International Tax and Public Finance (2025) 32:1839–1864
https://doi.org/10.1007/s10797-025-09894-9

Beneficial fiscal competition for foreign direct investment: transport infrastructure and economic integration

Shigeo Morita[1] · **Hirofumi Okoshi**[2]

Accepted: 10 March 2025 / Published online: 23 May 2025

Abstract

Fiscal policy competition for a multinational enterprise (MNE) resulting in the same location of firms is widely recognized as harmful owing to losses of the host government's budget without gains from firms' behavior. In this study, we provide a plausible explanation why fiscal competition for an MNE keeping firms' location choices unchanged can be beneficial by incorporating governments' decisions on public investments in transport infrastructure, such as ports, which reduces the trade costs between two competing countries. Our model divides transport costs into infrastructure-independent and infrastructure-dependent; investments in infrastructure reduce infrastructure-dependent costs. We show that fiscal competition increases countries' investments in infrastructure under low infrastructure-independent transport costs without affecting firms' locations. Furthermore, we show that the host country benefits from fiscal competition, although it pays a subsidy to the MNE. Moreover, as investments in infrastructure generate positive spillovers, fiscal competition that improves transport infrastructure benefits non-host countries and improves global welfare.

Keywords Fiscal competition for FDI · Public infrastructure · Transport costs · Strategic complement

JEL Classification F23 · H25 · H32 · H54

We thank the editor Daniel Reck, two anonymous referees, Andreas Haufler, Hiroshi Mukunoki, Yukihiro Nishimura, and Georg Ulrich Thunecke for their comments. This paper was presented in the 80th IIPF annual conference. This paper is financially supported by Japan Finance Organization for Municipalities. This paper was started when Okoshi was a visiting research fellow at Erasmus School of Economics in Rotterdam. He thanks members of the institution for their hospitality and support.

Extended author information available on the last page of the article

1 Introduction

In a globalized world with high firm mobility, policy competition between governments to attract foreign firms has been frequently observed. Among these policies, providing financial incentives, such as tax credits or subsidies, is known to be a driver to lure foreign firms. For example, Powerchip Semiconductor Manufacturing Co., Ltd., a Taiwanese company, announced in 2023 that it would open its first plant in Miyagi Prefecture in Japan in 2027, after it had received other policy proposals from more than 30 local governments.[1] As hosting a foreign firm is known to benefit host municipalities or countries in several ways, such as through increased consumption of goods owing due to inter-regional trade cost jumps, fiscal policy design is an important consideration for policy-makers.[2]

Although designing such a fiscal policy seems desirable from the viewpoint of the host country, fiscal policy competition has sometimes been criticized as a harmful phenomenon. The nature of harmfulness is well highlighted if policy competition does not affect firms' location choice. Because a host country needs to offer a subsidy to keep a foreign firm against a counteroffer by a rival country, the budget of the government and public goods provision in a host country decline, but no additional gains from firms arise. Specifically, OECD (1998) stated that,

> although tax is only one of the factors which may influence investment decisions, mobile services are very tax sensitive so that companies may actively seek out tax breaks and encourage countries to match preferences available in other countries. In these cases governments may find themselves in a "prisoners dilemma" where they collectively would be better off by not offering incentives but each feels compelled to offer the incentive to maintain a competitive business environment (OECD, 1998, p.34).

In line with this quotation, the extant literature widely recognizes that fiscal competition resulting in the same location of firms is harmful to a host country and has no impact on non-host countries. For example, Fumagalli (2003) theoretically demonstrated that subsidy competition for a multinational enterprise (MNE) keeping firms' location unchanged reduces welfare in a host country and has no impact on a non-host country (Propositions 1 and 2 of Fumagalli (2003)). In other words, the fiscal competition that does not affect a firm's location preference is (weakly) mutually harmful in a competing region.

[1] See https://www.powerchip.com/en-global/insights/press-releases/content/20231031 and https://www.reuters.com/technology/taiwans-powerchip-chooses-northern-japan-planned-54-bln-fab-2023-10-31/. As another case of sub-national governments competition within a country, in 2004, Kameyama City in Mie Prefecture offered 13.5 billion dollars and succeeded into attracting a plant from Sharp Corporation, a Japanese electronics company, which was also considering Sakai City in Osaka Prefecture as another location for its plant. One of the reason for this is the difference in public infrastructure between the two regions. See the first paragraph on p.61 of https://dl.ndl.go.jp/view/download/digidepo_999652_po_069103.pdf?contentNo=1 (written in Japanese).

[2] The discussion in this study is applicable to not only the competition between countries but also one between sub-national governments. To keep the paper short, our explanation is based on the former competition throughout the study.

In this study, we provide a plausible explanation for the opposite outcome of fiscal competition, namely, mutually beneficial fiscal competition for a competing region, by considering the interlink between fiscal policy and public investments in transport infrastructure. Several empirical studies have concluded that transport infrastructure is another important determinant of MNEs' location decisions, and therefore, fiscal policy and public investments in transport infrastructure seem tightly associated.[3] As better infrastructure in a country enhances its attractiveness as a host country, governments may increase public investment in its transport infrastructure to mitigate fiscal competition and reduce subsidies to target foreign firms.[4] In the above case of Miyagi Prefecture's hosting the Taiwanese firm, the local government aimed at attracting firms outside the region by investing in highway connections and airports and ports since 2010, and the company raised a better connection to the airport as one of the main reasons to establish its plant.[5] As such, a change in government investment through fiscal competition can shape welfare effects, and fiscal competition that keeps firms' location preferences unchanged does not necessarily hurt a host country.

Notably, transport infrastructure has an aspect of public goods for a competing region; hence, public investments in infrastructure can work as a "strategic complement." This is because a larger capacity for bridges or high-technology equipment in ports is expected to reduce transport costs, including shipping time, and an investment by one country spurs international trade, which benefits consumers and exporters in another country. Hence, if fiscal competition increases public investments in transport infrastructure in a host country, it can also boost public investments in its rival governments and improve welfare in the competing region, despite the unchanged locations of foreign firms.

As government fiscal policies reflect the opposing effects of consumers' gains and local firms' losses from attracting foreign firms, it is not clear when such beneficial fiscal competition occurs. In this study, the following two research questions are addressed: Does fiscal competition keeping the location of an MNE unchanged increase public investment in the transport infrastructure? Moreover, does such fiscal competition improve the welfare of competing countries? As mentioned in Keen and Konrad (2013, p.321), it is not enough for the literature to answer the basic question: "How can one distinguish tax competition that is 'harmful' from that which is not." This study aims to provide new insights into the conditions of beneficial fiscal

[3] Bellak et al. (2009) empirically showed the effects of government's policy related elements, such as corporate taxes and public infrastructure; for example, transport infrastructure. Hayakawa et al. (2022) investigated the impact of international Mekong bridges in Laos on foreign firms' location and concluded that they contribute to a rise in the number of foreign firms around the area. Khadaroo and Seetanah (2010) provided evidence that transport infrastructure availability contributes to countries' attractiveness for foreign direct investment (FDI).

[4] As Hauptmeier et al. (2012) empirically showed, a strategic interaction in the tax rate and public inputs, such as roads, means that a country responds to a reduction of taxes in neighboring countries by lowering its tax rate and increasing public inputs to enhance its attractiveness. Bénassy-Quéré et al. (2007) also showed that FDI inflow is negatively and positively associated with tax and public input, respectively.

[5] See https://www.fnn.jp/articles/-/612500?display=full (written in Japanese).

competition from public investments in transport infrastructure and the role of economic integration in reducing international trade costs.

In this study, we construct a model of international policy competition in a region with two equally sized countries for an MNE outside the region that wants to have its subsidiary in one country among two. To keep the model as simple as possible, we introduce one asymmetry in the competing countries: the extent of local market competition captured by one local firm in a country and no local firms in the other. Governments in competing countries have two policies that potentially influence the MNE's location: a lump-sum fiscal policy and public investments in transport infrastructure, such as ports, which reduce interjurisdictional transport costs between countries. Importantly, our model divides total transport costs into infrastructure-dependent and infrastructure-independent transport costs. The former is endogenously determined by government investments, whereas the latter is exogenously given. Hence, we interpret the reduction in infrastructure-independent transport costs as economic integration.

The equilibrium location of an MNE is in a country without local firms, irrespective of fiscal competition. The reasons for this are two-fold. First, because an MNE's location in a country with a local firm intensifies market competition and reduces its profits, the MNE prefers locating in a country without a local firm, which we refer to as the fundamental location advantage. Second, because the government with a local firm has some degree of hesitation in attracting MNEs owing to a reduction in the local firm's profits, its fiscal offer is less attractive than that of countries without local firms.

