Quality upgrading for tax avoidance*

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Abstract

Governments sometimes incentive firms to upgrade their quality of goods but such a policy makes it difficulty to collect tax revenue from multinational enterprises (MNEs) because the application of the arm's length principle is hard. Thus, with tax avoidance opportunities, results of the optimal policy for R&D is in question. This paper links the innovation for quality upgrading with profit shifting. As the opportunities of tax avoidance increases gains from an MNE's investment in quality, it contributes to quality upgrading, which spillovers to a local firm. Moreover, the optimal policy for firms' investment is to give subsidy without profit shifting, which is in line with Toshimitsu (2003). However, the optimal policy is to impose tax on R&D activities if profit shifting is easy and does not cost the MNE a lot.

Keywords: Tax avoidance; Vertical differentiation; The arm's length principle

JEL classification number: F23; H26; L13

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1 Introduction

As globalization proceeds, recent evidence has shown an increase in research and development (R&D) expenditure and remarkable technological progress. For example, National Science Foundation shows that worldwide R&D expenditure rose from $336 trillion in 2009 to $451 trillion in 2016.[1] Moreover, Bagwell (2007) also reports examples of large spendings on advertisement by U.S. firms which serve to increase product differentiation. In 2003, $3.43 billion was spent by General Mortors for cars and trucks, $3.32 billion was used for detergents and cosmetics manufactured by Protecter and Gamble, and Pfizer devoted $2.84 billion to advertise its drug. From the viewpoint of international trade, some empirical research have found links between trade liberalization. Amiti and Khandelwal (2013) shows that lower tariff encourages firms to upgrade their quality if the product varieties are close to the world frontier, and Fernandes and Paunov (2013) also conclude that transportation costs have a negative and significant impact on product quality. These empirical outcomes suggest that firms' investments are one of the most important strategies to survive in the globalized market.

The increase in R&D activities may be outcome of governments' policy designs. According to Appelt et al. (2019), the number of OECD countries with R&D tax incentives grew from 19 in 2000 to 30 out of 36 countries in 2018. Bloom et al. (2019) also argue some policies to spur technological innovation. As these technological progress are expected to result in economic growth, these kinds of policy-driven incentivization can be positively viewed.

From the viewpoint of international taxation, however, technological progress also causes a problem to make it difficult to collect corporate tax from multinational enterprises (MNEs). By the nature of intangible assets, one of the frequently used tax avoidance strategies of MNEs is to relocate their intangible assets such as patent rights and trademarks and collect profits in tax haven countries.[2] Belz et al. (2017) pointed out that a lot of R&D intensive firms have their subsidiaries in tax havens for tax avoidance via royalty payments. As relocation of intellectual property rights are easy, technological innovation increases MNEs' opportunities of profit shifting by creating new intangible assets.

Moreover, technological upgrading exacerbates MNEs' profit shifting because auditing their tax avoidance behaviour becomes harder. To prevent MNEs from avoiding taxes, manipulation of prices

[1] Note that these numbers does not distinguish "process" and "product" innovations. However, according to Scherer and Ross (1990), 3/4 of R&D expenditures by U.S. firms' are used for product R&D, which indicates that the expenditure on product differentiation is non-negligible.

[2] See Juranek et al. (2018) and Choi et al. (2019) for royalty payments. Other channels of profit shifting include internal debt or interest payment, and intra-firm trade. See, for example, Hong and Smart (2010) on the former and Kato and Okoshi (2019).

on intra-firm transaction, or transfer price, is regulated with OECD guideline. In the guideline, transfer price should be the one used in inter-firm transaction, or arm's length (AL) price, which is called the AL principle.[3] Following the principle, tax authorities try to audit MNEs' tax avoidance behaviour by comparing the transfer price with the AL price from comparable uncontrolled transactions. However, finding proper AL price is difficult because product differentiation including technological difference makes intra-firm transaction less comparable with other AL transactions. Therefore, in practice, both consultant companies and tax authorities frequently rely on a range of transfer prices, or AL range, which provides MNEs with room to manipulate their transfer prices for the purpose of profit shifting.

