only to promote trade liberalization but also to prevent the MNE from engaging in tax avoidance, and the latter effect is important to secure welfare-improving FTA formation. Proposition 6 suggests, however, that ROO can also deter the formation of an FTA if it is feasible without ROO.

5 Discussion

Our benchmark analysis provided a set of new results not thus far explored in the extant literature. In this section, we discuss an extension of the model and the robustness of the main results by relaxing some of the assumptions made in the benchmark model.

5.1 The optimal VA requirement

We showed that the MNE's choice and welfare effect of an FTA critically depend on the level of $\underline{\alpha}$. Here, we discuss how member countries choose $\underline{\alpha}$ if it is endogenously determined.

As $\frac{\partial \widetilde{W}^B}{\partial \underline{\alpha}}|_{\underline{\alpha}=0} > 0$ holds, the optimal level of the VA ratio, which is denoted by $\underline{\alpha}^{Opt}$, is always positive. Under scheme B, total welfare is an inverted U-shaped curve in $\underline{\alpha}$, and it is

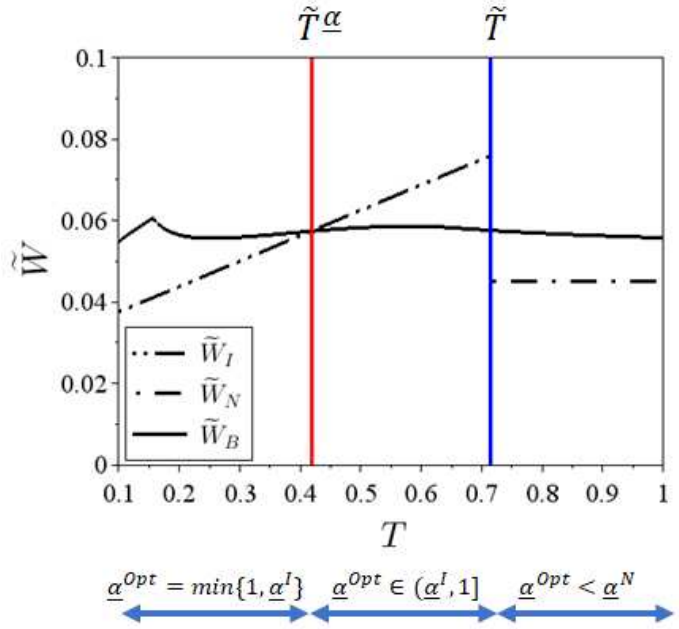

Figure 5: The welfare of member countries with the optimal level of $\underline{\alpha}$

maximized at $\underline{\alpha} = \underline{\alpha}_0^W$ at which $\frac{\partial \widetilde{W}^B}{\partial \underline{\alpha}} = 0$ is satisfied. If $\underline{\alpha}_0^W < \min[\underline{\alpha}^I, \underline{\alpha}^N]$ holds, and the welfare-maximizing level within scheme B becomes $\underline{\alpha}_0^W$. If $\underline{\alpha}_0^W \geq \min[\underline{\alpha}^I, \underline{\alpha}^N]$ holds, however, it becomes the upper bound of $\underline{\alpha}$ in scheme B, $\min[\underline{\alpha}^I, \underline{\alpha}^N]$.

A further increase in $\underline{\alpha}$ changes the equilibrium scheme from scheme B to either scheme N or scheme I. The full tax avoidance in scheme N means that total welfare is independent of the corporate tax in country H. Total welfare in scheme I, however, is increasing in T because it generates more tax revenues.

Figure 5 illustrates a numerical example that shows maximized total welfare in each scheme with optimal VA criterion, when $\tau < \tau^W$ holds.[32] The solid curve is total welfare in scheme B given that $\underline{\alpha}$ is optimally set to maximize total welfare. The two dotted lines illustrate total welfare in schemes I and N. In this example, we can see a threshold of T, denoted as $\widetilde{T}^{\underline{\alpha}}$, which satisfies $\widetilde{W}^B = \widetilde{W}^I$.

