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Lobbying and Tax Competition in an Oligopolistic Industry: A Reverse Home Market Effect

Hayato Kato

ABSTRACT This paper studies tax competition between two asymmetric countries for an oligopolistic industry with many firms. Each government sets its tax rate strategically to maximize the weighted sum of residents' welfare and political contributions by owners of firms. It is shown that, if the governments care deeply about contributions and trade costs are low, the small country attracts a more than proportionate share of firms by setting a lower tax rate. The well-known home market effect, which states that countries with a larger market attract a more than proportionate share of firms, may be reversed as a result of tax competition by politically-interested governments.

KEYWORDS: Tax competition; economic geography; reverse home market effect; lobbying

JEL CLASSFICATION: F15; F22; H20; H30

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1 Introduction

As economic integration proceeds, the world has witnessed a huge expansion of international trade of goods and movement of factors. The acceleration of international capital mobility is particularly noteworthy. In the post-war period, foreign direct investment (FDI) has grown more rapidly than international trade (WTO, 2013); in the period from 1970 to 2014, FDI flows increased 22.2-fold, or 2.2 times faster than trade (van Marrewijk, 2017, Ch.9). In response to this trend, a number of countries have engaged in competition for mobile firms, and this competition has been accelerating since the late 1990s (OECD, 1998). A particularly notable observation is that small countries 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 statutory corporate tax rates from 1982 to 2006, OECD (2007) concluded that large-sized OECD countries in terms of GDP continue to levy corporate taxes at higher rates than small-sized OECD countries.[2]

The theory of tax competition in economic geography, i.e., imperfectly competitive models of trade and location, tells us that the positive relationship between country size and tax rates results from the agglomeration advantage of large countries (Kind et al., 2000; Ludema and Wooton, 2000; Andersson and Forslid, 2003; Baldwin and Krugman, 2004; Borck and Pflüger, 2006).[3] Large countries offer larger markets, which attract firms seeking to save transportation costs of goods. This agglomeration tendency generates taxable rents that allow large countries to set their tax rates higher than small countries while keeping industries.

However, some small countries with low tax rates have succeeded in attracting a huge inflow of FDI into export-oriented industries where increasing returns to scale prevail, which contradicts the prediction of the theory of tax competition in economic geography. For in-

[1]The statutory corporate tax rates of these countries in 2013 were 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]In addition to statutory tax rates, several studies find that small countries have a low *effective* tax rate, defined as the ratio of taxes paid divided by profits. Grubert (2000), for example, examines the effect of the effective tax rate on U.S. outward 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 the total GDP of the EU27 have the highest effective tax rates. However, it is fair to say that empirical studies are inconclusive as to whether effective corporate tax rates in small countries are actually lower than those in large countries: see Devereux and Loretz (2013) for an extensive survey.

[3]Baldwin and Okubo (2014) obtain similar results in a heterogeneous firm model. This conclusion depends on static settings of the game (simultaneous or sequential game), with which most of the studies deal. Kato (2015) examines a tax game with an infinite time horizon and shows that rather than the initial condition, whether governments commit to their policies is crucial for the consequence of tax competition.

stance, since the late 1970s, Ireland has hosted a number of multinational manufacturing firms mainly in the computer, instrument engineering, pharmaceutical, and chemical industries, and these firms account for a large proportion of employment and output (Barry and Bradley, 1997). In Irish manufacturing, the major target of which is foreign markets, foreign multinational firms accounted for 91% of Ireland's tradable exports in 2009.[4] As for Singapore, policies including low tax rates and the liberalization of capital markets were basically for the purpose of export-oriented industrialization, which turned out to be successful in attracting increasing-return industries such as electronics and biotechnology (Cahyadi et al., 2004). In recent years, by undertaking pro-market reforms after the end of Soviet control, Estonia has established a competitive tax system and grown manufacturing exports rapidly owing to the inflow of FDI in recent years (UNCTAD, 2011).

In order to explain the above observations, we examine tax competition between two asymmetric countries for an oligopolistic industry. We then argue that the experience of these countries can be attributed to the political bias of governments. It is worth stressing three distinct features of the present model. First, unlike many previous studies that adopt monopolistic competition with the Dixit-Stiglitz preference, we choose a model of oligopolistic competition as in Haufler and Wooton (2010) and Thisse (2010). This is because we can analyze a pro-competitive effect, i.e., goods' prices being dependent on the number of firms, and can furthermore obtain interior spatial outcomes (or partial agglomeration of firms), which are in many cases hard to get in monopolistically competitive models. Second, two countries are *asymmetric* in that population and capital endowments are larger in one country than in another. Asymmetric country size allows us to investigate the relationship between country size and tax rates. Third, capital owners engage in lobbying to extract favorable tax policies from governments. Based on the political economy approach adopted by (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.[5] Consequently, the resulting tax rates and distribution of firms are biased in favor of the interests of capital owners, which seems plausible in modern society, where political pressure by firms influences policy decision-making processes.