Despite being in the same location as the MNE, fiscal competition alters governments' decisions regarding investments in transport infrastructure through the equilibrium fiscal policy of the host country. The equilibrium fiscal policy is a subsidy in equilibrium and is composed of a fundamental location advantage in the host country and the non-host country's counteroffer, yielding three channels of the effects of public investments in transport infrastructure on the equilibrium subsidy. First, through fundamental advantage, investments in transport infrastructure reduce transport costs and weaken the fundamental location in a country without local firms, which induces the host country to provide a more generous policy to attract the MNE. Additionally, investments in transport infrastructure have two opposing effects on counteroffers in a non-host country via the protection of local firms and consumer gains. On the one hand, public investments make the host country provide more subsidies because the non-host country's incentive to protect its local firm weakens, and the counteroffer can be a higher subsidy because of better transport infrastructure and lower transport costs. However, as lower transport costs owing to better transport infrastructure diminish consumer gains from attracting the MNE in a non-host country, a marginal investment in transport infrastructure mitigates fiscal competition and enables the host country to design fewer subsidies. Because the first two effects of firms' motivation are significant and dominate the last under large infrastructure-independent transport costs, fiscal competition reduces governments' investments in transport infrastructure when the region is not well integrated. However, when the region is well integrated, government investment levels are higher owing to fiscal competition. Notably, such public investments are strategic

complements in our setting; a non-host country also increases (decreases) its public investments when the host country invests more (less) in its infrastructure because of fiscal competition. In other words, economic integration is a crucial factor in increasing public investment and improving transportation systems.

Because infrastructure-independent trade costs play a crucial role in boosting public investment, our welfare analysis shows that sufficiently small trade costs are critical for beneficial fiscal competition in the region. Under sufficiently low infrastructure-independent transport costs, fiscal competition increases public investment. Because fiscal competition forces the host country to offer a subsidy to the MNE, net welfare gains arise only when consumer gains from public investments dominate the welfare losses from a subsidy. Hence, the host country can benefit from fiscal competition if the public investment is sufficiently efficient. Moreover, our model reveals that such fiscal competition benefits the non-host country and improves global welfare if it results in better transport infrastructure. This result is noteworthy because existing studies conclude that fiscal competition with no location change does not affect the non-host country and global welfare. However, in our model, the host government's fiscal policy is connected to public investments in infrastructure, and a change in infrastructure levels affects the non-host country and global welfare.

Our study relates mainly to the literature on fiscal competition to attract foreign firms, such as Haufler and Wooton (1999), and subsequent extended studies that conclude that fiscal policy competition is beneficial under certain conditions.[6] Haufler and Wooton (1999) constructed an international monopoly model where two different-sized countries in a region compete for an MNE headquartered in a third country, and showed that a larger country attracts the MNE even with a tax rather than a subsidy if the country has a larger population. Bjorvatn and Eckel (2006) introduced an indigenous local firm in a large country and concluded that fiscal competition can change the MNE's location preference from a country with a local firm to another with a local firm because a policy offer from the country with a local firm is lower owing to losses of the local firm's profits. As the separated location of firms increases consumer benefits in a country without a local firm and can be an efficient location from a global welfare viewpoint, fiscal competition can improve welfare in the region even though the equilibrium policy is a subsidy.[7] Moreover, Fumagalli (2003) explored subsidy competition between two countries to attract a foreign firm

[6] This literature is called "bidding for firms" model. See Keen and Konrad (2013) and Agrawal et al. (2022) as recent papers. Haupt and Krieger (2020) analyzed two-period fiscal competition for firms.

[7] Using a new economic geography model, Borck et al. (2012) showed the welfare-enhancing aspect of subsidy competition by affecting firms' location choices. In addition, a large amount of the literature on the new economic geography model, such as Baldwin and Krugman (2004) and Candau (2008), also argues the link between trade costs and taxation to attract capital. However, most previous studies have regarded public investment in infrastructure as an exogenous shock. Similarly, Bucovetsky (2005) focused on public input competition to attract skilled labor but ignored tax competition. A few studies, including Martin and Rogers (1995) and Gruber and Marattin (2010), incorporate government decisions regarding transportation infrastructure investments. Their primary focus is on how economic integration affects agglomeration patterns. The interlink between public investment levels and fiscal policy competition has not been explored, which is our main focus when looking at the unchanged equilibrium location of an MNE.

from a third country. She showed that, although subsidy competition weakly worsens welfare in competing countries if exports are not an alternative entry mode as mentioned above, it benefits the competing region by switching the foreign firm's supply mode from exports to FDI in the region. Thus, market entry through FDI allows the foreign firm to supply without trade costs between the region and the third country, and policy competition improves welfare in the region because of consumer gains. Unlike these studies, which revealed that beneficial fiscal competition occurs when the relocation of an MNE's production happens or the equilibrium fiscal policy is a tax, our model shows that beneficial fiscal competition results in the same location of an MNE and a subsidy as the equilibrium fiscal policy is possible, which is novel in the literature.

Following Bjorvatn and Eckel (2006), subsequent studies incorporate a local firm inside the competing region, as in our study, and examine other aspects of the model.[8] A few studies have considered several policy-related aspects in addition to fiscal policies. Amerighi and De Feo (2017) assumed that the local firm is a welfare-maximizing state-owned company instead of profit-maximizing private company and found that fiscal policy competition does not affect location choices of a foreign firm. Okoshi and Thar (2023) investigated the effects of FDI restriction in the presence of fiscal competition and showed that welfare effects of deregulation of foreign ownership restriction depends on the technological difference between a foreign and local firm. Because these studies do not consider governments' endogenous decisions regarding public investments in infrastructure, we focus on how governments' investments in infrastructure affect policy competition and welfare.

One exception examining the interlink between them is Hynes et al. (2019), who constructed an international monopoly model, as in Haufler and Wooton (1999), to examine the impacts of government investments in transport infrastructure on equilibrium fiscal policies. They showed that the difference in population between competing countries plays a crucial role in explaining whether investments in transport infrastructure mitigate fiscal competition. Unlike their study, our model is based on a model without country-size asymmetry but with differences in local firms, such as Bjorvatn and Eckel (2006), to consider the role of market competition. As the size of infrastructure-independent transport costs changes the effects of fiscal competition on public investments, our analysis provides additional insight into globalization that Hynes et al. (2019) neglect.

The remainder of this paper is organized as follows: Sect. 2 develops the model and equilibrium without fiscal competition. Section 3 introduces fiscal competition, shows how the results differ, and discusses the policy implications. Section 4 extends our model to argue the robustness of the main results and obtain additional insights. The final section concludes this paper.

[8] Ma and Wooton (2020) and Feng et al. (2023) examined the role of horizontal and vertical product differentiation. Furthermore, Mukunoki and Okoshi (2024) introduced the network externality of goods and Higashida and Okoshi (forthcoming) studied production-based pollution.

2 Model

We consider the three-country model in Fig. 1. The two countries in the region are indexed by $i \in \{A, B\}$ and differ in one respect: the existence of a local firm.[9] Country A owns its local firm, firm L, whose location is fixed because of its local preferences for operations, such as sharing the same language between the entrepreneur and workers or knowing country-specific business laws, whereas country B has no local firm. The two countries in a region compete for a foreign multinational firm, firm M, which is headquartered in a third country outside the region, country T. Because of the prohibitive transport costs between the third country and the region, firm M must establish a production plant in the region. Furthermore, we assume that firm M cannot have two plants in the region, because of the relatively high fixed costs of establishing a plant.[10] Therefore, firm M engages in export platform FDI to supply its goods to the region, and has the option of choosing one country in the region as its production location.

The two firms supply homogeneous goods to individuals in the region that share the same utility function $u_i = ax_i - \frac{x_i^2}{2}$, where x_i represents the amount of consumption in an imperfectly competitive market.[11] This yields the inverse demand function for the good as $p_i = a - x_i$. To focus on the role of investments in public infrastructure, we assume that firms have the same technology and that their marginal costs are normalized to zero. Specifically, by letting $f \in \{M, L\}$ be the firm identifier, we have $c_f = 0$.

More importantly, when firms export goods to foreign countries, they incur transportation costs. As a new element in the literature, such as Bjorvatn and Eckel (2006), we formulate the following total per-unit transport cost:

$$\tau(\tau_0, k) = \tau_0 - k = \tau_0 - (k_A + k_B)$$

where τ_0 represents the infrastructure-independent trade cost, and k and k_i capture total public investments and country i's investments in transport infrastructure, respectively. The first factor includes the quality of ships or traditional trade costs, such as the documentation costs of exports for preferential tariffs. As the quality of ships is chosen by firms in the transport sector and the documents for international trade are stipulated by other institutes such as the World Trade Organization, τ_0 is out of control for firms M and L and the governments; thus, it is exogenously given.

The second element reflects the development of the transport infrastructure, such as the quality and capacity of ports and international bridges. Because the higher capacities of ports and international bridges are expected to lower transport costs, including shipment time, by reducing congestion, and this improvement matters

[9] As our main motivation is to provide a reasonable explanation for the mechanism of why fiscal competition, keeping the same location decision, improves welfare in the competing countries, we assume that country B hosts firm M in the equilibrium irrespective of fiscal competition. In Sect. 4.1, we discuss the robustness of our results by considering other potential asymmetries across countries.

[10] These assumptions are standard in the literature. See Bjorvatn and Eckel (2006) and subsequent studies. Section 4.2 argues other cases that firm M choose to have two plants or to export from country T.

