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OKOSHI, Hirofumi
Okayama University

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Negotiation for Transfer Prices under the Arm's Length Principle*

Hirofumi OKOSHI
Okayama University

Abstract

Determining whether MNEs are engaged in tax avoidance by analyzing their transfer pricing practices is difficult due to the presence of firm-specific products or technologies; additionally, disputes about MNE transfer pricing activities sometimes arise. Because resolving such disputes formally is time consuming, an MNE and a tax authority may agree on a transfer price level in an informal negotiation. This study investigates how MNE transfer price is determined in informal negotiations processes by interlinking MNE investment in product quality and negotiation power, and how a longer period for resolving a dispute in a formal process affects the equilibrium transfer price. We find that a longer time for a formal process induces firm investment, but its effect on the equilibrium transfer price depends on each MNE's negotiation power against its tax authority. In addition, our analysis shows that tax revenues in a high-tax country may increase due to MNE tax avoidance activity, because increases in firms' investments boost their operating profits. Furthermore, a fixed subsidy for investments in quality may be more likely to reduce welfare during a prolonged dispute resolution when a high-tax country places extra weight on tax revenue.

Keywords: Tax avoidance, Negotiated transfer price, Nash bargaining, Vertical differentiation, The arm's length principle
JEL classification: F23, H26, L13

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1 Introduction

As globalization spreads, the tax avoidance behavior of multinational enterprises (MNEs) has become substantial. For example, the Organization for Economic Cooperation and Development (OECD) estimated that the annual revenue losses from MNEs' tax avoidance are between $100 billion and $240 billion.[1] Zucman (2014) shows an increasing share of US corporate profits made in tax havens from 2% in 1983 to 17% in 2013. Furthermore, Tørsløv et al. (2018) also estimate that MNEs have shifted more than $600 billion to tax havens. Of the tax avoidance channels, price manipulation on intrafirm transactions, namely transfer pricing, and licensing are dominant.[2] Because tax revenues are important sources for public goods provisions and welfare, international cooperation in fighting against MNEs' tax avoidance is indispensable, and countries develop some policies such as base erosion and profit shifting (BEPS) projects.[3]

One of the difficulties for countries in dealing with MNEs' tax avoidance via transfer pricing and licensing is finding the existence of comparable transactions between unrelated firms. Practitioners rely on the OECD guideline when determining an appropriate transfer price. In the guideline, the transfer price should be the one used in interfirm transactions, or arm's length (AL) prices; this is called the AL principle.[4] Following this principle, tax authorities attempt to audit MNEs' tax avoidance behavior by comparing the transfer and AL prices from comparable uncontrolled transactions. However, as MNEs often produce differentiated products and/or use their own unique intangible assets, less comparable transactions are common and finding proper AL prices is difficult. Therefore, in practice, both consultant companies and tax authorities frequently rely on a range of transfer prices, or AL range, allowing MNEs to manipulate their transfer prices for profit shifting.

Due to this difficulty, tax authorities and MNEs sometimes conflict over transfer prices and transfer pricing disputes are time consuming to resolve. In practice, transfer prices are argued and determined through informal negotiations.[5] If informal negotiations fails transfer price cases are discussed in a formal environment like a court. According to the OECD, transfer pricing cases in mutual agreement procedures took 35 and 32 months in 2020 and 2021, respectively, which were

[1] See `https://www.oecd.org/tax/beps/`.

[2] See Heckemeyer and Overesch (2017). Similar to this study, Juranek et al. (2018) and Choi et al. (forthcoming) investigated tax avoidance via royalty payments. International debt shifting is another channel (Hong and Smart, 2010). See Beer et al. (2020) for a recent survey.

[3] In the project, 3 of 15 actions are devoted to issues related to transfer pricing (see actions 8-10).

[4] The AL principle is established in Article 9 of the OECD Model Tax Convention. The OECD guideline states that "[T]here are some significant cases in which the arm's length principle is difficult and complicated to apply, for example, in MNE groups dealing in the integrated production of highly specialised goods, in unique intangibles and/or in the provision of specialised services." See `https://www.oecd-ilibrary.org/docserver/tpg-2017-en.pdf?expires=1580823209&id=id&accname=ocid49014612&checksum=0465D173CEED90A136FA054047E36AB3` on page 36.

[5] See `https://www.pwc.com/gx/en/international-transfer-pricing/assets/itp-2013-final.pdf`

longer than other cases.[6] Such periods differ across countries, and closing such cases can take 10 years.[7] As the number of disputes is expected to increase in the future, understanding the impacts of longer periods to close cases is an important issue.

Among the possible impacts, this study focuses on an MNE's research and development (R&D) activity in product differentiation, which could enhance MNE's negotiation power against a tax authority. As the AL principle is difficult to apply when an MNE shifts profits via transfer prices on differentiated products or licensing payments for unique intangible assets, it is logical to conclude that MNEs have greater negotiation power. Indeed, there is some evidence of the connections between R&D and profit shifting. By using export price data in France and the UK, Davies et al. (2018) and Liu et al. (2019) showed the significant difference between transfer prices and AL prices and that transfer prices are more sensitive to tax changes for differentiated goods than homogeneous goods (e.g. Davies et al. (2018), Table 2). Belz et al. (2017) also pointed out that many R&D intensive firms have their subsidiaries in tax havens for tax avoidance via royalty payments. Moreover, Amiti and Khandelwal (2013) showed that a lower tariff encourages firms to upgrade their quality if the product varieties are close to the world frontier, and Fernandes and Paunov (2013) concluded that transportation costs have a negative and significant impact on product quality. These empirical outcomes suggest that the globalized world induces MNEs to invest in vertical product differentiation, magnifying the importance of the topic.

Notably, although we have observed a pattern of growing R&D investments globally, this is driven firms' incentives to enlarge their market share and by government's policy.[8] In the literature on industrial organization, the equilibrium R&D activities are suboptimal because firms ignore consumer benefits and possible impacts on other firms, such as technological spillovers. Thus, some countries provide R&D subsidies and/or tax incentives to spur firms' investments.[9] Technological progress is expected to drive economic growth, some policy-driven incentivization can be positively viewed. However, it is nontrivial whether such R&D policies are beneficial once we consider the

[6]See `https://www.oecd.org/tax/dispute/oecd-releases-new-mutual-agreement-procedure-statistics-and-country-awards-on-the-resolution-of-international-tax-disputes.htm`.

[7]For example, China, India, Japan, South Africa, and the US spent more than 40 months closing transfer price cases, although in some countries such as the Netherlands adn Switzerland, cases can take approximately 2 years. See `https://www.grantthornton.com/insights/articles/tax/2022/why-transfer-pricing-disputes-are-hard-to-resolve` and `https://practiceguides.chambers.com/practice-guides/transfer-pricing-2023/uk/trends-and-developments`.

[8]For example, the National Science Foundation shows that worldwide R&D expenditure rose from $336 trillion in 2009 to $451 trillion in 2016. Note that these numbers do not distinguish between "process" and "product" innovations. However, according to Scherer and Ross (1990), 3/4 of R&D expenditures by US firms are used for product R&D, indicating that expenditures on product differentiation is non-negligible. Moreover, Bagwell (2007) also reported examples of significant advertising spending by US firms that increase product differentiation. In 2003, $3.43 billion was spent by General Motors for cars and trucks, $3.32 billion was used for detergents and cosmetics manufactured by Procter and Gamble, and Pfizer devoted $2.84 billion to advertise its drugs.

[9]According to Appelt et al. (2019), out of 36 countries, the number of OECD countries with R&D tax incentives grew from 19 in 2000 to 30 in 2018. Bloom et al. (2019) also argued that some policies spur technological innovation.

link between product differentiation and MNE's negotiation power on transfer prices.

To this end, this study constructs an international duopoly model with one MNE and one local firm producing high- and low-quality products, respectively. The MNE has its own shell company in a tax haven to shift profit via transfer pricing on intangible assets such as its patents. Following Becker and Davies (2015), our model introduces negotiation between an MNE and a tax authority in a high-tax country over a transfer price. The MNE's negotiation power is specified with quality-gap independent and dependent terms. Based on the AL principle, the MNE's negotiation power increases as its investments in vertical differentiation increase because a wider quality gap makes it difficult for the tax authority to find proper AL prices. This link encourages the MNE to engage more in their investments in vertical product differentiation compared to the case without profit shifting.