Since the world today has experienced a huge reduction in trade barriers, tax policies

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

[5] (Grossman and Helpman, 1994, 1995) rely on the common agency approach developed by Bernheim and Whinston (1986) and analyze trade policies in perfectly competitive models. More recent works apply the political economy approach to the analysis of trade policies in imperfectly competitive models. See Chang (2005) and Bombardini (2008) for monopolistic competition and Paltseva (2014) for oligopolistic competition.

rather than trade policies are becoming a major concern for multinational companies in developed countries. The experience of Northern Ireland shows a case where lobbying may determine tax policies. In 1997, the U.K. government started transferring some powers from central to regional bases, which is a process known as devolution. Three parts of the U.K., Scotland, Wales and Northern Ireland, were allowed to have a local assembly, but they had to follow the corporate tax rate set by the central government. Business leaders in Northern Ireland, the region with the smallest population among the three, lobbied for a further devolution of corporation tax-setting powers, claiming that a reduction in taxes was the fastest way to stimulate the local economy.[6] Northern Ireland eventually achieved the devolvement of powers in 2014, and now plans to set the corporate tax rate much lower than the U.K.-wide rate.[7]

Another example can be found in the debate over the Common Consolidated Corporate Tax Base (CCCTB) discussed in the European Commission. The CCCTB is aimed at (partially) harmonizing corporate tax system in EU, i.e., creating a single set of rules to calculate profits of multinational firms. The proposal has been opposed mainly by small countries with low tax corporate rates such as Ireland and Estonia (Arbak, 2008). In particular, Ireland-based multinational firms have lobbied the Irish government to support its position against the proposal.[8]

The main result of our analysis is as follows. If 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 a country with larger domestic demand hosts a more than proportionate share of firms, could be *reversed* when considering a non-cooperative policy game between politically-interested governments.[9]

To understand the intuition of the result, we look at the interests of capital owners in each country who receive the after-tax profits of firms. Increasing taxes not only directly decrease after-tax profits, but also indirectly affects them through changes in before-tax profits because

[6] "Leaders unite to lobby for NI corporation tax," *BBC News*, November 30, 2010; http://www.bbc.com/news/uk-northern-ireland-11863434

[7] "Northern Ireland welcomes cut to corporation tax," *Financial Times*, November 24, 2015; https://www.ft.com/content/3b7757e0-91dd-11e5-94e6-c5413829caa5

[8] "Government believes EU corporate tax reforms will fail," *The Irish Times,* August 17, 2017; https://www.irishtimes.com/business/government-believes-eu-corporate-tax-reforms-will-fail-1.3188978

[9] The reversal of the home market effect is obtained by several studies, including Robert-Nicoud and Sbergami (2004), Yu (2005), Behrens and Picard (2007), and Wiberg (2011). However, they do not consider policy competition, which is the focus of our analysis.

of the relocation of firms. The direct negative effect of taxes on after-tax profits clearly motivates capital owners in both large and small countries to seek a lower tax rate, but the impact of the indirect effect is different between the two asymmetric countries. If one country increases its tax rate, some firms move to the other country. Such relocation reduces domestic competition and in general raises the before-tax profits of the firms remaining in the tax-raising country. This indirect positive effect on before-tax profits mitigates the direct negative effect more effectively for firms in the large country than for those in the small country. Since firms in the large country can take advantage of their rich domestic market without incurring trade costs, they gain more from reduced competition in their domestic market than do firms in the small country.

Thus, the overall negative effect of the increased tax rate on after-tax profits is more pronounced in the small country, so that capital owners there are more eager to lower their tax rate than are those in the large country. The resulting political pressure pushes the small country to lower taxes more than the large country so that the small country may host a greater share of firms for its size. Our results are roughly consistent with the above-mentioned observation.

A few exceptions in the literature obtain the reversal of the home market effect.[10] Sato and Thisse (2007) and Miyagiwa and Sato (2014) introduce mechanisms that weaken the market-size advantage of the large country. In Sato and Thisse (2007), agglomeration of firms raises wages owing to a labor market-crowding effect, while in Miyagiwa and Sato (2014), firms in a country face an entry cost that is increasing in accordance with the number of firms there. They show that the small country attracts more than a proportionate share of firms by setting a *higher* tax rate than the large country, which is opposite to our results. Borck et al. (2012) consider external scale economies and characterize the conditions under which the small region, starting from the situation where it hosts all firms, prevents the relocation of firms to the large region. They show that the small region may defend its industry by choosing a lower tax rate because it attempts to keep offering its residents high wages resulting from external local scale economies. While these previous studies modify the *technology* side, our model generalizes the form of government objectives while keeping the technology side as simple as possible.

This study is also related to the literature on tax competition in public finance.[11] Using

[10]In the literature on bidding for a *single* multinational (Haufler and Wooton, 1999), Ma and Raimondos (2015) introduce profit shifting motives for location choices and show that the small country may win tax competition. Ma (2016) adopts the common agency approach and also shows the possibility of the small country winning the bidding war.

[11]Persson and Tabellini (1992), Lockwood and Makris (2006) and Haufler et al. (2008) examine the effect of capital mobility on tax rates. While they focus on voting mechanisms in perfectly competitive economies,

perfectly competitive models, Bucovetsky (1991) and Wilson (1991) show that the small country attains a higher capital-labor ratio while charging a lower tax rate. In the context of commodity tax competition, Kanbur and Keen (1993) obtain a similar result. Their result of the importance of being small comes from the fact that the small country faces a higher elasticity of tax base. The contribution of this study is that it provides another rationale for the advantage of small countries from different standpoints (i.e., agglomeration, oligopolistic competition and political economy) than those of the literature on tax competition using the neoclassical production function.[12] In our model, the advantage of small countries results from their attractiveness to export-oriented firms. As shown empirically by Romalis (2007), Ireland expands its exports more in capital-intensive industries, which can be subject to increasing returns. Thus, we believe that our framework better explain the experiences of some small countries such as Ireland.

In the literature on tax competition using perfectly competitive models, political aspects are highlighted by Lai (2014), who, as in our analysis, incorporates the common agency approach into the standard tax competition model. He shows that the small country may set a *higher* tax rate than the large country, unlike the models of Bucovetsky (1991), Wilson (1991) and ours.[13] In contrast to his prediction, we investigate the mechanism yielding the positive relationship between country size and tax rates.

