Endogenous Product Differentiation and Profit Shifting*

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Abstract

High product differentiation enhances consumers’ utility and firms’ profits but at the same time makes it difficult for tax authorities to audit MNEs’ tax avoidance strategies, as the arm’s length principle is difficult to apply. This paper combines these two aspects of product differentiation. I show that MNEs engage in more investment in product differentiation in the presence of profit shifting opportunities. Although stricter regulation on profit shifting increases tax revenue in the high tax country, it may reduce welfare in a high tax country due to less product differentiation.

Keywords: Tax avoidance; Product differentiation; International tax policy

JEL classification number: F23; H26; L13

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1 Introduction

Investment in product differentiation is one of the most important strategies of firms because competition among firms gets less fierce and firms are able to enjoy more market power by differentiating their products from those of rival firms.\textsuperscript{1} Empirical evidence suggests that product differentiation is a core reason for R&D. According to Scherer and Ross (1990), 3/4 of R&D expenditures by U.S. firms' are used for product R&D. Bagwell (2007) also reports examples of large spendings on advertisement by U.S. firms which serve to increase product differentiation.\textsuperscript{2} The increase in market power due to product differentiation is not always harmful for consumers, once individuals’ preference over varieties are considered.\textsuperscript{3} One classical theory which introduces heterogeneous preference on goods is Hotelling (1929). In his model, consumers’ preferences are uniformly distributed along an interval and the socially optimal level of duopolists’ product differentiation is positive. Therefore, higher degrees of product differentiation can benefit both firms and consumers so that one can think of product differentiation being beneficial for the whole economy.

From the viewpoint of global taxation, however, product differentiation exacerbates the difficulties of collecting corporate tax revenue, because of the tax avoidance behaviour of multinational enterprises (MNEs). MNEs exploits tax rate differentials between countries by shifting their profits to low tax environment by means such as transfer pricing. The transfer price is the price used in intra-firm transaction, on intermediate products and/or

\textsuperscript{1}For evidence on the link between market competition and product differentiation, see Hoberg and Phillips (2016) which conducted text-based investigation and shows that larger spendings on advertisement and R&D result in less ex post product-similarity, which is consistent with endogenous product differentiation theory.

\textsuperscript{2}In 2003, $3.43\text{ 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.}

\textsuperscript{3}This is also supported by “love of variety” pioneered by Dixit and Stiglitz (1977) and Krugman (1980). For evidence on the love of variety, see, for example, Ardelean (2006) who estimates the parameter of love of variety.
intangible asset such as trademarks. As OECD guidelines stipulate, such a price used in intra-firm transaction should be the one used in inter-firm transaction, or arm’s length (AL) price. Tax authorities compare the transfer price used by an MNE to the AL price from comparable uncontrolled transactions. However, product differentiation makes it difficult to find comparable transactions, since characteristics of the comparable products in inter-firm transaction should be similar to the ones of the good traded in the intra-firm transaction. 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 by academic literature as well. Bernard et al. (2006), Cristea and Nguyen (2016), and Davies et al. (2018) used export price data in the U.S., Denmark, and France and showed the significant difference between transfer price and AL price. 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). Surprisingly, even though the empirical evidence points to a link between product differentiation and MNEs’ profit shifting, a theoretical approach that combines these two aspects has not been developed so far. To my best knowledge, this is the first paper that studies the link and analyzes its welfare effects.

This paper incorporates tax avoidance behaviour into a model with endogenous product differentiation, proposed by Lin and Saggi (2002). To reflect the above argument, this paper introduces a link between product differentiation and the ease of profit shifting. When profit shifting is possible, MNEs benefit more from product differentiation because higher product differentiation makes shifting profits easier. Due to this additional incentive, we

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4 In a last few decades, the global economy has been substantially influenced by small number of but usually quite large MNEs. For empirical evidence on the importance of intra-firm transactions, see Bernard et al. (2010) and Lanz and Miroudot (2011) which report over 46% and around 50% of U.S. imports were done between related companies in 2000 and 2009, respectively. In addition, Bernard et al. (2005) shows that, in 2000, the number of MNEs are around 1% of total number of firms in U.S. while 29.1 % of labours were hired by MNEs and approximately 90% of U.S. trade were involved with MNEs.