As another important element, the model incorporates the costs of formal disputing closing processes to see the impact on the transfer price. Our model considers two processes to determine the transfer price: an informal negotiation and a formal process of closing a transfer pricing dispute.[10] First, both the MNE and the tax authority in a high-tax country negotiate the MNE's transfer price in an informal environment. If this negotiation succeeds, the MNE sets the transfer price and reports its taxable profits, while the tax authority collects tax revenues based on the reported profits. Alternatively, if the informal negotiation fails, they move to a formal process in a court to determine the transfer price. Formal negotiations are costly because court proceedings take a long time to resolve, requiring both the MNE and the tax authority to hire experts and prepare documents to justify their positions. Hence, greater time required for dispute resolution is regarded as greater potential costs that they need to take into account in an informal negotiation process.

In the negotiation game with two processes over a transfer price, the equilibrium transfer price is determined through an informal process comprised of (i) the expected transfer price in the formal process and (ii) the MNE's and tax authority's relative costs to gains in the formal process. The equilibrium transfer price increases with the MNE's negotiation power because the MNE has an advantage in informal negotiation and could enhance the transfer price to shift more profits. Moreover, the model shows that the greater costs of the formal process for both the MNE and the tax authority make them hesitate to move into a formal process and, thus, increase the impact of the negotiation power on transfer pricing.

One of the main findings is that the impacts of the higher costs of a formal process

[10] In reality, some MNEs and tax authorities determine transfer prices in informal negotiation processes. See `https://www.pwc.com/gx/en/international-transfer-pricing/assets/itp-2013-final.pdf`.

on the equilibrium transfer price vary depending on the initial level of its costs when the quality-independent negotiation term is low. When costs for the formal process are low, a marginally longer time to resolve the dispute reduces the transfer price. This is because low costs of a formal process diminish the MNE's and tax authority's incentive to agree on the level of transfer price in an informal negotiation; thus, the MNE is less likely to invest in product quality, increasing its negotiation power. In this case, the quality-independent part of negotiation power is crucial, and higher cost favor the tax authority, resulting in a smaller transfer price. However, as a higher cost of a formal process reduces their payoffs in a formal process, it increases such MNE's incentive to differentiate its product quality from the local firm to strengthen its negotiation power in an informal negotiation to increase transfer price and shift more profits. Therefore, even if the quality-independent negotiation power term is low, the quality-dependent negotiation power term grows and becomes sufficiently large under a high cost of a formal process. Hence, the transfer price increases with a higher cost of a formal process. The results imply that diminishing costs for a formal process is important to prevent MNEs from profit shifting.

Due to these ambiguous effects on transfer pricing, whether a marginal increase in the cost of a formal process increases the MNE's post-tax profits and tax revenues in a high-tax country also depends on the size of the costs. Importantly, as tax avoidance opportunities encourage the MNE to invest more in quality and subsequently the local firm, the tax base in the high-tax country could increase when a transfer price is low. Therefore, a small amount of the MNE's profit shifting may benefit the high-tax country. However, a sufficiently high cost of a formal process increases the equilibrium transfer price, leading to a dramatic drop in tax revenues.

In addition to the ambiguous effects on the MNE and tax revenues, the higher cost of a formal process positively impacts the local firm and consumers. Under the Bertrand model, greater MNE's investments in quality have positive spillover effects on the local firm. Furthermore, such quality upgrading for both firms benefits consumers. With the above effects, our numerical analysis finds there is an increasing pattern of welfare in the high-tax country as the cost of a formal process increases and quality upgrades are realized. However, if the high-tax country places extra weight on tax revenues, a marginal increase in the cost of a formal process under sufficiently high costs hurts the high-tax country due to a dramatic loss of tax revenue. The results imply that diminishing the cost of a formal process is an important policy target to mitigate tax revenue and welfare losses.

We also analyze the impact of R&D subsidy on welfare. According to the literature on R&D investment, the non-cooperative equilibrium investments are suboptimal because firms ignore spillover benefits to consumers and other firms. Therefore, providing a subsidy is likely to be

beneficial. However, due to the negative impact on tax revenues, our numerical examples show that such R&D subsidies could reduce welfare under a high cost of a formal process.

For the sake of comparison, we also argue that the MNE determines transfer price, which incurs a traditional concealment cost of transfer pricing. The basic results obtained in the modified model are the same, but it is noteworthy that the conditions for tax revenue and welfare losses from profit shifting are different. In the negotiation-based model, the equilibrium transfer price is higher as the cost of a formal process is high, and this is the case where welfare losses are likely to be significant. In the concealment-cost model, the equilibrium transfer price is higher when the cost of profit shifting is high, and profit shifting is difficult to achieve due to stronger enforcement of the AL principle, such as BEPS project. Hence, the traditional concealment-cost model indicates the importance of tightening transfer pricing regulations, whereas the new negotiation model emphasizes the importance of decreasing the cost of a formal process, such as having shorter periods to close disputes.

1.1 Related literature

This paper contributes to several fields of research. First, our model contributes to research on tax avoidance by MNEs. After Copithorne (1971) and Horst (1971), several authors have studied transfer pricing and profit shifting. Elitzur and Mintz (1996) showed the role of transfer prices as managerial incentives. Schjelderup and Sørgard (1997) pointed out another strategic purpose of manipulating transfer prices by assuming a decentralized MNE. Recent research focused on the AL principle by considering the interrelation between transfer pricing and other MNEs' strategies. Bauer and Langenmayr (2013), Choe and Matsushima (2013), Choi et al. (forthcoming), and Kato and Okoshi (2019) explored the impact of the AL principle on firms' FDI decisions, firms' incentive for tacit collusion, an MNE's licensing decision, and an MNE's location choice of input production, respectively.[11] However, these papers do not explicitly relate product differentiation to the ease of profit shifting.

One exception and the closest paper to the current paper is Okoshi (2021) which considers horizontal product differentiation in the traditional concealment cost model rather than vertical differentiation. The former focuses on differentiation based on personal preferences, such as tastes and designs, whereas the latter targets differentiation with clear rankings, such as quality.[12]

[11]There are other policies or international cooperation mechanisms to prevent MNEs from shifting profits across countries. For example, Nielsen et al. (2010) analyzed "separate accounting" and "formula apportionment", Haufler et al. (2018) explored controlled foreign company rules, and Gresik et al. (2017) considered "safe harbor rules" and "earning stripping rules."

[12]For example, Lin and Saggi (2002) investigated endogenous decision on horizontal R&D.

Therefore, the current paper provides additional insights from the viewpoint of vertical investment. Additionally, the current paper introduces a local firm whereas Okoshi (2021) investigates interaction between two MNEs, enabling us to assess the impact on a local firm. Moreover, the main analysis in our model is a negotiation-based model constructed by Becker and Davies (2015), which allows us to argue the impacts of costs of a formal process.

The second strand of literature related to this study is one exploring the optimal policy with endogenous choices of vertical product differentiation. Zhou et al. (2002) constructed a third-country market model with two firms from two different countries and analyzed the optimal policies from the perspective of a "strategic trade policy" discussion. Toshimitsu (2003) also analyzed the optimal policy in a closed economy using different types of market competition, namely, Bertrand versus Cournot competition, concluding that a subsidy for R&D is socially optimal under the Bertand competition. In contrast, a tax is the optimal policy under the Cournot competition. However, these papers ignore the tax avoidance of MNEs; thus it is impossible to draw conclusions about tax avoidance properties.

The rest of the paper is organized as follows. The next section explains the model and derives the equilibrium without profit shifting. Section 3 introduces a tax haven and develops a welfare analysis. Section 4 argues R&D subsidies and compares the main analysis with the traditional concealment-cost model. The last section concludes.

2 Model

We begin with our analysis without profit shifting, which is introduced in the next section. Consider a domestic country (country D) with three sectors: heterogeneous sector (sector X), homogeneous sector (sector Y), and public sector (sector G). The heterogeneous sector is characterized by a duopoly market structure with one local and one multinational firm, labeled firm L and M, while the homogeneous sector is assumed to be a perfectly competitive market. The government provides the public sector.

Government The government provides public goods in country D by using tax revenue from the country. Note that sector Y is perfectly competitive and has no tax base in the sector, whereas sector X is characterized by duopoly and a tax base arises. To collect tax revenue TR, the government levies an exogenously given positive tax rate t_D on the tax base. Let G be the amount of the public good provision. Then, the amount of the public good is equal to tax revenue, i.e., $G = TR$.

Consumers Consumers are vertically differentiated in their preference for product quality in the X sector. As in the extant literature, we assume that each consumer purchases either one or zero units of vertically differentiated, or different-quality products. Specifically, their type is characterized by $\theta \in [0, 1]$, and associated with the following utility function:

$$u(\theta, q_i) = \theta q_i \tag{1}$$

where $q_i \in [0, \infty)$ is the level of quality that firm i produces.