The rest of the paper is organized as follows. Section 2 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. The final section concludes the paper.

our emphasis is on lobbying mechanisms in the imperfect competitive model.

[12]If one interprets the size of countries more generally, the advantage of being small could be found in the literature on market-preserving federalism (Weingast, 1995; Qian and Weingast, 1997). The smaller power of central government, i.e., the greater level of decentralization, prevents it from arbitrarily intervening markets, making the country attractive to firms. Although the market-preserving federalism literature and our paper obtain a similar result, they give different implications for how governments should deal with lobbying. The literature emphasizes the autonomy and the independence of each levels of governments from political pressure by any special interest groups. By contrast, our finding suggests that governments subject to political pressure may take policies favorable to firms.

[13]In a companion paper, Lai (2010) deals with tax competition between symmetric countries. Haaparanta (1996) also uses the common agency approach and models governments as lobbyists, By contrast, Lai (2010, 2014) and we describe capital owners as lobbyists.

2 The Model

The economy consists of two unequal-sized countries, indexed by S (small) and B (big). Each country has two factors of production; labor and capital. The two countries differ in size and country S is assumed to have smaller shares of labor and capital. That is, supposing that the world amount of labor is L and that of capital is K, country S has $L_S = \sigma_S L$ and $K_S = \sigma_S K$ ($\sigma_S < 1/2$), while country B has $L_B = \sigma_B L$ and $K_B = \sigma_B K$, where $\sigma_B \equiv 1 - \sigma_S$.[14] L is assumed to be sufficiently large to make the production of the numéraire good possible and K is larger than two for the sake of consistency with oligopolistic competition. Since σ_i represents the country $i \in \{S, B\}$'s shares of world population and capital, it can be interchangeably referred to as market share or capital share. Residents are divided into two groups: workers and capital owners. Each worker has one unit of labor and each capital owner has one unit of capital. We assume that the fraction of capital owners among residents is negligible, and that they hold perfectly diversified portfolios that generate the return $\lambda_S r_S + \lambda_B r_B$ for one unit of capital, where $\lambda_S \in (0, 1)$ ($\lambda_B \equiv 1 - \lambda_S$) is the share of capital (or firms) located in country S and r_i is the (pre-tax) reward to capital invested in i.[15]

There are two industries that produce different homogeneous goods: the *modern* sector (its quantity denoted by q) and the *traditional* sector (denoted by q_o). The modern sector is characterized by oligopolistic competition. One unit of capital as a fixed plant cost is needed to set up a modern firm, which is the source of increasing returns. Firms play Cournot competition in both domestic and foreign markets. By contrast, the traditional sector is characterized by perfect competition. We choose the traditional good as the numéraire. Shipment of one unit of the modern good incurs an additional τ unit of trade costs, while shipment of the traditional good incurs no such costs.

[14] If we allow for the difference in capital-labor ratios, our main results, developed in Section 4, remain unchanged. See Appendix 1 for details.

[15] Instead of assuming the ownership structure of firms, we can assume that capital owners invest their capital in firms that offer the highest returns, i.e., the return is equal to $\max\{r_S, r_B\}$. Under this alternative assumption, the ownership structure is endogenously determined. For more on this point in a related context, see Ferrett and Wooton (2010).

2.1 Demand Side

Resident in country $i \in \{S, B\}$ share common preferences, and consume both the modern and traditional goods. The utility of an individual in country i, u_i, is given by

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

Aggregate utility of residents in country i, U_i, thus becomes

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

where $Q_i \equiv L_i q_i$ is the aggregate demand in country i for the modern good and $Q_{oi} \equiv L_i q_{oi}$ is that for the traditional good. Given the price of the industrial good, denoted by p_i, utility maximization yields the (inverse) demand function for the good:

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

The demand curve in each country has the identical intercept, but its slope is flatter in country B than in country S. Given the price, the large country demands more than the small country.

2.2 Supply Side

In the traditional sector, one unit of L produces one unit of output. Because of costless trade and the choice of the numéraire, the price of the good in the two countries is equalized to unity. That is, letting p_{oi} be the price, we have $p_{o,S} = p_{o,B} = 1$. Constant returns to scale production and the choice of units make the wage rates in both countries equal to the price of the good, i.e., $w_S = w_B = p_o = 1$.

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 is given by:

$$\begin{aligned}
\pi_S &= \pi_{SS} + \pi_{SB}, \\
&= p_S q_{SS} + (p_B - \tau) q_{SB}, \\
\pi_B &= \pi_{BS} + \pi_{BB}, \\
&= (p_S - \tau) q_{BS} + p_B q_{BB},
\end{aligned} \tag{3}$$

where π_{ij} denotes the profit of a firm based in i, earned from j, and q_{ij} represents the quantity produced by a firm based in i, sold in j $(i, j \in \{S, B\})$. Since shipping the modern goods is costly, trade costs $\tau > 0$ are subtracted from the export price. One unit of capital builds one firm so that the capital market clearing condition requires that the number of firms in country S is $\lambda_S K$, and that in country B is $\lambda_B K \equiv (1 - \lambda_S)K$. The aggregate demand of a country is met by the total supply by firms in both countries:

$$Q_S = \lambda_S K q_{SS} + \lambda_B K q_{BS},$$
$$Q_B = \lambda_S K q_{SB} + \lambda_B K q_{BB}.$$

Each firm engages in Cournot competition in both domestic and foreign markets. Substituting the demand functions (2) into the operating profits (3) and taking the first order conditions (FOCs) with respect to the quantity in both markets yield (see Appendix 2 for details):

$$\begin{aligned} q_{SS} &= L_S p_S, & q_{SB} &= L_B(p_B - \tau), \\ q_{BS} &= L_S(p_S - \tau), & q_{BB} &= L_B p_B, \end{aligned} \tag{4}$$

where

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

The domestic price declines as the share of domestic firms increases and trade costs decrease.