[11] Sect. 4.3 relaxes this assumption and discusses the role of product differentiation in the results.

only for international shipments, the transport cost decreases with investment levels. As both exports from and imports to one country are transported through the international port or bridge, public investments in one country reduce transport costs irrespective of the directions of trade.[12] Therefore, transport costs are endogenously determined by government investment policies, which is explained and analyzed later.[13]

In our model, we interpret a reduction in τ_0 as a measure of economic integration because technological developments in ships that cause higher shipment speeds and easier export processes allow smooth shipments and make exports easier. One may wonder whether economic integration occurs not only via a reduction in τ_0 but also via an increase in k_i, as the improvement of transport infrastructure enhances the connectivity between countries. Note that, in the equilibrium, the public investment levels k_i is a function of τ_0, and we can observe the effect of an "endogenous" economic integration via public investments indirectly triggered by a reduction in τ_0. Hence, we focus on reducing τ_0 as the primary source of economic integration.[14]

Firms maximize their profits from the region. Let $h \in \{A, B\}$ and $j(\neq h)$ be host and non-host countries, respectively. Then, given firm M's location in h, its profits are expressed as

$$\pi_M^h = p_h^h x_{Mh}^h + \left(p_j^h - \tau(\tau_0, k)\right)x_{Mj}^h + s_h, \quad \text{and} \quad \pi_L^h = p_A^h x_{LA}^h + \left(p_B^h - \tau(\tau_0, k)\right)x_{LB}^h, \tag{1}$$

where x_{fi}^h is the amount of supply to country i by firm f, and p_i^h represents the price of the good in country i. Therefore, the superscripts indicate firm M's location in h, whereas the subscripts indicate firm f and the country to which the goods are supplied. As explained next, s_i is a lump-sum fiscal policy designed by government i.

Governments are concerned about welfare maximization by designing two policies. Welfare in each country is defined as the sum of consumer surplus, the local firm's profits, a lump-sum fiscal policy if it is the host country, and the costs of investments in transport infrastructure. Let $s_i \in (-\infty, \infty)$ be a lump-sum fiscal policy in country i. Then, the welfare function in each country is expressed as

$$W_A^h = \frac{\left(x_A^h\right)^2}{2} + \pi_L^h - \zeta s_A - \frac{\gamma\left(k_A^h\right)^2}{2}, \quad \text{and} \quad W_B^h = \frac{\left(x_B^h\right)^2}{2} - (1-\zeta)s_B - \frac{\gamma\left(k_B^h\right)^2}{2}, \tag{2}$$

[12] In section 4.5, we consider another type of public investment that reduces the transport costs of exports only from a public infrastructure invested country to obtain implications on what kind of public investments are desirable.

[13] As public investments in international transport infrastructure are sometimes cooperatively conducted with some countries, one may wonder whether the current model does not capture reality well. However, a national project to upgrade or expand one country's border controls at and roads around an international port or bridge reduces transport costs for both exports and imports. Therefore, it is realistic to consider countries' noncooperative decisions on public investments, as the current model assumes.

[14] As we demonstrate later, the equilibrium public investments are negatively related to τ_0, which means that an exogenous economic integration via τ_0 induces an endogenous economic integration via k_i in our model.

where $x_i^h = x_{Mi}^h + x_{Li}^h$ is the total consumption in country i when firm M enters h, and ζ is a binary function that takes the value of unity if country A attracts firm M, and zero otherwise. The last two terms are policy related. First, if country i is the host country, then a pecuniary transfer between the government and firm M occurs. A positive sign of s_i indicates an FDI subsidy, whereas a negative sign indicates an FDI tax. To save the length of our paper, the current model does not argue sources of government budgets, but we can derive the same welfare function in Eqs.(2) by incorporating a head tax and a perfectly competitive sector, as in Haufler and Wooton (1999).[15] In addition, governments invest in public transport infrastructure, such as the quality and capacity of international ports. When a government invests k_i units of infrastructure, it costs $\frac{\gamma k_i^2}{2}$, where γ reflects the inverse efficiency parameter of public investments.[16] Throughout the analysis, we focus on the situation in which both firms supply positive amounts of goods to both markets, and the following assumption secures the interior solution:

$$\gamma > \frac{29}{9} \quad \text{and} \quad \frac{8a}{9\gamma} \equiv \underline{\tau_0} \leq \tau_0 \leq \overline{\tau_0} \equiv \frac{2(7+9\gamma)a}{81\gamma}$$

Assumption 1 The first equation comes from the second-order conditions of governments, whereas the second equation shows a range of τ_0 to secure firms' non-negative total transport costs and non-negative exports.

We solve the following four-stage game: In the first stage, governments determine public infrastructure investment k_i. Given the public infrastructure, governments simultaneously determine their fiscal policy s_i in the second stage.[17] This order of government decisions is natural because public investments in transport infrastructure take a longer period, but the fiscal policy design for a target MNE is a relatively short-run decision; thus, changing their fiscal policy is relatively easier than their decision on public investments in infrastructure. After observing k_i and s_i, firm M decides which country to locate in the third stage. Finally, firms compete in the markets in a Cournot fashion. The game is solved by backward induction. We begin our analysis without fiscal competition in the remainder of this section. The next section introduces fiscal competition.

2.1 Equilibrium without fiscal competition

In the fourth stage, Eq.(1) allows us to derive the standard Cournot outcomes, given firm M's location,

[15] See Okoshi and Thar (2023) for the full derivation for the welfare function with the head tax in the context of an indigenous local firm as in the current study.

[16] According to the IMF's 2015 report, approximately 30% of the potential gains from public investment in the size and quality of public infrastructure are lost because of inefficient processing of public investment. See also, https://www.imf.org/external/np/pp/eng/2015/061115.pdf for more details.

[17] Hynes et al. (2019) also employed this order of stage game. In the same order, Zissimos and Wooders (2008) investigated the linkage between industrial, public good provision and tax competition in a Hotelling fashion.

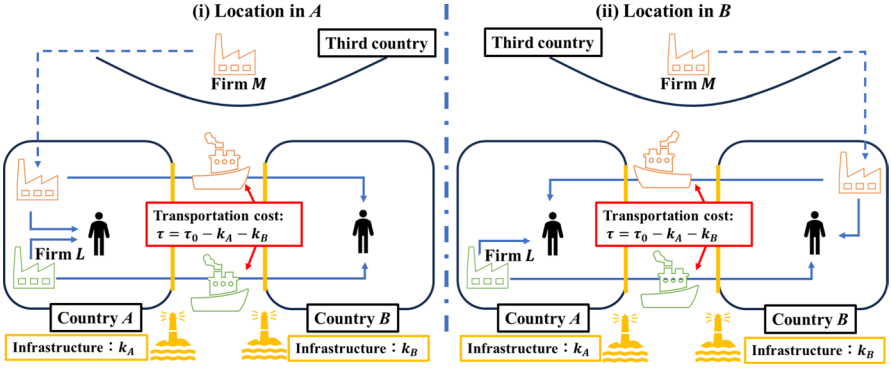

Fig. 1 Model

$$x_{MA}^{A*} = \frac{a}{3} > \frac{a-\tau(\tau_0,k)}{3} = x_{MB}^{A*}, \qquad \text{and} \quad x_{LA}^{A*} = \frac{a}{3} > \frac{a-\tau(\tau_0,k)}{3} = x_{LB}^{A*},$$
$$x_{MA}^{B*} = \frac{a-2\tau(\tau_0,k)}{3} < \frac{a+\tau(\tau_0,k)}{3} = x_{MB}^{B*}, \quad \text{and} \quad x_{LA}^{B*} = \frac{a+\tau(\tau_0,k)}{3} > \frac{a-2\tau(\tau_0,k)}{3} = x_{LB}^{B*}.$$

These optimal supplies yield the following profits for firms:

$$\pi_M^{A*} = \frac{a^2+\{a-\tau(\tau_0,k)\}^2}{9} + s_A, \qquad \text{and} \quad \pi_L^{A*} = \frac{a^2+\{a-\tau(\tau_0,k)\}^2}{9}$$
$$\pi_M^{B*} = \frac{\{a-2\tau(\tau_0,k)\}^2+\{a+\tau(\tau_0,k)\}^2}{9} + s_B, \quad \text{and} \quad \pi_L^{B*} = \frac{\{a+\tau(\tau_0,k)\}^2+\{a-2\tau(\tau_0,k)\}^2}{9}.$$

Both firms supply more in their domestic countries than in the exporting countries, $x_{Mh}^h > x_{Mj}^h$ and $x_{LA}^h > x_{LB}^h$, because of the lack of transport costs, which implies that the domestic market is a more important source of profits. Therefore, as separate locations of firms mitigate market competition in countries, firms make greater total profits when they are located in different countries at the expense of foreign markets, which we will see next.

In the third stage, firm M chooses its production location by comparing its profits. Suppose the governments do not have any policies to attract firm M, namely, $s_A = s_B = 0$. Taking the difference between π_M^{B*} and π_M^{A*}, we obtain fundamental location gains in country B as,

$$\Omega \equiv (\pi_M^{B*} - \pi_M^{A*})\Big|_{s_A=s_B=0} = \frac{4\tau(\tau_0,k)^2}{9} > 0,$$

which means that firm M locates in country B. Intuitively, firm M has an incentive to locate in country B because the only difference between the countries is the existence of firm L, and the degree of market competition in country B is less fierce.