The utility function yields the following net utility from consuming product i,

$$V(\theta, q_i, p_i) = \theta q_i - p_i, \tag{2}$$

where p_i is the price of the product i. As consumers have their one-dimensional quality preference θ, we can derive a unique threshold that all consumers with larger θ buy high-quality products. As explained later, let us assume that firm M produces a higher quality good than firm L, i.e., $q_M > q_L$ holds. Then, the marginal consumer for the high-quality good is

$$V(\theta, q_M, p_M) \geq V(\theta, q_L, p_L), \iff \theta \geq \frac{p_M - p_L}{q_M - q_L} \equiv \theta_M.$$

Analogously, we obtain the threshold for a low-quality good against the non-purchase option as follows:

$$V(\theta, q_L, p_L) \geq 0 \iff \theta \geq \frac{p_L}{q_L} \equiv \theta_L.$$

These two types of information immediately provides us with the following demand function:

$$x_M = 1 - \theta_M = 1 - \frac{p_M - p_L}{q_M - q_L}, \quad \text{and} \quad x_L = \theta_M - \theta_L = \frac{p_M - p_L}{q_M - q_L} - \frac{p_L}{q_L}. \tag{3}$$

Consumers own the firms, and their income I consists of post-tax profits of the firms in sector X. For simplicity, we assume that all consumers have enough income to purchase one differentiated good if they want it. All the remaining incomes after purchasing differentiated goods are used to consume the homogeneous goods. We use sector Y as the numéraire sector, and the price of the homogeneous good is unity. Therefore, total consumption of homogeneous goods is $\widehat{y} = I - p_M x_M - p_L x_L$, where I represents total individual income equal to firms' net profits.

Consumers also gain from the public goods provision. The aggregate utility or welfare in

country D is

$$W = \int_{\theta_L}^{\theta_M} u(\theta, q_L) - p_L d\theta + \int_{\theta_M}^{1} u(\theta, q_M) - p_M d\theta + \Pi_M + \Pi_L + \gamma G, \tag{4}$$

where Π_i is post-tax net profits of firm i, and γ is preference parameter of the public good.

Firms The two firms produce vertically differentiated products for consumers in country D. The levels of their quality are endogenously determined by R&D activities. Let q_i be the investment level for quality and the resulting quality level of firm i. The investment cost is $F(q_i)$ with the following set of standard assumptions for the existence and uniqueness of the equilibrium: $F'(q_i) > 0$, $F''(q_i) > 0$, $F'''(q_i) \geq 0$, $F'(0) = 0$ and $F'(\infty) = \infty$.

To focus on the tax avoidance channel, both firms produce their goods with zero constant marginal cost $c = 0$, while their level of quality differs. In particular, we assume that the MNE produces a higher quality product than the local firm, $q_M > q_L$.[13] This is because as the MNE has an opportunity for tax avoidance and the fraction of operating profits is greater for the MNE than for the local firm, the MNE's budget for R&D investment is greater. Given the differentiation levels, the firms determine the amount of supplies and generate operating profits, denoted by π_i.

The sequence of the game is as follow. In the first stage, both firms decide the investment level. Given the quality investment level, firms compete in a Bertrand fashion and make operating profits. At each stage, their decisions are made simultaneously. We solve the two-stage game by backward induction. In this section, we begin the analysis without a tax haven and then introduce a tax haven in which the MNE owns a shell company and shifts some profits. The model is illustrated with Figure 1.

2.1 Equilibrium in Benchmark case

From eq.(3), firm i maximizes the following operating profits by choosing price p_i

$$\pi_M = p_M \left(1 - \frac{p_M - p_L}{q_M - q_L}\right), \qquad \text{and} \qquad \pi_L = p_L \left(\frac{p_M - p_L}{q_M - q_L} - \frac{p_L}{q_L}\right).$$

[13] One might be concerned that it is natural to assume producing high-quality goods entails higher cost. However, because MNEs tend to be more productive than national firms, both types of firms may have the same/similar marginal costs.

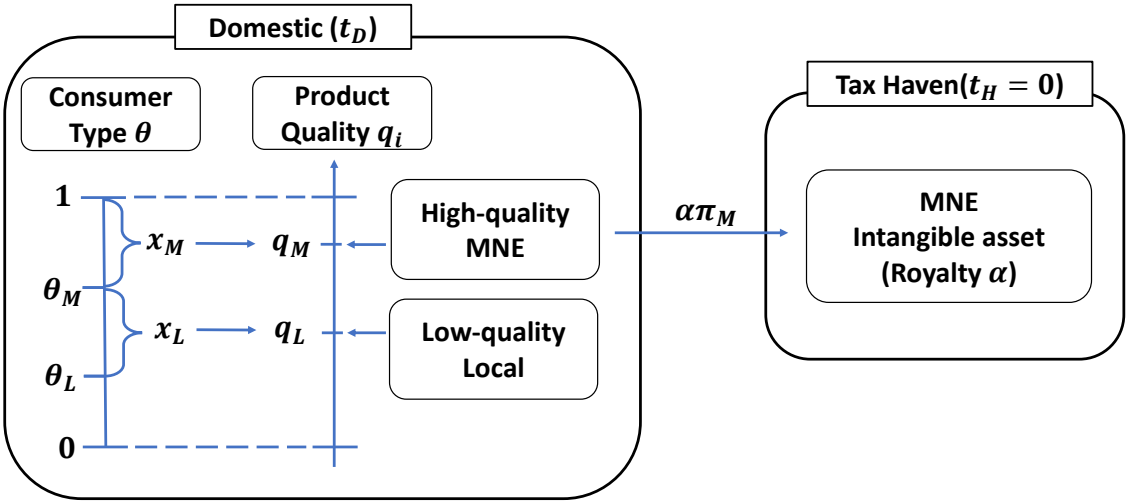

Figure 1: Model

By the first-order conditions, we obtain the following optimal prices,

$$p_M = \frac{2(q_M - q_L)q_M}{4q_M - q_L}, \qquad \text{and} \qquad p_L = \frac{q_L(q_M - q_L)}{4q_M - q_L},$$

and the consequent operating profits of the firms are,

$$\pi_M = \frac{4(q_M - q_L)q_M^2}{(4q_M - q_L)^2}, \quad \text{and} \quad \pi_L = \frac{(q_M - q_L)q_M q_L}{(4q_M - q_L)^2}. \tag{5}$$

As is known in the literature, $\frac{\partial \pi_M}{\partial q_M} = \frac{4q_M(4q_M^2 - 3q_M - q_L + 2q_L^2)}{(4q_M - q_L)^3} > 0$ always holds, meaning that a firm producing high-quality goods has an incentive to invest in quality upgrading to mitigate price competition. In addition, $\frac{\partial \pi_L}{\partial q_L} = \frac{q_M^2(4q_M - 7q_L)}{(4q_M - q_L)^3} > 0$ holds if and only if $q_M > \frac{7q_L}{4}$ holds. This is because quality upgrading by a low-quality firm has two conflicting effects. On the one hand, quality upgrades increase consumers' willingness to pay for the good; thus, the low-quality firm can increase its price. On the other hand, a narrower quality gap intensifies competition against the high-quality firm. Therefore, the low-quality firm is incentivized to upgrade its product quality when the quality gap is wide, and the first effect dominates the latter. Following the existing literature, we assume $q_M > \frac{7q_L}{4}$ throughout the analysis.

After the price decision, both firms determine their investment level by incurring investment

cost $F(q_i)$. Note that they also have to pay corporate tax, and the maximands are,

$$\Pi_M = (1 - t_D)\pi_M - F(q_M), \tag{6}$$

$$\Pi_L = (1 - t_D)\pi_L - F(q_L). \tag{7}$$

Let (q_M^*, q_L^*) be the equilibrium pair of qualities, which satisfy the following first-order conditions:

$$\frac{\partial \Pi_M}{\partial q_M} = (1 - t_D)\frac{\partial \pi_M}{\partial q_M} - F'(q_M) = 0, \tag{8}$$

$$\frac{\partial \Pi_L}{\partial q_L} = (1 - t_D)\frac{\partial \pi_L}{\partial q_L} - F'(q_L) = 0. \tag{9}$$

This first-order condition shows that the optimal investment qualities are based on the tax-adjusted marginal gain from investment and marginal cost of investment. As $\frac{\partial \pi_M}{\partial q_M} > \frac{\partial \pi_L}{\partial q_L}$ holds, we can easily confirm $q_M^* > q_L^*$.

3 Tax havens

This section introduces a tax haven (country H) into the model and the MNE's tax avoidance behavior. Following the extant literature, country H's tax rate is assumed to be zero, $t_H = 0$. In addition, as firm M makes greater net profits than firm L, only firm M is assumed to be able to have its shell company in country H due to the fixed costs of FDI and to engage in tax avoidance.

