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Lobbying and Tax Competition in an Agglomeration Economy: A Reverse Home Market Effect *

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Abstract

This paper analyzes tax competition between politically-motivated governments in a world economy with agglomeration forces. The well-known home-market effect, in which countries with a larger home market are attractive for firms, may be reversed as a result of tax competition played by politically-interested governments. The model economy includes trade costs, internationally mobile firms, and two countries of asymmetric size. Each national government sets its tax rate strategically to maximize the weighted sum of residents' welfare and political contributions by owners of firms as special interest groups. It is shown that, if the governments heavily care about contributions and trade costs are low, the small country attracts a more than proportionate share of firms by setting a lower tax rate.

Keywords: Tax/subsidy competition; Lobbying; Market size; Reverse home-market effect; International oligopoly

JEL classification: F15; F22; H20; H30

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1 Introduction

As the continuing economic integration of the contemporary world stimulates international trade of goods and movement of factors, a number of countries have engaged in competing for mobile firms and these activities have been accelerating since the late 1990s (OECD, 1998). Particularly, a notable observation is that small countries and regions in terms of their population and GDP such as Ireland, Singapore and Estonia tend to undertake a more aggressive reduction in corporate tax rates than large countries such as France, Japan and the U.S.[*1] By looking at the statutory corporate tax rates from 1982 to 2006, OECD (2007) concludes that large-sized OECD countries in terms of GDP continue to levy corporate taxes at higher rates than the small-sized OECD member countries.

Moreover, several studies suggest that small countries have low effective tax rates defined as the ratio of taxes paid divided by profits.[*2] Grubert (2000), for example, examines the effects of effective tax rates on the U.S. outward foreign direct investment (FDI) in 60 countries between 1984 and 1992 and finds that small, open and poor countries decreased their effective tax rates the most. In the context of Europe, Elschner and Vanborren (2009) report that the countries accounting for 10% or more of total GDP of the EU27 show the highest effective tax rates.

Thanks partly to their low corporate tax rates, some small countries have succeeded in attracting large investment from abroad. Taking a close look at the nature of foreign investment into these countries reveals that the investment is mainly export-oriented. Ireland, for instance, has hosted since the late 1970s a number of manufacturing multinational firms and these firms account for large proportion of employment and output (Barry and Bradley, 1997). In Irish manufacturing whose major target is foreign markets, the foreign multinational firms account for 91% of Ireland's tradeable exports in 2009.[*3] As for Singapore, policies including low tax rates and the liberalization of capital markets were basically for the purpose of export-oriented industrialization (Park, 2006). Estonia, undertaking pro-market reforms after the end of Soviet control, has established competitive tax system and has grown manufacturing exports rapidly due to the inflow of FDI in recent years (UNCTAD, 2011).

In order to explain the observation that some nations with small size and low tax rates are attractive for export-oriented FDI, we examine tax competition between asymmetric countries in agglomeration economies. We argue that the experience of these countries can be attributed to political pressure by

[*1] The statutory corporate tax rates of these countries in 2013 are 12.5% (Ireland), 17% (Singapore), 21% (Estonia), 33.33% (France), 38.01% (Japan), and 40% (U.S.). Source: KPMG, Corporate tax rates table; http://www.kpmg.com/global/en/services/tax/tax-tools-and-resources/pages/corporate-tax-rates-table.aspx

[*2] However, it is fair to say that empirical studies are inconclusive as to whether corporate tax rates in small countries are actually lower than those in large countries (see Devereux and Loretz, 2012 for an extensive survey).

[*3] "Foreign-owned firms accounted for 91% of Ireland's tradeable exports in 2009; Food & drink exports fell 15%," *Finfacts Business News Centre*, November 25th, 2010; http://www.finfacts.ie/irishfinancenews/article_1021094.shtml

special interest groups. Specifically, we analyze capital tax competition between two governments based on a simple model of location and trade characterized by mobile capital, international oligopoly and trade costs following Ludema and Wooton (2000). In our model, firms decide their location by responding to after-tax profits and engage in Cournot competition in the markets of both countries. The present model has two distinctive features. First, two countries are *asymmetric* in that population and capital endowment are larger in one country than those in the other country. By introducing size asymmetry of countries, we can capture a part of international tax competition in the real world. Second, capital owners engage in lobbying activities to extract favorable policies from governments. Based on the common agency approach developed by Bernheim and Whinston (1986) and Grossman and Helpman (1994, 1995), the objective of governments is formulated in a way that they consider not only their domestic residents' welfare but also the political contributions by capital owners when deciding their tax rate.[*4] Consequently, the resulting tax policy and distribution of firms are biased in favor of the interests of capital owners, which seems plausible in the modern society where political pressure by firms influences policy decision-making processes.

It is worth mentioning the growing political pressure from interest groups on tax policies over the world. In Japan, for example, one of the most influential business lobbies called Japanese Business Federation has strongly urged the government to lower the high corporate tax rate in recent years.[*5] The lobby has attempted to increase political contributions to the ruling party, though in Japan interest groups are not allowed to donate to individual politicians.[*6] Our approach can capture such a political aspect of tax policies.

The main result of our analysis is as follows. If the two governments are mainly concerned with contributions by their domestic capital owners and the cost of shipping goods abroad is low, tax competition leads firms in the large country to relocate to the small country. The result implies that the *home-market effect* (Helpman and Krugman, 1985), meaning that the country with a large market is attractive for industry, could be *reversed* when considering a non-cooperative policy game between politically-interested governments.[*7]

The mechanism behind the result is intuitive. For firms based in the large country, profits from

[*4] More recent works apply the common agency approach to the analysis of trade policies in imperfectly competitive models. See Chang (2005), Bombardini (2008), and Chang and Willmann (2014) for monopolistic competition and Paltseva (2014) for oligopolistic competition.

[*5] "New head of Japan business lobby seeks corporate tax cut," *NIKKEI ASIAN REVIEW*, June 3rd, 2014; http://asia.nikkei.com/print/article/33880

[*6] "Sadayuki Sakakibara confirms Keidanren will return to recommending political donations," *The Japan Times*, September 8th, 2014; http://www.japantimes.co.jp/news/2014/09/08/national/politics-diplomacy/sadayuki-sakakibara-confirms-keidanren-will-return-recommending-political-donations/#.VSEdSvmsVlo

[*7] The reversal of the home-market effect is obtained by several studies including Head and Ries (2001); Head et al. (2002); Yu (2005); Behrens and Picard (2007). However, they do not consider policy competition, which is the focus of our analysis.

domestic sales out of their total profits are relatively large compared to profits from export sales because the firms can take advantage of the large market without incurring transportation costs. In contrast, for firms located in the small country, when transportation costs are low enough, profits from exporting are of higher importance than those are for firms in the large country because of the small size of their domestic market. Both total profits of firms in the small country and those in the large country are likely to become higher as more rival firms locate in the small country, which makes the market in the large country less competitive. Therefore, the owners of firms seeking higher after-tax profits attempt to attain such an industrial configuration through their lobbying activities. The resulting political pressure pushes the small country to lower taxes more than the large country so that the small country hosts firms more than proportionately. The results that the small country imports capital and that firms located there enjoys the large foreign market are roughly consistent with the observations mentioned above.

This paper is related to the two strands of the literature, but draws most on the analyses of tax competition in the new economic geography framework (Kind et al., 2000; Ludema and Wooton, 2000; Andersson and Forslid, 2003;Baldwin and Krugman, 2004; Borck and Pflüger, 2006). The main conclusion of these earlier studies is that the country with a large number of firms at the beginning of the tax game maintain its position while setting its tax rate higher than the rival country with few firms.[*8] The advantage of big market brings a larger share of firms that seek to save transportation costs (*home-market effect*) and hence the large country can exploit taxable agglomeration rents.[*9] While most of these studies deal with symmetric market size, Ottaviano and van Ypersele (2005) and Haufler and Wooton (2010) analyze asymmetric tax competition in the related location models and obtains the similar results. In contrast, the present paper proposes a *reverse* home market effect by employing a similar framework but with political process. This would help understand the successful experience of some small countries and regions in hosting FDI, which the previous studies have difficulty explaining.

There are a few exceptions in the literature that obtain the reversal of the home-market effect.[*10] Among others, Miyagiwa and Sato (2014), by introducing increasing entry costs, numerically shows that the small country attracts a more than proportionate share of firms by setting a *higher* tax rate than the large country. Our model is different from theirs in that it captures political aspects and

[*8] This conclusion depends on static settings of the game (simultaneous or sequential game) which most of the studies deal with. Kato (2015) examines a tax game with an infinite time horizon and shows that rather than the initial condition, whether or not governments commit to their policies is crucial for the spatial outcome of tax competition.