5 Other channels of profit shifting include internal debt or interest payment, and licensing payments for patent. See, for example, Hong and Smart (2010) on the former and Juranek et al. (2018) and Choi et al. (2019) on the latter profit shifting channel.
find that the optimal investment in product differentiation in the presence of profit shifting is higher than in the absence of profit shifting. We also analyze the impact of stricter tax enforcement. We find that stricter tax enforcement results in lower post-tax profits of MNEs, lower consumer surplus from the differentiated products, and higher tax revenue in a high tax country.

The striking result from our model is that total welfare in a high tax country can be higher in the presence of profit shifting and a marginal increase in tax enforcement can reduce welfare when initial level of tax enforcement is low. This result arises from a decrease in consumer surplus due to less product differentiation, which dominates the increase in tax revenue. Thus, our model implies that more global cooperation to enforce tax payments from MNEs will increase tax revenue in a high tax country but may still lead to a decrease in total welfare due to less product differentiation, which is valued by consumers.

This paper contributes to several fields of research. The first strand of literature studies endogenous product differentiation. To explain the observed huge investment in product differentiation, Lin and Saggi (2002) shows a stronger incentive to engage in more product differentiation in the presence of process R&D which strengthens a benefit from product differentiation. Lambertini and Mantovani (2010) also analyzed a multiproduct monopolist’s incentive to engage in product and process innovation. Ebina and Shimizu (2012) extended Lin and Saggi (2002) by introducing spatial competition between firms. Other papers study endogenous product differentiation in the open economy. Bastos and Straume (2012) considers a two-country model and introduces per-unit tariff on firms’ exports. Ferguson (2015) analyzed the impact of trade liberalization in a monopolistically competitive model with a constant elasticity of substitution in consumption. Beladi et al. (2012) incorporated an outsourcing firm in their analysis, but the focus is on differences in technology and wages across firms and countries. Therefore, their analysis does not allow to draw conclusions for product differentiation due to a tax motive, which is the focus of our paper.

Second, 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. Kant (1988) first introduced legal or other costs of profit shifting to obtain an interior solution. Recent works also incorporated market imperfection in the analysis by using the costs of profit shifting. Schjelderup and Sørgard (1997) points out another purpose of manipulating transfer prices by assuming a decentralized MNE. However, one caveat of the cost function is that the function does not reflect comparability of an intra-firm transaction with another. Thus, the extant literature cannot see the link between product differentiation and profit shifting. Without using the costs of profit shifting, Kato and Okoshi (2019) considered the link between product differentiation and the ease of profit shifting in their robustness analysis. However, the degree of product differentiation is fixed in their analysis. The contribution of this paper is to incorporate an aspect of characteristics of products into the cost function, which plays a significant role in practice.

The final contribution of our paper is to the literature on anti profit shifting policies. A large literature has studied various types of anti-profit shifting policies. Hong and Smart (2010) analyzed thin capitalization rules to argue whether tax havens are desirable or not for high tax countries. Haufler et al. (2018) theoretically first investigates controlled-foreign-company rules. Among various policies, our paper is closely related to AL principle. Choe and Matsushima (2013), Choi et al. (2018), and Kato and Okoshi (2019) modelled AL principle as a policy that forbids MNEs to set the same input price as AL price if a comparable transaction exists. Unlike the focuses of these works, our model regards AL principle as an imperfect anti profit shifting policy whose extent of imperfectness is outcome of MNEs investment decision. This enables us to analyze MNEs’ incentive to

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6 The cost function is composed of two factors: a parameter measuring difficulty of profit shifting and a measure of profit shifting such as difference of transfer price and market price, transfer price and marginal cost, or the amount of shifted profits and so on.

7 Analysis on on-going discussion about international taxation scheme, separate accounting versus formula apportionment, has been done as well after Gordon and Wilson (1986). Kind et al. (2005) investigated tax competition and compared the results under the two different schemes. Nielsen et al. (2010) showed spillover effects of an increase in tax rate in one country. Clausing et al. (2016) showed empirical analysis for formula apportionment as one of the recent works.

8 Other papers have focused on the reasons why governments may permit some profit shifting. Peralta et al. (2006) analyzed governments’ inventive not to monitor profit shifting so as to attract MNEs’ production. Juranek et al. (2018) compares several methods to audit tax avoidance. These methods include transactional net margin method and transactional profit splot methods well as comparable uncontrolled price method.