Exporting is profitable for firms as long as the mill price $p_i - \tau$ is positive. For international trade to occur, 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:

$$\pi_S = \frac{\sigma_S L \left[1 + \tau(1 - \lambda_S)K\right]^2}{(K+1)^2} + \frac{\sigma_B L \left[1 - \tau \left\{1 + (1 - \lambda_S)K\right\}\right]^2}{(K+1)^2},$$
$$\pi_B = \frac{\sigma_S L \left[1 - \tau\{1 + (1 - \lambda_B)K\}\right]^2}{(K+1)^2} + \frac{\sigma_B L[1 + \tau(1 - \lambda_B)K]^2}{(K+1)^2}.$$

A competitive bidding by capital owners forces firms to earn zero excess profits so that the operating profits are equal to the factor rewards to capital, i.e., $r_i = \pi_i$.

Although the share of firm λ_S is endogenously determined in the location equilibrium, which will be discussed shortly, we treat it as an exogenous variable here 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 profit depends on the market size:

$$\frac{\partial \pi_i}{\partial \lambda_i} = \underbrace{\frac{\partial \pi_{ii}}{\partial \lambda_i}}_{<0} + \underbrace{\frac{\partial \pi_{ij}}{\partial \lambda_i}}_{>0} = \frac{2\tau K L \Gamma_i}{(K+1)^2} \begin{cases} \lesseqgtr 0 & \text{for} \quad i = S \\ < 0 & \text{for} \quad i = B \end{cases}, \tag{7}$$
$$\text{where} \quad \Gamma_i \equiv 1 - 2\sigma_i - \tau[1 - \sigma_i + (1-\lambda_i)K], \qquad \Gamma_S \lesseqgtr 0, \qquad \Gamma_B < 0.$$

An expansion of domestic firms makes local competition tougher by declining the domestic price ($\partial \pi_{ii}/\partial \lambda_i < 0$), while at the same time, it means a contraction of foreign firms, which relaxes competition in the foreign market ($\partial \pi_{ij}/\partial \lambda_i > 0$). For firms in the large country, the first negative effect always outweighs the second positive effect because changes in the number of firms make a stronger impact on profits from the large domestic market than on those from the small foreign market ($|\partial \pi_{BB}/\partial \lambda_B| > |\partial \pi_{BS}/\partial \lambda_B|$). Thus, the overall effect, $\partial \pi_B/\partial \lambda_B$, is negative. By contrast, the sign of $\partial \pi_S/\partial \lambda_S$ is ambiguous. For firms in the small country, profits from exporting to the large country may be affected more by changes in the number of firms than those from the small domestic market ($|\partial \pi_{SS}/\partial \lambda_S| < |\partial \pi_{SB}/\partial \lambda_S|$). Especially when trade costs are low, a greater number of domestic rivals helps a firm in S to earn higher total profits ($\partial \pi_S/\partial \lambda_S > 0$). The impact of increased competition on profits is quite different between firms based in the two asymmetric countries.

2.3 Location Equilibrium

Firms attempt to locate in a country that offers the highest profit, implying that the profits in both countries must be equalized:

$$\pi_S(\lambda_S) = \pi_B(\lambda_B),$$

as long as λ_S is in between zero and one. The above location equilibrium condition gives a unique distribution of firms:

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

Taking into account the small size of country S ($\sigma_S < 1/2$) and the regularity condition for trade costs (6), the second term is negative; therefore, it holds that $\tilde{\lambda}_S < \sigma_S$. The firm's share in country S is smaller than its market (or 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). The intuition behind this is easy to grasp. Consider, to the contrary, the case in which each country hosts a share of firms that equals its capital endowment, i.e., $\lambda_S = \sigma_S$. Locating in a large market saves trade costs so that firms there earn more from exporting goods and obtain a higher total profit ($\pi_S(\lambda_S = \sigma_S) < \pi_B(\lambda_B = \sigma_B)$). Firms in the small country will move to the large country until the profit difference disappears. In equilibrium, the distribution of firms becomes unequal in order to maintain the equalization of profits.

As can be seen in (8), a reduction in trade costs makes the distribution more unequal ($\mathrm{d}\tilde{\lambda}_S/\mathrm{d}\tau > 0$), and it is possible that all firms relocate to the large country when trade costs are extremely low. To ensure interior spatial outcomes, trade costs are assumed not to be too small:

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

Such a lowest level of trade costs in fact exists under the *no-black-hole* condition $\underline{\tau} < \overline{\tau}$ excluding the situation where agglomeration forces are too strong. This condition requires that country S should not be too small: $\underline{\sigma} \equiv (K + 1)/[2(2K + 1)] < \sigma_S < 1/2$. If the condition $\sigma_S \leq \underline{\sigma}$ does not hold, country B always attains full agglomeration for all levels of trade costs.