[*9] In empirical studies, overall conclusions are mixed: Charlot and Paty (2007), Brülhart et al. (2012) and Koh et al. (2013) support the taxable-agglomeration-rents hypothesis, whereas Luthi and Schmidheiny (2014) and Brülhart and Simpson (2014) do not.

[*10] A few exceptions include Sato and Thisse (2007), Borck et al. (2012) and Ma and Raimondos-Møller (2015). The first two papers derive the reverse home-market effect by highlighting competition among firms for hiring workers (Sato and Thisse, 2007), by focusing on inter and intra-sector spillovers (Borck et al., 2012). Ma and Raimondos-Møller (2015) shows that the small country may win bidding competition for a single multinational plant through profit shifting opportunities.

gives the reverse home-market effect where the small country sets a *lower* tax rate, which explains the observations mentioned before.

This paper is also related to the literature on tax competition in public finance. Bucovetsky (1991) and Wilson (1991) study tax competition between two asymmetric regions in the perfectly competitive framework. In contrast to the studies on tax competition in an agglomeration economy, they show that the smaller country levies a lower tax rate and has a higher capital-labor ratio than the larger country. This is because due to the diminishing marginal productivity of capital, the tax base in the small country responds more elastically to the tax differential than that in the large country. The contribution of the present paper is to provide another rationale for the advantages of small countries in different standpoints, i.e., agglomeration, oligopolistic competition and political economy, from those of the standard tax competition literature.

Political aspects in the analysis of tax competition are highlighted by Lai (2014) and Borck et al. (2012). Lai (2014) incorporates the common agency approach as in our analysis, into the standard tax competition model. He argues that the small country may set a *higher* tax rate than the large country unlike the standard models and ours. Borck et al. (2012) consider subsidy competition in the new economic geography framework played by governments that maximize a weighted sum of workers' and capitalists' welfare. They characterize the conditions under which the small region, starting from the situation where it hosts all firms, prevents the relocation of firms. Our and their analyses should be seen as complements. Both of them focus on biased governments and obtain the reverse home-market effect, but they differ in research strategies. Borck et al. (2012) adopt monopolistic competition and analyze corner solutions, whereas we adopt oligopolistic competition and look at interior equilibria.

The rest of the paper is organized as follows. The next section develops a simple general equilibrium model that induces agglomeration forces. Section 3 formulates tax competition with political process. Section 4 characterizes the Nash equilibrium tax rates and the industry allocation both when governments are benevolent and when they are politically-biased. Welfare implications are also mentioned. The final section concludes.

2 The model

In this section, we construct a simple model of geography and trade with the specification of Ludema and Wooton (2000). The economy consists of two countries, indexed by 1 and 2. Each country has two factors of production; labor and capital. The two countries differ in size and country 1 is assumed to have a smaller share of labor and capital. That is, suppose that the world amount of labor is L and that of capital is K, country 1 has $L_1 = sL$ and $K_1 = sK$ ($s < 1/2$) while country 2 has $L_2 = (1 - s)L$ and

$K_2 = (1-s)K$.[*11] Residents are divided into two groups, workers and capital owners. Workers supply their labor services inelastically, while capital owners, whose fraction among residents are assumed to be negligible, invest their capital in domestic firms.

There are two industries that produce different homogeneous goods, the *modern* sector (its product is denoted by q) and the *traditional* sector (denoted by z). The modern sector is characterized by oligopolistic competition. One unit of capital is needed to set up a modern firm and the firms play Cournot competition both in domestic and foreign market. In contrast, the traditional sector is characterized by perfect competition. We choose the traditional good as numéraire. Shipment of one unit of the modern good incurs an additional τ unit of trade costs, while there are no such costs when shipping the traditional good.

2.1 Demand Side

Residents in country $i \in \{1, 2\}$ share common preferences, and consume both the modern and traditional good:

$$u_i = \left(1 - \frac{q_i}{2}\right) q_i + z_i.$$

Aggregating over individuals gives total utility in country i:

$$U_i = L_i u_i = \left(1 - \frac{Q_i}{2L_i}\right) Q_i + Z_i, \tag{1}$$

where $Q_i \equiv L_i q_i$ is the aggregate demand in country i for the modern good and $Z_i \equiv L_i z_i$ is that for the traditional good. Given the price of the industrial good, denoted by p_i, utility maximization yields the demand function for the good:

$$p_i = 1 - Q_i/L_i, \tag{2}$$

Other things equal, the smaller the size of a country, the lower is the price there. The country with small market is less profitable for firms than that with large market.

2.2 Supply Side

In the traditional sector, the production of one unit of z requires one unit of L. Because of costless trade and the choice of numéraire, the price of the good in the two countries is equalized to unity. Constant returns to scale production and the choice of units make the wage rates in both countries equal the price of the traditional good, i.e., $w_1 = w_2 = 1$.

[*11] L is assumed to be sufficiently large to make the production of the numéraire good possible. K is larger than two for the sake of consistency with oligopolistic competition.

In the modern sector, after establishment, firms can produce without marginal costs and choose different quantities to be sold in domestic and export markets. The operating profit of a firm located in each country can be written as follows:

$$\begin{aligned} \pi_1 &= \pi_{11} + \pi_{12}, \qquad \pi_{11} \equiv p_1 q_{11}, \;\; \pi_{12} \equiv (p_2 - \tau) q_{12}, \\ \pi_2 &= \pi_{21} + \pi_{22}, \qquad \pi_{21} \equiv (p_1 - \tau) q_{21}, \;\; \pi_{22} \equiv p_2 q_{22}, \end{aligned} \tag{3}$$

where π_{ij} denotes the operating profit of a firm based in country i, earned from country j and q_{ij} represents the production level by a firm based in i, sold in j ($i, j \in \{1, 2\}$). One unit of capital builds one firm so that capital the market clearing condition requires that the number of firms in country 1 is $\lambda_1 K$ and that in country 2 is $\lambda_2 K \equiv (1 - \lambda_1)K$, where $\lambda_1 \in [0, 1]$ denotes the share of firms in 1. The aggregate demand of a country is met by the total supply by firms in both countries:

$$\begin{aligned} Q_1 &= \lambda_1 K q_{11} + (1 - \lambda_1) K q_{21}, \\ Q_2 &= \lambda_1 K q_{12} + (1 - \lambda_1) K q_{22}. \end{aligned}$$

Each firm engages in Cournot competition both in domestic and foreign markets. Substituting the demand functions (2) into the operating profits (3) and taking the FOCs with respect to the quantity in both markets yields

$$\begin{aligned} q_{11} &= sLp_1, & q_{21} &= (1 - s)L(p_2 - \tau), \\ q_{21} &= sL(p_1 - \tau), & q_{22} &= (1 - s)Lp_2. \end{aligned} \tag{4}$$

where

$$p_i = \frac{1 + \tau(1 - \lambda_i)K}{K + 1}. \tag{5}$$

The increase in the share of domestic firms and the reduction in trade costs make the domestic price decline.

Exporting is profitable for firms as long as the mill price $p_i - \tau$ is positive. In other words, trade costs must not be prohibitively high:

$$\tau < \overline{\tau} \equiv \frac{1}{K + 1}. \tag{6}$$

This inequality is assumed to hold throughout the analysis.

Substituting the equilibrium prices (5) and quantities (4) into the operating profits (3) gives

$$\begin{aligned} \pi_1 &= \frac{sL\left[1 + \tau(1 - \lambda_1)K\right]^2}{(K + 1)^2} + \frac{(1 - s)L\left[1 - \tau\left\{1 + (1 - \lambda_1)K\right\}\right]^2}{(K + 1)^2}, \\ \pi_2 &= \frac{sL\left[1 - \tau\{1 + (1 - \lambda_2)K\}\right]^2}{(K + 1)^2} + \frac{(1 - s)L[1 + \tau(1 - \lambda_2)K]^2}{(K + 1)^2}. \end{aligned}$$

Free entry and exit make excess profits zero so that the operating profits become equal to the factor rewards to capital.