9 Other papers have seen the change in a parameter in the profit-shifting cost function as changes in policy on profit shifting such as BEPS and ALP as we do in this paper. Amerighi and Peralta (2010) analyzed a potential firm’s incentive to establish the second plant, becoming an MNE or remaining an exporter while Stöwhase (2013) investigated the degree of tax competition.
engage in product differentiation for the sake of tax avoidance.

The rest of the paper is organized as follow. The next section explains the model and derives the equilibrium while section 3 explores welfare analysis. The last section concludes.

2 Model

Consider a world composed of a domestic country and a tax haven, (countries $D$ and $H$). Country $D$ imposes an exogenous positive corporate tax rate ($t_D$) on reported profits in the country while a tax rate in country $H$ is less than $t_D$ and assumed to be normalized to zero. In the economy, there exist two MNEs, labelled 1 and 2, that supply differentiated products to consumers in country $D$. Both MNEs have their affiliates in country $H$, which enables them to shift profits across countries.

**Consumers** Following Dixit (1979) and Lin and Saggi (2002), we assume that the utility function of representative individual in country $D$ is given by

$$u(x_i, x_j, m) = a(x_i + x_j) - \frac{x_i^2 + x_j^2}{2} - sx_ix_j + y, \quad i \in \{1, 2\}, \quad j \neq i$$

(1)

where $x_i$ is consumption level of the differentiated product manufactured by the MNE $i$, $y$ is consumption of numeraire good, and $s \in [0, 1]$ is the degree of product differentiation. The MNEs’ goods are homogeneous if $s$ is 1 while they are unrelated if $s$ is 0.\(^\text{11}\) The utility function yields the following inverse demand function,

$$p_i = a - x_i - sx_j.$$

(2)

Note that the inverse demand functions shift outward as the degree of product differentiation gets smaller. This is because one product is more differentiated so that

\(^\text{11}\)Although it is well known that CES utility function captures “love of variety” of consumers, our utility function also has the feature. If the two goods are perfect substitute $s = 1$, the inverse demand function is linear, which is the case that the elasticity of substitute is approaching to infinity, and love of variety effect vanishes. As the degree of product differentiation or the elasticity of substitute get smaller, indifference curves become more convex with respect to origin.
the individual’s willingness to pay on products gets higher.

Consumer’s income consists of two sources. First, as the residence owns the MNEs, all profits of the MNEs accrue to consumers. Second, we assume all tax revenues in country $D$ are redistributed to consumers in country $D$ in a lump-sum way.

**Firms** The MNEs produce their goods with constant marginal cost $c$ and compete over quantity only in country $D$. The MNEs also determine two other strategies: the level of product differentiation and the size of shifted profits. Following Lin and Saggi (2002), at the first stage, they engage in investment to differentiate their goods from the one made by the rival MNE. Let $d_i \in [0, \frac{1}{2}]$ be the investment level by MNE $i$. Then, the degree of product differentiation is given by $s = 1 - (d_1 + d_2)$. The investment cost is assumed to be $F(d_i)$ with $F'(d_i) > 0$ and $F''(d_i) > 0$. To secure interior levels of $d_i$, we assume that $F'(0) = 0$ and $F'(\frac{1}{2})$ is sufficiently large. Throughout the analysis, we assume that second order condition is satisfied.\(^{12}\) Given the differentiation levels, the MNEs determine the quantity and make operating profits which are denoted by $\pi_i$.

After the quantity decision, the MNEs have an opportunity to shift profits by some means such as transfer pricing or licensing fee. For the sake of simplicity, we isolate this decision from market outcome by assuming that the MNEs determine how much they shift profits to country $H$ which are denoted by $\pi_i^S$.\(^{13}\) Such a profit shifting entails costs to justify the transfer of profits. It is assumed that the costs increase as more profits are shifted. Following Amerighi and Peralta (2010), the cost is formulated as $C(\pi_i^S) = \frac{\delta(\pi_i^S)^2}{2\pi_i}$ where $\delta$ is a measure of difficulty of profit shifting.\(^{14}\) This specification implies firms’ accounts is less distorted to shift profits if they makes larger operating profits.

The novelty of this paper is to decompose $\delta$ into two elements. First part of $\delta$ is the degree of government’s attention to auditing profit shifting $\alpha$. Higher $\alpha$ can be interpreted as stricter policy or regulation such as worldwide cooperation, e.g. BEPS project or arm’s length principle. Second, the difficulty of profit shifting also depends on product

\(^{12}\)Specifically, $\frac{2(a-c)^2}{(3-2a)^3} \left(3(1-t_D) + \frac{2t_D^2(6-13d+6d)}{a(1-2d)} \right) - F''(d_i) < 0$ is assume to hold.