Finally, it is also worth mentioning the effect of reducing trade costs on prices. As seen from (5), a reduction in trade costs directly lowers the price and indirectly affects it through changes in the firm share. Since smaller trade costs magnify relocation from country S to country B, i.e., $\mathrm{d}\tilde{\lambda}_S/\mathrm{d}\tau > 0$, the indirect effect of reducing trade costs is negative for the price in B, while it is positive for the price in S. However, the direct negative effect is dominant even in country S so that smaller trade costs lead to lower prices in both countries.[16]

[16]To see this formally, we have

$$\frac{\mathrm{d}p_i}{\mathrm{d}\tau} = \frac{\partial p_i}{\partial \tau} + \frac{\partial p_i}{\partial \lambda_i}\frac{\mathrm{d}\lambda_i}{\mathrm{d}\tau} = \frac{K + 2\sigma_i - 1}{K + 1} > 0,$$

where we evaluate λ_i at the location equilibrium without taxes ($\lambda_i = \tilde{\lambda}_i$: (8)).

3 Tax Competition by Politically-motivated Governments

This section introduces taxes and governments into the economy. Tax competition with political pressure is analyzed in the following three-stage game. First, capital owners in each country form a lobby as a special interest group and choose a contribution schedule that depends on the domestic tax rate, given the tax rate of the foreign country. Second, each government receives contributions and non-cooperatively chooses their tax rate to maximize its objective. Finally, relocation of firms occurs in response to the after-tax profit difference. We solve the problem backward. The analysis of the first-stage game is delegated to Appendix 3.

3.1 Third-stage Game: Firm Location

The government in country $i \in \{S, B\}$ imposes a lump-sum tax, T_i, on each firm located in country i.[17] Tax rates are allowed to be *negative.* The location equilibrium requires the equalization of after-tax profits:

$$\pi_S(\lambda_S) - T_S = \pi_B(\lambda_B) - T_B = \rho.$$

The equilibrium share of firms depends on the tax difference:

$$\lambda_S(T_S, T_B) = \tilde{\lambda}_S - \frac{K+1}{2\tau^2 KL}(T_S - T_B), \tag{10}$$

where $\tilde{\lambda}_S$ 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 locate there. Collected tax revenues, $T_i \lambda_i K_i$, are redistributed to the domestic residents.

3.2 Second-stage Game: Governments

To describe the objective of the governments, we compute the welfare of workers and capital owners. From the assumptions that capital owners account for a sufficiently small fraction

[17]If a profit tax takes an ad valorem form instead of a lump-sum form, our qualitative results would remain unchanged. This is because basic mechanisms (i.e., government incentives to tax) apply to both forms of taxation, which will be discussed in the next section.

of the population, the welfare of capital owners in country i is simply represented as:

$$\begin{aligned} W_i^c &= [\lambda_S(\pi_S - T_S) + \lambda_B(\pi_B - T_B)]K_i \\ &= (\lambda_S \rho + \lambda_B \rho)K_i \\ &= \rho K_i. \end{aligned}$$

From the first to the second line, we use the result of the third-stage game, i.e., $\pi_S(\lambda_S) - T_S = \pi_B(\lambda_B) - T_B = \rho$.[18] We assume that tax revenues are redistributed only to workers, not capital owners. Allowing for transfer to capital owners do not change our main results. See Appendix 6 for details.

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 endowment of the numéraire. The individual budget constraint can be written as:

$$p_i q_i + q_{oi} = 1 + T_i \lambda_i K / L_i + \overline{q}_o,$$

where $\overline{q}_0$ is the initial endowment of the numéraire good and is assumed to be large enough to ensure positive consumption of the good. The national budget constraint is obtained by aggregating the individual one across workers. By inserting this national budget constraint into the aggregate utility (1) and evaluating it at the equilibrium quantities (4) and prices (5), the aggregate welfare of workers in country i is given by:

$$W_i^l = (CS_i + 1)L_i + T_i \lambda_i K + \overline{Q}_{oi},$$

where $\overline{Q}_{oi} = L_i \overline{q}_o$ and CS_i is the consumer surplus of an individual:

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

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).

[18] Specifically, we substitute λ_S defined in (10) into $\pi_S - T_S$ or $\pi_B - T_B$ to get ρ:

$$\begin{aligned} \rho &= \pi - \frac{T_S + T_B}{2} + \frac{(T_S - T_B)^2}{4\tau^2 L}, \\ \text{where} \quad \pi &\equiv \frac{4(2-\tau)^2 \sigma_S (1 - \sigma_S) + (K+1)^2}{4\tau^2 L(K+1)}. \end{aligned}$$

Under the alternative ownership structure stated in footnote 13, as we solve the problem backward, we also have $W_i^c = \max\{\pi_S - T_S, \pi_B - T_B\}K_i = \rho K_i$ in the second-stage game.

The governments care about not only the 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.[19] This assumption relies on the argument of *collective action* by Olson (2009): small interest groups (capital owners) can overcome free rider problems more easily than large interest groups (workers) and take collective actions.[20] The objective function of the government in country i is:

$$G_i(T_i;\ T_j) = \alpha_i W_i(T_i;\ T_j) + C_i(T_i;\ T_j),$$

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

As a result of the first-stage game analyzed in Appendix 3, we can rewrite the government objective as follows (ignoring constants):

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

Because of the presence of the "1", the government objective is biased toward the interest of capital owners. This problem can be solved backward. Given the distribution of firms defined in (10), we derive the FOCs of both governments by differentiating G_i with respect to T_i given T_j:

$$\frac{\mathrm{d}G_i}{\mathrm{d}T_i} = \alpha_i \frac{\mathrm{d}W_i^l}{\mathrm{d}T_i} + (1+\alpha_i)\frac{\mathrm{d}W_i^c}{\mathrm{d}T_i} = 0 \quad \text{or} \quad \frac{1}{\alpha_i}\frac{\mathrm{d}G_i}{\mathrm{d}T_i} = \frac{\mathrm{d}W_i^l}{\mathrm{d}T_i} + \beta_i \frac{\mathrm{d}W_i^c}{\mathrm{d}T_i} = 0,$$

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

[19] We do not allow for cross-border political donations (see e.g., Endoh, 2012 in the context of tariff competition). Some large countries, including the US, Canada, the UK, France and Japan, have laws against foreign donations.