Although the share of firm λ_1 is endogenously determined in the location equilibrium discussed shortly, we treat it as an exogenous variable at the moment in order to illustrate the relationship between the individual firm's profit and the distribution of firms. The marginal effect of an increased share of domestic firms on their total profit depends on the difference of the market size:

$$\begin{aligned} \frac{\mathrm{d}\pi_1}{\mathrm{d}\lambda_1} &= \frac{2\tau KL\Gamma_1}{(K+1)^2} \lesseqgtr 0, \quad \Gamma_1 \equiv 1 - 2s - \tau[1 - s + (1-\lambda_1)K] \lesseqgtr 0, \\ \frac{\mathrm{d}\pi_2}{\mathrm{d}\lambda_2} &= \frac{2\tau KL\Gamma_2}{(K+1)^2} < 0, \quad \Gamma_2 \equiv -(1-2s) - \tau[s + (1-\lambda_2)K] < 0. \end{aligned} \tag{7}$$

From the fact that country 1 is small ($1-2s > 0$), Γ_2 and thus the marginal effect for country 2, $\mathrm{d}\pi_2/\mathrm{d}\lambda_2$, are unambiguously negative. An expansion of domestic firms makes the local competition tougher by declining the domestic price, while at the same time it means an contraction of foreign firms, which relaxes the competition in the foreign market. For firms in the large country, the first negative effect always outweighs the second positive effect because of the large domestic market and thus $\mathrm{d}\pi_2/\mathrm{d}\lambda_2$ is negative. In contrast, the sign of the marginal effect for country 1, $\mathrm{d}\pi_1/\mathrm{d}\lambda_1$, is ambiguous. For firms in the small country, profits from exporting are more important than for firms in the large country so that the positive effect may exceed the negative effect. This is particularly true when trade costs are sufficiently low and the firms serving the small domestic market earn huge profits from supplying to the large foreign market.

The typical profits of a firm in small country 1 and in large country 2 are illustrated in figures 1 and 2. Remember that though the share of firms is an endogenous variable to be determined in equilibrium, these figures are drawn as if it changed exogenously. The total profit of a firm in country 1 reaches its peak when 1 hosts all the firms, $\lambda_1 = 1$, while that in 2 does so when 2 has no firms, $\lambda_2 = 1 - \lambda_1 = 0$. These figures suggest that firms both in 1 and 2 prefer industrial agglomeration in small country 1. These contrastive incentives of firms based in the different countries are the key to the following analysis.

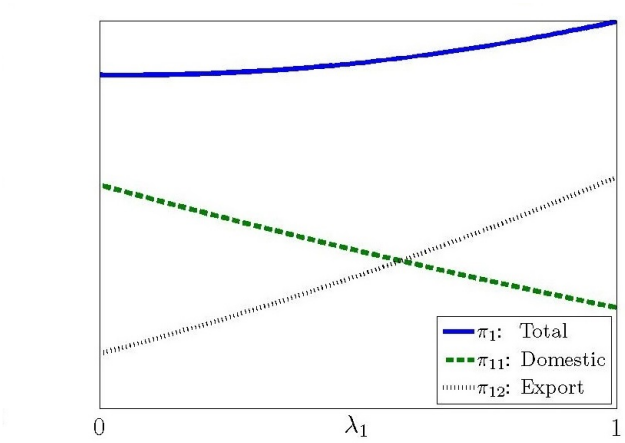

FIGURE 1 Profits of a firm in country 1.

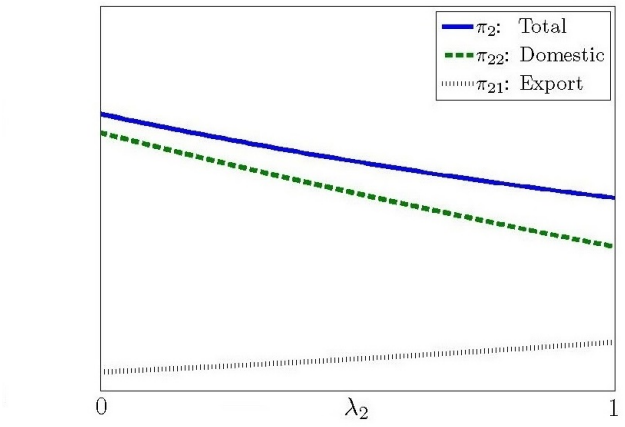

FIGURE 2 Profits of a firm in country 2.

2.3 Location equilibrium

Firms try to locate in a country that offers a higher profit. This implies that the profits in both countries must be equalized:

$$\pi_1(\lambda_1) = \pi_2(\lambda_2 \equiv 1 - \lambda_1),$$

as long as λ_1 is in the interior interval $(0, 1)$. If firms are completely agglomerated in one country, $\lambda_1 \in \{0, 1\}$, this equality does not hold. The above locational equilibrium condition gives an unique

distribution of firms:

$$\tilde{\lambda}_1 = s + \frac{(2s-1)[2-\tau(K+1)]}{2\tau K} < s. \tag{8}$$

Taking into account the small size of country 1 ($s < 1/2$) and the regularity condition for trade costs ((6): $\tau < \overline{\tau}$), the second term is negative and thus it holds that $\tilde{\lambda}_1 < s$. The firm's share in country 1 is smaller than its capital share. Namely, the small country becomes the exporter of capital, while the large country becomes the importer. This result is the so-called *home-market effect* (Helpman and Krugman, 1985). Intuition behind this is easy to grasp. Consider, to the contrary, the case where each country owns a share of firms that equals its capital endowment, i.e., $\lambda_1 = s$. Locating in the larger market saves trade costs so that firms there earn more from exporting and thus obtain a higher total profit, implying that $\pi_1(\lambda_1 = s) < \pi_2(1-\lambda_1 = 1-s)$. Because of the profit difference, firms will seek to move into the large country ($1 - \lambda_1 \Uparrow$) until the difference disappears. In equilibrium, the distribution of firms becomes unequal in order to maintain the equalization of the profits.

As can be seen in (8), a reduction in trade costs makes the distribution more unequal ($\tau \Downarrow \rightarrow \tilde{\lambda}_1 \Downarrow$) and it is possible that all firms relocate to the larger country when trade costs are extremely low. To ensure interior spatial outcomes, trade costs are assumed to be sufficiently large:

$$\tau > \underline{\tau} \equiv \frac{2(1-2s)}{K-2s+1}. \tag{9}$$

We further assume the *no-black-hole* condition $\underline{\tau} < \overline{\tau}$ excluding the situation where agglomeration forces are too strong, which implies that country 1 should not be too small: $1/2 > s > \underline{s} \equiv (K+1)/[2(2K+1)]$. If the condition does not hold: $s \leq \underline{s}$, the economy always reaches full agglomeration in country 2 for all levels of trade costs.

3 Tax competition with lobbying groups

This section introduces taxes and governments into the economy. The government in country $i \in \{1,2\}$ imposes a lump-sum tax, T_i on each firm located in country i, and total tax revenue of country i is thus $T_i\lambda_i K$. Tax rates are allowed to be *negative*. The locational equilibrium requires the equalization of the after-tax profits:

$$\pi_1(\lambda_1) - T_1 = \pi_2(1-\lambda_1) - T_2.$$

The equilibrium share of firms is thus affected by the tax difference:

$$\lambda_1(T_1, T_2) = \tilde{\lambda}_1 - \frac{K+1}{2\tau^2 KL}(T_1 - T_2), \tag{10}$$

where $\tilde{\lambda}_1$ is the equilibrium share of firms when there are no governments defined in (8). The higher the tax rate in a country, the fewer firms it obtains (e.g., $T_1 \Uparrow \rightarrow \lambda_1 \Downarrow$). Collected tax revenues are redistributed to the domestic residents.

3.1 Politically-motivated governments

Before discussing the objective of the governments, we compute the welfare of residents. The residents are divided into two groups: one is capital owners and the other is workers. From the assumptions that capital owners account for a sufficiently small fraction of the population and they invest their capital to the domestic firms, the welfare of the capital owners in country $i \in \{1, 2\}$ is simply represented as the rewards to capital, or the post-tax profits of firms in i:

$$W_i^c = (\pi_i - T_i)K_i.$$

The income of a worker consists of the wage paid to one unit of labor service in the traditional sector, the redistribution of tax revenue and the endowments of the numéraire. The individual budget constraint can be written as

$$p_i q_i + z_i = 1 + T_i \lambda_i K/L_i + \bar{z}_i.$$

The national budget constraint is obtained by aggregating the above across workers. By inserting this constraint into the aggregate utility (1) and evaluating it at the equilibrium quantities (4) and prices (5), the aggregate welfare of workers in country 1 is given by

$$W_i^l = (S_i + 1)L_i + T_i \lambda_i K + \overline{Z}_i,$$

where S_i is the consumer surplus of an individual:

$$S_i = \frac{(1 - p_i)^2}{2} = \left[\frac{1 + K\{1 - \tau(1 - \lambda_i)\}}{K + 1}\right]^2.$$

The total welfare of residents in country i is thus $W_i = W_i^c + W_i^l$.

