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International Tax Differences, Trade Costs, and the Multinational's Tax Avoidance

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Focusing on the MNEs that provide essential inputs to their affiliates and market rivals, this paper investigates how cross-border tax differences and trade costs influence an MNE's transfer pricing and location decision-making. Apart from the intra-firm profit-shifting and strategic competition via transfer pricing, we identify a channel substitution effect through which an MNE can manipulate its transfer price to partially substitute the input sale for the output sales, such that it can alleviate the burden of tax payments. If there exists a significant difference in corporate taxes and a lower trade cost across countries, the channel substitution effect is more prominent when the MNE separates its vertically related affiliates. We also present the results for such cases as the ALP application, multiple local downstream firms, the presence of a local upstream rival, and cases in which the other party bears transportation costs, and the tax burden difference between the two countries is exactly opposite to that in the baseline model.

Keywords: international tax differences, trade costs, internal transfer price, location choice, arm-length principle (ALP)
JEL classification: F12, F23, H25, H26

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1 Introduction

The activities of multinational enterprises (MNEs) during recent decades have driven the economic globalization process to a large extent. Since there are substantial differences in tariffs and corporate tax rates across nations, MNEs are likely to choose the appropriate location of their affiliates, taking advantage of tax maneuvers to pursue tax-saving activities and reduce their tax obligations. For instance, by designing an internal transfer price system, an MNE can manipulate its intrafirm transactions such that most of the consolidated profits of the whole enterprise would be amassed in some affiliates, which are usually located in low-tax countries.[1] However, such tax avoidance simply is not a social benefit and has been branded as an immoral and unethical practice. It has been well documented that base erosion and profit shifting (BEPS) of tax avoidance through transfer pricing is strikingly large.[2]

The larger tax loopholes and cross-country differences in tax rates may indeed induce MNEs to engage in tax avoidance. However, setting up an executive headquarters in one country while establishing affiliates in other countries would also cause MNEs additional transaction and trade costs (including shipping). Consequently, it should be an important issue to investigate how these two counterpart factors, namely tax rate difference and trade cost, influence MNEs' internal transfer pricing and the location decision-making.

[1] See Grubert and Mutti (1991) for US MNEs' activities in 33 countries. As noted by Peralta, Wauthy, and Ypersele (2006), multinational firms have several tools to shift profits into low tax regions, such as, to manipulate intrafirm transfer prices, to establish and finance an affiliate with debt or equity, to engage in a joint-venture with a local firm, or through the payment of management fees or royalties, etc. See also Hines and Rice (1994), Huizinga and Laeven (2008), Davies et al. (2018), and Liu, Schmidt-Eisenlohr, and Guo (2020) for the evidence that multinationals can utilize their affiliates for profit shifting across countries by using transfer prices. For the survey of recent empirical literature, see Heckemeyer and Overesch (2017) and Beer, Mooij, and Liu (2020).

[2] According to OECD estimates, MNEs' deliberate BEPS practices costs OECD countries 100–240 billion USD in lost revenue annually, accounting for equivalently 4–10% of the taxes revenues collected from the global companies. Bartelsman and Beetsma (2003) argue that for the OECD countries an increase in the tax rate leads to only a minor increase in the corporate tax revenue, because most of the additional revenue vanishes through income shifting. For the statistic, see http://www.oecd.org/tax/beps/.

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The main purpose of this study is to investigate how MNEs' transfer pricing and location decision strategies will be affected by the cross-national tax differences and trade costs. To target our research aims, we use an oligopolistic model of trade between two countries in which a vertically related MNE is the sole supplier of production factors to its downstream affiliate and a local firm. Both downstream firms are assumed to face cross-national tax differences and pursue Cournot competition in the final good market. Adopting an oligopolistic vertically related structure makes it feasible to investigate the two well-known effects of transfer pricing: the profit-shifting effect (PSE) and strategic effect (SE). The PSE demonstrates that, providing that there exist trade costs and large cross-national tax differences, an MNE can shift profits from high-tax to low-tax countries by using an intrafirm transfer price higher than the unit input production cost.[3] In contrast, the SE states that an MNE can enhance its downstream affiliate's competitive advantage by setting a lower intrafirm transfer price while charging the downstream local firm with a higher external intermediate price. On top of the two effects, we further identify a channel substitution effect (CSE), through which, with a higher transfer pricing, an MNE can substitute its final good sales with total intermediate good sales. To our knowledge, this CSE has not yet been explored in earlier literature.

The main findings in the paper are as follows. First, given the corporate tax difference across countries and an MNE acting as the sole supplier to produce the intermediate inputs, the MNE would intend to manipulate the input price to purposely weaken its downstream affiliate's competitiveness, i.e., by locating the upstream affiliate at the low-tax country, the MNE can increase its internal price on the downstream affiliate located at the high-tax country and thus be able to shift the profits of the latter to the upstream affiliate. This is the same as the conventional result of profit shifting via transfer pricing within an intrafirm transaction. Second, since a higher transfer price charged on its downstream affiliate may be adopted to have more profits from the input sale channel by partially substituting for the profits from the output sale channel, we further recognize such a channel substitution of intermediate goods between selling to the MNE's affiliate and its rivals is highly likely to occur. That is, since the MNE's aggregate revenue comes from the intermediate goods as well as final goods selling, there exists an-

[3]See Hirshleifer (1956), Horst (1971), and Samuelson (1982) for the profit-shifting effect. See Schjelderup and Sørgard (1997), and Zhao (2000) for the strategic effect.

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other tax-avoidance pathway through which, with a higher transfer pricing, the MNE can lighten the tax burden on its consolidated profits by substituting a portion of final goods sales with incremental intermediate goods sales. Thus, both the profit-shifting effect and the channel substitution effect account for the downstream affiliate's relatively lower competitiveness. Third, we identify that trade cost plays an important role in the MNE's location decision-making process. An MNE will separate (agglomerate) its vertically related affiliates across nations as the trade costs are small (large) enough. Also, the larger the level of the difference in international taxation, the higher the possibility that the MNE will separate its vertically related affiliates across nations.

Kato and Okoshi (2019) also analyze the location pattern of upstream production by taking the differences in corporate taxes across countries as given. Their model is the closest to ours in that we both consider a two-country model in which a vertically related MNE is assumed to be the sole input supplier to the two downstream firms. In contrast to our model, however, Kato and Okoshi (2019) assume that trade incurs no costs and the two downstream firms sharing the common inputs produce independent goods. They show that if the international tax difference between the parent and the host countries is sufficiently large, an MNE would choose to separately locate its affiliates in the two countries. When the parent country's tax rate is not sufficiently high, the MNE may always locate an upstream affiliate in the low-tax host country. Compared to their model, our model further allows for trade costs and gives a more general prediction that an MNE will separate its vertically related affiliates across nations as the international tax difference is sufficiently large for a given trade cost.

Peralta, Wauthy, and Ypersele (2006) and Kato and Okoshi (2022) also allow for both trade costs and asymmetric tax rates across nations. Peralta, Wauthy, and Ypersele (2006), however, construct a fiscal competition model in which the corporate tax rates and the choices to implement aggressive tax policy serve as policy instruments. They argue that taxation influences an MNE's location choice and the place where it declares its gross-of-tax profit. Also, there exists the possibility that a large country adopting a high-tax regime with relatively loose regulation policy (i.e., a lower effective tax rate) wins the MNE's plant when trade costs are high. Kato and Okoshi (2022) instead introduce transfer pricing into a two-country new economic geography model (NEG) in which MNEs can choose their optimal locations of production plants and foreign affiliates by determining the optimal

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capital-labor ratio, thus being able to shift profits within the corporate group through intrafirm transfer pricing. According to their result, the location pattern of multinational production is indeed non-monotonic. This is because, they argue, their NEG model inherits the home market effect in the sense that with high trade costs, the home market effect dominates, and the low-tax country attracts a higher share of multinational production than the high-tax country does. By contrast, the location pattern reverses while with a relatively low level of trade costs, production plants agglomerate in the high-tax country, since the strategic taxation saving considerations dominate the home market effect.[4]

To prevent MNEs' tax avoidance behavior, the most followed way in many countries is to apply the so-called arm's length principle (ALP) under which the price charged for goods in a controlled transaction between related firms should be similar to the price for comparable goods in an uncontrolled transaction. Thus, it deserves to be examined further how the MNEs' decision-making on transfer prices and the location of related affiliates may differ when the MNEs strictly follow the ALP rule. Despite the voluminous literature on the ALP, which mostly emphasizes the ALP effects on taxation revenue and welfare,[5] there exists little discussion on the im-

[4]Stöwhase (2005, 2013) and Johannesen (2010) investigate tax competition with asymmetric tax rates while no trade costs are assumed. Stöwhase (2005) and Johannesen (2010) find that low-tax countries attract more plants (or a higher capital-labor ratio) than high-tax countries do. Stöwhase (2013) examines tax competition between two countries of unequal size and obtain the opposite result that the large country sets a higher tax rate while attracting a single multinational plant. Only the profit-shifting effect was presented in Peralta, Wauthy, and Ypersele (2006), Choi, Furusawa, and Ishikawa (2020), and Kato and Okoshi (2022). Neither the strategic effect nor channel substitution effect were addressed.