If $T < \widetilde{T}^{\underline{\alpha}}$ holds, Scheme B realizes the highest total welfare. In this case, the optimal VA criterion is the highest one that realizes scheme B, $\underline{\alpha}^{Opt} = \min[1, \underline{\alpha}^I]$. If $\widetilde{T}^{\underline{\alpha}} < T < \widetilde{T}$ holds, Scheme I brings the highest total welfare. In this range of T, the optimal $\underline{\alpha}$ is any $\underline{\alpha}$ that induces the MNE to purchase local inputs within FTA countries, or $\underline{\alpha}^{Opt} \in (\underline{\alpha}^I, 1]$. If $T > \widetilde{T}$

[32]This figure is drawn with the following parameters: $a = 1$, $w = 1/2$, $\Delta = 1/32$, $\tau = 1/4$, and $t = 1/10$.

holds, scheme B again realizes the highest total welfare. However, the optimal level is less than the highest one that realizes Scheme B, and it is given by $\underline{\alpha}^{Opt} = \underline{\alpha}_0^W < \underline{\alpha}^N$. This is easily understood by considering the perceived marginal costs. Remember the perceived marginal cost rises as the tax gap widens or the VA criterion becomes stricter. A higher perceived marginal cost decreases the amount of exports, $\widetilde{x}^B$, as the tax gap widens or the VA criterion becomes stricter. Since the degree of the decrease in exports and its welfare cost are small when the tax gap is small, the increase in tax revenues dominates when $T < \widetilde{T}^{\underline{\alpha}}$ holds. If the tax gap is large, however, the optimal level of the VA requirement in scheme B balances out the gains from the increased tax revenues and losses from the increased perceived marginal cost.

This numerical analysis suggests that to determine the stringency of ROO, policymakers should take into account its effects on tax revenues. In reality, VA thresholds are usually set between 30% and 60%.[33] Our model predicts that the VA criterion of ROO may play a positive role in preventing tax avoidance by MNEs and secure welfare gains for member countries when the host countries of export platform MNEs impose high tax rates. This is actually the case with NAFTA (now USMCA), where Mexico attracts FDI and levies a high corporate tax. Moreover, as different VA thresholds are imposed on different products, the design of a VA criterion or choice of ROO criteria should differ across the products MNEs actively produce.

5.2 Partial procurement of inputs

We have assumed that the MNE makes a binary choice about input procurement, that is, a "make all or buy all" choice. It would be more realistic to suppose that the MNE purchases some proportion of parts from local suppliers and procures the rest via intra-firm transactions, which we refer to as scheme P.

Suppose that the MNE uses a continuum of inputs indexed in the $[0, 1]$ space. Let $\beta \in [0, 1]$ denote the proportion of inputs that firm M_H procures from firm M_O in country O. This means that the $1 - \beta$ proportion of the input is procured within FTA countries. The amount of intra-firm

[33] See http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=TAD/TC/WP(2015)28/FINAL&docLanguage=En.

trade becomes βx and the modified VA ratio is given by $\frac{p-\beta r}{p}$. The MNE maximizes

$$\Pi = (1-t)[\beta\{r-(w-\Delta)\}x+\overline{\pi}]+(1-T)[\{p-\beta r-(1-\beta)w\}x] \tag{15}$$

with respect to x, r, β, which is subject to $\pi_H \geq 0$, $\pi_O \geq 0$, and $\frac{p-\beta r}{p} \geq \underline{\alpha}$.

Since $\frac{\partial \Pi}{\partial r} > 0$ holds, the optimal transfer price, r^P, is again set at the level such that $p-\beta r^P-(1-\beta)w = 0$ is satisfied. Furthermore, we can also confirm that $\frac{\partial \Pi}{\partial \beta} > 0$ always holds, which implies that the MNE sets β as high as possible. Formally, the optimal β satisfies $\beta = \max\{0, 1-\frac{\underline{\alpha} p}{w} \equiv \beta^P\}$. Let x^P denote the corresponding optimal level of x. Then, the equilibrium post-tax profits in scheme P become

$$\Pi^P = (1-t)\left[\left(1-\frac{\underline{\alpha}\Delta}{w}\right)(p-c_M^P)x^P+\overline{\pi}\right], \tag{16}$$

where the modified perceived marginal cost is $c_M^P = \frac{w(w-\Delta)}{w-\underline{\alpha}\Delta}$, which falls between $w-\Delta$ and w.