The problem of the governments is formulated as in Grossman and Helpman (1994, 1995). The governments care about not only the aggregate welfare of their residents but also campaign contributions, We assume only capital owners can organize a lobbying group and make contributions C to their domestic government. The objective function of the government in country i is

$$G_i(T_i;\ T_j) = a_i W_i(T_i;\ T_j) + C_i(T_i;\ T_j).$$

where a_i denotes the weight that the governments place on their residents' welfare relative to the contributions.

Tax competition with political pressure is analyzed in the following three-stage game. First, capital owners in each country as a special interest group decide to form a lobbying group and they choose a contribution schedule that depends on the domestic tax rate given the tax rate of the rival country. Second, each government decides whether it receives or rejects the contributions. The tax rates are

non-cooperatively chosen so as to maximize the objective of the governments. Finally, relocation of firms occurs in response to the profit differential.

By making use of the truthful contribution schedule as in Bernheim and Whinston (1986), we can rewrite the government objective as[*12]

$$\begin{aligned} G_i(T_i;\ T_j) &= a_i W_i(T_i;\ T_j) + W_i^c(T_i;\ T_j), \\ &= a_i W_i^l(T_i;\ T_j) + (1+a_i) W_i^c(T_i;\ T_j). \end{aligned}$$

Because of the presence of the weight a_i, the government objective is biased toward the interest of capital owners. The problem can be solved backwardly. Given the distribution of firms defined in (10), we derive the FOCs of both government by differentiating G_i with respect to T_i given T_j:

$$\frac{\mathrm{d}G_i}{\mathrm{d}T_i} = a_i \frac{\mathrm{d}W_i^l}{\mathrm{d}T_i} + (1+a_i)\frac{\mathrm{d}W_i^c}{\mathrm{d}T_i} = 0 \quad \Rightarrow \quad \frac{1}{a_i}\frac{\mathrm{d}G_i}{\mathrm{d}T_i} = \frac{\mathrm{d}W_i^l}{\mathrm{d}T_i} + \beta_i \frac{\mathrm{d}W_i^c}{\mathrm{d}T_i} = 0.$$

where $\beta_i \equiv (1+a_i)/a_i$ is a political weight attached to the interests of capital owners. Solving the systems of equations yields equilibrium tax rates.

4 Equilibrium tax rates and distribution of firms

This section first examines the case of the governments free from political pressures ($a_i = \infty$ or $\beta_i = 1$). Then the next section explores the politically-motivated governments ($a_i < \infty$ or $\beta_i > 1$). The focus of the following analysis is on interior equilibria $\lambda_1 \in (0,1)$.

4.1 Benchmark: no-lobbying case

The marginal impact of the tax rate of country $i \in \{1,2\}$ on its government payoff is decomposed as follows (ignoring constant terms) :

$$\begin{aligned} 0 = \frac{\mathrm{d}W_i^l}{\mathrm{d}T_i} + 1 \cdot \frac{\mathrm{d}W_i^c}{\mathrm{d}T_i} &= \frac{\mathrm{d}}{\mathrm{d}T_i}\left[S_i L_i + T_i \lambda_i K + (\pi_i - T_i) K_i\right] \\ &= \frac{\mathrm{d}S_i}{\mathrm{d}T_i} L_i + \left(\lambda_i + T_i \frac{\mathrm{d}\lambda_i}{\mathrm{d}T_i}\right) K + \left(\frac{\mathrm{d}\pi_i}{\mathrm{d}T_i} - 1\right) K_i. \end{aligned} \tag{11}$$

where the second-order condition always holds because of $\mathrm{d}^2 G_i/\mathrm{d}T_i = -(2K+3)/(4L\tau^2) < 0$. A close inspection of each channel reveals the forces at work in the present model. The first term in (12) represents the impact on consumer surplus:

$$\frac{\mathrm{d}S_i}{\mathrm{d}T_i} = \frac{\partial S_i}{\partial \lambda_i}\frac{\mathrm{d}\lambda_i}{\mathrm{d}T_i} = \frac{\tau K^2 (1-\tau\lambda_i)}{(K+1)^2}\left(-\frac{K+1}{2\tau^2 K L}\right) = -\frac{K(1-\tau\lambda_i)}{2\tau L(K+1)} < 0.$$

[*12] The truthful strategy of capital owners in i takes the form: $C_i = \max\{W_i^c - B_i, F\}$, where B_i is the welfare of capital owners net of the contributions and F is a negative constant because we allow for negative contributions.

The negative impact on consumer surplus is intuitive: the outflow of firms resulting from an increased tax rate causes the domestic price to rise. This consideration gives the government both in the small and the large country an incentive to lower its tax rate.

The second term in (11) captures the impact on tax revenue. An increased tax rate affects the tax revenue both in a positive and a negative way: it raises additional tax revenues from incumbent firms ($\lambda_i K > 0$), but it also induces the erosion of the tax base ($(\mathrm{d}\lambda_i/\mathrm{d}T_i)K < 0$). Although the sign of the impact is ambiguous, the role of the asymmetric market size is clear: because of the larger share of incumbent firms, the large country has an larger incentive to increase its tax rate.[*13]

The third term in (11) shows the impact on after-tax profit income. An increase in the tax rate directly decreases after-tax profits (-1) and besides indirectly affects gross profits through the change of the distribution of firms in the following way:

$$\frac{\mathrm{d}\pi_i}{\mathrm{d}T_i} = \frac{\partial \pi_i}{\partial \lambda_i}\frac{\mathrm{d}\lambda_i}{\mathrm{d}T_i} = \frac{2\tau KL\Gamma_i}{(K+1)^2}\left(-\frac{K+1}{2\tau^2 KL}\right), \tag{12}$$

where Γ_i is defined in (7) and may take both positive and negative values. Although as in the previous case the sign of the overall impact is yet to be determined, we can still investigate how unequal-sized countries have different incentives to tax. For small country 1, the impact of an expansion of domestic firms on a firm's profits $\partial\pi_1/\partial\lambda_1$ (or $\mathrm{d}\pi_1/\mathrm{d}T_1$) is likely to be negative (or positive) under high trade costs and be positive (or negative) under low trade costs (see (7)). Decreasing trade costs, which improves the export profit from the large foreign market, incentivizes government 1 in the small country to attract firms by lowering taxes with a view to reducing rivals in the foreign market. On the other hand, for large country 2, the sign of $\partial\pi_2/\partial\lambda_2$ (or $\mathrm{d}\pi_2/\mathrm{d}T_2$) is always negative (or positive). Government 2 is always willing to raise taxes in order to drive domestic rivals away and gain from the large domestic market.

In sum, the large country tends to have larger incentives to tax than the small country.[*14] To see this hold in equilibrium, we solve the FOCs of both countries as a system of equations for tax rates (see appendix A.1. for details) :

$$\begin{aligned} T_1^n &= \frac{\tau KL}{K+1}\left[\tau - \frac{\tau}{2} - \frac{2-\tau}{4(K+1)}\right] - \frac{\tau L(1-2s)\Theta_1^n}{4(K+1)^2(4K+5)}, \\ T_2^n &= \frac{\tau KL}{K+1}\left[\tau - \frac{\tau}{2} - \frac{2-\tau}{4(K+1)}\right] + \frac{\tau L(1-2s)\Theta_2^n}{4(K+1)^2(4K+5)} \end{aligned} \tag{13}$$

where the superscript n stands for the no lobbying case and Θ_i^n is a positive bundling parameter that includes τ, s and K. Both T_1^n and T_2^n can be positive or negative, as we have seen that governments have incentives and disincentives to raise taxes.

[*13] To see this formally, we can check that $\mathrm{d}(T_1\lambda_1 K)/\mathrm{d}T_1 < \mathrm{d}(T_2\lambda_2 K)/\mathrm{d}T_2$ when $T_1 = T_2$ and $s < 1/2$.

[*14] It can be readily verified that $\mathrm{d}G_1/\mathrm{d}T_1 < \mathrm{d}G_2/\mathrm{d}T_2$ when $T_1 = T_2$ and $s < 1/2$.