[5]For instance, Choi, Furusawa, and Ishikawa (2020) examine MNEs' incentive to manipulate transfer prices to avoid tax payments, and consider how governments may respond to such practices. They show that the MNE's home country may tighten transfer-pricing regulation by lowering the transfer-price cap to counter transfer-pricing activities and eventually prevent the MNE shift all its profits to the low-tax country. Keuschnigg and Devereux (2013) argue that the application of the ALP will discriminate against FDI, and reduce MNE's foreign affiliates' investment and total profit. Although the ALP may raise tax revenue and welfare in the headquarter country, however, welfare losses may be larger in the subsidiary location, leading to a net loss in world welfare. Choi, Ishikawa, and Okoshi (2024) also argue that the ALP can decrease domestic welfare when an MNE licenses its patent to the local firm, since the MNE produces less to increase the local firm's revenues, and thus have

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pacts of the ALP on MNEs' location decisions under the consideration of cross-national tax differences and trade costs. To our knowledge, there are only two exceptions. Yao (2013), who uses a Hotelling-type model with cross-national tax differences, shows that an MNE's transfer pricing may depend on taxation policies as well as firms' location choices. By imposing the ALP rules on an MNE, a country does not necessarily raise more tax revenues under endogenous location choices. Kato and Okoshi (2019) argue that without the enforcement of the ALP rule, an MNE may locate its upstream and downstream divisions in different countries, and by doing so, it will be able to reduce tax burdens through profit shifting to low tax jurisdictions. However, when the arm's length principle has been followed, an MNE would locate all its associated enterprises in the lowest tax jurisdiction, since there can be no further profit due to the loss of price discrimination. In contrast to Kato and Okoshi (2019), in the extension when considering the ALP, we show that under the ALP, an MNE will be more likely to separate its vertically related affiliates across different countries. This occurs because the channel substitution effect is amplified, and inter-firm trade becomes more significant for the MNE when the ALP is fully implemented. Consequently, the MNE leverages channel substitution to maximize its overall profits.

In addition to the discussion of the ALP, our article also extends to analyze whether different circumstances would change the MNE's decision on the location pattern of its vertically related affiliates in different scenarios. We find that the MNE prefers to locate its upstream subsidiaries in low-tax countries when the number of its downstream rival companies increases. The MNE is also less likely to spin off its affiliates when there exist local upstream rivals. Since the presence of local upstream firms weakens the strength of the channel substitution effect, therefore, the MNE has weaker incentives to move its upstream subsidiaries to low-tax countries. Our main results remain robust when we further consider the cases where, compared to the benchmark model, the opposite party bears the transportation costs, and the tax burden difference between the two countries is exactly the opposite. The rest of the paper is organized as follows. Section 2 illustrates the model. In Section 3, a benchmark case is presented to discuss how cross-border tax differences and trade costs influence an MNE's transfer pricing and location decision-making. Section 4 discusses the robustness of the main results derived in Section 3 by considering some extensions of the model, includ-

larger MNE's revenues in a tax haven country through licensing revenues from the local firm.

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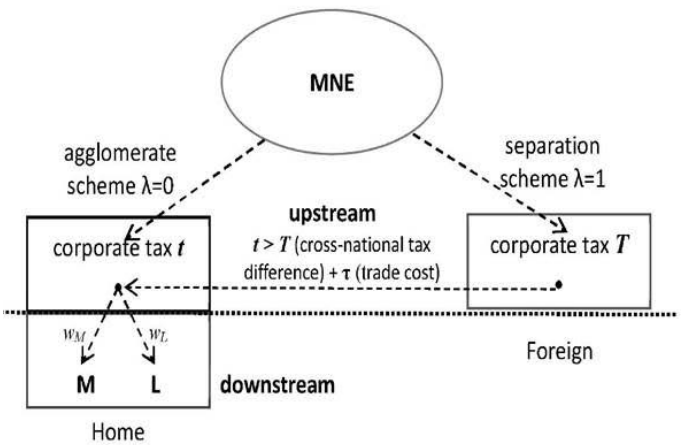


Figure 1: The structure of the model

ing the ALP application, multiple local downstream firms, a local upstream firm, the Incoterms® CIF case, and a relatively high-tax foreign country. The concluding remarks are presented in Section 5.

2 The model

We consider a two-country model with a vertically related industry, including an intermediate input market and a final good market. There are two firms: a local firm (L) and a multinational enterprise (M) with an upstream affiliate (U) and a downstream affiliate (D). A final good market is in country H, where the profit-maximizing local firm (L) and MNE's downstream affiliate (D) compete by producing heterogeneous goods and serving them á la Cournot. Without loss of any generality, we assume a symmetric inverse demand function, $p_i(q_i, q_j) = 1 - q_i - bq_j, i, j = L, M, i \neq j$, where q_L and q_M denote respectively the quantities of consumption of the final good produced by the local firm and MNE's downstream affiliate. The parameter $b \in [0, 1]$ measures the degree of substitution between the final goods: $b = 0$ represents both goods are independent, $b = 1$ represents both goods are homogeneous, and a larger value of b means more product substitution. Figure 1 summarizes the model.

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The MNE may locate its upstream affiliate either in country H, facing a corporate tax rate of t, or in country F, facing a rate of T. We assume $t > T$, indicating that country H is a relatively high-tax country compared to country F. In our model, considering the location of its upstream section is essential to the MNE. When both its upstream and downstream affiliates are established in country H, we say the MNE takes an "Agglomeration scheme", i.e., it agglomerates the locations of its upstream and downstream affiliates. By contrast, the MNE takes a "Separation scheme" when it separates the locations of its upstream and downstream affiliates, i.e., the MNE chooses to locate its upstream affiliate in a foreign country (F) but its downstream affiliate in the domestic country (H).[6]

We also assume the MNE's upstream affiliate is the only provider of input factors to its downstream affiliate and the local firm, both using the same production technology by which one unit of inputs is transformed into one unit of final products. The MNE's downstream affiliate is charged with an internal transfer price (w_M), while its competitor is charged with an external input price (w_L). The MNE operates under the decentralized mode, under which the MNE locates its upstream affiliates and makes the transfer price decision to maximize its total after-tax profits, but delegates the quantity decision to the downstream affiliate whose objective seeks to maximize its post-tax profits.[7] When the upstream affiliate is established abroad, there exists one extra per-unit trade cost (denoted by τ) associated with border crossing.

The MNE's optimization problem consists of the decisions on the location of its upstream section, the pricing of input products, and the quantity supplied of the final goods. The sequence of events is as follows. First, the MNE chooses the location of upstream production. Second, the MNE determines the optimal input prices charged to its downstream affiliate and the local firm to maximize the total post-tax profits of its upstream and downstream affiliates. Third, the MNE's downstream affiliate and the local firm choose outputs to maximize their profits.

Although the MNE may have strong incentives to maximize its total

[6]Since the final-good market is in the host country and direct access to the market is naturally the best choice for the MNE's downstream affiliate, we ignore the opportunity for the MNE relocating its downstream affiliate to the foreign country.

[7]See Baldenius and Reichelstein (2006) for more detailed statements about the prevailing uses of decentralized system in MNEs.

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post-tax profits through the decisions on the location of its upstream affiliate and input price discrimination, it must comply with country H' arm's length principle (ALP), e.g., the internal transfer price between the MNE's related affiliates should be consistent with the external input price under the underlying setting. We will also proceed by analyzing the case where the MNE is free from and the case where it obeys the ALP, i.e., $w_M = w_L$.

3 The benchmark case

We first consider the case where the ALP is not imposed, i.e., the MNE's upstream affiliate charges its downstream firm (M) and local firm (L) with different input prices. Let λ denote a state variable that takes zero (resp. one) if the MNE chooses to locate its upstream affiliate in country H (resp. F). The equilibrium outcomes are simultaneously derived considering the Agglomeration (with $\lambda = 0$) and Separation schemes (with $\lambda = 1$). By comparing the equilibrium profits under these two schemes, we demonstrate in which country the MNE may locate its upstream affiliate, given the tax differences and trade costs between countries H and F.

3.1 Output stage

The model is solved by using backward induction. First, derive the market equilibrium determined in the output stage. The unit cost of downstream firms, producing one unit of final good and selling to the consumers in country H, is given by $c_i = w_i + \lambda\tau$, for $i \in \{L, M\}$.[8] π_i^D denotes the downstream firm's pre-tax profits from the final good market, and we define it as below:

$$\pi_i^D = \left(p_i\left(q_i, q_j\right) - c_i\right) q_i. \quad \text{for} \quad i \in \{L, M\}. \tag{1}$$

Substituting the market price into (1) and solving the maximization problems yields the following equilibrium outputs for each downstream

[8] In the benchmark case, we assume the downstream firms incur the trade cost to deliver the intermediate inputs from country F to country H, i.e. using Incoterms® FOB. Later in Section 4.4. we will talk about the case with the input seller paying to insure and transport goods to the buyers (using Incoterms® CIF).

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firm:

$$q_i\left(w_i, w_j, \lambda, \tau\right) = \frac{1-\lambda\tau}{2+b} - \frac{2w_i - bw_j}{4-b^2}, \quad \text{for} \quad i, j \in \{L, M\}, \ \ i \neq j. \tag{2}$$

It is easy to get $\partial q_i/\partial w_i < 0$, $\partial q_i/\partial w_j > 0$, and $\partial q_i/\partial \tau < 0$ for $\lambda = 1$, $\partial q_i/\partial \tau = 0$ for $\lambda = 0$. Intuitively, under Cournot competition, each firm's production decreases with the increased cost of its output, whereas it increases its output when its rival faces a higher input price. In addition, when the MNE separates its vertically related affiliates, i.e., as $\lambda = 1$, the ensuing trade costs will lead both firms to decrease their outputs. The tax rate does not affect output levels since the government in country H imposes the corporate tax on firms' profits proportionally.

3.2 Transfer and input-price stage

Considering these derived quantities, the MNE sets input prices for the two downstream firms in this stage. By substituting the equilibrium outputs as shown in (2) into (1), each downstream firm's equilibrium pre-tax profits can be expressed as $\pi_i^D(w_L, w_M, \lambda, \tau)$, $i \in \{L, M\}$. By respectively defining the pre-tax profits of the MNE's upstream as $\pi_M^U(w_L, w_M, \lambda, \tau) = w_M q_M(w_L, w_M, \lambda, \tau) + w_L q_L(w_L, w_M, \lambda, \tau)$, and the MNE's pre-tax total profits as $V_M(w_L, w_M, \lambda, \tau) = \pi_M^D(w_L, w_M, \lambda, \tau) + \pi_M^U(w_L, w_M, \lambda, \tau)$, the MNE faces the following problems:[9]

$$\begin{aligned} \max_{w_L, w_M} \ & \Pi\left(w_L, w_M, \lambda, \tau, t, T\right) \\ &= (1-t)\pi_M^D\left(w_L, w_M, \lambda, \tau\right) \\ &\quad + [1 - \lambda T - (1-\lambda)t]\pi_M^U\left(w_L, w_M, \lambda, \tau\right) \\ &= (1-t)\left(\underbrace{\pi_M^D + \pi_M^U}_{V_M}\right) + \underbrace{\lambda(t-T)\pi_M^U}_{\text{tax-savings}}, \end{aligned} \tag{3}$$

where Π is defined as the MNE's total after-tax profits, as shown in the first RHS of (3), composed of the after-tax profits collected at the downstream affiliate and the counterpart at the upstream affiliate. When the MNE's

[9] We assume the upstream affiliate provides the inputs without any production costs.