Profit shifting is conducted via royalty payments for patent technology. The MNE owns the firm-specific technology because of R&D activities. The property rights of the technology is relocated in the shell company, which collects royalty revenues by licensing the technology at the royalty rate.[14] Specifically, let $\alpha \in [0, 1]$ be the transfer price on intangible assets, namely the royalty rate; hence firm M can shift profits to $\alpha\pi_M$.[15] Therefore, the post-tax profits of firm M are

$$\Pi_M^T = (1 - t_D)(\pi_M - \alpha\pi_M) + \alpha\pi_M - F(q_M) = (1 - t_D)\pi_M + t_D\alpha\pi_M - F(q_M).$$

Following Becker and Davies (2015), we incorporate the MNE's tax avoidance behavior by considering a negotiation between firm M and a tax authority in country D. Formally, we add this negotiation process as the third stage of the game, which includes two sequences. First, firm M

[14]This pattern of relocating property rights into a low-tax country is empirically supported. See, for example, Dischinger and Riedel (2011), Karkinsky and Riedel (2012), and Griffith et al. (2014).

[15]This type of royalty is known as an ad valorem royalty, and is one of the most frequently used way instead of a fixed royalty or a unit rotalty (San Martín and Saracho, 2010). In the context of profit shifting, Choi et al. (forthcoming) also use this method in their theoretical analysis.

and the tax authority informally negotiate the transfer price (α^N). If they agree on the transfer price level, firm M's transaction on intangible assets are based on α^N and the post-tax profits of firm M and its tax payments to country D are determined. In contrast, if their negotiation fails, a transfer price is determined through a formal court process, denoted by α^C. Therefore, in the informal negotiation in the first process, both firm M and the tax authority discuss the level of transfer price α^N given their expectation of the levels of transfer price in a court α^C with their own beliefs.

The second step of the negotiation process is an official process in a court, which is costly for both firm M and the tax authority. Such costs of going to a court, preparing documents to justify their statements, or wasting their time to wait for the decision are captured by δ_f and δ_g. Moreover, α^C is a stochastic variable, and both firm M and the tax authority independently have their own expectations about the distribution function of α^C. Specifically, firm M believes that α^C is drawn from a distribution function $H(\alpha^U)$ with its associate density function $h(\alpha^C) = H'(\alpha^C)$, whereas the tax authority regards $G(\alpha^C)$ as a distribution function of α^C and $g(\alpha^C) = G'(\alpha^C)$ as the associated density function. Then, the expected post-tax profits of firm M and the expected tax revenue from firm M are

$$
\begin{aligned}
E(\Pi_M^C) &= (1 - t_D)\pi_M + t_D E_f(\alpha^C)\pi_M - F(q_M) - \delta_f \\
E(TR_{DM}^C) &= t_D \pi_M - t_D E_g(\alpha^C)\pi_M - \delta_g,
\end{aligned}
$$

where $E_f(\alpha^C) = \int_0^1 \alpha^C f(\alpha^C) d\alpha^C$ and $E_g(\alpha^C) = \int_0^1 \alpha^C g(\alpha^C) d\alpha^C$ are firm M's and the tax authority's expected value of the transfer price. Firm M has an incentive to shift more profits whereas the tax authority is eager to prevent the firm from shifting profits; thus, we assume $E_f(\alpha^C) > E_g(\alpha^C)$.

Given the expected payoffs at the second step, firm M and the tax authority informally argue about the level of the transfer price in the first step, and we solve the Nash bargaining game. Note that we assume that the tax authority maximizes tax revenues from firm M in the negotiation step because current trends of large social demands to prevent MNEs from tax avoidance behavior direct the tax authority to care about collecting more tax from the MNE. With this assumption, the Nash product is

$$
\max_{\alpha^N \in (0,1)} \quad \left[\Pi_M^T - E(\Pi_M^C)\right]^{\beta} \left[TR_{DM}^C - E(TR_{DM}^C)\right]^{1-\beta} \tag{10}
$$

where $\beta \in (0,1)$ is the bargaining power of firm M. To ensure that both terms of the Nash product are positive, we assume $\delta_f + \delta_g > t_D \pi_M \left(E_f(\alpha^C) - E_g(\alpha^C)\right)$. Recall that, as mentioned in the introduction, product differentiation makes the MNE's justification for deviating from the AL

price easier and increases firm M's negotiation power. Hereafter, we specify $\beta = \beta_0 + \beta_1(q_M - q_L)$.

By solving the Nash bargaining game, we derive the equilibrium transfer price as follows,

$$\widehat{\alpha}^N = \widehat{E}(\alpha^C) + \frac{\beta\delta_g}{t_D\pi_M} - \frac{(1-\beta)\delta_f}{t_D\pi_M} = \widehat{E}(\alpha^C) + \frac{\beta(\delta_f+\delta_g)-\delta_f}{t_D\pi_M}, \tag{11}$$
$$\text{where} \quad \widehat{E}(\alpha^C) = \beta E_g(\alpha^C) + (1-\beta)E_f(\alpha^C) = E_f(\alpha^C) - \beta\left(E_f(\alpha^C) - E_g(\alpha^C)\right)$$

represents the expected negotiation-power weighted transfer price. The equilibrium transfer price $\widehat{\alpha}^N$ has the following features. First, the equilibrium transfer price is composed of two components: the expected weighted transfer price captured by the first term and the weighted relative costs to gains from a formal process, $\frac{\beta\delta_g}{t_D\pi_M}$ and $\frac{(1-\beta)\delta_f}{t_D\pi_M}$, which are reflected in the second and third terms. Note that $E_f(\alpha^C) > E_g(\alpha^C)$ holds; thus, higher bargaining power of firm M decreases the expected weighted transfer price. Regarding the second component, if the relative costs are smaller for firm M, it can be more aggressive because its payoffs from the outside option in a formal process are large. Thus, the equilibrium transfer price becomes higher, $-\frac{\partial\widehat{\alpha}^N}{\partial\delta_f} > 0$. Similarly, a higher negotiation power of firm M makes the second component larger because firm M has an advantage in the negotiation, resulting in a higher transfer price. Analogously, a smaller relative cost of the tax authority for the official process reduces the equilibrium transfer price, $-\frac{\partial\widehat{\alpha}^N}{\partial\delta_g} < 0$, because the expected payoffs from the outside option in the formal process are large and the authority is aggressive in the informal negotiation.

Second, the transfer price is influenced by the negotiation power, and the equilibrium transfer price increases with firm M's negotiation power. Formally, we obtain,

$$\frac{\partial\widehat{\alpha}^N}{\partial\beta} = -\left(E_f(\alpha^C) - E_g(\alpha^C)\right) + \frac{\delta_f+\delta_g}{t_D\pi_M} > 0. \tag{12}$$

The negotiation power has an impact through two channels. As explained above, more negotiation power of firm M decreases the expected weighted transfer price $\frac{\partial\widehat{E}(\alpha^C)}{\partial\beta} < 0$. In contrast, a higher negotiation power of firm M increases the relative costs of an official negotiation process. However, due to the assumption that the total costs for a formal process are large, and, thus, the latter effect dominates the former and an increase in firm M's negotiation power increases the transfer price.

With the equilibrium transfer price, the post-tax profits of the MNE are pinned down as

$$\Pi_M^T = \left(1 - t_D + t_D\widehat{E}(\alpha^C)\right)\pi_M + \underbrace{\beta\delta_g - (1-\beta)\delta_f}_{\text{Negotiation gains}} - F(q_M). \tag{13}$$

Due to the new terms, the first-order condition for the MNE's investment decision is modified as follow:

$$\frac{\partial \Pi_M^T}{\partial q_M} = (1-t_D)\frac{\partial \pi_M}{\partial q_M} - F'(q_M) + \underbrace{t_D E(\widehat{\alpha}^C)\frac{\partial \pi_M}{\partial q_M}}_{\text{Profit shifting gains}} + \underbrace{t_D \pi_M \frac{\partial \widehat{\alpha}^N}{\partial \beta}\frac{\partial \beta}{\partial q_M}}_{\text{Negotiation power channel}} = 0 \tag{14}$$

Compared with the case without a tax haven, two additional channels appear in the presence of a tax haven, which are represented in the third and fourth terms of eq.(14). First, as the MNE now saves $E(\widehat{\alpha}^C)\%$ of its tax payments, the profit-shifting-gains from its investment increase. Second, product differentiation increases firm M's negotiation power, affecting the decision on R&D investment. Note that the sign of $\frac{\partial \widehat{\alpha}^N}{\partial \beta}$ is positive.

As there is a spillover effect of a change in firm M's investment to the local firm, we have the following lemma.

Lemma 1. The opportunity of profit shifting increases both firms' investment in product R&D.