Therefore, the location in country B enables firm M to make larger profits in country B at the expense of opportunities for transport-cost-free supplies to country A.[18]

Given firm M's location in country B, we now consider the optimal investment by the government without fiscal competition in the first stage. The first-order conditions for k_i are

$$\begin{aligned}\frac{\partial W_A^B}{\partial k_A} &= \frac{2a-\tau(\tau_0,k)}{9}+\frac{-2\{a+\tau(\tau_o,k)\}+4\{a-2\tau(\tau_0,k)\}}{9}-\gamma k_A \\ &= \frac{2a-\tau(\tau_0,k)}{9}+\frac{2\{a-5\tau(\tau_0,k)\}}{9}-\gamma k_A=0\end{aligned} \tag{3}$$

$$\frac{\partial W_B^B}{\partial k_B}=\frac{2a-\tau(\tau_0,k)}{9}-\gamma k_B=0. \tag{4}$$

Note that the first terms of Eqs.(3) and (4) represent the consumer gains from public infrastructure, whereas the last term reflects the marginal investment costs of public infrastructure. The former is always positive because hosting firm M induces more supply to the country owing to trade-cost-free supplies from the firm, but the latter is always negative.

The second term in Eq.(3) is a country A specific factor which has an ambiguous impact on its local firm. On the one hand, investments in public infrastructure reduce firm L's profits from country A because they increase firm M's exports from country B, which is captured by the first element of the second term in Eq.(3). On the other hand, such investments also benefit firm L because they reduce transport costs and increase profits in country B, as reflected in the second component of the second term in Eq.(3). As firm L's benefits from a separate location are large when transport costs are large, marginal investment in public infrastructure can hurt firm L and the second term can be negative under a large transport cost.

By solving Eqs.(3) and (4), the equilibrium public investments are derived as

$$\widetilde{k}_A^B=\frac{\gamma(4a-11\tau_0)+2a}{3\gamma(3\gamma-4)},\quad \text{and}\quad \widetilde{k}_B^B=\frac{\gamma(2a-\tau_0)-2a}{3\gamma(3\gamma-4)}.$$

The investment levels in both countries are positive in equilibrium because of consumer gains.[19] In the next section, we examine whether introducing fiscal competition increases the equilibrium investment levels.

[18] This market-oriented FDI mechanism has been observed empirically (Lin and Chen, 2022).

[19] As country A's specific effect via firm L is ambiguous, the equilibrium order of investment levels in transport infrastructure depends on the parameters. However, we discuss the order of investment levels in Online Appendix A because it is outside the main aim of this study. However, exploring it provides a wider understanding of the model.

3 Fiscal competition

Hereafter, we introduce the second stage of the game, namely, fiscal competition between countries A and B. To distinguish the equilibrium variables under different cases we use a circumflex "$\widehat{\ }$" for the case under fiscal competition, whereas we use "~" for the case without fiscal competition.

3.1 Equilibrium with fiscal competition

Because we assume a lump-sum fiscal policy, the outcome in the fourth stage remains the same, whereas fiscal competition may affect firm M's location choice, and our analysis resumes in the third stage. As it is critical how generous fiscal policy each government can provide at most is critical to identify which country becomes a host, we next derive government i's most generous fiscal policy $\bar{s}_i$.

As government i maximizes its welfare, it is possible for the government to provide any levels of fiscal policy s_i which does not result in lower welfare than that when the country does not host firm M. Hence, the possible fiscal policy in country i to attract firm M is,

$$W_A^A - W_A^B = \left(CS_A^A - CS_A^B\right) + \left(\pi_L^A - \pi_L^B\right) - s_A \geq 0 \iff s_A \leq \frac{\tau(\tau_0,k)\left\{4a - 9\tau(\tau_0,k)\right\}}{18} \equiv \bar{s}_A.$$

$$W_B^B - W_B^A = \left(CS_B^B - CS_B^A\right) - s_B \geq 0 \iff s_B \leq \frac{\tau(\tau_0,k)\left(4a - 3\tau(\tau_0,k)\right)}{18} \equiv \bar{s}_B.$$

They have the following properties:

$$0 < \bar{s}_B \quad \text{and} \quad \bar{s}_A < \bar{s}_B.$$

Recall the optimal outputs derived in the final stage. The total consumption in each country is larger when a country hosts firm M; that is, $x_A^A - x_A^B = x_B^B - x_B^A = \frac{\tau(\tau_0,k)}{3} > 0$. This is the main reason governments compete for firm M in our model, and country B's most generous offer is always a subsidy. Regarding the second property, note that country A cares about firm L's profit losses from attracting firm M: country A's hesitation toward hosting firm M is reflected in $\bar{s}_A$ and its most generous fiscal policy is less attractive than that of country B.

The most generous fiscal policies clearly mean that firm M establishes its plant in country B, because of both the fundamental location gains and larger fiscal incentives from country B. Formally,

$$\pi_M^{B*} - \pi_M^{A*}\Big|_{s_A=\bar{s}_A, s_B=\bar{s}_B} = \Omega + \bar{s}_B - \bar{s}_A > 0,$$

and firm M's equilibrium location is in country B, likewise in the case without fiscal competition.

Although $\bar{s}_i$ is important to identify the location of firm M, it is not an equilibrium fiscal policy for country B. As it is certain that country B attracts firm M,

it is sufficient to design a fiscal policy that induces firm M to be located in that country. Specifically, let s_B^* be the optimal fiscal policy derived as follows:

$$\pi_M^{B*} - \pi_M^{A*}\Big|_{s_A=\bar{s}_A, s_B=s_B^*} = 0 \iff s_B^* = -\Omega + \bar{s}_A = \frac{\tau(\tau_0,k)\{4a - 17\tau(\tau_0,k)\}}{18}.$$

As shown later, the equilibrium fiscal policy in country B is a subsidy, and we interpret s_B^* as a subsidy hereafter. Intuitively, the equilibrium subsidy in country B is the sum of its fundamental location advantage in country B and the rival government's most generous fiscal policy. A large Ω indicates firm M's strong preference for country B and a small subsidy or lower s_B^* is sufficient for country B to attract an MNE. In addition, if rival government A offers a larger most generous fiscal policy $\bar{s}_A$, fiscal competition becomes fierce, and country B needs to increase its equilibrium subsidy or increase s_B^*.

Now, let us derive the equilibrium levels of government investments in transport infrastructure. Note that the welfare in country A stays the same but that in country B differs from the ones shown in the case without fiscal competition by s_B^*. Formally, the first-order conditions for k_i are:

$$\frac{\partial W_A^B}{\partial k_A} = \frac{2a - \tau(\tau_0,k)}{9} + \frac{2\{a - 5\tau(\tau_0,k)\}}{9} - \gamma k_A = 0, \tag{3}$$

$$\frac{\partial W_B^B}{\partial k_B} = \frac{2a - \tau(\tau_0,k)}{9} - \left(-\frac{2a - 17\tau(\tau_0,k)}{9}\right) - \gamma k_B = 0, \tag{4'}$$

where the second term in Eq.(4') indicates how an incremental unit of public investment affects the optimal fiscal policy. The new term can be decomposed as follows:

$$\frac{\partial s_B^*}{\partial k_B} = \left\{ \underbrace{-\left(\frac{\partial \Omega}{\partial \tau(\tau_0,k)}\right)}_{-} + \underbrace{\frac{\partial\left(CS_A^A - CS_A^B\right)}{\partial \tau(\tau_0,k)}}_{+} + \underbrace{\frac{\partial\left(\pi_L^A - \pi_L^B\right)}{\partial \tau(\tau_0,k)}}_{-} \right\} \underbrace{\left(\frac{\partial \tau(\tau_0,k)}{\partial k_B}\right)}_{-} = \frac{17\tau(\tau_0,k) - 2a}{9},$$

where the sign of the total effects is ambiguous.

This can be interpreted as follows. Public investment reduces transport costs and influences the optimal fiscal policy s_B^* through fundamental location advantage, Ω and the most generous policy, $\bar{s}_A$. First, lower transport costs reduce Ω because a reduction in transport costs leads to firm M's lower incentive to locate in country B. This means that the equilibrium fiscal policy tends to include larger subsidies to keep firm M in country B.

Additionally, an increase in k_B affects the most generous fiscal policy by government A, $\bar{s}_A$. This channel is captured by the second and third terms and has two opposing effects. On the one hand, more investments by government B reduce consumers' gains in country A by attracting FDI, which implies that a decrease in the most generous fiscal policy by governments A and B can reduce subsidy payments as the best response. On

the other hand, they also reduce the local firm's gains from keeping firm M away, which means that government A's hesitation to attract firm M weakens and the most generous fiscal policy of government A increases. In total, the sign of the total effects is positive, and an increase in k_B increases the equilibrium subsidy by government B under high transport costs because firms' gains from separate locations are large, and the impact on firms is dominant. Alternatively, if the transport cost is sufficiently small, the channel via consumer gain is the main one and, therefore, the marginal effect of public infrastructure by government B on the equilibrium subsidy in country B is negative, and country B increases its investment in infrastructure owing to fiscal competition.