[20] On the other hand, if workers are allowed to organize lobbies for taxes on their income (labor taxes), our results remain unchanged. To see this, suppose that each government imposes (lump-sum) labor taxes T_i^l on its workers. The aggregate welfare of workers is modified as:

$$W_i^l = (CS_i + 1)L_i + T_i \lambda_i K_i - T_i^l L_i.$$

The quasi-linear preference implies that labor taxes have no effect on industrial goods demand (the demand curve (2) is unchanged). Therefore, labor taxes do not affect the location equilibrium of firms, which also implies that capital owners do not have any incentive to lobby for labor taxes.

4 Consequence of Tax Competition

We now turn to the analysis of equilibrium tax rates and assume here that the two governments attach an equal political weight $\beta_S = \beta_B = \beta$ on the contributions. The assumption of common political weight is relaxed in Appendix 8. We impose a restriction on β so as to satisfy the second-order condition of the maximization problem, such that $\beta < \overline{\beta} \equiv (4K+3)/(2K)$.[21]

4.1 The Incentives of Governments

We show that (i) country S has a stronger incentive to lower taxes than country B and that (ii) this tendency is strengthened by the political weight β under low trade costs. To see which country chooses a lower tax rate, we compute the difference of the marginal effect of taxes on the government payoff as follows:

$$\frac{\mathrm{d}W_S^l}{\mathrm{d}T_S} + \beta\frac{\mathrm{d}W_S^c}{\mathrm{d}T_S} - \left(\frac{\mathrm{d}W_B^l}{\mathrm{d}T_B} + \beta\frac{\mathrm{d}W_B^c}{\mathrm{d}T_B}\right)$$

$$= \underbrace{-\frac{(1-2\sigma_S)[6-\tau(2\beta K+3)]}{4\tau}}_{<0} - \frac{(T_S - T_B)[\overbrace{2(3-\beta)K+5}^{>0}]}{4\tau^2 L}.$$

Under our assumptions that $\tau < \overline{\tau}$ and $\beta < \overline{\beta}$, the first term is negative, while $2(3-\beta)K+5$ in the second term is positive. In equilibrium, where the above formula equals zero, the second term must be positive, implying that $T_S < T_B$. As we have seen in Section 2.3, if there are no taxes, firms attempt to locate in the large country to save trade costs. This location advantage gives the large country B room to set higher tax rates, whereas the small country S has to offer a lower tax rate to offset its location disadvantage. We note that even if governments did not care about capital owners at all, i.e., $\beta = 1$, the small country would have a lower tax rate.

In equilibrium, where $T_S - T_B < 0$ holds, an increase in T_S decreases after-tax profits in

[21] This is a sufficient condition for the second-order condition. That is, supposing that $\beta < \overline{\beta}$ holds, it holds that $(1/\alpha)\mathrm{d}^2 G_S/\mathrm{d}T_S = [(2\beta K+1)\sigma_S - 4(K+1)]/(4L\tau^2) < 0$ for all $\sigma_S \in (0, 1/2)$. An analogous expression holds for country B.

the following way:

$$\beta \frac{\mathrm{d}W_S^c}{\mathrm{d}T_S} = \beta \frac{\mathrm{d}(\rho K_S)}{\mathrm{d}T_S} = \beta K_S \Bigg(\underbrace{\frac{\partial \pi_S}{\partial \lambda_S}}_{\lesseqgtr 0} \underbrace{\frac{\mathrm{d}\lambda_S}{\mathrm{d}T_S}}_{<0} - 1 \Bigg)$$
$$= \beta K_S \left(\frac{T_S - T_B}{2\tau^2 L} - \frac{1}{2} \right) < 0, \tag{11}$$

where we note (7) for the sign of $\partial \pi_S / \partial \lambda_S$.[22] Responding to the increased tax rate, firms in country S move to country B ($\mathrm{d}\lambda_S/\mathrm{d}T_S < 0$). The decreased number of firms in S may increase the domestic profits of an individual firm remaining there because it makes the market less competitive. Conversely, the movement of firms from S to B leads to tougher competition in B and reduces the export profits of a firm remaining in S. Since the export market is larger than the domestic market, firms in S may raise their total profit a little or even reduce it as a result of the decreased number of domestic rivals ($\partial \pi_S/\partial \lambda_S > 0$). Thus, the increased tax rate always has a negative effect on after-tax profits.

A similar expression holds for country B:

$$\beta \frac{\mathrm{d}W_B^c}{\mathrm{d}T_B} = \beta \frac{\mathrm{d}(\rho K_B)}{\mathrm{d}T_B} = \beta K_B \Bigg(\underbrace{\frac{\partial \pi_B}{\partial \lambda_B}}_{<0} \underbrace{\frac{\mathrm{d}\lambda_B}{\mathrm{d}T_B}}_{<0} - 1 \Bigg)$$
$$= -\beta K_B \left(\frac{1}{2} + \frac{T_S - T_B}{2\tau^2 L} \right) \lesseqgtr 0. \tag{12}$$

In contrast to the case of country S, decreasing the number of domestic rivals always increases the total profits of a firm in country B ($\partial \pi_B/\partial \lambda_B < 0$). Because of the large size of country B, gains from reduced competition in the domestic market B always exceed losses from increased competition in the foreign market S. Thus, an increase in T_B has an ambiguous effect on after-tax profits ($\mathrm{d}\rho/\mathrm{d}T_B \lesseqgtr 0$). Especially when trade costs are small, firms become more sensitive to the increased tax rate, resulting in a greater outflow of firms from B to A.