Supposing that the two countries are identical in size ($s = 1/2$), only the first term in (13) is left and thus the equilibrium tax rates and distribution of firms becomes symmetric. Each term in the big square brackets (partly) represents the consideration of each component of the government's objective, each of which has been discussed above (see appendix A.2. for details).[*15] The first positive term in the brackets comes from a *tax-revenue effect*, which means that governments can exploit location rents of incumbent firms avoiding competitive market with many rivals. The second negative term resulting from a *consumer-price effect* reflects the motivation of governments to attract firms so as to decrease consumer prices. The third negative term we call a *profit-income effect* reflects the fact that governments seek to lessen the direct burden of tax incidence on domestic capital owners.

When the two countries differ in size, the second term in (13), which we call a *market-size effect*, appears and the tax rates and the industrial configuration are no longer symmetric. The market-size effect incorporates all the impacts resulting from the difference of market size and modifies the three effects mentioned above. Due to the firms' motives of locating a larger market for saving trade costs, large country 2 can levy a higher tax rate than small country 1. Note that the market-size effect for T_1^n is negative whereas that for T_2^n is positive.

The difference of the tax rate is given by

$$T_1^n - T_2^n = -\frac{\tau L(1-2s)[6-\tau(2K+3)]}{4K+5}. \tag{14}$$

The regularity condition (6) ensures that the square bracket in the numerator of (14) is positive. It turns out that country 1 with $s < 1/2$ always sets a lower tax rate than country 2. The fact that (14) is increasing in trade costs under $\tau < \overline{\tau}$ implies that the gap shrinks as trade costs fall.

Evaluating the equilibrium configuration (10) at the tax differential given by (14) yields

$$\lambda_1^n = s - \frac{(1-2s)[K+2-\tau(K+1)^2]}{\tau K(4K+5)}. \tag{15}$$

It is easily verified that when trade costs are not too low ($\tau > \underline{\tau}$) and the no-black-hole condition ($s > \underline{\tilde{s}}$) holds, λ_1^n always lies in between zero and one. We can also check that country 1 gets more firms than it has when there are no governments ($\lambda_1^n > \tilde{\lambda}_1$), but it exports some fraction of capital ($\lambda_1^n < s$). Thanks to the market-size effect, large country 2 can import capital while having a higher tax rate. This result that the home-market effect still prevails under tax competition is consistent with previous studies such as Ottaviano and van Ypersele (2005) and Haufler and Wooton (2010).

These findings are summarized as follows:

PROPOSITION 1. *Consider tax competition between the two benevolent governments ($\beta_1 = \beta_2 = 1$). Assume that country 1 is small ($s \in (\underline{\tilde{s}}, 1/2)$) and $\tau \in (\underline{\tau}, \overline{\tau})$. Then country 1 hosts a smaller share of firms than its capital share ($\lambda_1^n < s$) and its tax rate is always lower than that of country 2 ($T_1^n < T_2^n$).*

[*15] This decomposition is first proposed by Haufler and Wooton (2010). See section A.2. in the appendices for detail.

4.2 Lobbying case

We now turn to the lobbying case and here assume that the two governments attach an equal political weight $\beta_1 = \beta_2 = \beta$ on the contributions. The assumption of the common political weight is relaxed in the next section. We impose a restriction on β so as to satisfy the second-order condition of the maximization problem such that $\beta < \overline{\beta} \equiv (4K + 3)/(2K)$.[*16] The presence of the political weight β modifies the governments' incentives to tax in the following way:

$$0 = \frac{\mathrm{d}W_i^l}{\mathrm{d}T_i} + \beta \frac{\mathrm{d}W_i^c}{\mathrm{d}T_i} = \frac{\mathrm{d}S_i}{\mathrm{d}T_i} L_i + \left(\lambda_i + T_i \frac{\mathrm{d}\lambda}{\mathrm{d}T_i} \right) K + \beta \left(\frac{\mathrm{d}\pi_i}{\mathrm{d}T_i} - 1 \right) K_i.$$

The politically-motivated governments put more emphasis on the interests of capital owners, i.e., the after-tax profit income.

Having the results of the benchmark case in mind, let us again look at the impact of an increased domestic tax rate on the profit of a firm locating there. Substituting the location equilibrium condition (10) into (12) gives

$$\frac{\mathrm{d}\pi_1}{\mathrm{d}T_1} = \frac{1}{2} + \frac{T_1 - T_2}{2\tau^2 L}, \quad \frac{\mathrm{d}\pi_2}{\mathrm{d}T_2} = \frac{1}{2} - \frac{T_1 - T_2}{2\tau^2 L}.$$

As has seen in the previous section, the large market in country 2 is expected to push its government to have an higher tax rate: $T_1 - T_2 < 0$. An lower tax rate of country 1 clearly accelerates the relocation of firms from country 2 to country 1. We have seen from (7) and (12) that, for firms based in 1, this change in industrial distribution makes their export market more profitable and at the same time makes their local market less profitable. Due to the smallness of the local market, the former benefit tends to exceed the latter loss so that such a lowering tax rate is likely to enhance the profit of domestic firms. Conversely, for firms based in 2, the larger home market is more important than the small export market. Hence, the opposite policy, i.e., increasing the domestic tax rate to drive local rival firms away, is likely to be desirable for them. Capital owners residing in the different countries make contributions to their national government to extract *different* tax policies but achieve the *identical* spatial outcome, i.e., industrial agglomeration in small country 1.

The equilibrium tax rates take similar forms as those in the no-lobbying case (13) (see appendix A.1. for details):

$$\begin{aligned} T_1^* &= \frac{\tau K L}{K+1} \left[\tau - \frac{\beta\tau}{2} - \frac{2-\tau}{4(K+1)} \right] - \frac{\tau L (1-2s)\Theta_1^*}{4(K+1)^2[2(3-\beta)K+5]}, \\ T_2^* &= \frac{\tau K L}{K+1} \left[\tau - \frac{\beta\tau}{2} - \frac{2-\tau}{4(K+1)} \right] + \frac{\tau L (1-2s)\Theta_2^*}{4(K+1)^2[2(3-\beta)K+5]} \end{aligned} \tag{16}$$

[*16] This is a sufficient condition for the second-order condition. That is, supposing $\beta < \overline{\beta}$ holds, then we have $(1/a)\mathrm{d}^2 G_1/\mathrm{d}T_1 = [(2\beta K + 1)s - 4(K+1)]/(4L\tau^2) < 0$ for all $s \in [0,1]$. Symmetric expression holds for country 2.

where Θ_i^* is a positive bundling parameter that includes β, K, s and τ. An additional weight $\beta > 1$ on the second term of the big square brackets reinforces the profit-income effect, but it also appears in the second term and changes the market-size effect. The difference of the tax rate becomes

$$T_1^* - T_2^* = -\frac{\tau L(1-2s)[6-\tau(2\beta K+3)]}{2(3-\beta)K+5} < 0. \tag{17}$$

As long as the regularity condition (6) and $\beta < \overline{\beta}$ hold, country 1 with $s < 1/2$ always sets a lower tax rate than country 2 as we have expected.

Combining the tax differential defined above with the location equilibrium condition (10) gives

$$\lambda_1^* = s - \frac{(1-2s)[K+2-\tau(K+1)^2+2(\beta-1)K\{\tau(K+1)-1\}]}{\tau K[2(3-\beta)K+5]}, \tag{18}$$

where the denominator of the second term is positive when $\beta < \overline{\beta}$. The condition that we have imposed on trade costs ($\tau > \underline{\tau}$) ensures interior spatial outcomes.

Whether country 1 exports or imports capital depends on the sign of the second term in (18). Let β^* be the critical value that changes the sign:

$$\beta^* \equiv \frac{3K+2-\tau(K+1)(3K+1)}{2K[1-\tau(K+1)]}.$$

We can confirm that β^* is smaller than the upper bound $\overline{\beta}$ when

$$\tau < \tau^* \equiv \frac{1}{K+2}.$$

We redefine the no-black-hole condition that ensure the existence of τ^* in the interval $(\underline{\tau}, \overline{\tau})$, implying that country 1 is not too small: $1/2 > s > (K+3)/[2(2K+3)] \equiv \underline{s}^*$.

If $\beta < \beta^*$ holds and/or trade costs are sufficiently high ($\tau > \overline{\tau}^*$), the second term (including minus sign) in (16) is negative, meaning that the share of firms in country 1 is smaller than its capital share ($\lambda_1^* < s$) as in the benchmark case. Tax competition played by relatively benevolent governments gives the qualitatively same results as in the benchmark case. Higher trade impediments also preserve the advantage of large country 2 by enhancing the incentives of firms to relocate to the larger market and save trade costs.