Proof. As the third and fourth terms in eq.(14) are positive, eqs.(8) and (14) means $q_M^T > q_M^*$ where q_M^T is the equilibrium investment level of firm M. In addition, as $\frac{\partial^2 \pi_L}{\partial q_M \partial q_L} = \frac{2q_L q_M(8q_M+7q_L)}{(4q_M-q_L)^4} > 0$ holds, the first term in eq.(9) increases and, thus, $q_L^T > q_L^*$ holds where q_L^T is the equilibrium investment level of firm L. □

This lemma conforms to and provides a new rationale for what was argued in the introduction. In the literature on international trade, reduction in trade costs, such as lower tariffs or transportation costs, leads to quality upgrading. Our model indicates that observed quality upgrading is promoted by increasing the opportunities for tax avoidance.

The core mechanism of the proposition is similar to the findings of Toshimitsu (2003) that considers firm-specific policies. In his paper, a firm-specific policy is considered, and subsidizing a high-quality firm results in quality upgrading in both firms under Bertrand competition. In our model, tax avoidance works as if it is a high-quality firm-specific R&D subsidy.

3.1 Comparative statistics on costs for a formal process

Thus far, we regarded δ_f and δ_g as costs for a formal process, and the equilibrium transfer price crucially depends on the costs. The costs include administration and documentation costs for a court, and a larger δ is interpreted as a longer time for trials. As argued in the introduction, resolving transfer pricing disputes is time consuming, and examining the impacts of such costs is

important. For simplicity, we assume that the size of the cost of a formal process is the same for both the MNE and tax authority, $\delta_f = \delta_g \equiv \delta$.

First, let us consider the direct effect of δ on firm M's decision on investment, which is pinned down with eq.(14). In the first-order condition, the costs of the formal process affect the negotiation power channel, namely, $\frac{\partial}{\partial \delta}\left(\frac{\partial \widehat{\alpha}^N}{\partial \beta}\right) = \frac{2}{t_D \pi_M} > 0$. This means that an increase in δ increases the marginal benefits from investing in product differentiation and, thus, induces more R&D investment by firm M, $\frac{\partial q_M}{\partial \delta} > 0$. This is because higher costs for the formal process make both firm M and the tax authority hesitate to move to the formal process; thus, the negotiation power in the informal process becomes more important.

Next, we now consider how a change in δ influences the equilibrium transfer price. By differentiating eq.(11), we obtain

$$\begin{aligned}\frac{\partial \widehat{\alpha}^N}{\partial \delta} &= \frac{\partial \widehat{\alpha}^N}{\partial \delta} + \frac{\partial \widehat{\alpha}^N}{\partial \beta}\frac{\partial \beta}{\partial q_M}\frac{\partial q_M}{\partial \delta} + \frac{\partial \widehat{\alpha}^N}{\partial \beta}\frac{\partial \beta}{\partial q_L}\frac{\partial q_L}{\partial q_M}\frac{\partial q_M}{\partial \delta} \\ &= \frac{2\beta - 1}{t_D \pi_M} + \beta_1 \frac{\partial \widehat{\alpha}^N}{\partial \beta}\left(1 - \frac{\partial q_L}{\partial q_M}\right)\frac{\partial q_M}{\partial \delta} \end{aligned} \tag{15}$$

As the first line shows, three channels arise. As a direct effect, a high cost of a formal process reduces the negotiation power of both firm M and the tax authority. If the negotiation power of firm M is larger (smaller) than 0.5, a higher cost of a formal process favors the MNE (tax authority), and thus, increases (decreases) the equilibrium transfer price. In addition to the direct effect, there are indirect effects in which a larger δ influences firm M's investment, subsequently affecting firm L's investment. Note that these two indirect effects have opposing outcomes on each other: An increase in firm M's investment increases firm M's negotiation power but that in firm L's R&D decreases firm M's negotiation power. However, as the impact on firm L is secondary, the sum of the indirect effects is positive.

In total, the sign of $\frac{\partial \widehat{\alpha}^N}{\partial \delta}$ is ambiguous. Regarding this ambiguity, we have the following proposition.

Proposition 1. Suppose the cost of a formal process between an MNE and a tax authority is the same for both, $\delta_f = \delta_g = \delta$. A higher cost of the formal process encourages the MNE and local firm to invest more in quality. In addition, if firm M's negotiation power is greater than 0.5, a larger δ increases $\widehat{\alpha}^N$. However, if it is smaller than 0.5, the effect of δ on $\widehat{\alpha}^N$ is ambiguous.

Proposition 1 is drawn in Figure 2 with $\beta = 0.2 + (q_M - q_L)$.[16] The solid curve shows the

[16]The following set of parameters is used: $t_D = \frac{3}{10}$, $E_f(\alpha^C) = \frac{1}{5}$, $E_g(\alpha^C) = \frac{1}{10}$, $\beta_0 = \frac{1}{5}$, $\beta_1 = 1$, $F(q_i) = \frac{3q_i^2}{10}$. The parameters are used also for Figure 3.

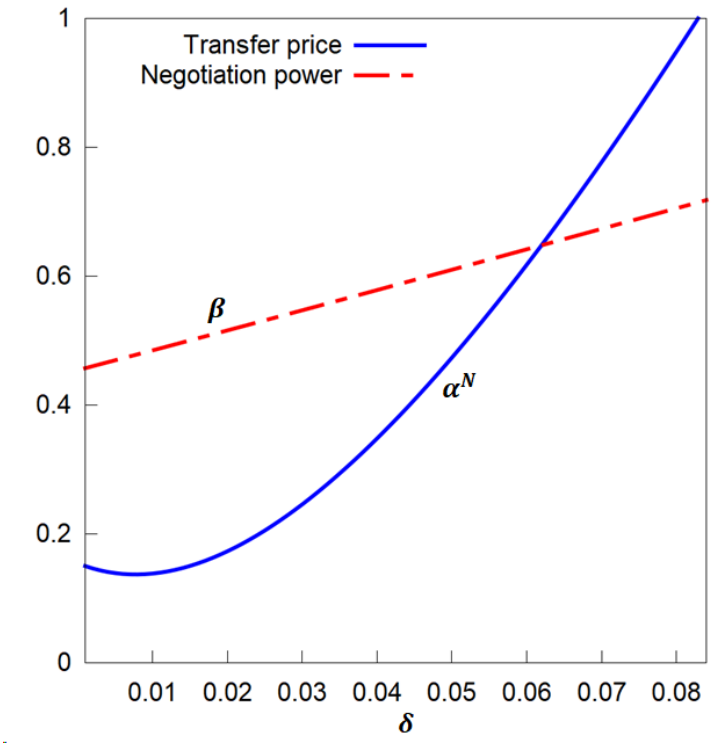

Figure 2: Transfer price and negotiation power

equilibrium transfer price, whereas the dashed curve represents the subsequent negotiation power over different sizes of costs for a formal process. With the, dashed curve, we observe a monotonic pattern of the effect of δ on firm M's negotiation power. Recall that a larger δ induces firm M's investment and subsequently firm L's investment. As the subsequent increase in firm L's investment is a second effect, the main effect via an increase in firm M's investment on its negotiation power dominates the opposing effect of an increase in firm L's investment.

Furthermore, the solid curve representing the equilibrium transfer price is U-shaped, as Proposition 1 shows. With low costs for a formal process, firm M's investment is not large and its negotiation power is low. Therefore, an increase in δ favors the tax authority, thus decreasing the transfer price. However, with a sufficiently large δ leading to firm M's large investment and its high negotiation power, an increase in δ favors firm M. Additionally, under a large δ, the indirect effects via changes in investments in product differentiation also drive the transfer price up due to a higher negotiation power caused by huge quality gap.

This proposition adds new insight into the effect of δ on the transfer price to the finding of Becker and Davies (2015). Proposition 2 of Becker and Davies (2015) indicates that the distribution of bargaining power between the MNE and the tax authority is an important element in identifying the effects of lower costs for the formal process. In our model, however, the MNE's bargaining power

increases in the costs of the formal process, and the MNE has a strong negotiation power. Therefore, the non-monotonic impacts of δ are obtained. This result provides an important discussion on action 14 of BEPS about mutual agreement procedure. This action aims to improve resolving tax-related disputes between jurisdictions, including transfer pricing. As BEPS 14 is expected to lower the costs of the formal process, it is important for policy makers to consider the interlink between MNEs' incentive to invest in product differentiation and the distribution of negotiation power.