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affiliates agglomerate in country H, they confront the same higher tax rate t. In contrast, when the MNE separates its affiliates, the upstream has a lower tax rate, T, whereas the downstream still holds a higher tax rate.

The difference in the cross-border tax rates allows the MNE to grasp profits by manipulating profit-shifting activities, as shown by the second term on the RHS side of the bottom equation of (3). When downstream and upstream affiliates co-locate at country H, that is $\lambda = 0$, the MNE's total pre-tax profits will equal the sum of its affiliates' pre-tax profits, which amounts to $V_M = p_M q_M + w_L q_L$. Alternatively, when the upstream affiliate moves location to country F, that is $\lambda = 1$, the MNE's total after-tax profits will include an additional income, captured in the term $(t - T)\pi_M^U$ as shown in (3). Imagine that when the upstream affiliate is in country F, it can transfer the taxable income π_M^U from a high-tax country to a low-tax country, and thus will save the tax payments up to $(t-T)\pi_M^U$. This induced amount of tax-saving via separating locations is the benefit of profit-shifting activities. However, there will be a trade cost when doing cross-border business with the upstream affiliate. The downstream affiliate will now incur a cross-border trade cost τq_M and the sum of the MNE affiliates' pre-tax profits becomes $V_M = p_M q_M + w_L q_L - \tau q_M$ when the upstream affiliate is in country F.

The MNE's headquarters simultaneously chooses w_L and w_M to maximize Π. Deriving the two first-order condition equations from the MNE's problem ($d\Pi/dw_i = 0$, for $i = L, M$), and solving the system of equations for (w_L, w_M), we obtain the following equilibrium input and transfer prices, respectively:

$$w_L^* = \frac{1 - \lambda\tau}{2}, \tag{4}$$

$$w_M^* = \frac{1 - \lambda\tau}{2}\left[1 - \frac{2 - b}{2 - b^2 + (4 - b^2)\,\delta\lambda}\right], \tag{5}$$

where we introduce a new variable δ, defined by $\delta = (t - T)/(1 - t)$,[10] to capture the quantitative level of an international tax difference between countries H and F.

Note that the expression in the bracket of the right-hand side of w_M^* as shown in Equation (5) is positive and less than 1 if $\lambda = 1$, which echoes

[10] In our proceeding analysis, we will focus on the situation with $0 < \delta \leq 1$ because we seldom observe the corporate tax rates across the world economy exceed 50%.

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earlier literature findings on transfer pricing. First, $w_M^* < w_L^*$, which means the internal transfer price is lower than the external input price. This property is exactly the strategic nature of transfer price, indicating that the MNE can set a transfer price on its downstream affiliate below the input price charged on its downstream rival, such that the MNE's downstream affiliate can take a competitive edge over its rival in the final good market. Second, w_M^* is positive, which means the MNE's transfer price is always larger than its marginal cost of producing inputs. This illustrates the conventional *profit-shifting effect* of transfer pricing, i.e. the MNE can manipulate its internal transfer price to allocate a portion of its total pre-tax profits from a relatively high-tax country to a low-tax one to reduce its total tax payments.

It is also interesting to investigate how the MNE can manage its internal and external input prices corresponding to different location choices of its upstream affiliate. To find the consequences, we can take a close look at the relative price ratio between w_L^* and w_M^*. Denoting $\omega^* = w_M^*/w_L^*$, and using Equations (4) and (5), it can be shown as below:

$$\omega^* = \frac{w_M^*}{w_L^*} = 1 - \frac{2-b}{2-b^2+(4-b^2)\,\delta\lambda}. \tag{6}$$

Given $0 \leq b \leq 1$ and $0 < \delta \leq 1$, we can get $0 \leq \omega^* < 1$. ω^* is relatively bigger at $\lambda = 1$ than at $\lambda = 0$, saying that the relative price ratio ω will increase as the MNE switches its location mode from the Agglomeration scheme (with $\lambda = 0$) to Separation scheme (with $\lambda = 1$). The result implies that, compared to such a situation with the upstream affiliate staying in the high-tax country, the MNE will manipulate the relative price ratio between w_L and w_M to purposely raise its downstream affiliate's incurred cost after it moves its upstream affiliate to the low-tax country. Proposition 1 is thus set up to highlight the outcome obtained above.

Proposition 1. Given the corporate tax difference across countries and an MNE is the sole supplier to produce the intermediate inputs, the MNE's downstream affiliate will face a relatively higher (resp. lower) transfer price when the MNE separates (resp. agglomerates) the locations of its related upstream and downstream affiliates.

The economic intuition behind Proposition 1 is as follows. As illustrated in Equation (3), the profits of the MNE can be exactly shown as $\Pi = (1-t)V_M + \lambda(t-T)\pi_M^U$, where V_M and π_M^U, respectively, measure the MNE's

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pre-tax total profits and its pre-tax profits collected at the upstream affiliate. Under the Agglomeration scheme (with $\lambda = 0$), the MNE without the route of tax avoidance has the strongest incentive to boost the competitive advantage of its downstream affiliate by enlarging the gap of input prices to favor its downstream affiliate such that the downstream affiliate can capture the most extent of market share. Indeed, with the final goods being perfectly homogeneous, the MNE's downstream affiliate will monopolize the market since the difference in input prices is so sufficiently large to foreclose its rivals from the market, i.e., $q_L = 0$ under the Agglomeration scheme.[11]

In contrast, under the Separation scheme (with $\lambda = 1$), the MNE separates its related affiliates and confronts different tax rates between countries, thereby it can try to find and exploit the tax loophole by manipulating the transfer price to dodge the tax burden. We argue that two price maneuvers of transfer pricing can induce the MNE to enlarge its upstream affiliate's profits and thereby enjoy such tax benefits. First, by locating the upstream affiliate in the low-tax country (F), the MNE can increase its internal price on the downstream affiliate located in the high-tax country (H) and then shift the increased costs of the latter, i.e., $w_M q_M$, to the upstream affiliate. This profit shifting via transfer pricing within intrafirm transactions is the conventional result of profit-shifting manipulation. Second, since the tax rate imposed on input sales is lesser than that on final-good sales, the MNE can further exploit this tax niche again through an increase in the level of transfer price because it will indirectly induce the downstream rival to purchase more inputs, and then increase the upstream affiliate's profits via the sale to its downstream customer, i.e., $w_L q_L$. On balance, by separating the locations of the affiliates, the MNE can charge a higher transfer price on its downstream affiliate to enjoy more tax savings by replacing some amounts of its profits from final-good sales at the high tax country (H) with the increased amounts of profits from the input sales at the lower tax country (F). For such a reverse effect (vis-à-vis the strategic effect) on the transfer pricing, we call it the *channel substitution effect*, which refers to when there exist dual channels, namely, one channel through the final-good sale to customers, and

[11] After substituting w_L^* and w_M^* respectively expressed in Equations (4) and (5) into Equation (2), we can rewrite the equilibrium outputs of each product given by $q_L^* = \{(1 - \lambda\tau)[1 - b + (2 - b)\delta\lambda]/[4 - 2b^2 + (8 - 2b^2)\delta\lambda]\}$ and $q_M^* = \{(1 - \lambda\tau)(1 + \lambda\delta)(2 - b)/[4 - 2b^2 + (8 - 2b^2)\delta\lambda]\}$. Therefore, with $\lambda = 0$ and $b = 1$, i.e. $q_L^* = 0$, the local firm will exit from the market.

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the other channel through the input sale to its downstream rival. A higher transfer price charged on its downstream affiliate may be adopted to have more profits from the input sale channel by partially substituting for the profits from the output sale channel.

To sum up, when the MNE moves its upstream affiliate to the lower tax country (F), two added effects arise from motives with profit-shifting and channel substitution to the existent strategic effect. Because these two effects all induce the MNE against the strategic motive to increase the level of the transfer price, thus we can conclude that, compared to the situation when the upstream affiliate is located in the higher tax country (H), these two counterpart effects (vis-à-vis the strategic effect) account for relatively higher costs faced by the downstream affiliate.

At the end of this section, we come to delineate the equilibrium outcomes of the benchmark case in each location scenario of the MNE's affiliates. By substituting w_L^* and w_M^* into Equations (2) and (3), respectively, we obtain the MNE's equilibrium quantities and total profits. The following lemma summarizes the results (All variables superscripted with an asterisk are equilibrium values of variables related to the benchmark case).