On the other hand, if $\beta > \beta^*$ holds given sufficiently low trade costs ($\tau < \tau^*$), the opposite is true; we can observe a *reversal* of the home-market effect ($\lambda_1^* > s$). If both the governments heavily care about the capital owners, they determine their tax rates so as to realize the industrial configuration in favor of profit income owned by capital owners. As a result, contrary to the home-market effect, small country 1 chooses a lower tax rate and imports capital while larger country 2 chooses a higher rate and becomes a capital exporter. For the reverse home-market effect to emerge, trade costs should be small enough for firms in 1 to make exporting fairly profitable compared to serving domestic market.

These findings are summarized in

PROPOSITION 2. *Consider tax competition between the politically-motivated governments with a common political weight* $\beta \in (1, \overline{\beta})$*. Assume that country 1 is small* $(s \in (\underline{s}^*, 1/2))$ *and* $\tau \in (\underline{\tau}, \overline{\tau})$*. Then two cases may arise:*

(i) if the political weight is small $(\beta < \beta^*)$ *and/or trade costs are large* $(\tau > \tau^*)$*, country 1 hosts a smaller share of firms than its capital share* $(\lambda_1^* < s)$*.*

(ii) if the political weight is large $(\beta > \beta^*)$ *and trade costs are small* $(\tau < \tau^*)$*, country 1 hosts a larger share of firms than its capital share (the reverse home-market effect:* $\lambda_1^* > s$*).*

In both cases, the tax rate of country 1 is always lower than that of country 2 $(T_1^* < T_2^*)$*.*

The reversal of the home-market effect is illustrated in the range $(\beta^*, \overline{\beta})$ in figure 3. Country 1 attracts more firms as the governments put more emphasis on the interests of capital owners.[*17] The result may explain well the fact that small countries with a lower corporate tax rate have succeeded better in attracting FDI than large countries with a higher rate.[*18]

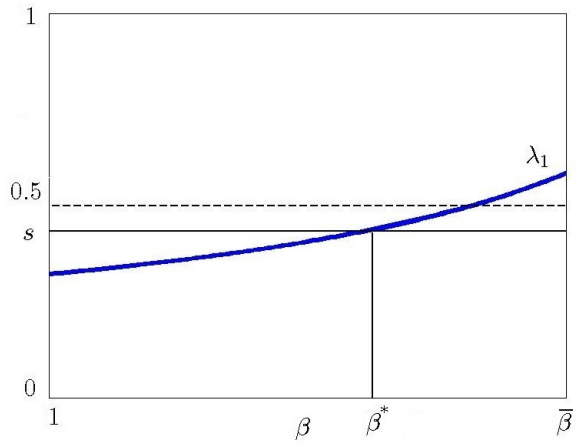

FIGURE 3 Equilibrium share of firms under the politically-motivated governments

[*17] To check this formally, it is verified that $d\lambda_1^*/d\beta = -\Psi d(T_1^* - T_2^*)/d\beta > 0$ for all $\tau \in (\underline{\tau}, 3/(3K+4))$ where $\Psi \equiv (K+1)/2\tau^2 KL > 0$. Since $\tau^* < 3/(3K+4)$ holds, we have $d\lambda_1^*/d\beta > 0$ when the reverse home market effect prevails ($\beta > \beta^*$ and $\tau < \tau^*$).

[*18] Although many empirical studies on the protection-for-sale model obtain remarkably low estimates of political weight β (or high estimates of a) (Goldberg and Maggi, 1999; Gawande and Bandyopadhyay, 2000), there are several studies that obtain fairly high estimates of β (Mitra et al., 2006; Gawande et al., 2012) or report mixed results (McCalman, 2004).

4.3 Welfare implications

To see welfare implications, we compare the socially desirable industrial configuration to the spatial outcome under tax competition. We consider the social planner who chooses the industry allocation λ_1 to maximize the sum of national welfare of the two countries $W \equiv W_1 + W_2$. The social planner implements the policy through lump-sum transfers among agents while taking as given the equilibrium market prices (5) and quantities (4) (see appendix A.3. for details).

Figure 4 shows the global welfare function along with the distribution of firms that attains the optimum λ_1^o, that under benevolent governments λ_1^n and that under politically-interested governments λ_1^*. λ_1^n is larger than λ_1^o, meaning that tax competition played by lobbying-free governments leads to an excessive tax gap and thus to a more equalized distribution. This can be explained by international externalities resulting from market size asymmetry. Country 1 is exporting capital and thus bears the burden of tax incidence imposed by country 2. Since increasing the tax rate in 1 brings the positive externality from 1 to 2, i.e., delocation of firms in 1, government 1 sets a too low tax rate from the global point of view. In contrast, from the fact that country 2 is importing capital and its tax rate has the negative externality, government 2 ends up choosing an inefficiently higher tax rate. The large tax difference generates arbitrage opportunities for capital owners and as a consequence yields inefficiently equalized distribution.

As we have seen in the previous sections, the relationship between λ_1^n and λ_1^* is clear: when the governments are heavily biased in favor of capital owners and trade barriers are low, λ_1^* is larger than λ_1^n and the more so, the higher political weight β.

We summarize these as follows:

PROPOSITION 3. *The equilibrium share of firms where the reverse home market effect is prevailing is more socially inefficient than that under the benevolent governments* ($\lambda_1^o < \lambda_1^n < s < \lambda_1^*$).

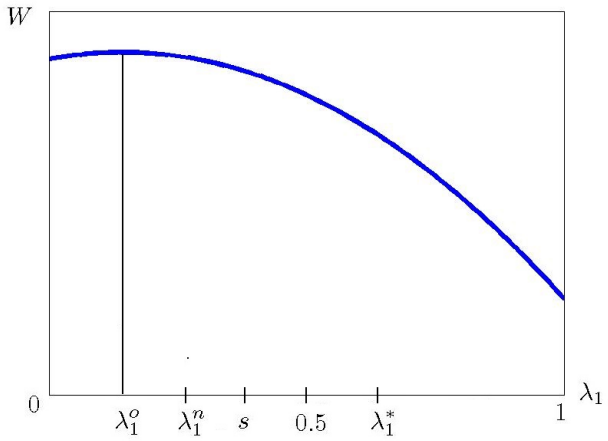

FIGURE 4 Global welfare

5 Extensions: asymmetric political weight

In the previous analysis, we assumed the political weight β is common to the two governments. In this section, we allow for the asymmetry of the weight and confirm that our main result of the reverse home-market effect still holds. In order to single out the effect of different political weights, we first analyze the case of symmetric market size, i.e., $s = 1/2$. The equilibrium tax rate in country $i \in \{1, 2\}$ is given by

$$T_i^{**} = \frac{\tau KL}{K+1}\left[\tau - \frac{\beta_i \tau}{2} - \frac{2-\tau}{4(K+1)}\right].$$

The profit-income effect, the second term in the square bracket, reflects the asymmetric weights and is stronger as the weight gets higher. The tax differential becomes

$$T_1^{**} - T_2^{**} = -\frac{\tau^2 KL(\beta_1 - \beta_2)}{[6-(\beta_1+\beta_2)]K+5},$$

which is negative if $\beta_1 > \beta_2$.[*19] The government with a higher weight sets a lower tax rate so as to reduce the direct tax burden on capital owners.

Since there is no market-size effect and thus only the tax differential matters for the industrial configuration, the more politically-motivated government setting a lower tax rate attracts more firms than

[*19] The denominator is positive as long as $\beta_i < \overline{\beta}$ holds as we have assumed in the previous analysis.

its capital share:

$$\lambda_1^{**} = \frac{1}{2} + \frac{(K+1)(\beta_1 - \beta_2)}{2[\{6 - (\beta_1 + \beta_2)\}K + 5]} > s,$$

as long as $\beta_1 > \beta_2$ holds.

Having made clear the role of different political weights, we then consider the most general situation where both country size and weights are asymmetric. Since it is hard to analytically characterize the conditions that make the home-market effect reversed, we rely on numerical simulations. Figures 5 and 6 show the equilibrium share of firms based in country 1 (z-axis) for various levels of political weights along with the horizontal plane representing the country 1's size: $s = 0.4$. The diagonal line linking the north corner to the south corner corresponds to the case of symmetric weight. As β_i moves from low to high given a particular level of β_j, the share of firms based in country i increases for $i \neq j$. Moreover, the government with a higher political weight (e.g., $\beta_1 > \beta_2$), which engages actively in tax reduction, is likely to host a more than proportionate share of firms ($\lambda_1^{**} > s$).