This link between product differentiation and profit shifting is empirically supported. Bernard et al. (2006), Cristea and Nguyen (2016), Davies et al. (2018) and Liu et al. (2019) used export price data in the U.S., Denmark, France, and U.K. and showed the significant difference between transfer prices and AL prices. Moreover, they categorized industry into homogeneous and differentiated sectors and conclude that transfer prices are more sensitive to tax change for differentiated goods category as compared to homogeneous goods (e.g. Davies et al. (2018), Table 2).

The impacts of MNEs' tax avoidance is sizeable, which is widely recognized. For example, OECD estimated that the annual revenue losses from MNEs' tax avoidance are from $100 billion to $240 billion.[4] Zucman (2014) shows an increasing share of U.S. corporate profits made in tax havens from 2% in 1983 to 17% in 2013. Furthermore, Tørsløv et al. (2018) also estimate that MNEs shifted more than $600 billion to tax havens.[5] Although these empirical facts imply the importance of understanding MNEs' motive of R&D activities by linking tax avoidance, few theoretical research has been conducted. As recent development of R&D activities can be supported by some policies mentioned above, it is essential to reconsider effects of policies related to R&D.

To this end, this paper constructs an international duopoly model with one MNE and one local firm producing vertically differentiated goods, or different-quality goods. Our model introduces a link between quality gap and ease of profit shifting. When profit shifting is possible, an MNE benefits more from R&D investments because wider quality gap makes shifting profits easier. Due to this additional incentive, we find that the optimal investment in quality upgrading with profit

[3]AL principle is set in Article 9 of the OECD Model Tax Convention. the OECD guideline states thet "[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 prodution 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.

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

[5]Because of these huge losses, OECD countries try to deal with this issue by launching "base erosion and profit shifting (BEPS) project." In the project, 3 out of 15 actions are devoted for issues related to transfer pricing (see action 8-10).

shifting is higher than without profit shifting.

The MNE's quality upgrading induces the local firm to invest more in its quality as well. This is because wider quality gap due to the MNE's upgrading mitigates the market competition, and thus the local firm's gains from investment in quality also increases.

We also analyse the impact of policies for R&D investment. In the absence of profit shifting, the optimal policy is to give subsidies because non-corporative competition between the firms results in underinvestment in R&D activities, which is in line with the extant literature. However, our numerical analysis shows that R&D subsidies are not always the optimal policy once profit shifting is possible. Specifically, the optimal policy is to levy tax on R&D investment if profit shifting is less costly.

1.1 Related literature

This paper contributes to several fields of research. First, our model contributes to the research on tax avoidance by MNEs. After Copithorne (1971) and Horst (1971), a variety of authors have studied transfer pricing and profit shifting. Elitzur and Mintz (1996) shows the role of transfer price as managerial incentives. Schjelderup and Sørgard (1997) points out another strategic purpose of manipulating transfer prices by assuming a decentralized MNE. Recent development of research focuses on the AL principle by considering interrelation between transfer pricing and other MNEs' strategies. Bauer and Langenmayr (2013), Choe and Matsushima (2013), Choi et al. (2019), and Kato and Okoshi (2019) explores the impact of the AL principle on firms' decision of FDI, firms' incentive for tacit collusion, MNEs' choice of licensing, and an MNE's location choice of input production, respectively.[6] However, these papers do not explicitly relate product differentiation to ease of profit shifting.

One exception and the closest paper to the current paper is Okoshi (2021) which considers horizontal product differentiation 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.[7] Therefore, the current paper provides additional insights from the viewpoint of vertical investment. Moreover, the current paper introduces a local firm whereas Okoshi (2021) investigates interaction between two MNEs, which enables us to see the subsequent impact on a local firm.

[6]There are other policies or international corporation to prevent MNEs from shifting profits across countries. For example, Nielsen et al. (2010) analyse "separate accounting" and "formula apportionmengt", Haufler et al. (2018) explore controlled foreign company rules, and Gresik et al. (2017) considers "safe habor rules" and "earning stripping rules".