Lemma 1. Under the benchmark case (with no regulations on the transfer price), the equilibrium transfer price, input price, quantities, the pre-tax profits of MNE's affiliates, and the MNE's total post-tax profits, respectively, are

$$
\begin{aligned}
w_M^* &= \frac{1-\lambda\tau}{2}\left[1-\frac{2-b}{2-b^2+(4-b^2)\,\lambda\delta}\right],\\
w_L^* &= \frac{1-\lambda\tau}{2},\\
q_M^* &= \frac{(1+\lambda\delta)(1-\lambda\tau)(2-b)}{4-2b^2+(8-2b^2)\,\lambda\delta},\\
q_L^* &= \frac{(1-\lambda\tau)(1-b+(2-b)\lambda\delta)}{4-2b^2+(8-2b^2)\,\lambda\delta},\\
\pi_M^{D*} &= \left(q_M^*\right)^2,\\
\pi_M^{U*} &= \frac{(1-\lambda\tau)^2\left[\lambda\delta(2-b)\left(4-2b^2+\delta\lambda\left(4-b^2\right)\right)+b^3-2b^2+1\right]}{2\left[2-b^2+(4-b^2)\,\lambda\delta\right]^2},\\
V_M^* &= \Big\{(1-\lambda\tau)^2\left[\delta\lambda(2-b)\,(12+10\delta\lambda-b(1+2b)(2+\delta\lambda)\right)
\end{aligned}
$$

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$$+(3-2b)\left(2-b^2\right)\Big]/\left[4-2b^2+\left(8-2b^2\right)\lambda\delta\right]^2\Big\}, \quad \text{and}$$

$$\Pi^* = \frac{(1-t)(1+\lambda\delta)(3-2b+2(2-b)\lambda\delta)(1-\lambda\tau)^2}{8-4b^2+(16-4b^2)\lambda\delta}.$$

3.3 Location stage

Lemma 1 expresses the equilibrium post-tax profits owned by the MNE as a function of λ. Since λ is a binary variable, taking either 0 or 1, the MNE's total net profits can be expressed as $\Pi^*(0)$ for the case of Agglomeration scheme where the MNE's upstream and downstream affiliates being vertically agglomerated in country H, and alternatively $\Pi^*(1)$ for the case of Separation scheme where vertically related affiliates being separated between countries H and F. After substituting $\lambda = 0$ and $\lambda = 1$ into $\Pi^*(\lambda)$, and letting $\Pi^A = \Pi^*(0)$ and $\Pi^S = \Pi^*(1)$, we have:

$$\Pi^A = \frac{(1-t)(3-2b)}{4\left(2-b^2\right)}, \quad \text{and}$$

$$\Pi^S = \frac{(1-t)(1+\delta)(3+4\delta-2b(1+\delta))(1-\tau)^2}{4\left[2(1+2\delta)-(1+\delta)b^2\right]}. \tag{7}$$

To analyze the MNE's optimal location pattern of its related affiliates, we firstly subtract Π^S with Π^A in Equation (7) and proceed to obtain the conditions under which it is better for the MNE to choose the Separate or Agglomeration pattern. Straight calculation gives the following equation:

$$\Pi^S - \Pi^A = \frac{(1-t)\Omega}{4\left(2-b^2\right)\left[2(1+2\delta)-(1+\delta)b^2\right]}, \tag{8}$$

where $\Omega = -\tau(2-\tau)(1+\delta)(2-b^2)[3+4\delta-2b(1+\delta)]+2\delta[1-2b^2+b^3+\delta(2-b)(2-b^2)]$. Noticing that the denominator of the right side of Equation (8) is positive, thus Ω in the numerator determines the sign of the difference in profits between two alternative location patterns. It is easy to show that Ω decreases in the trade cost, i.e. $\partial\Omega/\partial\tau < 0$. Since Ω is greater than zero when it is evaluated at $\tau = 0$ and lesser than zero when evaluated at $\tau = 1$,[12] thus it is obvious that there exists a critical value of τ, which is

[12] Given $\delta > 0$, we can calculate and show (i) $\partial\Omega/\partial\tau = -2(1-\tau)(1+\delta)(2-b^2)[3+4\delta-2b(1+\delta)] < 0$; (ii) $\Omega(\tau=0) = 2\delta[1-2b^2+b^3+\delta(2-b)(2-b^2)] > 0$ and $\Omega(\tau=1) = -(3-2b)[2+4\delta-(1+\delta)b^2] < 0$.

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referred as τ^N and defined by $\Omega(\tau^N) = 0$, such that the MNE will choose the Separate scheme if the trade cost is strictly lower than τ^N whereas it will choose the Agglomeration scheme if the trade cost is bigger than τ^N. That is, from setting the right-hand side of Equation (8) equal to zero, we have:

$$\tau^N = 1 - \sqrt{1 - \frac{2\delta\left[1 - 2b^2 + b^3 + \delta(2-b)\left(2-b^2\right)\right]}{(1+\delta)\left(2-b^2\right)\left[3 + 4\delta - 2b(1+\delta)\right]}}. \tag{9}$$

After finding out the condition that describes the accurate choice of location pattern for the MNE, we go further in studying how the change in tax difference affects the MNE's optimal location pattern. To answer these questions, we simply investigate the influence of the size of δ on the value of τ^N. Simply differentiating τ^N in Equation (9) with respect to δ yields $d\tau^N/d\delta > 0$,[13] implying that the wider the size of international tax difference allow the MNE more easily to separate its related affiliates in different countries. We summarize the analytic results in the following proposition.

Proposition 2. Given the MNE is the sole supplier to produce the intermediate inputs, (i) The MNE will separate (agglomerate) its vertically related affiliates across nations as the trade costs is small (large) enough, (ii) The larger the level of the difference in international taxations, ceteris paribus, the higher the possibility the MNE will separate its vertically related affiliates across nations.

The economic intuitions in Proposition 2 are as follows. The first point of Proposition 2 is a straight result. As shown in Equation (7), the trade cost always plays a negative role against the establishment of the upstream affiliate in the foreign country, thus, the Separation scheme is beneficial for the MNE when it faces a low level of trade cost, as shown in Equation (9). The second point of Proposition 2 is in line with the motivations behind the action of tax avoidance. As the level of difference in international taxation increases, facing a wider window of tax loopholes, the MNE will have

[13] Let $x = \{2\delta[1 - 2b^2 + b^3 + \delta(2-b)(2-b^2)]/(1+\delta)(2-b^2)[3+4\delta-2b(1+\delta)]\}$ and straightly calculation gives $(dx/d\delta) = \{2(3-2b)[1 + (1+\delta)(2-b)((4-b^2)\delta - b^2)]/(2-b^2)(1+\delta)^2[3+4\delta-2b(1+\delta)]^2\}$. Executing numerical simulation and limiting both values of b and δ within [0,1], we can show $dx/d\delta > 0$. Since Equation (9) reveals $d\tau^N/d\delta$ have the same mathematical sign with $dx/d\delta$, we thus conclude $d\tau^N/d\delta > 0$.

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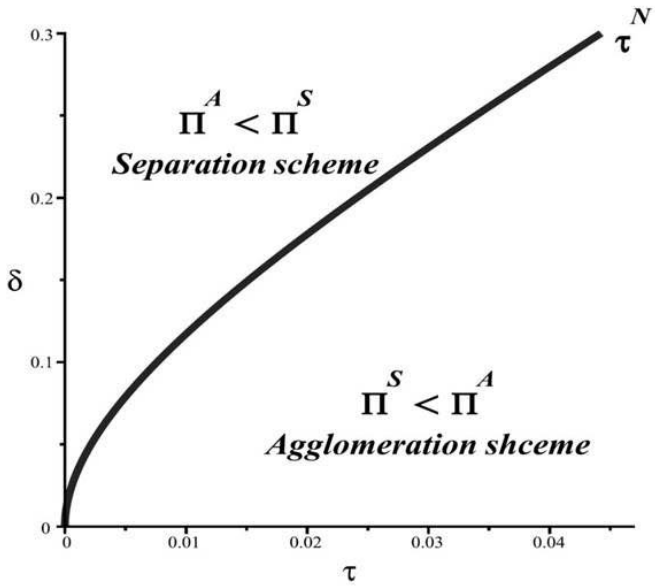


Figure 2: MNE's optimal location pattern

stronger motives to raise the transfer price to enjoy more tax savings based upon the profit-shifting effect and the channel substitution effect. To serve such a tax-avoidance purpose, the MNE can only select to adopt the Separation scheme. Therefore, as the incentive of tax avoidance will grow with a higher level of international taxation, the critical value of trade cost must correspondingly be larger to eliminate the MNE's plan to split the locations of its vertically related affiliates. But, a larger critical value of the trade cost just implies, ceteris paribus, more possibility for the Separation scheme to be chosen by the MNE.

Figure 2 represents the results in Proposition 2 for the case with $b = 1$. In this figure, the critical value of trade cost, τ^N, is plotted with a bold line that separates the (τ, δ) space into two unjointed subspaces. Each pair of (τ, δ) in the upper (resp., lower) subspace meets the condition $\tau <$ (resp., $>$) τ^N, therefore the upper (resp., lower) space is the portion that the MNE will select the Separation (resp., Agglomeration) scheme. Notice that the τ^N line gradually rises with the level of δ, which exactly reflects the second point of Proposition 2.

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Figure 2 will further assist us in inferring the impacts of two international policy issues – international tax harmonization and trade liberalization on the MNE's location arrangement. First, using Figure 2, we can easily recognize that, for any given level of trade cost (τ), when countries cooperatively facilitate the goal of international tax harmonization, i.e., as δ gets gradually smaller, the MNE will correspond to such a policy proposal by ultimately agglomerating its related affiliates because a sufficiently lower difference in taxation will significantly decrease the MNE's benefits from locating its upstream affiliate in the lower tax country. In this situation, the traditional strategic effect will be greater than the profit-shifting and channel substitution effects, thus, the MNE will choose to agglomerate its related affiliates. Second, from Figure 2, we can also observe that, for any given level of difference in international taxation (δ), the MNE will react to the implementation of trade liberalization, as reflected by a smaller level of τ, by separating the related affiliates in the end since trade liberalization helps sap the hefty trade costs incurred when the MNE transports the intermediate inputs internationally. In this case, lower trade frictions induce the MNE to manipulate the channel substitution effect to enjoy the tax-savings benefits, and thus choose to separate its related affiliates.

We argue that the MNE is more willing to take the Separation scheme and locate its upstream affiliate in a low tax country when the product substitution in the downstream market is small. Consider downstream firms offering heterogeneous products that compete in quantity, i.e., $b < 1$. The τ^N curve in Figure 2, obtained by plotting equation (9), will move downward in a clockwise direction. When b deviates from 1 and gets smaller, for any given level of trade cost (τ), the traditional strategic effect will become weaker. In contrast, the profit-shifting and channel substitution effects will become stronger, which makes the MNE less willing to agglomerate its affiliates. When $b = 0$, i.e., downstream firms produce independent goods, it can be still identified that if the international tax difference between the domestic and foreign countries is large, an MNEs is more willing to choose to separately locate its affiliates in the two countries, which is just the result as yielded by Kato and Okoshi (2019).[14]

[14]We are indebted to an anonymous reviewer for pointing out the role that product differentiation plays in this discussion. Generally, the increase in product differentiation mitigates the traditional strategic effect but strengthens the profit-shifting and channel substitution effects. We further found that when the value of b drops down to 0.6096, the τ^N curve

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We summarize these two findings mentioned above with the following corollary.