The reason why the optimal β can be zero is explained as follows. Given that the MNE sets the abusive transfer price as r^P, the VA ratio with $r = r^P$ becomes $\frac{(1-\beta)w}{p}$. If $\frac{w}{p} \leq \underline{\alpha}$ holds, the MNE can never comply with the ROO when $\beta > 0$. Since $\frac{w}{p}1$, there exists a unique cutoff of $\underline{\alpha}$, $\underline{\alpha}^P_{\beta=0}$, above which the MNE sets $\beta^P = 0$. In this case, the MNE manipulates its transfer price to comply with the ROO (i.e., scheme B), or it may choose scheme I or N. Thus, we can conclude that schemes N, I, and B are still the equilibrium outcomes when $\underline{\alpha} \geq \underline{\alpha}^P_{\beta=0}$ holds, whereas the area of scheme B is replaced with that of scheme P below $\underline{\alpha} < \underline{\alpha}^P_{\beta=0}$.

One notable difference from the benchmark model is that ROO can transform a feasible FTA into an infeasible one in scheme P. This happens in the benchmark model when the equilibrium outcome is scheme I. However, in this modified setup, the MNE's tax base is zero and ROO reduce the gains from an FTA formation, which generates a possibility that ROO worsen total welfare if the required VA ratio is high. Specifically, let $\underline{\alpha}^P_W$ be the threshold such that $\widetilde{W}^P = W^{O*}$ holds. Then, an FTA formation is infeasible when $\underline{\alpha} > \underline{\alpha}^P_W$ holds.

5.3 Concealment costs for transfer price manipulation

In the benchmark model, the MNE can freely manipulate the transfer price. Here, we show that the assumption of costless transfer pricing is not critical to obtain the main results.

In practice, MNEs need to explain the plausibility of transfer pricing to shift profits across countries. As MNEs shift more profits between countries, explaining the reasons for the greater deviation from the appropriate price, or the arm's length price, becomes more difficult. Following the literature on transfer pricing, we introduce the following "concealment cost" in the case of offshoring, which is increasing in the gap between the transfer price and production cost of inputs:

$$C(r, x^O) = \frac{\delta\{r - (w - \Delta)\}^2 x^O}{2}. \tag{17}$$

In this concealment cost, the parameter δ captures the difficulty of concealing tax avoidance, which reflects a well-enforced tax authority, for example. The post-tax profits under offshoring are modified as

$$\begin{aligned} \Pi^O &= (1-t)[\{r - (w-\Delta)\}x^O\overline{\pi}] + (1-T)[(p - r - \lambda_M\tau)x^O] - C(r, x^O), \\ &= (1-t)\overline{\pi} + (1-T)(p - c_M^C)x^O, \end{aligned} \tag{18}$$

where $c_M^C = \frac{(1-t)(w-\Delta)+(1-T)\lambda\tau-(T-t)r}{1-T} + \frac{\delta\{r-(w-\delta)\}^2}{2(1-T)}$ is the effective marginal cost.

In this setup, the concealment cost can prevent the MNE from transferring all the profits from country H to country O. In other words, the MNE can choose the transfer price and final good price such that $p > r + \lambda_M\tau$ holds, even in the absence of ROO. Given that some of the MNE's tax base remains in country H, our welfare analysis has several modifications.

First, an FTA formation in the absence of ROO now depends on the tax differential between T and t. Substituting the optimal level of r that maximizes Π^O into c_M^C, the perceived marginal cost in the equilibrium is calculated as $c_M^C = w - \Delta + \lambda\tau - \frac{(T-t)^2}{2\delta}$. Thus, as the tax difference between countries widens, the perceived marginal cost lowers. Since the MNE becomes less willing to increase r because of the concealment cost, it has an incentive to increase x^O and lower p, which saves the MNE's tax payments in country H by narrowing the gap between p and $r + \lambda_M\tau$. This incentive is reflected in the perceived marginal cost. Because the elimination of

tariffs increases the gap between p and $r + \lambda_M \tau$, it gives the MNE an extra incentive to increase x^O to avoid tax payments. The increase in x^O is advantageous for member countries because it benefits consumers. Therefore, in the presence of concealment costs, an FTA formation without ROO is more likely to benefit member countries as the tax gap widens.

Second, $p > r + \lambda_M \tau$ implies that the VA ratio is positive even in the absence of ROO. In the benchmark model, the MNE always chooses a zero VA ratio in FTA countries in the absence of ROO. This implies that the VA requirement of ROO affects neither the MNE's transfer pricing nor its location choice when $\underline{\alpha}$ is sufficiently small because the MNE has already satisfied the required VA ratio.