Given the nature of the above, from Eqs.(3) and (4'), we derive the following equilibrium investment levels[20]

$$\widehat{k}_A^B = \frac{9\gamma(4a-11\tau_0)-28a}{9\gamma(9\gamma-29)} = \widetilde{k}_A^B + \frac{11\{2(3\gamma+13)a-51\gamma\tau_0\}}{9\gamma(3\gamma-4)(9\gamma-29)},$$
$$\widehat{k}_B^B = \frac{9\gamma(4a-18\tau_0)+28a}{9\gamma(9\gamma-29)} = \widetilde{k}_B^B + \frac{(9\gamma-11)\{2(3\gamma+13)a-51\gamma\tau_0\}}{9\gamma(3\gamma-4)(9\gamma-29)}.$$

Recall that $\widetilde{k}_i^B$ is the equilibrium investment in transport infrastructure without fiscal competition.[21] Therefore, fiscal competition increases (decreases) public investment in transport infrastructure if infrastructure-independent transport is low (high). Formally, we have,

$$\widehat{k}_i^B \gtreqless \widetilde{k}_i^B \iff \tau \lesseqgtr \frac{2a(3\gamma+13)}{51\gamma} \equiv \tau_0^k.$$

Importantly, the effects of fiscal competition on public investments in transport infrastructure occur in the same direction because k_i is a strategic complement.[22] In other words, public investments in one country have a positive spillover effect on a rival country by increasing the volume of international trade. Figure 2 illustrates this. The dashed curves in the figure illustrate the equilibrium investment level without fiscal competition, whereas the solid curves represent equilibrium investment level with fiscal competition. The solid curves are above (below) the dashed curves when $\tau < \tau_0^k$ ($\tau > \tau_0^k$).[23]

Note that such increases in public investments in transport infrastructure are conducted with a lump-sum subsidy for FDI. Although the fundamental location advantage in country B reduces the FDI subsidy, and the most generous fiscal policy by country A can be a tax under a large transport cost, public investments in transport

[20] At the equilibrium levels of k_i, we have $\frac{\partial s_B^*}{\partial k_B} = \frac{\{2a(3\gamma+13)-51\gamma\tau_0\}}{3(9\gamma-29)} \gtreqless 0 \iff \tau_0 \lesseqgtr \frac{2a(3\gamma+13)}{51\gamma} \equiv \tau_0^k$.

[21] Related to footnote 19, we find a reversal in the investment level orders of governments from $\widetilde{k}_A^B < \widetilde{k}_B^B$ to $\widehat{k}_A^B > \widehat{k}_B^B$ with large τ_0 and γ. See Online Appendix A.

[22] By differentiating Eq.(3) with respect to k_B, we have $\frac{\partial}{\partial k_B}\left(\frac{\partial W_A^B}{\partial k_A}\right) = \frac{11}{9} > 0$.

[23] Note that the negative relationship between τ_0 and the equilibrium public investment levels are in line with China's expansion of investments in airports after its accession to the World Trade Organization in 2001: Transport infrastructure investment and maintenance spending for airports in China was about 2.7 billion Euro in 2000 and about 4.6 billion Euro in 2006. See OECD data explore https://data-explorer.oecd.org/?lc=en with "Transport infrastructure investment and maintenance spending."

infrastructure reduce the location advantage and government A's incentive to protect the local firm L. Therefore, the equilibrium investment levels can result in FDI subsidies, as they strengthen government A's incentive to provide subsidies based on consumer gains. Formally, we obtain this result by substituting $\widehat{k}_i^B$ into s_B^*:

$$\widehat{s}_B = \frac{(9\gamma\tau_0 - 8a)\{4(5+9\gamma)a - 153\gamma\tau_0\}}{18(9\gamma - 29)^2} > 0$$

This implies that the equilibrium fiscal policy in country B to attract firm M is always a subsidy.

The following proposition summarizes the effects of fiscal competition on public investments in transport infrastructure and the equilibrium fiscal policy in the host country B.

Proposition 1 Host country B without local firms provides a lump-sum subsidy in the equilibrium. Fiscal competition increases (decreases) government investment if infrastructure-independent transport costs are lower (higher) than τ_0^k.

The above shows two opposing effects of fiscal competition on welfare in host country B. On the one hand, compared with the case without fiscal competition, country B's welfare tends to worsen because of the FDI subsidy. On the other hand, fiscal competition may drive public investments and improve welfare. The next subsection explores this aspect as well as welfare in a non-host country and global welfare.

3.2 Welfare analysis

As briefly argued above, how fiscal competition influences the host country is not clear, and we investigate the welfare effects of fiscal competition. First, consider the welfare effect in host country B.

We define Δ as the effect of fiscal competition and $\Delta W_B \equiv \widehat{W}_B - \widetilde{W}_B$ as the welfare effect in the host country, where the first (second) term is welfare in the presence (absence) of fiscal competition. Then, we have,

$$\Delta W_B = \Delta CS_B - \frac{\gamma}{2}\left(\left(\widehat{k}_B^B\right)^2 - \left(\widetilde{k}_B^B\right)^2\right) - \widehat{s}_B = \frac{\{2(3\gamma+13)a - 51\gamma\tau_0\}\theta_{W_B}}{162(3\gamma-4)^2(9\gamma-29)^2} - \widehat{s}_B$$

where $\theta_{W_B} \equiv -2(243\gamma^3 - 162\gamma^2 + 180\gamma - 341)a + 3\gamma(1377\gamma^2 - 3717\gamma + 2695)\tau_0$. Although the sign of the welfare effect is ambiguous, the welfare change has the following two features: First, fiscal competition affects welfare in the host country even when it causes no changes in government investments in infrastructure. We can see this by evaluating $\tau_0 = \tau_0^k$, where fiscal competition does not affect investment levels.

$$\Delta W_B\big|_{\tau_0=\tau_0^k} = \underbrace{\Delta CS_B - \frac{\gamma}{2}\left(\left(\widehat{k}_B^B\right)^2 - \left(\widetilde{k}_B^B\right)^2\right)}_{=0} - \widehat{s}_B\big|_{\tau_0=\tau_0^k} = -\frac{2a^2}{153} < 0$$

As the investment levels are the same at $\tau_0 = \tau_0^k$, the welfare effects on consumers and investment costs disappear. However, the equilibrium fiscal policy of the host

country must be an FDI subsidy $\widehat{s}_B > 0$ because of the non-host government's subsidy offer. Thus, fiscal competition clearly reduces welfare in the host country when government investments remain unchanged.

However, fiscal competition can benefit the host country if it boosts public investments and the consumers' gains from public investments are large. By evaluating at the lower edge of infrastructure-independent transport costs, $\tau_0 = \underline{\tau_0}$, which definitely causes increases in public investments, we have,

$$\Delta W_B\big|_{\tau_0=\underline{\tau_0}} = -\frac{2a^2(81\gamma^2 - 405\gamma + 407)}{729\gamma(3\gamma-4)^2} \gtreqless 0 \iff \gamma \lesseqgtr \frac{45+\sqrt{397}}{18} \approx 3.607$$

The result shows that fiscal competition improves welfare in the host country only when both the efficiency parameter of public investments in infrastructure and the infrastructure independent transport costs are sufficiently low.[24] As country B has to pay a subsidy for firm M, a welfare improvement is possible when the efficiency of public investments is low and consumer's gains from infrastructure are large. Hence, although the efficiency parameter γ does not have any crucial role for proposition 1 about the sign of equilibrium fiscal policy and directions of changes in public investment, it is a key factor to predict welfare effects in the host country because it determines the size of gains from public investments.

Note that Haufler and Wooton (1999) also concluded that a large market size country attracts the MNE irrespective of fiscal competition, and the policy competition can benefit a large host country. This is because a wide gap in country size increases the fundamental location advantage of the large country and enables the host country to impose lump-sum taxes. In contrast, the equilibrium subsidy in our model is the main source of the decrease in the welfare of host country B. However, such a negative effect is dominated by an increase in public investment, which is magnified by the rival country's investment decisions owing to the nature of positive crossover spillovers.

The left figure of Fig. 3 illustrates the welfare effects of fiscal competition in the host country, with $a = 1$ and $\gamma = 3.25$. In the figure, the solid curve depicts equilibrium welfare with fiscal competition, whereas the dot-dashed curve represents welfare without fiscal competition. At $\tau_0 = \tau_0^k$, the welfare level in the case of fiscal competition is lower than that without fiscal competition by FDI subsidies. Additionally, the figure shows the range of transport costs for which fiscal competition improves welfare in the host country.

In addition to new insights into the welfare effect in the host country, we should mention another important welfare effect in the non-host country A. The traditional view is that fiscal competition among firms in the same location has no impact on the non-host country. However, because our model allows for real economic changes

[24] We can derive the following properties of ΔW_B: $\frac{\partial^2 \Delta W_B}{\partial \tau_0^2} = \frac{17\gamma(729\gamma^3 - 3321\gamma^2 + 5013\gamma - 2695)}{9(3\gamma-4)^2(9\gamma-29)^2} > 0$ and $\frac{\partial \Delta W_B}{\partial \tau_0}\Big|_{\tau_0=\tau_0^k} = -\frac{352a}{27(3\gamma-4)(9\gamma-29)} < 0$. This shows the uniqueness of the threshold of τ_0 below which fiscal competition improves welfare in the host country if any.

in governments, the welfare effects of such fiscal competition also arise in non-host countries. Similar to the welfare analysis for country B, we obtain[25]

$$\Delta W_A = \Delta CS_A + \Delta \pi_L - \frac{\gamma}{2}\left(\left(\widehat{k}_A^B\right)^2 - \left(\widetilde{k}_A^B\right)^2\right) \propto 2(3\gamma + 13) - 51\gamma\tau_0 \gtreqless 0 \iff \tau_0 \lesseqgtr \tau_0^k$$

The equations show that fiscal competition improves welfare in the non-host country A when it boosts investments in infrastructure, namely, $\tau_0 < \tau_0^k$. From Proposition 1, government investments in infrastructure increase (decrease) in response to fiscal competition if $\tau_0 < \tau_0^k$ ($\tau_0 > \tau_0^k$) holds. Therefore, as long as transport costs are low and public investments in infrastructure increase owing to fiscal competition, fiscal competition benefits non-host countries. Otherwise, fiscal competition would be harmful to country A.