Corollary 1. The policy associated with international tax harmonization will push the MNE to choose to agglomerate its related affiliates, whereas the policy associated with trade liberalization will induce the MNE to choose to separate its related affiliates.

4 Extensions of the model

In this section, we extend our discussion to several strands of interesting issues, including the exercise of the Arm's Length Principle (ALP), multiple local downstream firms, a local upstream firm, Incoterms® CIF case, and a relatively high-tax foreign country ($t < T$). We will focus on analyzing whether different circumstances would change the MNE's decision on the location pattern of its vertically related affiliates by comparing equilibrium outcomes to those obtained in the benchmark case.

4.1 Arm's length principle

As we have seen in the current economy, where MNEs play a prominent role, and people often suspect some of them carry out their transactions with a tax avoidance purpose, applying the "arm's length principle" (ALP) is thus the international consensus on transfer pricing. Under the ALP, the price agreed in a transaction between two related parties must be the same as the price agreed in a comparable transaction between two unrelated parties. Therefore, applying the ALP to the transactions involved with dual distribution aims to prevent the downstream local firm from being discriminated against the MNE's downstream affiliate, based on an equal footing under comparable circumstances within the final good market.

To examine whether the application of ALP will change the MNE actions, especially on the location arrangement of its related affiliates, we repeat the procedure of solving the problems in Section 3, but assuming that the MNE sets its internal transfer price identical to the external factor price

moves to the relative lowest position. When $b \in [0, 0.6096)$, reversely, higher product differentiation mitigates the profit-shifting and channel substitution effects, but strengthens the traditional strategic effect. However, when $b = 0$, the τ^N curve still clearly below the curve under $b = 1$.

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charged to its downstream competitor, i.e., $w_M = w_L = w$ under the ALP case. Based on the ensuing calculation, Lemma 2 summarizes the equilibrium outcomes under the ALP rule (All variables superscripted with "ALP" are equilibrium values of variables related to the ALP case).

Lemma 2. Under the ALP case (with regulations on the transfer price), the equilibrium input price, quantities, the pre-tax profits of MNE's affiliates, and the MNE's total post-tax profits, respectively, are

$$
\begin{aligned}
w^{ALP} &= \frac{1-\lambda\tau}{2}\left[1-\frac{1}{3+2b+(4+2b)\lambda\delta}\right],\\
q_M^{ALP} &= q_L^{ALP} = \frac{(1+\lambda\delta)(1-\lambda\tau)}{3+2b+(4+2b)\lambda\delta},\\
\pi_M^{D,ALP} &= \left(q_M^{ALP}\right)^2,\\
\pi_M^{U,ALP} &= \frac{2(1+\lambda\delta)(1-\lambda\tau)^2[1+b+(2+b)\lambda\delta]}{[3+2b+(4+2b)\lambda\delta]^2},\\
V_M^{ALP} &= \frac{(1+\lambda\delta)(1-\lambda\tau)^2[3+2b+(5+2b)\lambda\delta]}{[3+2b+(4+2b)\lambda\delta]^2}, \quad \text{and}\\
\Pi^{ALP} &= \frac{(1-t)(1+\lambda\delta)^2(1-\lambda\tau)^2}{3+2b+(4+2b)\lambda\delta}.
\end{aligned}
$$

By comparing the input price in Lemma 2 (with ALP) to the transfer price and the input price in Lemma 1 (without ALP), it is clear and straightforward that $w_M^* < w^{ALP} < w_L^*$, for any given value of λ. This comparison merits a proposition as follows.

Proposition 3. Under the ALP case, the transfer price charged on the MNE's downstream affiliate will be greater than in the case without the ALP regulation, regardless of the MNE's choice of location scheme of its affiliates.

The finding in Proposition 3 is straightforward. In the absence of ALP, we have acknowledged and demonstrated in the benchmark case that the MNE will charge a higher input price on its downstream rival than the transfer price on its downstream affiliate, i.e., $w_M^* < w_L^*$, aroused from the competitive motivation. However, after applying ALP, which legally prohibits the implementation of discriminatory pricing on the internal and external input prices, the MNE now responds to ALP regulation by raising the internal transfer price, decreasing the external input price, and converging them

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to the same level. Thus, we can obtain that the transfer price in the presence of ALP will be greater than the one absent the ALP.

Proposition 3 has a significant implication on the usage of the transfer price as ALP is applicable. Since the transfer price will be higher and the external input price will be lower under the case of ALP than without it, the application of ALP naturally lets firm L's market share increase (to 1/2) and induce the MNE to lay a heavier weight on the revenue from the input sales compared to that in the absence of ALP. Using outcomes in Lemma 1 and Lemma 2, we will see below that the above argument is even clearer by comparing the profits of MNE affiliates before and after the ALP is implemented.

$$\pi_M^{D,ALP} - \pi_M^{D*} = \left(q_M^{ALP}\right)^2 - \left(q_M^*\right)^2 < 0, \tag{10}$$

$$\pi_M^{U,ALP} - \pi_M^{U*} = \frac{(1-\lambda\tau)^2\left\{7+4b+(2+b)\left[4\lambda\delta(2+\lambda\delta)-b^2(1+\lambda\delta)^2\right]\right\}}{\left[2-b^2+(4-b^2)\lambda\delta\right]^2\left[3+2b+2(2+b)\lambda\delta\right]^2} > 0, \tag{11}$$

where the sign of (10) comes from the fact: $w_M^* < w^{ALP}$, and thereby $q_M^{ALP} < q_M^*$; the sign of (11) is positive regardless of the values of $\lambda = \{0, 1\}$, $b \in [0, 1]$ and $\delta \in (0, 1]$. Because $V_M = \pi_M^D + \pi_M^U$, Equations (10) and (11) thus imply that the MNE will assign a more significant proportion of its pre-tax profits to the input sales. The following lemma states the profit changes of the MNE affiliates before and after the ALP is executed.

Lemma 3. Given a specific value of λ, when the host country applies the ALP, the profits of the MNE's downstream (resp., upstream) affiliate will be less (resp., higher) than it is free of such a rule.

Analogically, to evaluate the condition under which it is better for the MNE facing the ALP to choose the Separate or Agglomeration pattern, we insert $\lambda = 0$ and $\lambda = 1$, respectively, into Π^{ALP} in Lemma 2. A simple calculation gives:

$$\Pi^{ALP}(\lambda = 1) - \Pi^{ALP}(\lambda = 0) = \frac{(1-t)\Omega^{ALP}}{(3+2b)[3+2b+(4+2b)\delta]}, \tag{12}$$

where $\Omega^{ALP} = [2 + 2b + (3 + 2b)\delta - \tau(2 - \tau)(3 + 2b)(1 + \delta)^2]$. Likely, through checking Ω^{ALP} on the RHS of (17), we can see the numerator

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is greater (resp., lesser) than 0 when $\tau = 0$ (resp., $\tau = 1$). Since Ω^{ALP} decreases in τ when $\tau \in (0, 1]$, it implies that the MNE will locate its upstream affiliate in the low-tax country if the trade cost is smaller than the critical value τ^{ALP}, which is given by

$$\tau^{ALP} = 1 - \sqrt{1 - \frac{\delta[2 + 2b + (3 + 2b)\delta]}{(3 + 2b)(1 + \delta)^2}}. \tag{13}$$

We can directly derive that the value of τ^{ALP} is increasing in the relative size of the difference in international taxations. Thus, the results in Proposition 2 and its economic explanations apply here, too.

We are further interested in examining whether the ALP regulation will influence the MNE's location decision on its upstream affiliate. By comparing the value of τ^N in (9), namely the critical value of trade cost without the ALP, with the value τ^{ALP} in (13) under the ALP principle, we then obtain the following comparison result:

$$\tau^{ALP} > \tau^N, \quad \text{for each given value of } \delta \text{ and } b. \tag{14}$$

Figure 3 illustrates the result in (14) with $b = 1$. As Figure 3 shows, the region of the pairs of (τ, δ), bounded by the τ^N and τ^{ALP} curves, elicits the MNE to continuously select the Separation scheme regarding its related affiliates under the ALP regulation. In contrast, the MNE will opt for the Agglomeration scheme without ALP.

According to the above facts, bolstered by Equation (14) and Figure 3, we can provide the following statement in Proposition 4.

Proposition 4. Supposing the vertically integrated MNE is the sole production input provider for other local final-good producers, the MNE is more willing to locate its upstream affiliate in a low-tax country to comply with the ALP principle.

This proposition indicates that, compared to the location chosen without ALP, the MNE will be more likely to separate its vertically related affiliates across different countries. Intuitively, when the ALP is applicable, the strategic motive behind the setting of transfer price absent such a policy now disappears. In contrast to this phenomenon, the channel substitution effect would be undoubtedly enhanced when the ALP is fully implemented, since $w_M < w^{ALP} < w_L$ and the MNE will relatively focus more on the

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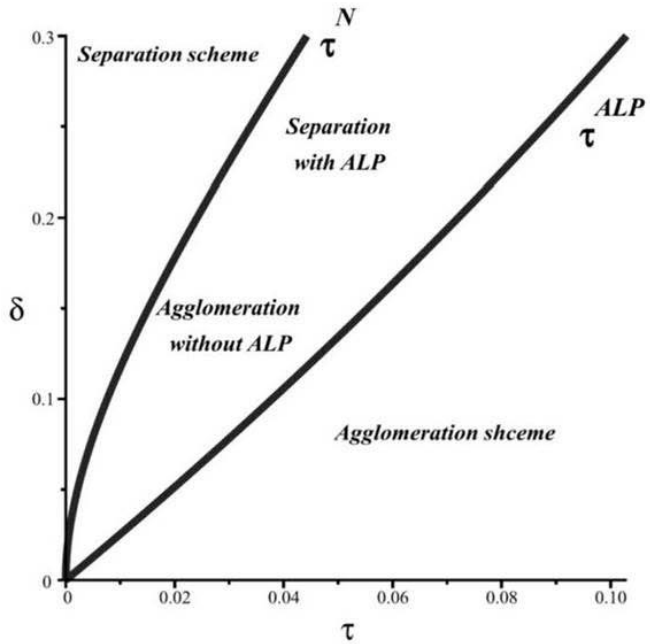


Figure 3: Location comparison between cases with and without the ALP

profits from the input sales to its downstream rival, a significant implication of Lemma 3. As a result, the incentives of the MNE to separate its vertically related affiliates across different countries increase. This is an interesting finding in this paper, which contradicts the perception that a successful ALP implementation may reduce the MNE's incentives to shift profit centers across jurisdictional borders.