\(^{13}\)In reality, intra-firm trade mainly takes place between non-haven countries. However, introduction of product markets in both countries does not change our main results.

\(^{14}\)This specification is also used in some empirical papers. See, for example, Hines Jr and Rice (1994), Huizinga and Laeven (2008), and Gumpert et al. (2016).
differentiation between MNEs. As tax authorities find it difficult to search comparable uncontrolled price, shifting profits gets easier as products are more differentiated.^{15} Here, we assume $\delta \equiv \alpha s$.

The sequence of the game is as follow. At the first stage, both MNEs decide the investment level. Given the investment level, and equivalently the degree of product differentiation, the MNEs compete in a Cournot fashion and makes operating profits. Finally, the MNEs determine the amount of shifted profits to country $H$. At each stage, their decisions are made simultaneously. We solve the three stage game by backward induction.

### 2.1 3rd stage: Profit shifting

MNE $i$ maximizes the following post-tax global profits,

$$
\Pi_i = (1 - t_D)(\pi_i - \pi_i^S) + \pi_i^S - F(d_i) - \frac{\alpha s(\pi_i^S)^2}{2\pi_i}, \tag{3}
$$

where the first term is post tax profits in country $D$ and the second term is those in country $H$. First order condition provides the following optimal shifted profits,

$$
\hat{\pi}_i^S = \frac{t_D}{\alpha s} \pi_i. \tag{4}
$$

Since MNEs balance the marginal benefit with marginal benefit from profit shifting, eq.(4) shows that the transferred profits increase as tax gap gets wider, the level of tax enforcement gets lower, or the degree of profit shifting gets lower. In our specification of cost function of profit shifting, larger operating profits lowers the marginal cost of profit shifting so that the shifted profits becomes larger as larger operating profits. To secure positive profits in country $D$, we assume $\frac{t_D}{\alpha s} \in [0, 1]$. Plugging the optimal shifted profits, the consequent

^{15}Although the MNEs invest in product differentiation of final products in our model, firms in reality also differentiate intermediate products. However, differentiated inputs often result in high degree of product differentiation of final products.
profits become,

$$
\Pi_i = \left(1 - t_D + \frac{t_D^2}{2s} \right) \pi_i - F(d_i). \quad (5)
$$

The last term of the first parenthesis appears in the presence of profit shifting, which captures the gains from tax savings.

### 2.2 2nd stage: Market outcome

As eq.(5) shows, maximization of the post-tax global profits at the second stage is equivalent to that of operating profits. Thus, as in standard Cournot competition, the equilibrium output level by MNE \(i\) and consequent price of the product are

$$
\hat{x}_i = \left(\frac{a - c}{2 + s}\right) = \left(\frac{a - c}{3 - d_i - d_j}\right), \quad \text{and,} \quad \hat{p}_i = \frac{a + (2 - d_1 - d_2)c}{3 - d_1 - d_2}. \quad (6)
$$

Intuitively, more product differentiation leads to more supplies by MNEs because the market competition between the MNEs gets less fierce.\(^{16}\) However, more supplies by MNEs does not mean reduction in price. Remember that the inverse demands shift outward because of more product differentiation, which creates more demands and consumers’ willingness to pay gets higher. In other words, the effects of both weaker competition between MNEs and more residual demands for MNEs on price are both positive.

### 2.3 1st stage: Investment decision

As product differentiation affects profit shifting behaviour, investment decision is made so as to maximize the global profits given the optimal supplies. To clarify the impact in the presence of profit shifting, let us first focus on the case without profit shifting (identified by a superscript \(O\)). Given eq.(5) and (6), the post tax profits for MNE \(i\) is

$$
\Pi_i^O = (1 - t_D) \left(\frac{a - c}{3 - d_i - d_j}\right)^2 - F(d_i). \quad (7)
$$

\(^{16}\)We can see this from the best response function of MNE \(i\). Let denote \(x_i^R\) be the best response function \(x_i^R = \frac{a - c - xs}{2s}\). This shows that higher \(s\), more homogeneous goods, results in more changes due to changes in the rival MNE’s supplies.
Thus, the optimal investment level $d^O$ is characterized in symmetric equilibrium,

$$\frac{\partial \Pi_i^O}{\partial d_i} \bigg|_{d_i = d_j = d^O} = \frac{2(1 - t_D)(a - c)^2}{(3 - 2d^O)^3} - F'(d^O) = 0. \quad (8)$$

The first term is the marginal benefit from investment in product differentiation and the second term is the marginal cost of the investment. As more product differentiation increase both prices and supplies, the marginal benefit is always positive. Thus, the optimal investment level is such that the (tax weighted) marginal benefit is equal to the marginal cost of investment.