These welfare effects allow us to consider the impacts of fiscal competition on regional welfare, which is defined as the sum of the welfare in countries A and B, $W_R = W_A + W_B$. When infrastructure-independent transport costs are high, investments in infrastructure fall, and the equilibrium FDI subsidy clearly reduces regional welfare. However, investments in transport infrastructure become greater, and welfare improvement in country A occurs under a smaller $\tau_0 < \tau_0^k$, which is more likely to improve regional welfare than welfare in country B. This is illustrated in the right figure of Fig. 3.

From the welfare analysis above, two further discussions exist on beneficial fiscal competition. First, the left-hand side of Fig. 3 implies that an extremely low infrastructure-independent transport cost is essential for beneficial fiscal competition for the host country. Although we assumed the competing regions to be countries, we can interpret the regions as subnational units of one country, such as states and provinces. Therefore, because τ_0 must be lower in the case of subnational regions, our results indicate that such beneficial fiscal competition for a host region is likely to occur at the level of local governments in a country rather than that of countries. Second, Even if $\gamma > 3.607$ holds, and fiscal competition reduces welfare in country B, regional welfare increases under sufficiently low infrastructure-independent trade costs.[26] Therefore, international fiscal competition seems to benefit a host country in limited cases in reality, it benefits the competing region more generally under a well integrated world compared with the case one ignores the interlink between fiscal competition and public investments in transport infrastructure.

A similar discussion of the welfare effect in country A holds when we extend these arguments to a global viewpoint. Let $WW = W_A + W_B + \pi_M$ be global welfare. Then, we have

$$\Delta WW = \Delta CS_A + \Delta \pi_L + \Delta CS_B - \frac{\gamma}{2}\sum_{i=\{A,B\}}\left(\left(\widehat{k}_B^B\right)^2 - \left(\widetilde{k}_B^B\right)^2\right) + \Delta \pi_M^B \propto 2(3\gamma + 13)a - 51\gamma\tau_0.$$

[25] We have $\Delta W_A = \Delta CS_A - \frac{\gamma}{2}\left(\left(\widehat{k}_A^B\right)^2 - \left(\widetilde{k}_A^B\right)^2\right) + \Delta \pi_L = \frac{(9\gamma-11)\{2(3\gamma+13)-51\gamma\tau_0\}\theta_{W_A}}{162(3\gamma-4)^2(9\gamma-29)^2}$, where $\theta_{W_A} \equiv 2(108\gamma^2 - 261\gamma - 31)\left(a - \frac{33(18\gamma-44)\tau_0}{2(108\gamma^2-261\gamma-31)}\right) > 0$, and the last inequality is identified with $\underline{\tau_0} < \tau_0 < \overline{\tau}_0$.

[26] We show this numerically in Figure 5 of Online Appendix B.

Because the above condition is equivalent to the condition for an increase in public investment because of fiscal competition, whether fiscal competition is beneficial depends on τ_0.[27] As a subsidy is simply a pecuniary transfer from the host country to the target firm M, the crucial welfare effect is the real change in public investments in transport infrastructure. Likewise, the welfare change in the non-host country A is a novel result in the literature, which shows that fiscal competition has no global welfare impact if it has no impact on firm M's location.

Overall, fiscal competition is beneficial in our setting if infrastructure-independent transport costs are low. The results are summarized as follows:

Proposition 2 When fiscal competition boosts governments' investments in infrastructure, or $\tau_0 < \tau_0^k$, it (i) improves welfare in the non-host country and global welfare and (ii) benefits the host country only when governments' infrastructure investments are efficient and sufficiently small τ_0.

This study has two policy implications. First, our results indicate that economic integration, in the form of a reduction in infrastructure-independent trade costs, is a crucial condition for beneficial fiscal competition. As such, trade costs include traditional trade barriers, such as tariffs or documentation costs for rules of origin to qualify for preferential tariffs, and international corporation for trade liberalization is a core policy assist for a beneficial fiscal competition.

Second, in well-integrated cases, fiscal competition could contribute to concerns about suboptimal levels of government investments in infrastructure. As public investments are expected to generate positive spillovers and policy makers in one country ignore benefits arising in another country, it is well known that provision of public investment is likely to be suboptimal (Gordon, 1983; Bond, 2006; Bougheas et al., 2003; Lorz, 2020). This seems true for investments in transport infrastructure because governments ignore positive externalities outside their borders through active international trade and thus, a free-rider problem arises.[28] In the presence of fiscal competition, such externalities are internalized via an equilibrium fiscal policy and fiscal

[27] Similar to W_A, we formally have $\Delta WW = \Delta CS_A + \Delta\pi_L + \Delta CS_B - \frac{\gamma}{2}\sum_{i=\{A,B\}}\left(\left(\widehat{k}_i^B\right)^2 - \left(\widetilde{k}_i^B\right)^2\right) + \Delta\pi_M^B = \frac{\{2(3\gamma+13)a - 51\gamma\tau_0\}\theta_{WW}}{162\gamma(3\gamma-4)^2(9\gamma-29)^2}$, where $\theta_{WW} \equiv 2(682 + 450\gamma - 3699\gamma^2 + 1215\gamma^3)\left(a - \frac{3\gamma(2266 - 6210\gamma + 2025\gamma^2)\tau_0}{2(682 + 450\gamma - 3699\gamma^2 + 1215\gamma^3)}\right) > 0$. The final inequality is that $\underline{\tau_0} < \tau_0 < \overline{\tau}_0$.

[28] In the literature on fiscal competition for capital as a production factor, some studies analyzed whether fiscal competition results in the underprovision of public goods. Among them, Bayindir-Upmann (1998) has a scope similar to that of our study, as it explores the role of industrial, public goods, such as infrastructure, which benefits local firms. He found that the overprovision of industrial, public goods may occur due to policy competition because more public infrastructure increases production and prevents capital outflows. Unlike the domestic effects of public infrastructure, Bjorvatn and Schjelderup (2002) analyzed the role of international spillovers from public goods and concluded that international spillovers mitigate tax competition. Unlike these studies, our model does not demonstrate the overprovision of public investments from a global perspective because competing countries ignore benefits to the MNE irrespective of fiscal competition. In addition, as those papers assumed that public infrastructures increase productivity of firms, our mechanism of benefiting exporting firms is a new argument to the previous literature.

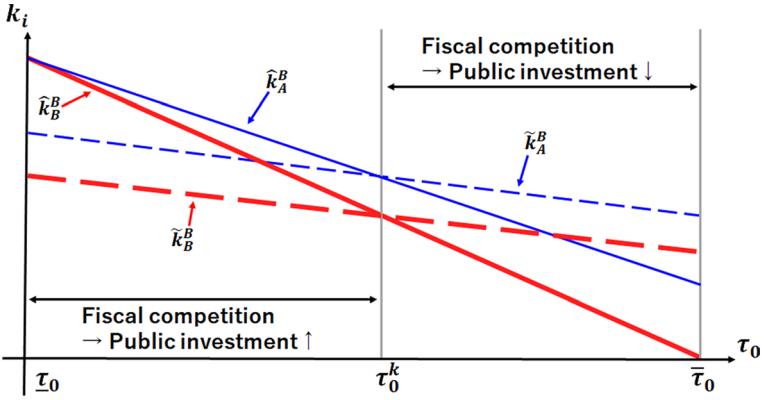

Fig. 2 Equilibrium investment levels

competition might contribute globally to the mitigation of such concerns regarding the underprovision of infrastructure, even in non-cooperative situations when interregional transport costs are low, as in Proposition 1.

4 Discussions

Thus far, our model shows a clear mechanism by which fiscal competition without affecting firms' locations can be beneficial in a simple way. In this section, we discuss certain assumptions for determining their roles and for obtaining additional insights. First, we discuss the sources of the asymmetry across countries to understand the robustness of our results. In addition, as all the other modified models qualitatively reproduce the same results in certain situations, our discussion focuses on different aspects, whereas the appendices provide detailed computations.

4.1 Another asymmetry across countries

Following the literature on bidding for a firm, our main analysis assumes that competing countries differ in their number of local firms.[29] This assumption allows one country to be the host country of the MNE, irrespective of fiscal competition, because of its fundamental location advantage and larger incentive to host the firm in the country. Note that, even if we introduce another source of asymmetry that maintains the same location decision as firm M, we obtain the same results.

For example, suppose that both competing countries have the same positive number of local firms but that the wage in country B is cheaper than that in country A. In such a case, firm M chooses country B as its production country irrespective of

[29] This assumption of one asymmetry is also made in Ferrett and Gravino (2021), who investigated fiscal competition for FDI under technological spillovers, although the literature on bidding for a firm often incorporates country-size asymmetry as well.

fiscal competition. Without fiscal competition, country B has a larger fundamental location advantage, owing to its cheaper wages. In addition, with fiscal competition, country B's most generous fiscal offer or subsidy is larger than that in country A because the location in country B enables firm M to produce more supplies because of low wages, and consumers' gains from attracting firm M in country B are larger. Since fiscal competition does not affect firm M's location choice, all subsequent discussions are the same as those in the main analysis.