4.2 Multiple local downstream firms

In this subsection, we consider a situation in which the home country hosts many local firms while we keep the basic features of the benchmark case, and also the MNE is the sole input supplier both to its downstream affiliate and rivals. The competition events sequentially occur aligned with a three-stage game: first, the MNE firstly announces its upstream affiliate's location, then it proceeds to set both internal and external input prices to maximize post-tax profits, and at the last stage, all downstream firms compete in the

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final good market á la Cournot.

With the same backward procedure of derivation, we summarize the equilibrium outcomes to the case with multiple local downstream firms as below.

Lemma 4. When the MNE is the sole supplier to provide production inputs to its downstream affiliate and n local rivals ($n \geq 1$), the equilibrium internal transfer price (w_M), input price (w_L), quantities, MNE profits, and the critical value of trade cost ($\tau[n]$) for partitioning the agglomeration and separation cases are respectively as below:

$$w_M = \frac{1-\lambda\tau}{2}\left[1 - \frac{1+(1-b)n}{1+2\delta\lambda+(1-b^2+(2-b^2)\,\delta\lambda)\,n}\right],$$

$$w_L = \frac{1-\lambda\tau}{2},$$

$$q_M = \frac{(1-\lambda\tau)(1+\delta\lambda)(1+(1-b)n)}{2+2(1-b^2)n+2(2+(2-b^2)n)\delta\lambda},$$

$$q_L = \frac{(1-\lambda\tau)[1-b+(2-b)\delta\lambda]}{2+2\,(1-b^2)\,n+2\,(2+(2-b^2)\,n)\,\delta\lambda},$$

$$\Pi^A = \frac{(1-t)(1+2(1-b)n)}{4+4n\,(1-b^2)},$$

$$\Pi^S = \frac{(1-t)(1+\delta)(1+\delta+(2(1-b)+(3-2b))n)(1-\tau)^2}{4+8\delta+(4+8\delta-4(1+\delta)b^2)\,n}, \quad \text{and}$$

$$\tau[n] = 1-\sqrt{1-\delta\frac{A}{B}},$$

where $A \equiv n(1-b)(1+n)(1+b) - 2nb^2 + (1+3n-2bn)\left(1+n-nb^2\right)\delta$,

$B \equiv (1+\delta)\left(1+n\left(1-b^2\right)\right)(1+2n(1-b)+(1+3n-2bn)\delta)$.

Note that when the MNE faces many local firms, the input price wedge between w_L and w_M becomes smaller as the MNE shifts its related affiliates from the Agglomeration pattern (i.e., $\lambda = 0$) to the Separation pattern (i.e., $\lambda = 1$). This result just reemphasizes Proposition 1, indicating that compared to the Agglomeration case, the MNE will decrease the relative competitive advantage of its downstream affiliate to the local firms after the

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related affiliates are separated. Such an input price wedge becomes even smaller as the number of local firms gets larger, implying the advantage of the downstream affiliate will be exaggeratedly reduced when more local firms act in the market.

Let us next examine the $\tau[n]$ function, the critical value of trade cost under the case with multiple local firms, above (resp. below) which the MNE will agglomerate (resp. separate) its related affiliates. The value of $\tau[n]$ is identical to the value of τ^N in Equation (9) when $n = 1$. Clearly, $\tau[n]$ gradually gets bigger when n gets larger. We may therefore conclude the relationship between the MNE's location pattern and the number of local firms in the following Proposition 5.

Proposition 5. Supposing the vertically integrated MNE is the only production input provider for final-good producers, the MNE is more willing to locate its upstream affiliate in a low-tax country when the number of local firms increases.

The intuition behind Proposition 5 is straightforward. As more local firms act in the final-good market, the market share of the MNE's downstream affiliate becomes smaller, and that of all the local firms becomes bigger. Thus, the MNE will rely more upon the input revenues from the sales to the local firms than those revenues earned from selling final goods. This is because the total market share and the output quantity will blow up with the number of local firms, thereby the MNE will have a stronger incentive, based upon the channel substitution effect, to shorten the price wedge such that it can simultaneously earn more revenue from the input sales, and enjoy more tax savings from substituting final-good sales with input sales.

4.3 A local firm in the upstream industry

In the case when the upstream affiliate is the only supplier of inputs, we have seen that the MNE may separate its affiliates when the trade cost is not too high, and the greater the difference in international taxations, the higher the possibility the MNE will separate its vertically related affiliates across nations (Proposition 2). Now, envision a scenario where a local downstream firm can source its production factors directly from a nearby upstream firm, which provides homogeneous input factors, operating with marginal cost c, and competing with the MNE's upstream affiliate. To simplify and categorize the analysis, we assume the MNE first chooses the upstream location strategy,

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and then the MNE decides whether or not to supply its input factors to the local rival firm, competing with the local upstream firm under factor price competition. Then the MNE judges whether it is better to supply input to the downstream customer, firm L. If it settles on doing so, the MNE and the local upstream firms will compete in input prices to attract firm L; otherwise, the MNE sets the transfer price for the downstream affiliate, and the local upstream picks an input price for firm L. Finally, the downstream affiliate and firm L source the inputs and produce the final goods.

As inputs produced by the two upstream firms are homogeneous, firm L buys inputs from the lowest-price supplier. Hence, the dominant strategy for the local upstream firm against the MNE is to set its input price equal to the marginal cost c. Considering this strategy of the local upstream and the input buyer incurring the freight fee, the MNE sets input prices equal or lower than c (*resp.*, $c - \tau$) as it agglomerates (*resp.*, separates) the affiliates. Under this scenario, the MNE's upstream affiliate facing price competition from the local upstream firm has its pre-tax profits as follows:

$$\pi_M^U = w_M q_M + \theta(c - \lambda\tau)q_L,$$

where, aside from λ indicating the MNE's location choice, the new parameter θ is also a binary indicator referring to the situations regarding the MNE's input-supply choice: $\theta = 1$ means the MNE will supply the inputs to firm L; $\theta = 0$ states the MNE will only supply its inputs to the downstream affiliate.

According to the new game structure, given the MNE's location pattern, either under the agglomeration scheme ($\lambda = 0$) or under the separation scheme ($\lambda = 1$), there are two subgames: one in which the MNE supplies the inputs to firm L ($\theta = 1$) and the other in which it does not ($\theta = 0$). Below, we analyze the results from whether or not the MNE supplies the inputs to firm L under the agglomeration and separation schemes, respectively, and present the optimal choice for the MNE to arrange the location patterns of its vertically-related affiliates. The detailed calculations are illustrated in the Appendix.

When there exists a local upstream factor supplier to provide homogenous inputs to the downstream local firm (L), the difference between MNE's profits under when the MNE does ($\theta = 1$) and does not ($\theta = 0$) supply the inputs to firm L in the agglomeration case (A) can be expressed as:

$$\Pi^A(\theta = 1) - \Pi^A(\theta = 0) = \frac{c(1-t)(2-5c)}{8}.$$

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Given $c < 2/5$ while ensuring that the quantity is positive, it is clear that the right-hand side of the above equation is positive. Therefore, we conclude that the MNE's input-supply decision will be made when the MNE's affiliates are co-located to supply the inputs to firm L.

Next, the difference between MNE's profits under when the MNE does ($\theta = 1$) and does not ($\theta = 0$) supply the inputs to firm L in the Separation scheme (S) can be shown as:

$$\Pi^S(\theta = 1) - \Pi^S(\theta = 0) = \frac{2 - 5c + 3\tau + (10 - 13c + 3\tau)\delta}{(1 + \delta)(1 - c - 2\tau)^2}.$$

Similarly, given $c < 2/5$, it is clear that the right-hand side of the above equation is positive. Therefore, we conclude that when the MNE's affiliates are co-located, it will choose to supply the inputs to firm L.