With profit shifting (identified by a superscript $\ast$), MNEs maximize,

$$\Pi_i^\ast = \left(1 - t_D + \frac{t_D^2}{2a(1 - d_1 - d_2)}\right) \left(\frac{a - c}{3 - d_1 - d_2}\right)^2 - F(d_i). \quad (9)$$

Similarly, the first order condition requires that the optimal investment level $d^\ast$ satisfy,

$$\frac{\partial \Pi_i^\ast}{\partial d_i} \bigg|_{d_i = d_j = d^\ast} = \frac{t_D^2(5 - 6d^\ast)}{2a(1 - 2d^\ast)^2(3 - 2d^\ast)^3} - \frac{2(1 - t_D)(a - c)^2}{(3 - 2d^\ast)^3} - F'(d^\ast) = 0. \quad (10)$$

In the presence of profit shifting, the first term appears as the term capturing a marginal benefit from tax savings. The new term is always positive since more product differentiation decreases cost of profit shifting. In addition, this benefit is magnified by the increase in supplies due to more product differentiation. As seen in the absence of profit shifting, the MNEs determine the optimal level of investigation to equate the marginal benefit and cost from the investment but the benefit also includes the gains from tax avoidance in the presence of profit shifting. Thus, the existence of profit shifting induces MNEs to invest more in product differentiation. This leads to the following proposition.

**Proposition 1.** The opportunity of profit shifting induces MNEs to invest more in product R&D, or $d^O < d^\ast$.

**Proof** See Appendix A.1.
2.4 Comparative statics: Change in tax enforcement

As the above statement suggests, the consequent product differentiation level is influenced by the degree of difficulty for the MNEs to shift profits to country $T$. To see this point, we consider the change in $\alpha$. A stricter tax enforcement, captured by a higher $\alpha$, decreases the MNEs’ gains from product differentiation via the fist term in eq.(10). Therefore, the optimal investment level is negatively affected by the level of tax enforcement.

A stricter tax enforcement also affects the global post-tax profits of the MNEs in two ways. First, a stricter tax enforcement directly restricts the MNEs’ profit shifting strategy. In addition, less product differentiation due to the stricter regulation on profit shifting makes market competition fierce, which results in less operating profits as well. These are summarized as the following proposition.

Proposition 2. A marginal increase in restriction on profit shifting induces less investment level of MNEs and hurts MNEs, or $\frac{\partial d^*}{\partial \alpha} < 0$ and $\frac{\partial \Pi^*_i}{\partial \alpha} < 0$.

Proof See Appendix A.2.

Tax revenue Since the purpose of such a stricter enforcement is to prevent outflows of profit to tax havens, we also investigate an impact of a stricter regulation on the following tax revenue in country $D$,

$$TR^*_D = t_D \left( \sum_{i \in \{1,2\}} \pi^*_i - \pi^*_i \right) = 2t_D \left( 1 - \frac{t_D}{\alpha(1 - 2d^*)} \right) \left( \frac{a - c}{3 - 2d^*} \right)^2. \tag{11}$$

As expected as a direct effect, an increase in $\alpha$ prevents the MNEs from shifting profits. With profit shifting, it arises other sequential impacts via product differentiation channel. On a positive side, less product differentiation makes it difficult to audit profit shifting so that outflows of profits become smaller. On a negative aspect, however, more similar characteristics leads to fiercer market competition, which results in less operating profits. Thus, the impact of stricter regulation on tax revenue in country $D$ is not obvious but our numerical example, seen in Fig.(2) in appendix, suggests the positive effects dominates the negative effect.
3 Welfare analysis

In this section, we investigate the welfare impact of regulation on profit shifting. Since the impact on tax haven is obviously negative due to a decrease in tax saving gains, $\frac{\partial D}{\partial s}$, and a decrease in profits in operating profits $\pi_i$, our focuses are more on the welfare in country $D$.