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

Second strand of related literature is ones to explore the optimal policy with endogenous choices of vertical product differentiation. Zhou et al. (2002) construct a third-country-market model with two firms from different two countries and analyse the optimal policies from the perspective of "strategic trade policy" discussion. Toshimitsu (2003) also analyzes the optimal policy in closed economy with different competition, namely, Bertrand versus Cournot competition, and concludes that a subsidy for R&D is socially optimal under Bertand competition whereas a tax is the optimal policy under Cournot. However, these papers ignore tax avoidance of MNEs, and thus it is impossible to draw conclusions with tax avoidance properties.

The rest of the paper is organized as follow. The next section explains the model and derives the equilibrium without profit shifting. Section 3 introduces a tax haven while section 4 explores welfare analysis. 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 characterised by duopoly market structure with one local and one multinational firm, labelled firm L and M while the homogeneous sector is assumed to be perfectly competitive market. The public sector is provided by the government.

Government The government provides public good by using tax revenues in the country. Note that sector Y is perfect competitive and there are no tax base in the sector whereas sector X is characterised by duopoly and tax base arises. To collect tax revenue TR, the government levies an exogenously given positive tax rate t_D on the tax base. Therefore, the amount of public good is equal to tax revenue, that is, $G = TR$.

Consumers Consumers are vertically differentiated in their preference on product quality in sector X. As in the extant literature, we assume that each consumer purchases either one or zero unit of vertically differentiated, or different quality products. Specifically, their type is characterized by $\theta \in [0, 1]$, and associated with a 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 consumer surplus from consumer surplus

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

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

$$V(\theta, q_M, p_M) \geq V(\theta, q_L, p_L), \iff \theta \geq \frac{p_M - p_L}{q_M - q_L} \equiv \theta_M. \tag{3}$$

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

$$V(\theta, q_L, p_L) \geq 0 \iff \theta \geq \frac{p_L}{q_L} \equiv \theta_L. \tag{4}$$

These two information immediately provides us with the following demand function,

$$x_M = 1 - \theta_M = 1 - \frac{p_M - p_L}{q_M - q_L}, \quad \text{and} \quad x_L = \theta_M - \theta_L = \frac{p_M - p_L}{q_M - q_L} - \frac{p_L}{q_L},. \tag{5}$$

Consumers own the firms and the their income I consists of post-tax profits of the firms in sector X and initial endowment E. For simplicity, we assume that all consumers have enough income to purchase one differentiated good if they want it. All the remaining incomes after purchase of differentiated good is used for consumption of the homogeneous goods. We use sector Y as a numeraire sector and the price of the homogeneous good is unity. Therefore, the total consumption of the 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 and initial endowment E.

Consumers are also gains from public goods provision. Let G be the amount of public good provision. Then, the aggregate utility, or welfare, in country D is,

$$W = \int_{\theta_L}^{\theta_M} u(\theta, q_L) d\theta + \int_{\theta_M}^{1} u(\theta, q_M) d\theta + \widehat{y} + \beta G, \tag{6}$$

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

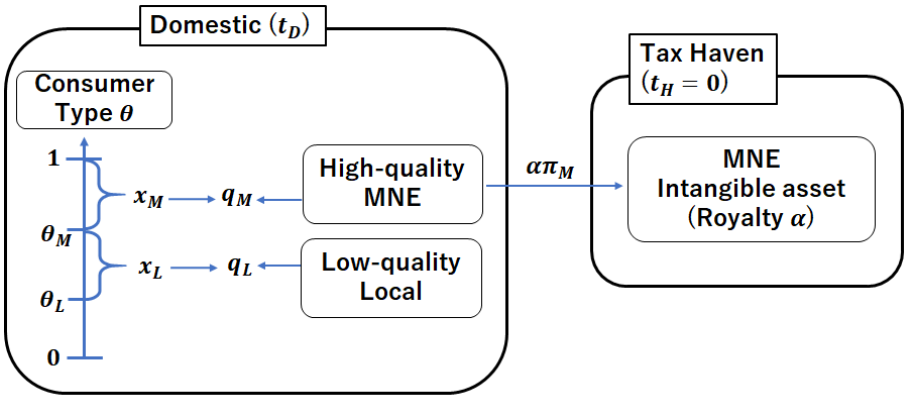

Figure 1: Model

Firms The two firms produce vertically differentiated product to consumers in country D. To focus on 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 higher quality product than the local firm, $q_M > q_L$.[8]

The levels of their quality is endogenously detemined 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 $F'(\infty) = \infty$. Given the differentiation levels, the firms determine an amount of supplies and make operating profits which are denoted by π_i.