[22] In the text, we use $\rho = \pi_S - T_S$ for the sake of explanation. However, as $\rho = \pi_S - T_S = \pi_B - T_B$ holds, we note the following:

$$\beta \frac{\mathrm{d}(\rho K_S)}{\mathrm{d}T_S} = \beta \frac{\mathrm{d}[(\pi_B - T_B) K_S]}{\mathrm{d}T_S} = \beta K_S \underbrace{\frac{\partial \pi_B}{\partial \lambda_S}}_{>0} \underbrace{\frac{\mathrm{d}\lambda_S}{\mathrm{d}T_S}}_{<0}$$
$$= \beta K_S \left(\frac{T_S - T_B}{2\tau^2 L} - \frac{1}{2} \right) < 0.$$

In this case, the degree of competition in B is greatly reduced so that the after-tax profit increases.

When (11) is negative and (12) is positive under low trade costs, as a result of considering the interests of capital owners, the small country prefers lower taxes, while the large country prefers higher taxes. As both governments care more about their capital owners, i.e., higher β (care less about their workers, strictly speaking), their direction of incentives becomes more divergent and the tax difference widens.

4.2 Tax Rates and Firm Distribution in Equilibrium

We solve the FOCs of both countries as a system of equations for tax rates (see Appendix 4 for details):

$$T_i^* = \frac{\tau K L}{K+1}\left[\underbrace{\tau}_{(a)} \underbrace{-\frac{\beta\tau}{2}}_{(b)} \underbrace{-\frac{2-\tau}{4(K+1)}}_{(c)}\right] \underbrace{-\frac{\tau L(1-2\sigma_i)\Theta_i^*}{4(K+1)^2[2(3-\beta)K+5]}}_{(d)}, \tag{13}$$

where Θ_i^* is a positive bundling parameter that includes β, K, σ_S and τ. Both T_S^* and T_B^* can be positive or negative.

Supposing that the two countries are identical in size ($\sigma_S = 1/2$) and only the big bracket term in (13) is left, the equilibrium tax rates and the distribution of firms become symmetric. Each term in the bracket term (partly) represents the consideration of each component of the government's objective (see Appendix 5 for details). The first positive term (a) in the bracket comes from a *tax-revenue effect*, which means that governments can exploit location rents of incumbent firms. The second negative term (b), which we call a *profit-income effect*, reflects the fact that governments seek to lessen the direct burden of tax incidence on capital owners. The profit-income effect is reinforced by the political weight β. The third negative term (c), resulting from a *consumer-surplus effect*, reflects the motivation of governments to attract firms so as to decrease the consumer price.

If the two countries differ in size, the second fractional term (d) 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 of the impacts resulting from the difference in market size and modifies the three effects mentioned above. The market-size effect for T_S^* is negative whereas that for T_B^* is positive.[23] Owing to the firms' motives of locating a larger market for saving trade costs, country B can levy a higher tax rate than country S.

[23]Note that Θ_i^* and the denominators of the fractional term are positive under $\beta \in [1, \overline{\beta})$.

The difference in the tax rates is given by:

$$T_S^* - T_B^* = -\frac{\tau L(1-2\sigma_S)[6-\tau(2\beta K+3)]}{2(3-\beta)K+5} < 0. \tag{14}$$

The regularity condition on trade costs (6) ensures that the square bracket in the numerator of (14) is positive. It turns out that country S always sets a lower tax rate than country B. Furthermore, a higher political weight in general leads to lower taxes, as shown in Figure 1. There may be a case where, as the weight gets higher, the large country raises its tax rate if raising taxes causes massive capital outflow from the country, thereby bringing huge profits to domestic firms.

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

$$\lambda_S^* = \sigma_S - \frac{(1-2\sigma_S)[K+2-\tau(K+1)^2-2(\beta-1)K\{1-\tau(K+1)\}]}{\tau K[2(3-\beta)K+5]}, \tag{15}$$

where the denominator of the second term is positive under $\beta \in [1, \overline{\beta})$. Our assumptions ensure that λ_S^* lies between zero and one.

Consider first the case of benevolent governments, i.e., $\beta = 1$. It is verified that the distribution of firms in country S under the lobbying-free governments, denoted by λ_S^n, is greater than the distribution under no taxes, i.e., $\lambda_S^n > \tilde{\lambda}_S$, because country S chooses a lower tax rate. However, the firm share is smaller than the market share, i.e., $\lambda_S^n < \sigma_S$, because of the home market effect. The fact that the home market effect still prevails under tax competition is consistent with previous studies such as Haufler and Wooton (2010).

Consider then the case of politically-biased governments, i.e., $\beta > 1$. Whether country S exports or imports capital depends on the sign of the second term in (15). 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:

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

If the political weight is small ($\beta < \beta^*$) and/or trade costs are high ($\tau > \tau^*$), the second term in (15) is negative, which means that the share of firms in country S is smaller than its market share ($\lambda_S^* < \sigma_S$). Tax competition played by relatively benevolent governments gives the qualitatively same results as those in the lobbying-free case. Higher trade costs also preserve the advantage of the large country by enhancing the incentives of firms to relocate to the large market to save trade costs.