3.2 Welfare

Because of such ambiguous impacts on the equilibrium transfer price, investigating impacts on firm M and tax revenues are also important. Figure 3 illustrates these effects. The solid curves show firm M's post-tax profits and tax revenues in the presence of a tax haven, whereas the dashed lines capture those without a tax haven. Regarding firm M's post-tax profits, a change in δ affects in two ways: the transfer price and investment in quality. As a higher transfer price helps the MNE save tax payments and is beneficial for it, the higher (lower) transfer price increases (decreases) the post-tax profits. In addition, an increase in firm M's quality increases the operating profits of firm M. Therefore, the solid curve is U-shaped and above the post-tax profits without profit shifting.

Regarding tax revenue in country D, $TR = t_D \left\{ \left(1 - \widehat{\alpha}^N\right) \pi_M + \pi_L \right\}$, there are three channels in response to a change in δ. First, contrary to the impact on firm M, a lower transfer price keeps firm M's tax base higher in country D and is desirable. Hence, an inverse U-shaped curve is observed. Furthermore, increases in both firms' investment boost their operating profits. Therefore, compared to the case without a tax haven, it is possible that country D benefits from tax avoidance via an increase in firms' tax bases. In the figure, this is shown in an intermediate range of δ where the solid curve is above the dashed line.

The effects of δ on firm M and tax revenues are ambiguous. In contrast, we confirm the clear impacts of a higher cost of a formal process on other welfare components, namely, consumer surplus and local firm's profits. We can develop consumer surplus as follows;

$$CS = \int_{\theta_L}^{\theta_M} \theta q_L - p_L d\theta + \int_{\theta_M}^{1} \theta q_M - p_M d\theta = \frac{q_M^2 (4q_M + 5q_L)}{2(4q_M - q_L)^2}. \tag{16}$$

With the assumption $q_M > \frac{7q_L}{4}$, $\frac{\partial CS}{\partial q_i} > 0$ holds. Moreover, regarding the local firm, we have $\frac{\partial \pi_L}{\partial q_L} > 0$ and $\frac{\partial^2 \pi_L}{\partial q_M \partial q_L} > 0$. Therefore, policies stimulating quality upgrading benefit consumers and the local firm.

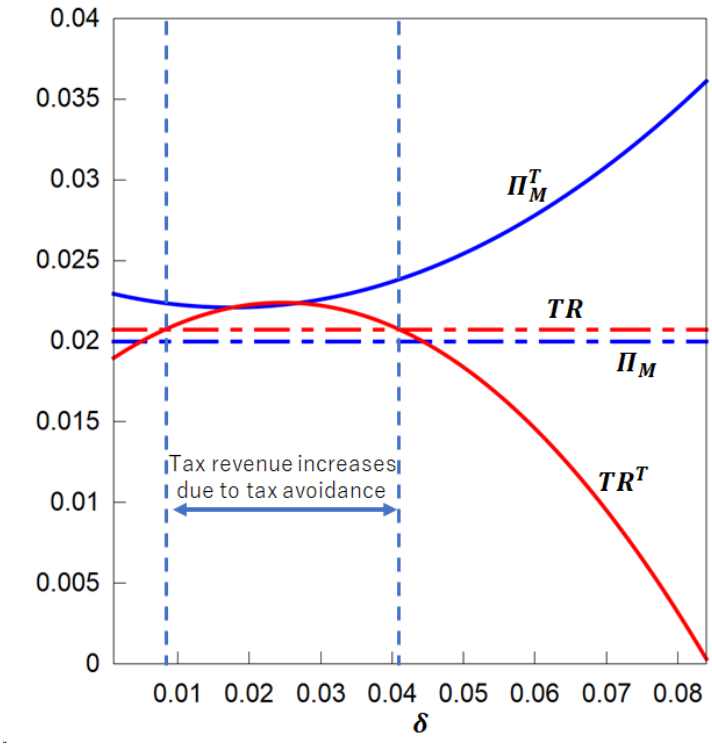

Figure 3: MNE's post-tax profits and tax revenues

Here, let us clarify welfare in country D. Based on eq.(4), welfare is rewritten as

$$W = \frac{q_L x_L(\theta_M + \theta_L)}{2} + \frac{q_M x_M(1+\theta_M)}{2} + (\gamma - 1)t_D \left\{ \left(1 - \widehat{\alpha}^N\right) p_M x_M + p_L x_L \right\} - \{F(q_M) + F(q_L)\} + I. \tag{17}$$

Figure 4 depicts welfare effects of δ with different marginal weights on public goods with $\gamma = 1$ for the left figure and $\gamma = \frac{7}{5}$ for the right one.[17] The solid (dashed) curves in each figure show consumer surplus and total welfare in country D in the presence (absence) of a tax haven. The left figure shows upward curves for both consumer surplus and total welfare, even though the marginal increase in total welfare decreases over δ. This decline in the marginal increase in total welfare is due to a reduction in tax revenue if the weight on public goods is equally valued as consumers surplus and firms, $\gamma = 1$. Importantly, the right figure with a larger weight on public goods, $\gamma = \frac{7}{5}$, shows that welfare in country D is hump-shaped. Therefore, if a government has a larger weight on public goods, a higher cost of the formal process reduces the weighted welfare under a large δ.

[17] We use the same parameter values as in Figure 2 and 3.

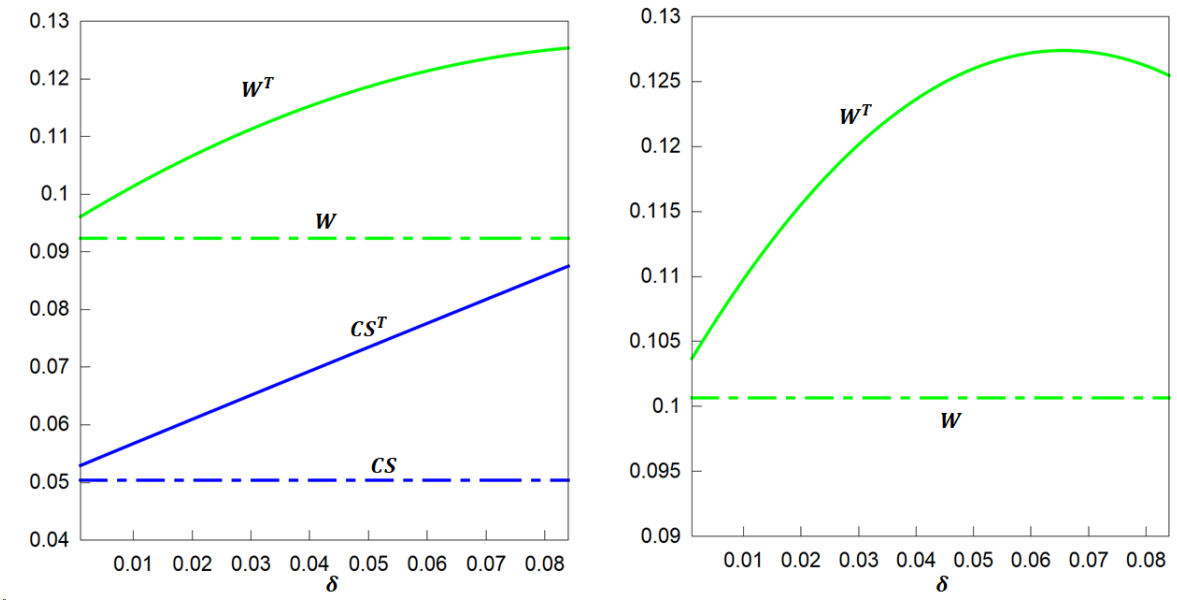

Figure 4: Welfare effects

4 Discussion

We have investigated the ambiguous effect of the costs of a formal process on the transfer price, which leads to some new results. In this section, we discuss two aspects: the role of R&D subsidy and comparing the benchmark analysis with the traditional method of incurring concealment costs instead of the informal negotiation process.

4.1 Fixed R&D subsidy

As we already saw, firms ignore benefits outside them and the R&D subsidy could be a beneficial policy, although such a policy complicates applying the AL principle and, thus, may be harmful. This section explores how the cost of the formal process affects welfare outcomes in the presence of R&D subsidies.

Following Toshimitsu (2003), the government offers the R&D policy such that the government pays $s(\in [-1,1])$ portion of R&D costs to firm i as a subsidy. If s is negative, the policy represents an R&D tax. The subsidy is financed by tax revenues in the industry.

In Figure 5, two curves illustrate the weighted welfare in the high-tax country with $\gamma = \frac{7}{5}$.[18] The solid curve shows the welfare level without a subsidy, $s = 0$, whereas the dotted curve draws that with $s = 0.1$. As the dotted curve is above the solid one under small δ, the R&D subsidy is beneficial for the country. This is because the positive impacts of R&D subsidy on consumers and

[18]We use the same parameter values as in the previous figures.