The model is illustrated with Figure 1. The sequence of the game is as follow. At 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.

2.1 Equilibrium in Benchmark case

From eq.(5), firm i maximizes the following operating profits by choosing price p_i

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

[8]One might concern that it is natural to assume producing high quality goods entails larger cost. However, as MNEs tend to be more productive than national firms, it is possible that both types of firms have the same/similar marginal costs.

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

$$p_M = \frac{2(q_M - q_L)q_M}{4q_M - q_L}, \qquad \text{and} \qquad p_L = \frac{q_L(q_M - q_L)}{4q_M - q_L}, \tag{7}$$

and the consequent operating profits of the firms are,

$$\pi_M = \frac{4(q_M - q_L)q_M^2}{(4q_M - q_L)^2}, \quad \text{and} \quad \pi_L = \frac{(q_M - q_L)q_M q_L}{(4q_M - q_L)^2}. \tag{8}$$

As known in the literature, $\frac{\partial \pi_M}{\partial q_M} > 0$ always holds, which means that a firm producing high-quality goods has an incentive to invest in quality upgrading to mitigate price competition. In addition, $\frac{\partial \pi_L}{\partial q_L} > 0$ holds if and only if $q_M > \frac{7q_L}{4}$ holds. This is because quality upgrading for a low-quality firm has two conflicting effects. On the one hand, quality upgrade increases consumers' willingness to pay for the good, and thus the low-quality firm can increase its price. On the other hand, narrower quality gap intensifies competition against the high-quality firm. Therefore, the low-quality firm has an incentive to upgrade its product when the quality gap is wide and the first effect dominates the latter. Following the extant 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,

$$\Pi_M = (1 - t_D)\pi_M - F(q_M), \tag{9}$$

$$\Pi_L = (1 - t_D)\pi_L - F(q_L). \tag{10}$$

Let (q_M^*, q_L^*) be the equilibrium pair of qualities, and then they satisfy the following first order conditions,

$$\frac{\partial \Pi_M}{\partial q_M} = (1 - t_D)\frac{\partial \pi_M}{\partial q_M} - F'(q_M) = 0, \tag{11}$$

$$\frac{\partial \Pi_L}{\partial q_L} = (1 - t_D)\frac{\partial \pi_L}{\partial q_L} - F'(q_L) = 0. \tag{12}$$

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

3 Tax havens

This section introduces tax haven (country H) which imposes low corporate tax which are assumed to be zero $t_H = 0$ following the extant literature. As firm M makes greater net profits than firm L, the firm is able ot establish its shell company in country H and collect its intangible assets such as intellectual property rights from quality investment, which enable the firm to shift profits across countries for avoiding tax payments in country D. Specifically, let $\alpha \in [0, 1]$ be transfer price on intangible assets, namely royalty rate, and hence firm M can shift profits to $\alpha\pi_M$.[9]

Profit shifting arises costs to justify their decision on transfer pricing, and the cost is known as concealment costs in the literature. For example, concealment costs include wage and rewards to hire experts such as lawyers and consultant staffs to make documents for transfer pricing regulations. As justifying transfer pricing gets more difficult as the firm tries to shift more profits, rewards to the experts must increase to give them incentives to exert efforts.[10] To reflect the nature, this paper introduces the following form of concealment costs,

$$C(\eta, \alpha) = \frac{\eta\alpha^2\pi_M}{2} \tag{13}$$

where η is a measure of difficulty of profit shifting.