From the above discussions respectively of the Agglomeration scheme and the Separation scheme, we know that the MNE will always choose to supply its downstream rival when there is a local upstream firm. This result is different from the one we obtain in the text, where we have assumed the MNE is the only input supplier and it will expel the downstream rival out of the market when $b = 1$. Now, we continue to explore whether the MNE should separate its vertically related affiliates apart or not. Subtracting the MNE's profits with inputs supplied to firm L when affiliates are separate, $\Pi^S(\theta = 1)$, with its profits with input supplied to firm L when affiliates are agglomerated, $\Pi^A(\theta = 1)$, we have

$$\Pi^S(\theta = 1) - \Pi^A(\theta = 1) = \frac{(1 - t)\tilde{\Omega}}{8(1 + 3\delta)}, \tag{15}$$

where $\tilde{\Omega} = \delta[(1 + 12c - 12c^2)\delta - (1 - 2c)^2] - \tau(1 + \delta)[(14 - 12c - \tau) + 6a - 4c - \tau]$. The $\tilde{\Omega}$ in the right-hand side of the numerator of Equation (15) determines the sign of the difference in profits between two location schemes. It is easy to show that (i) $\tilde{\Omega}$ decreases in the trade cost, (ii) $\tilde{\Omega}$ is greater than zero when $\tau = 0$ and $\delta > (1 - 2c)^2/(1 + 12c - 12c^2)$, and (iii) $\tilde{\Omega}$ is lesser than zero when $\tau = c$. Thus, there exists a critical value, referred to τ^{LN} and defined by $\tilde{\Omega}(\tau = \tau^{LN}) = 0$, such that the MNE will choose the Separate scheme if the trade cost is strictly lower than τ^{LN}; otherwise, it will choose the Agglomeration scheme. Formally, we can derive the value of τ^{LN} as below:

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$$\tau^{LN} = [3 - 2c + (7 - 6c)\delta - X], \tag{16}$$

where

$$X \equiv \frac{\sqrt{(3 - 2c + (7 - 6c)\delta)^2 - (1 + 12c - 12c^2)\,\delta^2 + (1 - 2c)^2\delta}}{1 + \delta}.$$

The above arguments thus hold the result of point (i) of Proposition 2 in the text with the minor modification that the MNE will separate its affiliates across nations with significant differences in the level of taxation, provided the trade cost is not significant. We conclude this section by comparing the two critical values, τ^{LN} and τ^{N}, that segregate the trade costs into alternative location schemes in the presence and the absence of the local upstream firm, respectively. By superimposing the plots of τ^{LN} and τ^{N} in the same figure below, we demonstrate that the former value is greater than the latter for any given value of $c < 2/5$. Therefore, for trade costs falling between $[\tau^{LN}, \tau^{N}]$, the MNE will separate its affiliates across different countries in the absence of a local upstream firm. In contrast, it will agglomerate them in the high-tax country in the presence of a local upstream firm.

This fact thus leads us to conclude that the MNE is less likely to separate its affiliates when there is a local upstream firm. The reason is straightforward. The presence of a local upstream firm lessens the strength of the channel substitution effect; thereby, the MNE has a weaker incentive to move its upstream affiliate to the low-tax country. Figure 4 illustrates the result in Equation (15) with $b = 1$. As shown in Figure 4, τ^{LN} lies in the upper left of curve τ^{N}. The region of the pairs of (τ, δ), bounded by the τ^{LN} and τ^{N} curves, shows the MNE's location strategy of choosing the Separation scheme in the benchmark case, while in the presence of upstream competition, the MNE turns to adopt the Agglomeration scheme. Note that when c gets higher, curve τ^{LN} moves rightward, which means that with a higher c the MNE is more willing to separate its affiliates.

4.4 Incoterms® CIF case

In the above discussion, we assume the downstream firms incur the trade costs to deliver the intermediate inputs from country F to country H, practicing an international transportation agreement called free-on-board (Incoterms® FOB). However, parties sometimes involved in an international transaction sign an international shipping agreement regarding the expenditure

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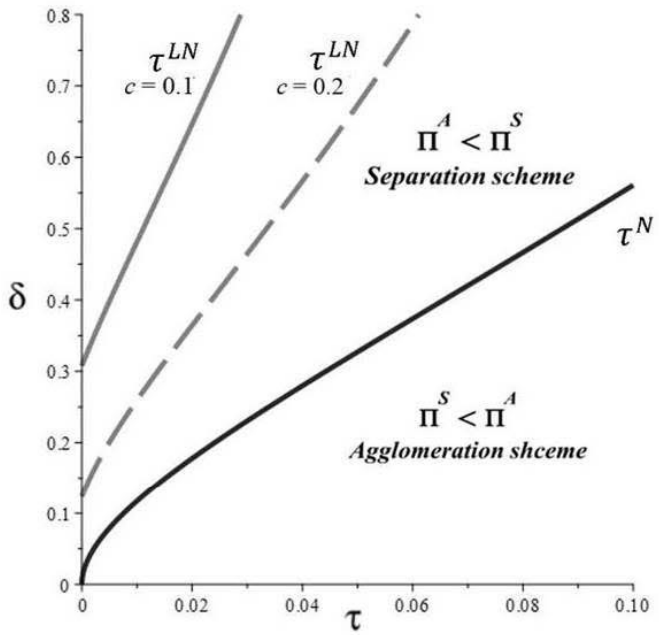


Figure 4: Location comparison between cases with and without a local upstream firm

of cost, insurance, and freight (Incoterms® CIF) that the seller pays to insure and transport goods to the buyer's destination port. Under our setting, CIF requires the MNE's upstream affiliate to take charge of the transportation affairs. It is interesting to see whether the different ways of assigning which party takes the transportation costs should change the MNE's location decision. This subsection tries to answer this problem.

Without changing the basic features of the benchmark case with FOB in Section 3, the downstream firm's pre-tax profit in the presence of the CIF term is $\pi_i^D = (p_i - w)q_i$, $i = L, M$, whereas that of the upstream affiliate becomes $\pi_M^U = (w - \lambda\tau)(q_L + q_M)$. Utilizing the same problem-solving procedure, we summarize the equilibrium outcomes of the case with the CIF term as below.

Lemma 5. Supposing the upstream affiliate takes charges of the transportation costs, and the downstream firms compete á la Cournot, the equilibrium outcome and the critical value of trade cost (τ^{CIF}) for partitioning the ag-

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glomeration and separation cases respectively are:

$$
\begin{aligned}
w_M^{CIF} &= \frac{1+\lambda\tau}{2}\left[1-\frac{(2-b)(1-\lambda\tau)}{\left[2-b^2+(4-b^2)\,\lambda\delta\right](1+\lambda\tau)}\right],\\
w_L^{CIF} &= \frac{1+\lambda\tau}{2},\\
q_M^{CIF} &= \frac{(1+\lambda\delta)(1-\lambda\tau)(2-b)}{4-2b^2+(8-2b^2)\,\lambda\delta},\\
q_L^{CIF} &= \frac{(1-\lambda\tau)(1-b+(2-b)\lambda\delta)}{4-2b^2+(8-2b^2)\,\lambda\delta},\\
\pi_M^{D,CIF} &= \left(q_M^{CIF}\right)^2,\\
\pi_M^{U,CIF} &= \frac{(1-\lambda\tau)^2\left[\lambda\delta(2-b)\left(4-2b^2+\delta\lambda\left(4-b^2\right)\right)+b^3-2b^2+1\right]}{2\left[2-b^2+(4-b^2)\,\lambda\delta\right]^2},\\
\Pi^* &= \frac{(1-t)(1+\lambda\delta)(3-2b+2(2-b)\lambda\delta)(1-\lambda\tau)^2}{8-4b^2+(16-4b^2)\,\lambda\delta}, \quad \text{and}\\
\tau^{CIF} &= 1-\sqrt{1-\frac{2\delta\left[1-2b^2+b^3+(2-b)\left(2-b^2\right)\delta\right]}{(1+\delta)\left(2-b^2\right)[3+4\delta-2b(1+\delta)]}}.
\end{aligned}
$$

Except for the transfer/input price, all the outcomes in Lemma 5 are the same as those in Lemma 1 associated with outcomes under the FOB term. So, when the trading parties switch the transportation term from FOB to CIF, it only increases the input seller's cost and leads the MNE to charge higher transfer and input prices than in the FOB case, i.e., $w_i^{CIF} > w_i^*$, $i = L, M$. The outcomes in Lemma 1 and 5 thus imply that the MNE can achieve its desired quantities and profits regardless of the types of transportation term. Moreover, since the MNE's post-tax total profits are the same at both the FOB and CIF terms, the critical value of trade cost under the CIF term that divides the Separation and Agglomeration schemes is equal to the level under the FOB term.

4.5 A relatively high tax rate in a foreign country

In the main text, we posit that there exists a disparity in corporate tax rates on an international scale, particularly noting that the tax rate in downstream market country H is higher than that in the potential upstream investment

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target country F. Consequently, we conclude that when this international tax rate disparity is substantial concerning trade costs, the MNE is likely to engage in tax avoidance strategies by relocating its upstream affiliate from the high-tax jurisdiction to the low-tax jurisdiction. We will later confirm that the main mathematical results listed in Lemma 1 still apply, and the results in Proposition 2 extend to the case where $T > t$.

To guarantee a positive output for each downstream firm, we limit the range of δ values. Formally, it entails the following assumption:

Assumption 1. $-(2-b^2)/(4-b^2) < \delta \leq 0$.

Next, when $\delta < 0$, we can see that the equilibrium transfer price w_M^*, as shown in Equation (5), is now smaller compared to the case with $\delta > 0$. And w_M^* even can be negative. For example, it is easy to verify $w_M^* < 0$ either when $b = 1$ and $-1/3 \leq \delta \leq 0$, or when $b = 0$ and $-1/2 \leq \delta \leq 0$. To understand why w_M^* may be negative, it is helpful to rewrite the expression in Equation (3). By bringing out a factor $1-t$ and employing the definition of $\delta = (t-T)/(1-t)$, the MNE's total after-tax profits in (3) turn out to be as follows:

$$\Pi = (1-t)\left[V_M + \lambda\delta\pi_M^U\right],$$

where V_M is the sum of the affiliates' pre-tax profits, and π_M^U is the pre-tax profits of the upstream affiliate. When $\delta > 0$, as analyzed in the main text, one way the MNE can exploit to maximize its post-tax profits, Π, is to increase the upstream affiliate's profits, π_M^U. To achieve this aim, the MNE may choose to separate its affiliates' locations in countries with different taxations and sequentially design a due transfer price to shift profits from the downstream affiliate and its rival to the overseas affiliate. However, in sharp contrast, when $\delta < 0$, such a window of profit shifting to the upstream is closed because a relatively higher tax rate is now imposed on the upstream than on the downstream, implying that the MNE incurs more tax payments rather than tax savings. On the contrary, facing $\delta < 0$ and intending to lessen the tax burden in Country F, the MNE can offer its downstream affiliate an under-invoiced price, thereby leading to lower profits accumulated in the overseas upstream. However, noting that the MNE also sells inputs to its downstream rival, it still has the incentive to set a positive transfer price to entice more sales from the downstream rival. Therefore, in the absence of the channel substitution effect that occurs when $\delta > 0$, w_M^* will be lower than it would be when $\delta > 0$, and when the profit-shifting incentive (now

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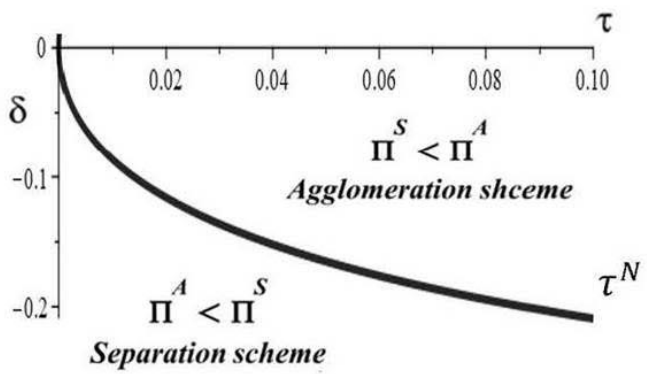


Figure 5: MNE's optimal location pattern when ($t < T$)

transferring profits from the upstream to the downstream) is significantly strong, w_M^* may even be less than zero.