4.2 Exports from country *T*

In the benchmark analysis, we assume that prohibitively high transport costs between the third country and the region force the MNE to establish its plant inside the region, and the high fixed costs of FDI make it choose one country as its production base. As fiscal competition works as an FDI subsidy, we consider another possible case in which firm M exports from a third country to countries in the region without engaging in FDI in the absence of fiscal competition, and fiscal competition enables it to invest in its plant in a country inside the region.[30]

As in Online Appendix C, the modification shows that fiscal competition increases both countries' investments in the transport infrastructure under a small τ_0. In contrast to the benchmark analysis, we obtain two thresholds of τ_0 below which country i invests more in infrastructure: $\widetilde{k}_i^T < \widehat{k}_i^B$ holds under $\tau_0 < \tau_0^{k_i T}$, where the superscript T denotes the case in which firm M enters through exports from country T. Specifically, we have $\tau_0^{k_A T} < \tau_0^{k_B T}$; thus, country B is more likely to invest more in transport infrastructure because of fiscal competition. This is because government A's incentive to invest in transport infrastructure is strong without fiscal competition because government A's investment reduces transport costs between countries A and B but not between countries T and B, and firm L can occupy a large market share in country B because of the larger transport costs of firm M from country T.

This provides additional insight into the welfare effects of fiscal competition in each country. In the main analysis, when fiscal competition boosts public investments the host country is likely to be a loser of fiscal competition in the welfare sense owing to the provision of subsidies, but the non-host country tends to be a winner thanks to its better infrastructure. However, in a modified world, the host country can gain more than the non-host country. For host country B, the relocation of firm M due to fiscal competition increases the consumer surplus because of the avoidance of high trade costs τ_0^T and more public investments. In the non-host country, firm M's FDI reduces the local firm's profits because of fierce market competition. Therefore, whether fiscal competition induces a foreign firm to have a subsidiary is also important when discussing the winner and loser of fiscal competition.

[30] As shown in Online Appendix D, the equilibrium at which fiscal competition induces a second plant in the region does not exist in our setup.

4.3 Product similarity

Another assumption in the main analysis is that both firms produce homogeneous goods. Because some industries are known to produce differentiated products, it is intriguing to explore how the results differ according to the similarity of products. Here, we assume that firms operate in completely different industries because comparing benchmark results with those in such extreme cases provides clear insights.[31] To secure the MNE's location choice in country B, we assume that firm M prefers country B if the operating profits of firm M are the same under the location choices because of external factors, such as cultural or language similarities. See Online Appendix E for the detailed computations.

A notable difference from the benchmark analysis is the impact of fiscal competition on the investment level in non-host country A. Although fiscal competition discourages government A from investing in transport infrastructure under a large τ_0 in the benchmark case, it increases k_A for firms in different industries. This is because product similarity generates firm interactions, and country A is concerned about intensified market competition and wants to protect firm L by inducing firm M to locate in country B. Thus, the lower the similarity in product manufacturing, the more likely it is that fiscal competition increases public investment in infrastructure. In other words, fiscal competition among firms in similar industries is likely to be harmful.

4.4 Three countries in a region

One important feature of our benchmark analysis is the complementarity of the public infrastructure. Although this is understandable, we cannot ignore another aspect of public infrastructure: country-specific benefits through smaller trade costs to neighboring countries. We consider this by introducing country-specific trade costs from $i \in \{A, B\}$ to neighboring country C in the region, denoted by $\tau_{iC} \equiv \tau_0 - k_i - k_C$.[32] As export-platform FDI is well observed, it is important to understand how the nature of strategic substitution of public infrastructure complicates the effects of fiscal competition and when the modified model reproduces the main results. See the detailed computation and discussion in Online Appendix F.

Unlike the benchmark case, firm M's location in country B is no longer in equilibrium when the public investment independent trade cost is sufficiently small. In the presence of a neighboring country, firm M's gains from being located in country B are written as follows:

[31] We modify the utility function as $u_i = a(x_{iL} + x_{iM}) - \frac{x_{iL}^2 + 2\beta x_{iL} x_{iM} + x_{iM}^2}{2}$, where $\beta \in [0, 1]$ captures the similarity of the goods. The benchmark model corresponds to $\beta = 1$ (homogeneous goods), and the remaining discussion is based on the case in which $\beta = 0$ (independent goods).

[32] This specification means that public infrastructure independent trade costs are the same across countries, and the total costs are now a function of public investment levels in host country i and destination country C, but not in non-host country $j(\neq i)$.

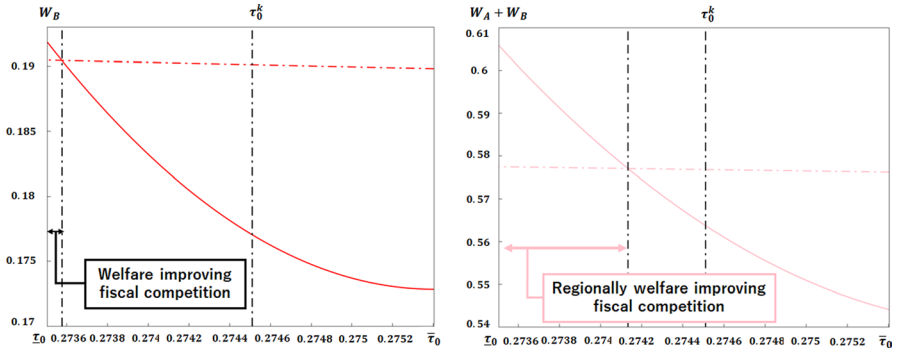

Fig. 3 Welfare in the host country B and regional welfare

$$\pi_M^B - \pi_M^A = \underbrace{\frac{4\tau^2}{9}}_{=\Omega} \underbrace{-\frac{(k_A - k_B)(a - \tau_{BC})}{9}}_{\equiv\Omega_{BC}} + (s_B - s_A). \tag{5}$$

The second term is new and captures the export-platform location advantage in country A. As indicated by the benchmark analysis, country A is likely to invest more than country B because it has its own local firm and an incentive to support the firm by lowering trade costs. This implies that the sign of Eq.(5) is ambiguous, unlike the benchmark case. In particular, when the public independent trade cost τ_0 is small, the first term is small, and the second term is relatively important. Therefore, without fiscal competition, where $s_A = s_B = 0$, the second negative term dominates the first term, and firm M may prefer to be located in country A.

However, note that firm M's location in country B is still in equilibrium under reasonably high trade costs, and we obtain qualitatively the same result: fiscal competition induces firm M's location in country B in the case, $\bar{s}_B - \bar{s}_A > 0$. Under fiscal competition, fiscal policies determine the equilibrium location. Country C influences only country A's welfare through firm L's profit from country C. Because country A's public investment tends to be larger and attracting firm M in country A reduces the trade costs of firm M to country C and reduces firm L's profits, country A has additional hesitation in luring firm M to a neighboring country.

However, regarding the optimal investment decision by government B, export access to a neighboring country reduces the marginal gains of country B from its public investment via the channel of the equilibrium fiscal policy $\frac{\partial s_B^{*C}}{\partial k_B} > 0$ and disincentivizes country B to invest. If country B invests more in public infrastructure, firm M's trade costs from B to C decrease, and country A's hesitation to attract firm M weakens, as firm M in country B becomes more competitive in market C. This means that country A's incentive to attract firm M increases and the subsidy from country A is larger. Corresponding to the increase in the counter-offer by government A, the total effect on the equilibrium fiscal policy in country B increases, although firm M's location advantage in B also increases.

In total, once we add an aspect of strategic substitution of public infrastructure, several additional effects emerge, and discussions must be complicated. In other words, as the previous literature mainly discusses the competing role of public investments against rival countries in attracting firms, our benchmark analysis clearly highlights the overlooked nature of the complementarity of public investments in infrastructure in a simple way. Our results hold if neighboring countries in the competing region are not profitable for firms because of their isolated locations or small markets.

4.5 Export-spurring investments in transport infrastructure

The benchmark model assumes that public investment in transport infrastructure affects both exports and imports. However, governments sometimes aim to improve port quality for either export or import, and our assumption reflects an extreme case.[33] To widen our understanding of the type of public investment, this subsection incorporates the weight of investment in export trade costs, η, such that public investments are completely for exports if $\eta = 1$ and are for both exports and imports, as seen in the benchmark analysis, if $\eta = 0$.[34] See Online Appendix G for the detailed discussion.

Under a certain parameterization, our numerical example indicates that, regardless of fiscal policy competition, firm M is located in country B. Notably, the numerical example shows that although the infrastructure-independent trade cost is larger than τ_0^k and fiscal competition leads to a decline in public investment infrastructure, fiscal competition can enhance public investments when countries' investments are more export-spurring, namely, $\widetilde{k}_i^B < \widehat{k}_i^B$ for $i = \{A, B\}$. This is because export-promoting investments allow country B to lower the transportation costs of firm M and reduce subsidies to attract the firm.

From these results, another important implication can be obtained. Proposition 1 shows that when infrastructure-independent transport cost τ_0 is higher than τ_0^k, the level of public investment under fiscal competition is lower than that under no fiscal competition, $\widetilde{k}_i^B > \widehat{k}_i^B$ for $i = \{A, B\}$. Our numerical example implies that export-spurring investment can increase global investments and improve welfare even under conditions of higher transportation costs; therefore, some regulations that allow countries to compete only in export-promoting investments seem to be one way to avoid harmful fiscal competition if economic integration is insufficient.