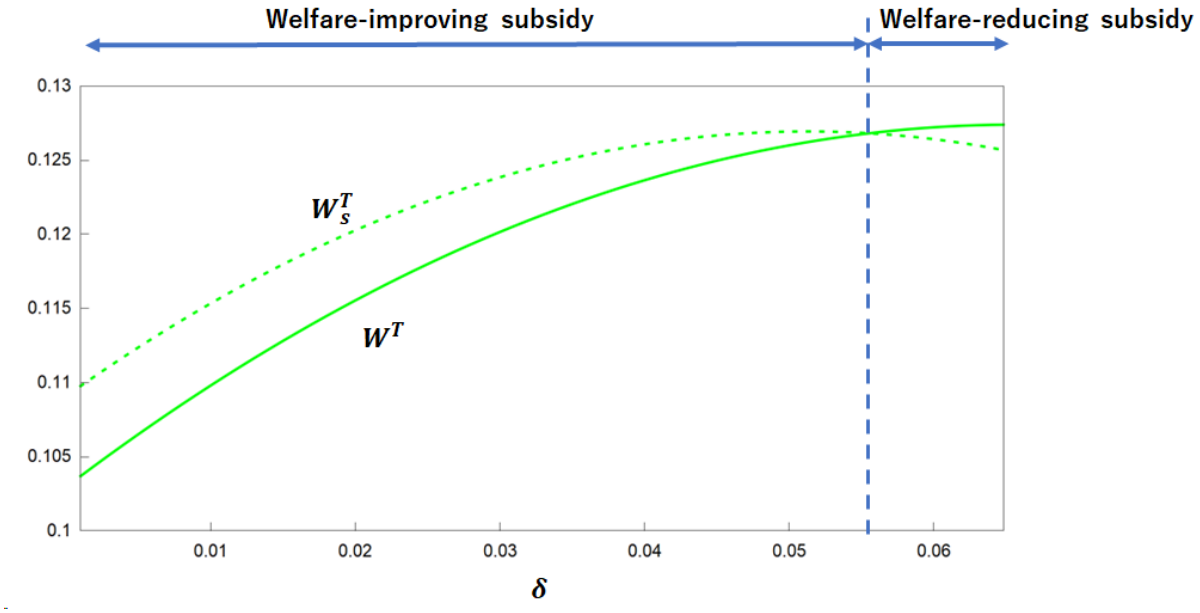

Figure 5: Welfare effects with R&D subsidy

their rival firms are dominant. In contrast, under a large δ, the policy induces firm M to invest more in its quality and obtain a higher negotiation power, reducing tax revenues and welfare. This result implies that, if the country places extra weight on the public goods, an R&D subsidy is likely to be harmful when the cost of a formal process is high.

4.2 Concealment cost

In the benchmark analysis, we consider the negotiation game to derive the equilibrium negotiated transfer price and the impact of costs in a formal process. To understand the model's features, this subsection considers the traditional approach by introducing a concealment cost of transfer pricing. See Appendix A for the detailed computation.

Profit shifting raises costs to justify the decision on transfer pricing, which is known as concealment costs in the literature. For example, concealment costs include wages and rewards for hiring experts such as lawyers and consultants to prepare documents for transfer pricing regulations. As justifying transfer pricing becomes more difficult as the firm tries to shift more profits, rewards to the experts must increase to provide them incentives to exert the necessary effort.[19] To reflect this,the following form of concealment costs is introduced,

$$C(\eta, \alpha) = \frac{\eta \alpha^2 \pi_M}{2} \tag{18}$$

[19]Alternatively, concealment costs can be interpreted as the expected penalties due to audits by tax authorities.

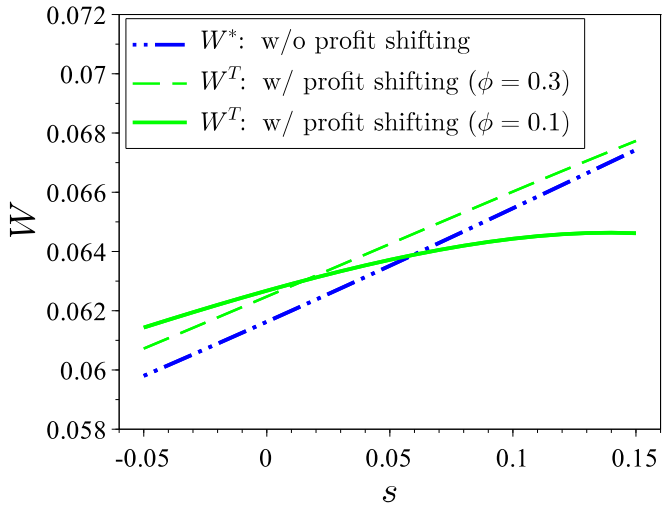

Figure 6: Welfare effects with R&D subsidy under concealment-cost model

where η is a measure of the difficulty of profit shifting.

We modify the concealment cost by introducing a quality difference based on the property of the AL principle. As argued in the introduction, it is difficult for tax authorities to find proper AL prices; thus, profit-shifting cost increase.[20] To reflect this property, we decompose η into two elements: the enforcement level of transfer pricing ϕ and the difference in the qualities of the goods $(q_M - q_L)$. For simplicity, η is assumed to be $\eta = \frac{\phi}{q_M - q_L}$. This specification means that a larger ϕ represents stricter enforcement of international cooperation such as the BEPS project, whereas a wider quality gap makes applying the AL principle more difficult and profit shifting easier.[21]

The modified model qualitatively reproduces the same results as the benchmark model. One notable result from the modified model is to see when an R&D subsidy harms the high-tax country. Figure 6 illustrates welfare under the concealment-cost model with different levels of ϕ and $\gamma = \frac{3}{2}$.[22] The double dots-dashed curve shows the case without profit shifting, $\phi = \infty$, whereas the dashed (solid) curve depicts the case with profit shifting under a stricter (looser) enforcement of transfer pricing regulation, $\phi = 0.3$ ($\phi = 0.1$). Comparing the double dots-dashed and dashed curves illustrates the benefit of firm M's tax avoidance at any level of R$D policies. This is because R&D investments are suboptimal without tax avoidance, and tax avoidance change works as the

[20] In reality, tax authorities frequently rely on the Transactional Net Margin Method to audit tax avoidance. Under this method, tax authorities compare an MNE's profit level indicator, such as a ratio of net profit, to an appropriate indicator of a reference firm. Thus, we can also interpret a wider quality gap as less likely when that the low-quality firm is chosen as a reliable reference firm.

[21] In this study, we do not endogenize a government's enforcement level of regulation by a government. See Hindriks and Nishimura (2021) for the endogenous choice of regulation.

[22] We use $t_D = 0.3$ and $F(q_i) = \frac{q_i^2}{2}$.

MNE-specific R&D subsidy.

However, when the enforcement of transfer pricing regulation is very loose, namely $\phi = 0.1$, the solid curve is even below the double-dots-dashed curve with a generous R&D subsidy, meaning an R&D subsidy results in lower welfare under the case without profit shifting. Intuitively, the reason is that firm M's investment in its quality is substantial and easily shifts profits to the tax haven, making it difficult for country D to collect tax revenues. The result indicates that, when an R&D subsidy is provided to spur firms' R&D investment, tightening transfer pricing regulations mitigates outflows of tax revenue and tends to benefit the high-tax country, whereas the benchmark analysis implies that diminishing the cost of a formal process is important.

5 Concluding remarks

Under globalization, we have observed quality upgrading and tax avoidance in parallel. To prevent MNEs' profit shifting, countries have cooperated internationally through stricter enforcement of transfer pricing regulations. However, because of the AL principle stipulated in the OECD guideline, product differentiation appears to affect MNEs' negotiation power against tax authorities because applying the AL principle is difficult. Hence, sometimes transfer pricing sometimes results in disputes, and closing such disputes is time consuming.

In this paper, we have constructed the negotiation based transfer pricing model to observe the effects of longer periods and equivalently higher costs of a formal process on the negotiated transfer price in an informal negotiation process. The equilibrium transfer price has two determinants: the expected transfer price in a formal process and an MNE's and a tax authority's relative costs to gains from the formal process. The transfer price increases with the MNE's negotiation power and the tax authority's relative costs for the formal process but decreases with the MNE's relative costs for the formal process. Note that a higher cost of the formal process makes the tax authority and MNE hesitate to proceed with a formal process, which reflects their aggressiveness in an informal negotiation.