In the case of common political weight, as the key to the reverse home-market effect, we pointed out the coincidence of the desirable industrial configuration for firms both in small and large countries. The mechanism still works when trade costs are low (figure 6). If β_1 and β_2 are in [2, 2.5], λ_1^{**} may exceed s even when $\beta_1 < \beta_2$ holds, meaning that the profit-income effect of government 2 is stronger than that of government 1. Although the stronger profit-income effect of government 2 puts more downward pressure on the tax rate of 2, the market-size effect works in a way that government 2 reduces the pressure on tax cut with a view to avoiding the influx of capital, which hurts profits of firms in large country 2. The emergence of the reverse home-market effect and its mechanism remain unchanged in the general situation.

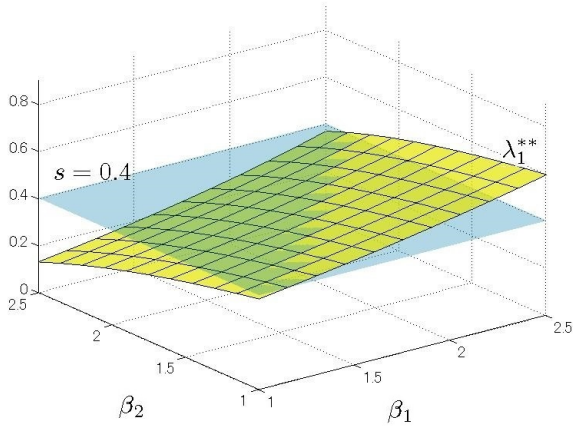

FIGURE 5 Equilibrium share of firms under asymmetric political weight and high trade costs
NOTE: Parameter values are $K = 3$, $s = 0.4$ and $\tau = 0.249$.

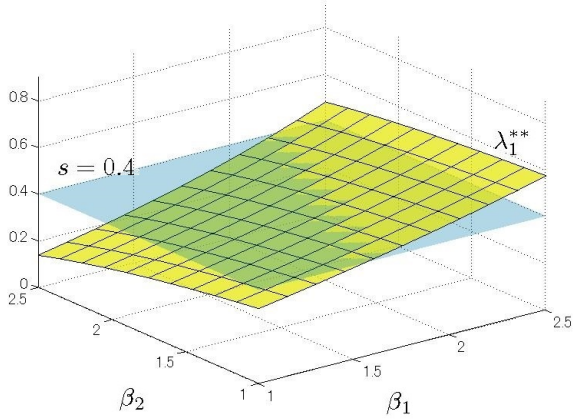

FIGURE 6 Equilibrium share of firms under asymmetric political weight and low trade costs
NOTE: Parameter values are $K = 3$, $s = 0.4$ and $\tau = 0.138$.

6 Conclusion

This article has analyzed a tax game between two countries of asymmetric size taking into account a political economic issue. The political process is modeled as a Principle-Agent relationship between the governments and the capital owners as in Grossman and Helpman (1994, 1995). It is shown that if the governments are sufficiently biased toward the interests of capital owners and trade costs are low, the smaller country attracts a more than proportionate share of firms (the reverse home-market effect). The important source of the profit of firms in the small country is from exporting to the large foreign market, while that of firms in the large country is from serving the large domestic market. Therefore, capital owners, whose rewards are equal to the after-tax profits of domestic firms, prefer capital movement from the large country to the small country, in which case the profit of firms both in the small country and in the large country tends to be higher. The interests of capital owners are well reflected in the spatial outcome of tax competition if the governments heavily care about the welfare of capital owners.

The reverse home-market effect caused by the willingness of firms to avoid competition is a new insight into the literature of agglomeration and tax competition, which conclude that the larger market size and/or the initial locational advantage are crucial for determining the winner of competition. The implication that the smaller market size can be attractive for firms when considering politically-biased governments may be helpful in understanding how tax competition works in the real world.

7 Appendices

A.1. Derivation of equilibrium tax rates

Consider the most general case where two countries differ in size and political weight. From the first-order condition $(1/a_i)\mathrm{d}G_i/\mathrm{d}T_i = 0$, we obtain the following best response function for each government:

$$\frac{s(2K+1)-4(K+1)+2sK(\beta_1-1)}{4\tau^2 L}T_1 - \frac{s(2K+1)-2(K+1)+2sK(\beta_1-1)}{4\tau^2 L}T_2 = -\frac{2\tau(1-s)K^2-(5s\tau-4\tau-6s+4)K+(1-2s)(2-s)(2-\tau)}{4\tau(K+1)} + \frac{sK(\beta_1-1)}{2}, \tag{A.11}$$

$$\frac{s(2K+1)+1-2K(1-s)(\beta_2-1)}{4\tau^2 L}T_1 - \frac{s(2K+1)+2K+3-2K(1-s)(\beta_2-1)}{4\tau^2 L}T_2 = -\frac{2s\tau K^2+(5s\tau-\tau+6s+2)K+(1-2s)(s+1)(2-\tau)}{4\tau(K+1)} + \frac{K(1-s)(\beta_2-1)}{2}, \tag{A.12}$$

where (A.11) is the best response function for government 1 and (A.12) for government 2.

Benevolent governments. We first consider the no-lobbying case. Setting $\beta = 1$ in (A.11) and (A.12) and solving for tax rates yield

$$T_1^n = \frac{\tau KL}{K+1}\left[\tau - \frac{\tau}{2} - \frac{2-\tau}{4(K+1)}\right] - \frac{\tau L(1-2s)\Theta_1^n}{4(K+1)^2(4K+5)},$$

$$T_2^n = \frac{\tau KL}{K+1}\left[\tau - \frac{\tau}{2} - \frac{2-\tau}{4(K+1)}\right] + \frac{\tau L(1-2s)\Theta_2^n}{4(K+1)^2(4K+5)},$$

$$\Theta_1^n \equiv \alpha s + \gamma, \quad \Theta_2^n \equiv \alpha(1-s)+\gamma,$$

$$\alpha \equiv -2(K+2)(4K^2+4K-1)\tau + 4(6K^2+5K-2), \quad \gamma \equiv -(2K^2+9K+8)\tau + 2(7K+8),$$

as given by (13). To check the sign of Θ_i^n, we note that α and γ are decreasing in τ and evaluate these parameters at the maximum level of trade costs, i.e., the prohibitive trade costs $\overline{\tau} \equiv 1/(K+1)$, reveals

$$\alpha(\tau = \overline{\tau}) = \frac{2(2K+1)(4K^2+3K-2)}{K+1} > 0,$$

$$\gamma(\tau = \overline{\tau}) = \frac{12K^2+21K+8}{K+1} > 0.$$

α and γ are always positive when $\tau < \overline{\tau}$ and hence Θ_1^n and Θ_2^n are also always positive since $s \in [0,1]$.

Politically-motivated governments with symmetric political weight. We next consider a lobbying case where both governments place an equal weight on their contributions. Imposing $\beta_1 = \beta_2 = \beta$ on (A.11) and (A.12) and solving the system of equation, we obtain the following equilibrium tax rates:

$$T_1^* = \frac{\tau KL}{K+1}\left[\tau - \frac{\beta\tau}{2} - \frac{2-\tau}{4(K+1)}\right] - \frac{\tau L(1-2s)\Theta_1^*}{4(K+1)^2[2(3-\beta)K+5]},$$

$$T_2^* = \frac{\tau KL}{K+1}\left[\tau - \frac{\beta\tau}{2} - \frac{2-\tau}{4(K+1)}\right] + \frac{\tau L(1-2s)\Theta_2^*}{4(K+1)^2[2(3-\beta)K+5]},$$

$$\Theta_1^* \equiv \delta s + \epsilon, \quad \Theta_2^* \equiv \delta(1-s)+\epsilon,$$

$$\delta \equiv -2[4K^2(K+1)\beta^2 - 2K(4K+5)\beta + 3K + 4]\tau + 4[2\beta K(3K+4) - (3K+2)],$$

$$\epsilon \equiv [4K^2(K+1)\beta^2 - 2K(2K^2-3)\beta - (6K^2+15K+8)]\tau - 4K(3K+4)\beta + 2(6K^2+15K+8),$$

as given by (16). δ and ϵ can be negative.