[33] For example, in 2017, the Japanese government decided to invest in the port of Ishikari in Hokkaido to spur exports of agricultural and marine products. See https://www.pa.skr.mlit.go.jp/general/image/policy/export/part2/05_siryo4.pdf, available only in Japanese. In addition, the port of Hamburg announced having found Germany's first large-scale green energy import terminal port in 2022. See https://www.hafen-hamburg.de/en/press/news/erstes-terminal-fuer-gruenen-ammoniak-kommt-nach-hamburg/.

[34] We modify the formulation of the total unit transport cost from country i to country j as $\tau_{ij} = \tau_0 - k_i - (1 - \eta)k_j$, where $i \neq j = \{A, B\}$.

5 Conclusion

Interjurisdictional fiscal competition for FDI is commonplace and sometimes considered harmful because it reduces government budgets and results in less public goods provision. This is best highlighted if fiscal competition does not affect the location of a target firm because it does not change any real economic activity of the firm, and the host government needs to pay some money to attract the firm and provide fewer public goods. As such, harmful fiscal competition has long been discussed in the context of international tax issues, and understanding the conditions under which fiscal competition leads to harmful beggar-thy-neighbor policies is essential.

In this study, we provide a simple theoretical framework to explain the mechanism by which fiscal competition can be beneficial, even though it does not affect the location of the target firm, by introducing public investments in the transport infrastructure. In equilibrium, the target firm prefers to be located in a country without local firms because of mitigated market competition and an incentive of a country with a local firm to protect its domestic industry. In the presence of fiscal competition, public investments in transport infrastructure influence the host government's equilibrium fiscal policies. Specifically, the host country's marginal investment increases the equilibrium subsidy when transport costs are high because it reduces the target firm's incentive to choose the less competitive country, disincentivizes the non-host country to protect its local firm, and increases its subsidy offer. Otherwise, fiscal competition increases the investment levels of both governments.

Moreover, we show that such an increase in public investment improves welfare in the non-host country and can increase welfare in the host country, even though it subsidizes the MNE. The latter occurs only when governments are efficient in conducting public investment, and fiscal competition increases consumers' gains from public investments in transport infrastructure. This finding has important policy implications regarding harmful fiscal policy competition. As more investment in infrastructure driven by fiscal competition is predicted only when transport costs are sufficiently low, it is essential to lower infrastructure-independent transport costs to transform harmful fiscal competition into beneficial ones. Notably, the welfare result is different from the existing literature, which shows no welfare effects of fiscal competition without location changes, and a revisiting evaluation of fiscal competition is required and an empirical analysis of welfare effects from fiscal competition remains for future research. Our results show that policies to spur the development of shipping technology or explore better shipment routes are important in parallel with public investments in transport infrastructure.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s10797-025-09894-9.

Acknowledgements We thank the editor Daniel Reck, two anonymous referees, Andreas Haufler, Hiroshi Mukunoki, Yukihiro Nishimura and Georg Ulrich Thunecke for their comments. This paper was presented in 80th IIPF annual conference. This paper is financially supported by Japan Finance Organization for Municipalities. This paper was started when Okoshi was a visiting research fellow at Erasmus School of Economics in Rotterdam. He thanks members of the institution for their hospitality and support.

Author Contributions All authors conducted analysis, wrote the main text of the manuscript, and reviewed it.

Funding Open Access funding provided by Okayama University.

Availability of data and materials No datasets were generated or analysed during the current study.

Declarations

Conflict of interest The authors declare no Conflict of interest.

References

Agrawal, D. R., Hoyt, W. H., & Wilson, J. D. (2022). Local policy choice: Theory and empirics. *Journal of Economic Literature, 60*, 1378–1455.

Amerighi, O., & De Feo, G. (2017). Tax competition for foreign direct investments and the nature of the incumbent firm. *Journal of Public Economic Theory, 19*, 811–826.

Baldwin, R. E., & Krugman, P. (2004). Agglomeration, integration and tax harmonisation. *European Economic Review, 48*, 1–23.

Bayindir-Upmann, T. (1998). Two games of interjurisdictional competition when local governments provide industrial public goods. *International Tax and Public Finance, 5*, 471–487.

Bellak, C., Leibrecht, M., & Damijan, J. P. (2009). Infrastructure endowment and corporate income taxes as determinants of foreign direct investment in central and eastern european countries. *World Economy, 32*, 267–290.

Bénassy-Quéré, A., Gobalraja, N., & Trannoy, A. (2007). Tax and public input competition. *Economic Policy, 22*, 386–430.

Bjorvatn, K., & Eckel, C. (2006). Policy competition for foreign direct investment between asymmetric countries. *European Economic Review, 50*, 1891–1907.

Bjorvatn, K., & Schjelderup, G. (2002). Tax competition and international public goods. *International Tax and Public Finance, 9*, 111–120.

Bond, E. W. (2006). Transportation infrastructure investments and trade liberalization. *The Japanese Economic Review, 57*, 483–500.

Borck, R., Koh, H. J., & Pflüger, M. (2012). Inefficient lock-in and subsidy competition. *International Economic Review, 53*, 1179–1204.

Bougheas, S., Demetriades, P. O., & Morgenroth, E. L. (2003). International aspects of public infrastructure investment. *Canadian Journal of Economics/Revue Canadienne d'économique, 36*, 884–910.

Bucovetsky, S. (2005). Public input competition. *Journal of Public Economics, 89*, 1763–1787.

Candau, F. (2008). Entrepreneurs'location choice and public policies: A survey of the new economic geography. *Journal of Economic Surveys, 22*, 909–952.

Feng, H., Ma, J., & Yue, Y. (2023). Competition for multiproduct firms. *Review of International Economics, 31*, 904–930.

Ferrett, B., & Gravino, D. (2021). Fiscal competition for foreign direct investment with knowledge spillovers and trade costs. *The World Economy, 44*, 2821–2837.

Fumagalli, C. (2003). On the welfare effects of competition for foreign direct investments. *European Economic Review, 47*, 963–983.

Gordon, R. H. (1983). An optimal taxation approach to fiscal federalism. *The Quarterly Journal of Economics, 98*, 567–586.
Gruber, S., & Marattin, L. (2010). Taxation, infrastructure and endogenous trade costs in new economic geography. *Papers in Regional Science, 89*, 203–223.
Haufler, A., & Wooton, I. (1999). Country size and tax competition for foreign direct investment. *Journal of Public Economics, 71*, 121–139.
Haupt, A., & Krieger, T. (2020). The role of relocation mobility in tax and subsidy competition. *Journal of Urban Economics, 116*, 103196.
Hauptmeier, S., Mittermaier, F., & Rincke, J. (2012). Fiscal competition over taxes and public inputs. *Regional science and urban economics, 42*, 407–419.
Hayakawa, K., Keola, S., Silaphet, K. & Yamanouchi, K. (2022). Estimating the impacts of international bridges on foreign firm locations: A machine learning approach. IDE Discussion Paper 847.
Higashida, K., & Okoshi, H. (forthcoming). Together or apart? Eco-friendly location under fiscal competition. *International Tax and Public Finance*, forthcoming.
Hynes, K., Ma, J., & Yuan, C. (2019). Transport infrastructure investments and competition for FDI. *Scottish Journal of Political Economy, 66*, 511–526.
Keen, M., & Konrad, K. A. (2013). The theory of international tax competition and coordination. *Handbook of Public Economics, 5*, 257–328.
Khadaroo, A., & Seetanah, B. (2010). Transport infrastructure and foreign direct investment. *Journal of International Development: The Journal of the Development Studies Association, 22*, 103–123.
Lin, C. C., & Chen, K. M. (2022). Market competition, exchange rate uncertainty, and foreign direct investment. *Review of Development Economics, 26*, 405–422.
Lorz, O. (2020). Investment in trade facilitating infrastructure: A political-economy analysis. *European Journal of Political Economy, 65*, 101928.
Ma, J., & Wooton, I. (2020). Market size, product differentiation and bidding for new varieties. *International Tax and Public Finance, 27*, 257–279.
Martin, P., & Rogers, C. A. (1995). Industrial location and public infrastructure. *Journal of International Economics, 39*, 335–351.
Mukunoki, H. & Okoshi, H. (2024). Keep your friends close and your enemies closer: Network externality and tax competition. RIETI Discussion Paper Series 24-E-024 .
OECD, (1998). Harmful Tax Competition. https://doi.org/10.1787/9789264162945-en.
Okoshi, H. & Thar, K. (2023). Backfired deregulation of foreign ownership restrictions under fiscal competition for foreign direct investment. RIETI Discussion Paper Series 23-E-059 .
Zissimos, B., & Wooders, M. (2008). Public good differentiation and the intensity of tax competition. *Journal of Public Economics, 92*, 1105–1121.

Authors and Affiliations

Shigeo Morita[1] · Hirofumi Okoshi[2]

✉ Hirofumi Okoshi
hirofumi.okoshi1@gmail.com

Shigeo Morita
shmorita@fukuoka-u.ac.jp

[1] Faculty of Economics, Fukuoka University, 8-19-1, Nanakuma, Jonan-ku, Fukuoka 814-0180, Japan

[2] Faculty of Economics, Okayama University, 3-1-1, Tsushima, Kita-ku, Okayama 700-8530, Japan