Following Baldwin and Okubo (2009), we assume the government’s objective function is the welfare of the consumers, namely, consumer surplus. Although we do not endogenize tax rate since corporate tax rate is not determined by only this industry, this identification of welfare is helpful to discuss the impacts of regulation.\(^{17}\)

Since we assumed two sources of income of the consumer in country $D$, the MNEs’ profits and tax revenue in country $D$, the optimal consumption of homogeneous products is $\hat{y}^* = \sum_{i \in \{1,2\}} \Pi_i^* + TR_D - \sum_{i \in \{1,2\}} \hat{p}_i^* \hat{x}_i^*$. By plugging this and the optimal supplies by MNEs $\hat{x}^*$ into eq.(1), consumer surplus is computed as

\[
u(\hat{x}^*, \hat{y}^*) = CS_X + \sum_{i \in \{1,2\}} \Pi_i^* + TR_D^*, \tag{12}\]

where $CS_X = a(\hat{x}^* + \hat{y}^*) - \frac{(\hat{x}^*)^2 + (\hat{y}^*)^2}{2} - s (\hat{x}^*)^2 - \sum_{i \in \{1,2\}} \hat{p}_i^* \hat{x}_i^*$ is consumer surplus from the differentiated products. As the previous section argued the impacts of a stricter tax enforcement on the global post-tax profits and tax revenue, we investigate the impact on consumer surplus from the differentiated products.

As consumers enjoy more differentiated products under profit shifting case, the stricter regulation or elimination of profit shifting opportunity deteriorates consumer surplus from X industry although it leads to reductions in prices via fiercer competition. This implies the gains from differentiation always dominates the effect of changes in prices.

As the impacts of a stricter tax enforcement on three welfare components are not the same direction, whether a stricter regulation on profit shifting improves welfare in country $D$ is ambiguous. Our numerical analysis shows that the sign of $\frac{\partial u(\hat{x}, \hat{y})}{\partial \alpha}$ depends on the size of $\alpha$. Fig.1 depicts the welfare change due to change in $\alpha$ and shows that stricter regulation

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\(^{17}\) Section 2.4 provides some implications on welfare if the government sees more weight on firms and tax revenue.
reduces welfare when $\alpha$ is small enough while it improves welfare when regulation on profit shifting is strict enough.\textsuperscript{18} It should be stressed that welfare in the presence of profit shifting can be greater than that in the absence of that since the increase in consumer surplus from differentiated industry dominates losses from tax revenue. In other words, stricter regulation can successfully increase tax revenue in country $D$ at the expense of consumers’ gain. This is summarized in the following proposition.

**Proposition 3.** A marginal increase in $\alpha$ can decrease welfare in a domestic country.

Most literature on tax avoidance shows profit shifting opportunity results in a decline in total tax revenue, which can cause scarce supply of public goods. Hence, tax avoidance is viewed as harmful for the worldwide welfare. Likewise our model, only a few papers indicate that the opportunity of tax avoidance can be desirable.\textsuperscript{19} Although they consider

\textsuperscript{18}The following numerical values for parameters are used: $a = 2$, $c = 1$, $t_D = 0.2$, and $F(d_i) = \frac{d_i^2}{2}$.

\textsuperscript{19}Amerighi and Peralta (2010) introduces asymmetry sized countries and a firm’s choice of organization structure, export to a foreign market or establishing a plant there, and points out that profit shifting opportunity induces a firm to found the second plant in foreign country and to avoid trade cost. Stöwhase (2013) also considers location choice of an MNE and concludes that the opportunity of profit shifting mitigates tax competition between asymmetric sized countries since a smaller country expects inflows of shifted profits and have less incentive to compete against a larger country.
a location choice of firms, desirable profit shifting can be the case once the link between profit shifting and product differentiation is introduced as our model showed.

4 Concluding remarks

In this paper, we have analyzed MNEs’ incentive to invest more in product differentiation in the presence of profit shifting. Product differentiation reduces the similarity of MNEs’ products, which makes it difficult for tax authorities to find comparable or appropriate AL price and audit MNEs’ tax avoidance behaviours. Based on this practical difficulty, our model has shown a new rationale that MNEs engage in higher product differentiation. We also have analyzed the impacts of stricter tax enforcement. A marginal increase in tax enforcement reduces a benefit of product differentiation via tax savings, which results in less product differentiation. Subsequently, less product differentiation decreases consumer surplus from differentiated products and MNEs’ operating profits due to higher competition while increases tax revenue in a high tax country.