Figure 5 shows that each pair of (τ, δ) below (resp., above) the τ^N line meets the condition $\tau <$ (resp., $>$)τ^N, therefore the lower (resp., upper) subspace is the region from which the MNE will select the Separation (resp., Agglomeration) scheme. Notice that the τ^N line gradually rises with the absolute level of δ, which exactly supports the validity of Proposition 2.

At last, it is worth comparing our arguments with the results obtained by Kato and Okoshi (2019). Their seminal paper assumes that products are independent, trade cost does not exist, and country H has a relatively higher tax rate than country F, which corresponds to $b = 0$, $\tau = 0$, and $\delta < 0$ in our model. Substituting these parameters into Lemma 1, we can obtain $\Pi^A = 3(1-t)/8$ and $\Pi^S = (1-t)(1+\delta)(3+4\delta)/8(1+2\delta)$, which leads to

$$\Pi^S - \Pi^A = \frac{(1-t)(1+4\delta)\delta}{8(1+2\delta)}.$$

It is easy to observe that $\Pi^S > \Pi^A$ either if $\delta > 0$, or if $-1/2 < \delta < -1/4$, where the last inequality partially comes from substituting $b = 0$ into the *Assumption*. In the main text, we focus on the case with $\delta > 0$. In contrast, Kato and Okoshi (2019) emphasize $\delta < 0$. So, compared to theirs, we find that the MNE has an even stronger incentive to arrange the locations of its affiliates into different countries. The reason behind

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this comparison is provided below. When $\delta > 0$ the MNE via separating the affiliates has two channels to transfer profits from both the downstream affiliate and its rival to the upstream affiliate, whereas when $\delta < 0$ it can transfer the profits from the upstream affiliate to the downstream one only by charging a lower or even an under-invoice price to the downstream affiliate. Therefore, the MNE needs more wedges in international taxation to exploit the opportunity of tax avoidance.

5 Conclusion

The larger tax loopholes and cross-country differences in tax rates undoubtedly induce MNEs to engage in tax avoidance; however, setting up an executive headquarters in one country while establishing affiliates in other countries would also cause MNEs additional transaction and trade costs (including shipping). Consequently, it is an important issue in the research of the MNE strategies to investigate how these two counterpart factors, namely tax rate difference and trade cost, influence MNEs' internal transfer pricing and location decision-making. The paper has investigated the issue and also re-examined how the results may differ when the MNEs' decision is strictly restricted to the ALP rule.

The paper has identified alternative channels through which an MNE can maximize its aggregate profits with the optimal decisions on its internal transfer pricing and affiliate location decisions. In addition to the conventional profit-shifting effect in the literature, we also discussed how the competition between the strategic effect and the channel substitution effect works through the adoption of a transfer pricing strategy. We have illustrated that through the strategic effect of transfer pricing, an MNE can set a lower intrafirm transfer price compared to a downstream local firm and strengthen its downstream affiliate's competitive advantage. We also pointed out that there may exist a channel substitution effect, which was not discussed in the earlier literature. Through the channel, an MNE can evaluate whether it should lower the internal transfer price or external intermediate price to increase total sales of intermediate goods at the expense of the final good sales.

On the effect of the ALP on location choice, our study also illustrated that the MNE will be more likely to separate its vertically related affiliates across different countries when the ALP is imposed. This is due to the dominant effect through channel substitution because inter-firm trade is more

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important for the MNE under ALP. We also extended to discuss the case in which there are many Nash competitors in the final good market. The result shows that the more competitive the downstream industry, the more likely the MNE is to locate its upstream affiliate or division in a low-tax country. Further, the study also demonstrates that the MNE has weaker incentives to move its upstream subsidiary to a low-tax country when the presence of local upstream firms weakens the strength of the channel substitution effect. Our main results remain robust when considering the case in which the other party bears transportation costs and the tax burden difference between the two countries is exactly opposite to that in the baseline model.

Appendix

The calculation for Subsection 4.3.

Agglomeration scheme ($\lambda = 0$)

The MNE does not supply the inputs to firm L ($\theta = 0$)

Substituting $\lambda = 0$ and $\theta = 0$ into each firm's profit function and following the same procedure of backward induction, we solve the problems and list the equilibrium outcomes as follows:

$$w_L = c; \quad w_M = -\frac{1+c}{4};$$
$$q_L = \frac{1-3c}{4}; \quad q_M = \frac{1+c}{2};$$
$$\Pi^A(\theta = 0) = \frac{(1-t)(1+c)^2}{8}.$$

When the MNE does not supply the inputs to its downstream rival, it earns money from its downstream affiliate. So, the MNE gives a negative transfer price to strategically boost its downstream affiliate's competitive edge in the market. Indeed, the MNE will own the same profits as a market leader, and the local downstream will own the same profits as a market follower.

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The MNE supplies the inputs to firm L ($\theta = 1$)

Likely, we substitute $\lambda = 0$ and $\theta = 1$ into each firm's profit function and solve the problem backwardly, we have:

$$w_L = c; \quad w_M = -\frac{1-2c}{4};$$
$$q_L = \frac{1-2c}{4}; \quad q_M = \frac{1}{2};$$
$$\Pi^A(\theta = 1) = \frac{(1-t)\left(1+4c-4c^2\right)}{8}.$$

When the MNE supplies the inputs to its downstream rival, it plans to collect the money from both its output sales and input sales. Therefore, compared to the case with no inputs supplied to firm L, the MNE will subsidize its downstream affiliate slightly such that it can strategically assist its downstream affiliate and simultaneously have revenues from its downstream customer.

Separation scheme ($\lambda = 1$)

The MNE does not supply the inputs to firm L ($\theta = 0$)

Substituting $\lambda = 1$ and $\theta = 0$ into each firm's profit function and following the same procedure of backward induction, we solve the problems and list the equilibrium outcomes as follows:

$$w_L = c - \tau; \quad w_M = \frac{(3\delta-1)(1+c-2\tau)}{4(1+3\delta)};$$
$$q_L = \frac{1-3c+2\tau+(5-7c+2\tau)\delta}{4(1+3\delta)};$$
$$q_M = \frac{(1+\delta)(1+c-2\tau)}{2(1+3\delta)};$$
$$\Pi^S(\theta = 0) = \frac{(1-t)(1+\delta)^2(1+c-2\tau)^2}{8(1+3\delta)}.$$

It deserves to be noted that the MNE will set a transfer price higher than its input production cost based on an incentive of own-profit shifting when the difference of international taxation rates is significant, i.e., $\delta > 1/3$. Conversely, when $\delta \leq 1/3$, the transfer price is negative, reflecting that a strategic incentive is so strong to dominate the profit-shifting effect.

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The MNE supplies the inputs to firm L ($\theta = 1$)

Likely, we substitute $\lambda = 1$ and $\theta = 1$ into each firm's profit function and solve the problem backwardly, we have:

$$
\begin{aligned}
w_L &= c - \tau; \\
w_M &= \frac{(3\delta - 1)(1 + 2c - \tau) + 3(1 + \delta)(c - \tau)}{4(1 + 3\delta)}; \\
q_L &= \frac{1 - 2c + \tau + (5 - 6c + \tau)\delta}{4(1 + 3\delta)}; \\
q_M &= \frac{(1 + \delta)(1 - \tau)}{2(1 + 3\delta)}; \\
\Pi^S(\theta = 1) &= \frac{(1 - t)(1 + \delta)^2(1 + c - 2\tau)^2}{8(1 + 3\delta)} \\
&\quad \left[1 + \frac{2 - 5c + 3\tau + (10 - 13c + 3\tau)\delta}{(1 + \delta)(1 - c - 2\tau)^2}\right].
\end{aligned}
$$

Comparing the transfer prices between the case with the MNE supplying its inputs to firm L and the case without supplies, it is clear that the former is larger than the latter, which aligns with the discussion in the Agglomeration scheme that the MNE will raise its transfer price to accrue more revenue from input sales. Moreover, the level of difference in transfer prices will rise with the level of taxation differentiation, justifying that the channel substitution effect comes into play here.

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國際稅收差異、貿易成本與跨國公司避稅

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本文旨在研究跨境稅收差異和貿易成本如何影響跨國企業的移轉定價和區位決策。我們特別考量當跨國企業能同時提供自身下游公司以及其下游市場競爭對手的生產要素下, 該跨國企業除了透過移轉定價進行企業內部利潤轉移和策略競爭之外, 我們發現這過程中存有通路替代效應 (channel substitution effect)。跨國企業可以透過此效應操縱移轉價格, 讓部分最終財的銷售能由生產要素的銷售所替代, 從而減輕稅負。我們發現, 如果跨國間稅率有顯著差異且貿易成本較低時, 則通路替代效應更為顯著, 跨國公司更有動機將其上下游公司分別設立在不同國家。我們也將模型延伸分析, 考慮了包括: ALP 的適用、多家本地下游企業、存在本地上游競爭對手以及對方承擔運輸成本等情況的結果。

關鍵詞: 國際稅收差異, 交易成本, 內部移轉價格, 區位選擇, 公平交易原則 (ALP)
JEL 分類代號: F12, F23, H25, H26

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