Politically-motivated governments with asymmetric political weight. In the most general case where the political weights are different in countries, we get the following equilibrium tax rates by directly dealing with (A.11) and (A.12) :

$$T_1^{**} = \frac{\tau KL}{K+1}\left[\tau - \frac{\beta_1\tau}{2} - \frac{2-\tau}{4(K+1)}\right] - \frac{\tau L(1-2s)\Theta_1^{**}}{4(K+1)^2[\{6-(\beta_1+\beta_2)\}K+5][2\{3-(\beta_1 s+\beta_2(1-s))\}K+5]},$$

$$T_2^{**} = \frac{\tau KL}{K+1}\left[\tau - \frac{\beta_2\tau}{2} - \frac{2-\tau}{4(K+1)}\right] + \frac{\tau L(1-2s)\Theta_2^{**}}{4(K+1)^2[\{6-(\beta_1+\beta_2)\}K+5][2\{3-(\beta_1 s+\beta_2(1-s))\}K+5]},$$

$$\Theta_1^{**} \equiv \zeta s^2 + \eta s + \theta, \quad \Theta_2^{**} \equiv \zeta(1-s)^2 + \eta(1-s) + \iota,$$

$$\zeta \equiv 4K(\beta_1-\beta_2)(2-\tau)[\{6-(\beta_1-\beta_2)\}K+5],$$

$$\eta \equiv -2[\{6-(\beta_1+\beta_2)\}K+5]$$
$$\times[4\beta_1\beta_2\tau K^3 + 2\{4(\beta_1+\beta_2+\beta_1\beta_2) - 3(\beta_1+\beta_2)\}K^2 + \{(3\beta_1+7\beta_2-3)t + 2(3-6\beta_2-2\beta_1)\}K + 2(2-\tau)],$$

$$\theta \equiv -8\tau(6\beta_1 - 3\beta_2 - 4\beta_1\beta_2 + \beta_1\beta_2^2)K^4 - [4(31\beta_1 - 29\beta_2 - 13\beta_1\beta_2 + 2\beta_1\beta_2^2 + 2\beta_2^2 + 9)\tau + 12(\beta_2-1)(6-\beta_1-\beta_2)]K^3$$
$$+ 2[(84\beta_2 - 51\beta_1 + 9\beta_1\beta_2 - 5\beta_2^2 - 60)\tau + 8\beta_1\beta_2 - 93\beta_2 - 15\beta_1 + 8\beta_2^2 + 120]K^2$$
$$+ [(73\beta_2 - 27\beta_1 - 123)\tau + 2\{123 - 8(\beta_1+6\beta_2)\}]K + 40(2-\tau),$$

$$\iota \equiv \theta - 2K(\beta_1-\beta_2)[4\tau(\beta_1\beta_2 - 9)K^3 + 2\{2(\beta_1+\beta_2+\beta_1\beta_2-30)\tau + 3(6-(\beta_1+\beta_2))\}K^2$$
$$+ \{4s(s-1)(6-(\beta_1+\beta_2))(2-\tau) + (5(\beta_1+\beta_2) - 135)\tau + 2(39 - 4(\beta_1+\beta_2))\}K$$
$$+ 40(s^2-s+1) - 10(2s^2-2s+5)\tau],$$

which reduce to (16) when $\beta_1 = \beta_2 = \beta$. The tax differential and the resulting distribution of firms become

$$T_1^{**} - T_2^{**} = -\frac{\tau L[2\tau K\{\beta_1 s - \beta_2(1-s)\} + 3(3s\tau - 4s - \tau + 2)]}{2[\{3-(\beta_1 s+\beta_2(1-s))\}K+5]},$$

$$\lambda_1^{**} = \frac{2K[\beta_1 s(s\tau - 2s + 1) + \beta_2(1-s)(s\tau - 2s - \tau - \tau K + 1)] + (3K+2)[(2-\tau)s - 1] + (K+1)(3K+1)\tau}{\tau K[\{6-(\beta_1 s+\beta_2(1-s))\}K+5]}.$$

We use λ_1^{**} for the simulation analysis in section 5.

A.2. Three effects on tax rates

We show that equilibrium tax rates can be decomposed into three effects, namely, the consumer-price effect, the profit-income effect and the tax-revenue effect as explored in section 4.1. For the sake of illustration, we restrict our attention to the no-lobbying case and put weights ω_S and ω_π on components of welfare:

$$W_i = \omega_S S_i L_i + \omega_\pi(\pi_i - T_i)K_i + T_i\lambda_i K, \quad i \in \{1,2\}.$$

Supposing $s = 1/2$, where an additional market-size effect does not emerge, as in appendix A, we can compute equilibrium tax rates as follows:

$$T_1 = T_2 = \frac{4\tau KL}{K+1}\left[\tau - \frac{\omega_\pi\tau}{2} - \frac{\omega_S(2-\tau)}{4(K+1)}\right].$$

If the government solely care about the tax revenue, the two weights are zero ($\omega_S = \omega_\pi = 0$) and only the first term (τ) in the square bracket remains, which we call a *tax-revenue effect*. Clearly, the

second term ($-\omega_\pi\tau/2$) and the third term ($-\omega_S(2-\tau)/[4(K+1)]$) come from the after-tax profit income ($(\pi_i - T_i)K_i$) and from the consumer surplus (S_iL_i), respectively. Hence, we name the second term a *profit-income effect* and the third term a *consumer-price effect*.

A.3. Welfare analysis

Quasi-linear preferences imply that the sum of the two countries' indirect utilities consists the global welfare as follows (ignoring constants):

$$\begin{aligned}
W(\lambda_1) &\equiv W_1(\lambda_1) + W_2(\lambda_2 \equiv 1-\lambda_1) \\
&= [sS_1(\lambda_1) + (1-s)S_2(\lambda_1)]L + [\pi_1(\lambda_1) - T_1]K_1 + [\pi_2(\lambda_1) - T_2]K_2 + T_1\lambda_1 K + T_2(1-\lambda_1)K \\
&= [sS_1(\lambda_1) + (1-s)S_2(\lambda_1)]L + [\{\pi_1(\lambda_1) - T_1\} - \{\pi_2(\lambda_1) - T_2\}](s-\lambda_1)K + \pi_1(\lambda_1)\lambda_1 K + \pi_2(\lambda_1)(1-\lambda_1)K \\
&= [sS_1(\lambda_1) + (1-s)S_2(\lambda_1)]L + \pi_1(\lambda_1)\lambda_1 K + \pi_2(\lambda_1)(1-\lambda_1)K.
\end{aligned}$$

From the third line to the forth, we use the fact that $\pi_1 - T_1 = \pi_2 - T_2$. Solving the FOC of the social planner's problem in λ_1 gives the globally optimal level of industry allocation:

$$\lambda_1^o = s - \frac{(1-2s)[K+2-\tau(K+1)^2]}{\tau K(2K+3)}.$$

We can check that the second-order condition trivially holds: $-\tau^2K^2L(2K+3)/(K+1)^2 < 0$. We have $\lambda_1^o < \lambda_1^n$ for all $\tau \in (\underline{\tau}, \overline{\tau})$ and $\lambda_1^n < \lambda_1^*$ for all $\tau \in (\underline{\tau}, \tau^*)$. Therefore, when the reverse home market effect is dominant ($\beta > \beta^*$ and $\tau \in (\underline{\tau}, \tau^*)$), we oder the spatial outcomes in this way: $\lambda_1^o < \lambda_1^n < \lambda_1^*$.

Additionally, we can compute the tax differential to replicate λ_1^o from the location equilibrium condition (10):

$$\begin{aligned}
&\lambda_1^o = \tilde{\lambda}_1 - \frac{K+1}{2\tau^2 KL}(T_1^o - T_2^o) \\
&\Rightarrow T_1^o - T_2^o = -\frac{\tau L(1-2s)(2-\tau)}{2K+3},
\end{aligned}$$

where $\tilde{\lambda}_1$ is defined in (8) and the level of each country's tax rate is indeterminate. Comparing this to the tax differential under benevolent governments gives

$$|T_1^n - T_2^n| - |T_1^o - T_2^o| = \frac{4\tau KL(\beta-1)(1-2s)[3-\tau(3K+4)]}{(4K+5)[2(3-\beta)K+5]},$$

which is positive when $\tau \in (\underline{\tau}, \tau^*)$ holds.

By noting that $\mathrm{d}|T_1^* - T_2^*|/\mathrm{d}\beta = -\mathrm{d}(T_1^* - T_2^*)/\mathrm{d}\beta = \Phi(1-2s)[3-\tau(3K+4)] > 0$ for $\tau \in (\underline{\tau}, 3/(3K+4))$ where $\Phi \equiv 4\tau KL(1-2s)/[2(3-\beta)K+5]^2 > 0$, we have $|T_1^o - T_2^o| < |T_1^n - T_2^n| < |T_1^* - T_2^*|$ for $\tau \in (\underline{\tau}, \tau^*)$.

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