We modify the concealment cost by introducing quality difference based on the property of the AL principle. As argued in Introduction, it is difficult for tax authorities to find proper AL prices, and thus the cost of profit shifting gets larger.[11] To reflect this property, we decompose η into two: the enforcement level of transfer pricing ϕ and the difference of 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 larger ϕ represents stricter enforcement of international corporation such as BEPS project, whereas wider quality gap makes applications of the AL principle more difficult and profit shifting becomes easier.

[9] This type of royalty is known as ad-valorem royalty, and this is one of the most frequently used ways. For empirical evidence, see San Martín and Saracho (2010). In the context of profit shifting, Choi et al. (2019) also use this method in their theoretical analysis.

[10] Alternatively, concealment costs can be interpreted as the expected penalties because of being audited by tax authorities.

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

3.1 Equilibrium with tax haven

Give the concealment cost, the stage game is modified by adding profit shifting phase in the last stage. In the 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,

$$\widehat{\alpha} = \frac{t_D}{\eta} = \frac{(q_M - q_L)t_D}{\phi}. \tag{14}$$

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

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

$$\Pi_M^T = \left(1 - t_D + \underbrace{\frac{(q_M - q_L)t_D^2}{2\phi}}_{\text{Tax saving gains}}\right)\pi_M - F(q_M), \tag{15}$$

whereas the maximand of firm L is the same as eq.(10). The new post-tax profits of firm M has an additional term in the parenthesis which captures tax saving gains. Due to the new term, the first order condition for the MNE's quality decision is also modified as follows,

$$\frac{\partial\Pi_M^T}{\partial q_M} = (1-t_D)\frac{\partial\pi_M}{\partial q_M} + \underbrace{\frac{(q_M - q_L)t_D^2}{2\phi}\frac{\partial\pi_M}{\partial q_M}}_{\text{Profit shifting gains}} + \underbrace{\frac{t_D^2}{2\phi}\pi_M}_{\text{Differentiation gains}} - F'(q_M) = 0. \tag{16}$$

The second term in the above equation capture an additional incentive for quality upgrading because more operating profits remain in the firm, we refer "profit shifting gains". The third term captures the gains from wider quality gap to make profit shifting less costly, which is referred as "differentiation gains". These two additional gains clearly increase the investment of the MNE. Let q_i^T be the equilibrium quality level of firm i. Then, $q_M^T > q_M^*$ holds.

Given the higher new quality of the MNE, we can also see quality upgrading for firm L. This is because an increase in 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 $q_L^T > q_L^*$.

The following proposition summarizes the above argument.

Proposition 1. The opportunities of profit shifting upgrades the quality of both high and low quality goods. That is, $q_M^* < q_M^T$ and $q_L^* < q_L^T$ hold.

This proposition is in line with and provide a new rationale for the observed fact argued in Introduction. In the literature of international trade, reduction in trade costs such as lower tariff or transportation costs leads to quality upgrading. Our model indicates observed quality upgrading is promoted by growing opportunities of tax avoidance. Note that our price competition model suggests that quality upgrading spillovers to local firm as well.

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

This result provides us with a new explanation on a currently observed fact of quality upgrading argued in Introduction. Some paper relates to intensified competition under globalization whereas others focuses on policy-driven effects. From the viewpoint of tax avoidance, a traditional rationale looking at MNEs is that they have more opportunities of tax avoidance and gains from profit shifting. The proposition sheds lights on such a sequential effect of MNEs on a local firm. Therefore, the proposition shows a spillover effect of tax haven on a local firm.[12]

4 Welfare analysis

In the last section, we found an obvious effect of profit shifting: quality upgrading versus tax avoidance. In addition, such an increase in quality can influence both positively and negatively welfare via an increase in price and quality. Therefore, revisit of welfare effect is important.

Thus, This section considers the optimal policy about R&D investments. Let s be proportion of R&D investment costs which is covered by the government. Thus, positive $s > 0$ means subsidy whereas negative $s < 0$ represents tax. Specifically, $sF(q_i)$ be the total amount of subsidy (tax) for investment of firm i. This modification enables us to compare the result from Toshimitsu (2003).