Even if we consider these new elements, the nature of our results does not change. Specifically, an FTA formation without ROO may harm member countries, and ROO can transform an infeasible FTA into a feasible one. The opposite case is also possible, where ROO transform a feasible FTA into an infeasible one.

5.4 The role of profit shifting

So far, we have analyzed the impact of ROO given the MNE always has an option to manipulate transfer price to shift profits. In the literature on tax avoidance, whether profit shifting itself is harmful for high-tax countries is one of the main interests. Although profit shifting hurts high-tax countries by reducing tax revenues, the effect is more complicated than it seems. For instance, Hong and Smart (2010) theoretically showed that the use of tax havens is beneficial for a high-tax country because it stimulates the economic activities of MNEs and enables a high-tax country to set an even higher tax rate. Here, we provide another reason why MNEs' profit shifting is beneficial for high-tax countries. To this end, we consider the situation in which the MNE cannot manipulate transfer price.

In this alternative setup, the intra-firm transaction takes place at the price of $w - \Delta$ and all the tax base of the MNE remains in country H irrespective of whether an FTA is formed. This means that scheme O is always the optimal choice for the MNE in the pre-FTA equilibrium. Once an FTA with ROO is formed, the VA ratio is calculated as $\alpha = \frac{a-w+\Delta}{a+w-\Delta} \equiv \underline{\alpha}^{UB}$. Therefore, the MNE keeps producing its own inputs in country O as long as $\underline{\alpha} \leq \underline{\alpha}^{UB}$ holds. If $\underline{\alpha} > \underline{\alpha}^{UB}$

holds, however, the MNE cannot comply with the ROO on the self-production of inputs. In this case, the MNE always starts procuring inputs inside the FTA (scheme I) because the gains from the elimination of tariff is greater than the loss from the higher input cost (i.e., $\tau > \Delta$). From the viewpoint of welfare, FTA countries prefer the MNE to produce its own inputs (scheme O) and thus they set the optimal VA ratio below $\underline{\alpha}^{UB}$.

Given this equilibrium property under no profit shifting, we compare the post-FTA welfare of high-tax member countries with and without profit shifting. The required VA ratio with profit shifting is also set at the level that maximizes the joint welfare of member countries. We find that if the corporate tax rate in the high-tax country, T, is relatively small, profit shifting can improve the welfare of high-tax member countries.[34]

The intuition behind this outcome is explained as follows. Without profit shifting, country H can collect tax revenues from the MNE, but these are relatively small because T is not large. Thus, the welfare of high-tax member countries becomes relatively small in these tax environments. With profit shifting, Proposition 4 suggests that the MNE rather shifts its profits from a low-tax country to a high-tax country if τ is relatively high and the tariff elimination motive of transfer pricing is large. This implies that allowing transfer pricing actually leads to larger tax revenues in high-tax countries because the MNE manipulates its transfer price to eliminate tariffs rather than avoid tax. Thus, our analysis provides the possibility that transfer pricing benefits a high-tax country.

6 Conclusion

The recent proliferation of FTAs is playing a key role in advancing trade liberalization between countries and the cross-border economic activities of MNEs prevail globally. This study investigated a vertically integrated MNE's input production and pricing strategies to analyze the welfare effects of FTA formation when the MNE can manipulate its transfer price of intra-firm trade. As in previous studies, the MNE uses its transfer price to avoid a high corporate tax. After the formation of an FTA, however, there emerges another reason for transfer price manipulation in the presence of ROO. Specifically, if the ROO of the FTA employ a VA criterion, the FTA

[34]The detailed calculation of the numerical example in this case will be provided upon request.

induces the MNE to manipulate the transfer price to comply with the ROO and be eligible for tariff elimination.

When the VA criterion of the ROO is low, the MNE prefers transfer price manipulation since adjusting the transfer price is straightforward. However, once the required VA level is high, transfer price adjustment decreases the efficiency of tax avoidance so that the manipulation of the transfer price for the ROO is suboptimal. If the tax gap between a country outside the FTA and a member country is large, the MNE produces a necessary input in the outside country at the expense of the FTA tariff rate because the gain from tax avoidance is large. If it is small, the MNE procures the input in the inside country to qualify for the FTA tariff. This result is in line with empirical and anecdotal evidence that (i) FTAs sometimes induce input relocation to inside FTA countries, (ii) not all firms export using the preferential tariffs of FTAs, and (iii) transfer price manipulation is a factor in the difference in corporate tax rates and the required VA criterion of ROO.