Importantly, our analysis have suggested the possibility that a marginal increase in tax enforcement leads to a reduction in welfare in high tax country when an initial tax enforcement level is low. As seen, the impacts of stricter regulation on profit shifting is conflicting effects. As seen, the increase in tax revenue is materialized at the expense of consumers and MNEs. When an initial tax enforcement level is low, the positive effect is dominated by the negative one.

Our analysis can be extended in several ways. First of all, as briefly discussed, firms also manufacture differentiated intermediate products. Since our analysis assumed product differentiation of final products, market competition of intermediate products cannot be analyzed. As effects of market competition among intermediate product on inputs’ prices can differ from ones of tax motive, further research on interaction between profit shifting and product differentiation on inputs is essential. Second, governments’ behaviours should be analyzed in order to obtain richer policy implications. Especially, as globally cooperative actions such as BEPS project begins, interaction between countries in non-cooperative and cooperative way can be one of the interesting extensions.
Appendices

A Proofs

A.1 Proof of proposition 1

By evaluating eq.(10) at \( d = d^O \), we obtain,

\[
\left. \frac{\partial \Pi_i^*}{\partial d} \right|_{d_i = d_j = d^O} = \frac{t_D^2(5 - 6d^O)}{2\alpha(1 - 2d^O)^2} \frac{(a - c)^2}{(3 - 2d^O)^3} > 0 \quad (A-1)
\]

holds since \( \frac{2(1-t_D)(a-c)^2}{(3-2d^O)^3} - \frac{\partial F(d^O)}{\partial d_i} = 0 \) holds. This implies \( d^O < d^* \) since the marginal benefit from product differentiation is greater that the marginal cost from that at \( d = d^O \).

A.2 Proof of proposition 2

By differentiating eq.(10) with respect to \( \alpha \),

\[
\frac{\partial}{\partial \alpha} \left( \left. \frac{\partial \Pi_i^*}{\partial d} \right|_{d_i = d_j = d^O} \right) = \frac{-t_D^2(5 - 6d^O)}{2\alpha^2(1 - 2d^O)^2} \frac{(a - c)^2}{(3 - 2d^O)^3} < 0. \quad (A-2)
\]

is obtained, which shows that an increase in \( \alpha \) decreases the marginal benefits from product differentiation. This implies \( \frac{\partial d^*}{\partial \alpha} < 0 \) because the marginal benefits from product differentiation gets smaller as \( \alpha \) becomes higher.

Given \( d = d(\alpha) \), the first derivative is computed as

\[
\frac{\partial \Pi_i^*}{\partial \alpha} = -\frac{t_D^2}{2\alpha^2(1 - 2d^*)} \left( \frac{a - c}{3 - 2d^*} \right)^2 + \frac{t_D^2}{\alpha(1 - 2d^*)^2} \left( \frac{a - c}{3 - 2d^*} \right)^2 \frac{\partial d^*}{\partial d} \left( \frac{a - c}{3 - 2d^*} \right)^2 \frac{\partial d^*}{\partial \alpha} \\
+ 4 \left( 1 - t_D + \frac{t_D^2}{2\alpha(1 - 2d^*)} \right) \frac{(a - c)^2}{(3 - 2d^*)^3} \frac{\partial d^*}{\partial \alpha} - \frac{\partial F(d^*)}{\partial d} \frac{\partial d^*}{\partial \alpha}. \quad (A-3)
\]
In equilibrium, eq.(10) holds so that eq.(A-3) becomes,

\[
\frac{\partial \Pi^*_i}{\partial \alpha} = -\frac{t_D^2}{2\alpha^2(1-2d^*)} \left( \frac{a-c}{3-2d^*} \right)^2 \\
+ \left( \frac{\partial d^*}{\partial \alpha} \right) \left( \frac{t_D^2(1+2d^*)(a-c)^2}{2\alpha(1-2d^*)^2(3-2d^*)^3} + \left( \frac{2(a-c)^2}{(3-2d^*)^3} \right) \left( 1 - t_D + \frac{t_D^2}{\alpha(1-2d^*)} \right) \right) < 0.
\]

(A-4)

This concludes proposition 2. ■

B Figure

![Figure 2: Tax revenue](image)

References