[12]In Cournot competition, Toshimitsu (2003) shows that a subsidy for the high-quality firm decreases the investment of low-quality firm in quality, and thus this spillover effect does not seem to hold. However, this does not mean the current result always holds. however, As the operating profits of the high-quality firm is greater than those of the low-tax firm, our results that the high-quality firm's incentive of quality-upgrading is greater, and thus it is possible that profit shifting can lead to quality upgrading.

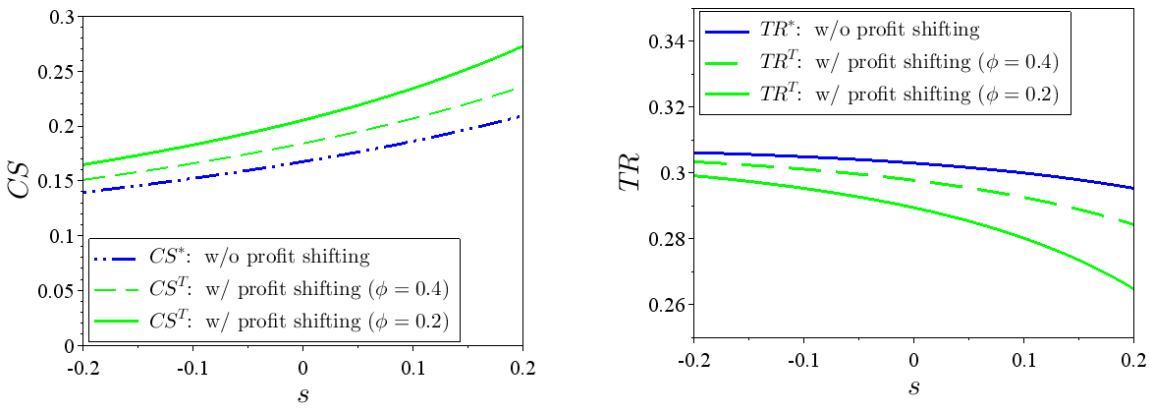

Figure 2: Consumer surplus and tax revenues

Here, let us clarify welfare in country D. Based on eq.(6), welfare is rewritten as,

$$W = \frac{q_L x_L(\theta_M + \theta_L)}{2} + \frac{q_M x_M(1+\theta_M)}{2} - (1-s)\{F(q_M) + F(q_L)\} \\ + \beta t_D \left[p_M x_M \left(\beta - 1 - \frac{t_D(q_M - q_L)(2\beta - 1)}{2\phi} \right) + p_L x_L(\beta - 1) - s(F(q_M) + f(q_L)) \right] \quad (17)$$

where the first line shows consumer surplus minus firm-burdened cost of investments, and the second line shows net-tax revenue.

Due to analytical difficulty, we rely on the following numerical analysis to obtain insights on the optimal policy. Before considering total welfare, it is beneficial to take a closer look at the impacts on consumers and tax revenues. The left of Figure 2 shows the effect of subsidy on consumers whereas that on tax revenue is drawn in the right one. As we can see, tax avoidance benefits consumers but decreases tax revenues. Although the effect on consumers have conflicting effects, namely an increase in price versus an increase in quality, the figure shows the latter effect is dominant. On tax revenue, tax revenue decreases, which is in line with results of tax avoidance. Even though tax avoidance benefits firms as the previous section shows, the increase in tax base of firms seems the secondary effect, and thus tax revenue declines.

These numerical examples imply that the total effect of subsidy for investment is unclear, which is the next question we will confirm. The effect of the policy is illustrated by Figure 3.[13] The double-doted upward sloping curve shows welfare levels without profit shifting, which indicates that the optimal policy is to subsidise firms. This is in line with the result of Toshimitsu (2003).

In the presence of profit shifting, however, the results does not always hold as the two below

[13]We use the following parameter values: $t_D = 0.3$, $\beta = 1.1$, and $F(q_i) = \frac{q_i^2}{2}$.