Our model also showed the possibility that ROO can prevent profit shifting by an MNE via either a change in procurement strategy or another use of transfer prices. Owing to the emergence of the MNE's tax base, ROO can transform an infeasible FTA into a feasible one. Therefore, the formation of FTAs with ROO is expected to work as an effective policy to not only induce trade liberalization but also keep MNEs away from tax avoidance. A remarkable result is that the direction of the MNE's shifted profits is the opposite of that under common knowledge when the MNE manipulates the transfer price for ROO.

The above argument does not indicate that the highest VA criterion is always optimal because it deteriorates the efficiency of tax avoidance, increases the MNE's perceived marginal cost, and reduces the amount of exports to another FTA member country. Our analysis showed that the optimal VA level depends on corporate tax rates. This implies that policymakers should pay close attention to the link between tariffs and corporate taxes even though cooperation between customs departments and tax authorities is rarely observed in reality.

There remains room for further research. We assumed that tax rates and tariff rates are exogenously given. It would be intriguing to investigate how the formation of an FTA affects the outcomes of tax competition among countries as well as the optimal tariffs set by FTA

members. Another direction in which to extend the model is to examine the effects of regulations on transfer pricing, such as the arm's length principle, in the presence of ROO. Finally, further empirical investigation on the relationship between ROO and transfer pricing is essential.

Appendix

A.1 Proof of Proposition 2

The post-tax profits of the MNE under schemes N and I are given by

$$\widetilde{\Pi}^N = \frac{(1-t)(a-w+\Delta-\tau)^2}{4} + (1-t)\overline{\pi}, \tag{A-1}$$

$$\widetilde{\Pi}^I = \frac{(1-T)(a-w)^2}{4} + (1-t)\overline{\pi}. \tag{A-2}$$

The condition under which the MNE prefers scheme I to scheme N is given by

$$\widetilde{\Pi}^I - \widetilde{\Pi}^N > 0 \iff T < 1-(1-t)\left(\frac{a-w+\Delta-\tau}{a-w}\right)^2 \equiv \widetilde{T}. \tag{A-3}$$

From equation (9), we can easily confirm that the following inequality holds:

$$\widetilde{\Pi}^B|_{\underline{\alpha}=0} = \frac{(1-t)(a-w+\Delta)^2}{4} + (1-t)\overline{\pi} > \max\{\widetilde{\Pi}^N, \widetilde{\Pi}^I\}. \tag{A-4}$$

Further, the first derivative of $\widetilde{\Pi}^B$ with respect to $\underline{\alpha}$ is

$$\frac{\partial\widetilde{\Pi}^B}{\partial\underline{\alpha}} = \frac{(T-t)\{(1-t)(a-w+\Delta)-(T-t)a\underline{\alpha}\}}{4\{1-t-(T-t)\underline{\alpha}\}}[-\{1-t-(T-t)\underline{\alpha}\}-(1-t)(w-\Delta)] < 0. \tag{A-5}$$

Let $\underline{\alpha}^x$ denote the cutoff level of $\underline{\alpha}^x$ such that $\widetilde{x}^B = x^{O*}(=\widetilde{x}^N)$ holds. Specifically, we have

$$\widetilde{x}^B \gtreqless x^{O*} \iff \underline{\alpha} \lesseqgtr \frac{(1-t)\tau}{(T-t)(w-\Delta+\tau)} \equiv \underline{\alpha}^x. \tag{A-6}$$

If evaluated at $\underline{\alpha} = \underline{\alpha}^x$, equation (9) becomes

$$\widetilde{\Pi}^B|_{\underline{\alpha}=\alpha_x} = \frac{(1-t)(w-\Delta)(a-w+\Delta-\tau)^2}{4(w-\Delta+\tau)} + (1-t)\overline{\pi} \left(< \widetilde{\Pi}^N\right). \tag{A-7}$$