One of the main findings is that, when the MNE's negotiation power is small, the marginal impact of the formal process's cost depends on the cost level. If the cost is sufficiently small, the MNE invests less in its quality because the outside payoffs under a formal process are still large and its incentive to increase its negotiation power by quality upgrading is weak. In this case, a higher cost of the formal process favors the tax authority and the equilibrium transfer price becomes lower. Under a high cost of the formal process, however, MNE's investment is substantial because it

strengthens its negotiation power. With such strong negotiation power, a higher cost of the formal process favors the MNE; thus, diminishing the cost of the formal process prevents MNEs from avoiding taxes.

Such ambiguous effects of the cost influences tax revenues and welfare in a high-tax country. Notably, as the chance of tax avoidance encourages the MNE to invest more in its quality and positively spills overs onto a local firm, a slight level of tax avoidance can increase tax revenue. In addition, such an increase in R&D activities by firms generates welfare gains for consumers and firms, and welfare in the high tax country increases at the expense of tax revenue. As the decline in tax revenue is drastic under the high costs of the formal process, the marginal increase in welfare of the formal process decreases. In particular, if the country places extra weight on tax revenue, the marginal effect of a higher cost of the formal process decreases its weighted welfare.

Moreover, our numerical analysis of the R&D subsidy shows that the R&D policy is not always beneficial for the high-tax country when the country places extra weight on it. This is simply because the MNE invests substantially in its quality under a sufficiently high cost of the formal process, and tax revenue losses are quite large.

We can qualitatively reproduce the same results under the traditional concealment-cost model. One important difference is the condition that an R&D subsidy is harmful for the high-tax country with the extra weight. In the concealment-cost model, R&D subsidy is welfare-reducing when the enforcement of transfer pricing regulation is loose, whereas the negotiation-based model showed that a higher cost of the formal process is a crucial factor. The results indicate an additional important policy implication that not only tightening transfer pricing regulation represented by the BEPS project but also diminishing the cost of the formal process are desirable to mitigate the tax avoidance problem in the globalized world.

Although this paper provides some new insights, several future research directions remain. First, as governments sometimes compete for MNEs' R&D activities, it is important to introduce competition between governments. Second, as globalization also induces firms to offshore upstream high-tech inputs, considering vertically related industries can be interesting. Moreover, it is essential to empirically investigate the link between product differentiation and tax avoidance.

Appendices

A. Concealment cost approach

Given the concealment cost, the stage game is modified by adding a profit-shifting phase in the last stage. In this stage, firm M determines α to maximize the following post-tax profits;

$$\Pi_M^T = (1-t_D)(\pi_M - \alpha\pi_M) + (1-t_H)\alpha\pi_M - F(q_M) - \frac{\eta\alpha^2\pi_M}{2},$$

which yields the following optimal transfer price;

$$\widehat{\alpha} = \frac{t_D}{\eta} = \frac{(q_M - q_L)t_D}{\phi}. \tag{19}$$

The optimal transfer price increases if the tax rate in country D is higher because the benefits from tax avoidance are greater. In contrast, the optimal transfer price decreases if transfer mispricing is difficult either due to stronger tax enforcement (larger ϕ) or a narrower quality gap (smaller $q_M - q_L$).

By substituting the optimal transfer price, the equilibrium post-tax profits of firm M are,

$$\Pi_M^T = \left(1 - t_D + \underbrace{\frac{(q_M - q_L)t_D^2}{2\phi}}_{\text{Tax saving gains}}\right)\pi_M - F(q_M), \tag{20}$$

whereas the maximand of firm L is the same as eq.(7). The new post-tax profits of firm M have an additional term in the parenthesis that captures tax saving gains. Due to the new term, the first-order condition for the MNE's quality decision is also modified as follows;

$$\frac{\partial\Pi_M^T}{\partial q_M} = (1-t_D)\frac{\partial\pi_M}{\partial q_M} + \underbrace{\frac{(q_M - q_L)t_D^2}{2\phi}\frac{\partial\pi_M}{\partial q_M}}_{\text{Profit shifting gains}} + \underbrace{\frac{t_D^2}{2\phi}\pi_M}_{\text{Differentiation gains}} - F'(q_M) = 0. \tag{21}$$

The second term in the above equation captures an additional incentive for quality upgrading because more operating profits remain in the firm. We refer to this gains as "profit shifting gains". The third term captures the gains from wider quality gap to make profit shifting less costly, which is referred to as "differentiation gains". These two additional gains clearly increase the MNE's investment. Let q_i^T be the equilibrium quality level of firm i. Therefore, $q_M^T > q_M^*$ holds.

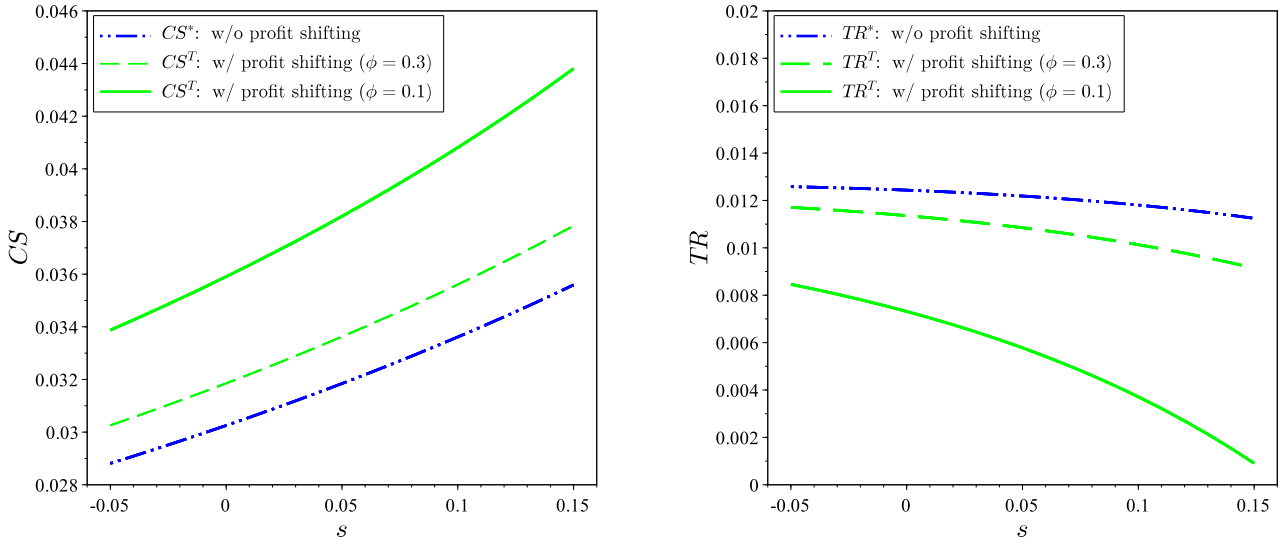

Figure 7: Consumer surplus and tax revenue

Given the higher new quality of the MNE, we can also see quality upgrading for firm L. This is because an increase in the quality of the MNE mitigates market competition, and thus results in greater operating profits of firm L, or $\frac{\partial \pi_L}{\partial q_M} > 0$. Hence, we obtain $q_L^T > q_L^*$.

Figure 7 illustrates policy effects on consumers and tax revenue, respectively.[23] The left of Figure 7 shows the effect of the subsidy on consumers, whereas that on tax revenues is drawn on the right side. In each figure, three curves are depicted; the blue dotted one represents the case without profit shifting, and the green dashed and solid curves show the cases with profit shifting under different regulation levels.

From the left figure, we can also see the upward sloping curves, showing that R&D subsidy benefits consumers. Moreover, at any subsidy level, the solid curve is the highest among the three, but the dotted curve is located at the bottom, meaning that looser enforcement of transfer pricing regulation benefits consumers. This is intuitive as more opportunities for profit shifting boosts R&D by both firms.

The tax revenues are computed as,

$$TR = t_D \left\{ \left(1 - \frac{t_D(q_M - q_L)}{\phi} \right) \pi_M + \pi_L \right\} - sF(q_M) - sF(q_L). \tag{22}$$

Quality upgrading driven by the opportunities of tax avoidance has three effects on tax revenue.

[23] We use the following parameter values: $t_D = 0.3$ and $F(q_i) = \frac{q_i^2}{2}$.

First, operating profits of both firms increase because of less market competition. Second, however, such increases in R&D costs increase R&D subsidies which, in turn, reduce tax revenues. Moreover, as the main tax avoidance influences the MNE whereas the local are impacted indirectly, the quality gap increases and the MNE's tax base outflows more.

The locations of the three curves on tax revenues are completely reversed; the dotted line lies at the top and the solid line is at the bottom. Hence, although profit-shifting opportunities increase the operating profits of firms, tax revenues decrease and stricter enforcement of transfer pricing regulations increases tax revenue at any level of R&D subsidy, as expected. In addition, these two negative effects decrease tax revenues as the government provides greater R&D subsidies.

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