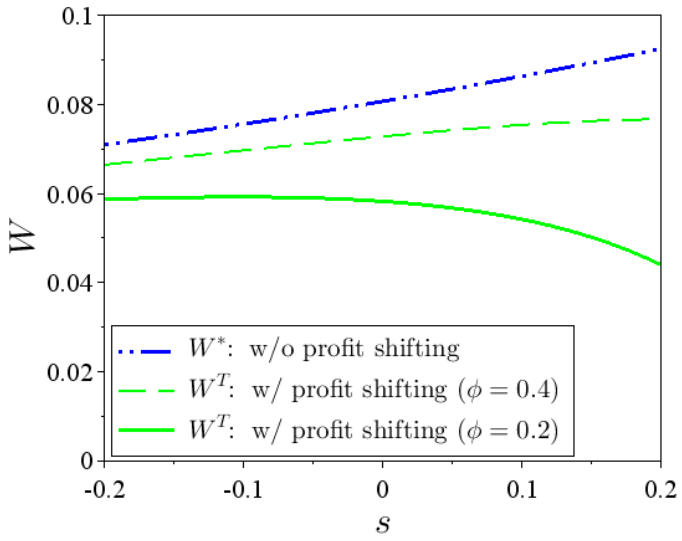

Figure 3: Optimal policy

curves show. These curves represent welfare levels with different enforcement levels of transfer price regulation. The dashed curve is the case with stricter enforcement ($\phi = 0.4$) whereas the solid one is the one with loose enforcement level ($\phi = 0.2$). With stricter regulation, the optimal policy is still a subsidy whereas the curve under loose regulation is downward sloping, and thus the optimal policy is to tax R&D activities.

This clear contrast stems from loss of tax revenues. As the MNE's investment in quality contributes to more profit shifting, giving a subsidy makes it more difficult to collect tax revenues and more public good provision. Thus, the effect of giving a subsidy under the case with loose regulation negatively influences welfare in country D.

The above discussion is summarized as the following proposition.

Proposition 2. In the presence of tax havens, the optimal policy for investment can levy tax when profit shifting is easy to conduct.

As the proposition shows that ϕ is a critical factor for the optimal policy, it is notable to interpret ϕ related to globalisation. So far, we regard larger ϕ as stricter enforcement of transfer price regulation, and thus recent international corporation such as BEPS project tends to direct policy makers to design for subsidy. However, it is also possible that smaller ϕ as the measure of globalisation that .[14] Therefore, the proposition means the optimal policy for R&D must be designed by being reconsidered with the degree of international corporation for transfer price regulation and

[14]This interpretation is also done by the extant literature. For example, see Haufler et al. (2008).

globalisation.

5 Concluding remarks

Under globalisation, we have observed quality upgrading and tax avoidance in parallel. To prevent MNEs' profit shifting, countries have cooperated internationally such as enforcement of transfer pricing regulation. Based on the AL principle stipulated in the OECD guideline, ease of MNEs' transfer pricing seems related to product differentiation.

In this paper, we have revisited the optimal policy on R&D activities based on vertical product differentiation by introducing an MNE's tax avoidance behaviour. As an additional incentive to invest in quality arises with profit shifting, an MNE's quality upgrading is accelerated, which can spillover to a local firm.

Moreover, our numerical analysis shows that an increase in quality investment due to tax avoidance benefits firms and consumers whereas it decreases tax revenues. This provides us with a natural question: what is welfare effect and is the optimal policy. In the absence of profit shifting, the optimal policy for R&D investment is giving a subsidy to firms which is in line with the results of Toshimitsu (2003). In the presence of tax havens, however, the result does not always hold. If profit shifting is easy to conduct and does not arise concealment cost much, the optimal policy levies tax on investment.

The contrasting result includes an important message in the globalised world. As R&D investment seems positively considered because it can result in economic growth, governments sometimes provides firms with subsidies such as patent box introduced in European countries. To improve welfare, our analysis shows that strengthening international corporation of transfer pricing regulation is essential.

Although the paper provides some new insights, there remain several directions of extensions. First, as governments sometimes compete for MNEs' R&D activities, it is important to introduce competition between governments. Second, as globalisation also induce firms to offshore upstream high-tech inputs, considering vertically related industry can be interesting. Moreover and more importantly, empirical investigation on the link between product differentiation and tax avoidance is essential.

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