This implies that there exists the unique cutoff level of $\underline{\alpha}$, $\underline{\alpha}^N \in (0, \underline{\alpha}^x)$, such that $\widetilde{\Pi}^N \geq \widetilde{\Pi}^N$ holds with $\underline{\alpha} \leq \underline{\alpha}^N$ and $T \geq \widetilde{T}$. Moreover, remember that $\frac{\partial \widetilde{\Pi}^I}{\partial T} < 0$ and $\widetilde{\Pi}^I = \widetilde{\Pi}^N$ holds at $T = \widetilde{T}$. Then,

$$\widetilde{\Pi}^I > \widetilde{\Pi}^I|_{T=\widetilde{T}} = \widetilde{\Pi}^N > \widetilde{\Pi}^B|_{\underline{\alpha}=\underline{\alpha}^x} \tag{A-8}$$

holds for any $T \in [t, \widetilde{T}]$. Note that $\widetilde{\Pi}^B > \widetilde{\Pi}^I$ holds if the following condition is satisfied:

$$\widetilde{\Pi}^B|_{\underline{\alpha}=1} > \widetilde{\Pi}^I \iff T < 1 - (1-t)\left(\frac{w-\Delta}{w}\right). \tag{A-9}$$

This implies that there exists the unique cutoff level of $\underline{\alpha}$, $\underline{\alpha}^I \in (0, \underline{\alpha}^x)$, such that $\widetilde{\Pi}^B \geq \widetilde{\Pi}^I$ holds with $\underline{\alpha} \leq \underline{\alpha}^I$ and $1 - (1-t)\left(\frac{w-\Delta}{w}\right) \leq T < \widetilde{T}$. ■

A.2 Proof of Proposition 3

Under scheme I, the changes in the amount of supplies from the pre-FTA equilibrium to the post-FTA equilibrium without ROO are

$$\widetilde{x}^I - x^{O*} = \frac{\tau - \Delta}{2} > 0, \tag{A-10}$$

$$\widetilde{x}^I - \widehat{x}^O = \frac{-\Delta}{2} < 0, \tag{A-11}$$

because $\tau > \Delta$ holds. Under scheme B, the FTA formation increases the amount of exports to country F when $\underline{\alpha} < \underline{\alpha}^x$ holds. From Proposition 2, we know that $\underline{\alpha} < \underline{\alpha}^x$ holds under scheme B and we always have $\widetilde{x}^B > x^{O*}$. In addition, we can easily confirm that

$$\widetilde{x}^B - \widehat{x}^O = \frac{-(T-t)(w-\Delta)\underline{\alpha}}{2\{1-t-(T-t)\underline{\alpha}\}} < 0 \tag{A-12}$$

holds. ■

A.3 Proof of Proposition 4

From equation (11), we obtain

$$\frac{\partial \widetilde{r}^B}{\partial \underline{\alpha}} = -\frac{\{1-t-(T-t)\underline{\alpha}\}^2 + (1-T)(1-t)(w-\Delta)}{2\{1-t-(t-t)\underline{\alpha}\}^2} < 0. \tag{A-13}$$

Therefore, $\widetilde{r}^B = w - \Delta + \frac{a-w+\Delta}{2} > w - \Delta$ holds at $\underline{\alpha} = 0$ and $\widetilde{r}^B$ takes the minimum value at $\underline{\alpha} = 1$, which is given by

$$\widetilde{r}^B|_{\underline{\alpha}=1} = 0 < w - \Delta. \tag{A-14}$$

Scheme B is the equilibrium at any $\underline{\alpha}$ if $T < \widetilde{T}$ holds. Therefore, there exists a unique $\underline{\alpha}_r$ such that $\widetilde{r}^B < w - \Delta$ holds when $\underline{\alpha} > \underline{\alpha}_r$ holds. ■

B. Key Symbols for Notations

Scheme	λ	Export	Transfer price	MNE's post-tax profits	FTA Welfare
No FTA (w/ "$*$")					
Offshoring ($s = O$)	1	x^{O*}	r^*	Π^{O*}	W^{O*}
FTA w/o ROO (w/ "$\widehat{\ }$")					
Offshoring ($s = O$)	0	$\widehat{x}^O$	$\widehat{r}$	$\widehat{\Pi}^O$	$\widehat{W}^O$
FTA w/ ROO (w/ "$\widetilde{\ }$")					
Inshoring ($s = I$)	0	$\widetilde{x}^I$	$\widetilde{r}^I$	$\widetilde{\Pi}^I$	$\widetilde{W}^I$
Non-compliance ($s = N$)	1	$\widetilde{x}^N$	$\widetilde{r}^N$	$\widetilde{\Pi}^N$	$\widetilde{W}^N$
Binding ROO ($s = B$)	0	$\widetilde{x}^B$	$\widetilde{r}^B$	$\widetilde{\Pi}^B$	$\widetilde{W}^B$

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