On the other hand, if the political weight is high ($\beta > \beta^*$) and trade costs are low ($\tau < \tau^*$), the direction of capital flow becomes opposite; we can observe a *reversal* of the home market effect ($\lambda_S^* > \sigma_S$). If both governments deeply care about the capital owners, they determine their tax rates to realize the industrial configuration in favor of profit income owned by capital owners. As a result, the small country chooses a lower tax rate and imports capital while the large country chooses a higher rate and becomes a capital exporter, contrary to what the home market effect suggests. For the reverse home market effect to emerge, trade costs should be small enough for firms in S to make exporting fairly profitable compared to serving the domestic market.

These findings are summarized in

Proposition. *Consider tax competition between the politically-motivated governments with common political weight $\beta \in [1, \overline{\beta})$. Assume that country S is small ($\sigma_S \in (\underline{\sigma}, 1/2)$) and $\tau \in (\underline{\tau}, \overline{\tau})$ holds. Then two cases may arise:*
(i) if the political weight is small ($\beta < \beta^*$) and/or trade costs are large ($\tau > \tau^*$), country S hosts a smaller share of firms than its market share ($\lambda_S^* < \sigma_S$).
(ii) if the political weight is large ($\beta > \beta^*$) and trade costs are small ($\tau < \tau^*$), country S hosts a larger share of firms than its market share (the reverse home market effect: $\lambda_S^* > \sigma_S$).
In both cases, the tax rate of country S is always lower than that of country B ($T_S^* < T_B^*$).

In the case of no taxes, we have seen that a reduction in trade costs lowers prices in both countries. It can be verified that this generally holds true in this tax-competition case. However, if the political weight is sufficiently high, freer trade leads to a higher price in country B ($\mathrm{d}p_B/\mathrm{d}\tau < 0$).[24] Lower trade costs accelerate relocation from the large to the small country so that the reducing share of firms in the large country may result in a higher price there.

[24] To check this, we have

$$\frac{\mathrm{d}p_S}{\mathrm{d}\tau} = \frac{\sigma_S(3K+2) + 3K^2 + K - 1 - 2\beta K(\sigma_S K + 2\sigma_S - 1)}{(K+1)(6K+5-2\beta K)} > 0,$$
$$\frac{\mathrm{d}p_B}{\mathrm{d}\tau} = \frac{(K+1)(3K+1) - \sigma_S(3K+2) - 2\beta K[K+1-\sigma_S(K+2)]}{(K+1)(6K+5-2\beta K)} \gtreqless 0.$$

$\mathrm{d}p_B/\mathrm{d}\tau < 0$ holds at β close to $\overline{\beta}$.

The reversal of the home market effect is illustrated in the range $\beta \in (\beta^*, \overline{\beta})$ in Figure 2. Country S attracts more firms as the governments put more emphasis on the interests of capital owners.[25] The result may explain well the fact that small countries with lower corporate tax rates have succeeded better in attracting FDI than large countries with higher rates.[26]

We relax the assumption of common political weight and consider asymmetric political weight in Appendix 8. Since having a higher political weight leads governments to choose lower tax rates, it is natural to see that if two countries have the same size, the country with a higher political weight attracts a larger share of firms than its market share. If the small country has a higher weight than the large country, the reverse home market is observed in a wide range of parameters. The central implication of our analysis holds in the general setting.

Welfare implications are discussed in Appendix 7.

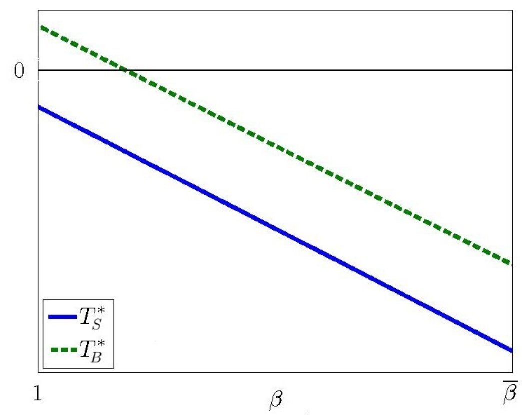

Figure 1. The equilibrium tax rates and the political weight.

[25]To check this formally, it is verified that $\mathrm{d}\lambda_S^*/\mathrm{d}\beta = -\Psi \mathrm{d}(T_S^* - T_B^*)/\mathrm{d}\beta > 0$ 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 $\mathrm{d}\lambda_S^*/\mathrm{d}\beta > 0$ when the reverse home market effect prevails ($\beta > \beta^*$ and $\tau < \tau^*$).

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

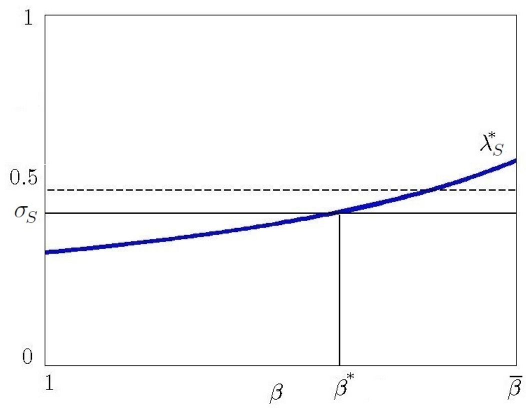

Figure 2. The equilibrium share of firms and the political weight.

5 Conclusion

This study has analyzed a tax game between two countries of asymmetric size taking the lobbying activities of capital owners into account. It was shown that if the governments are sufficiently biased toward the interests of capital owners and trade costs are low, the small country attracts a more than proportionate share of firms (the reverse home market effect). Capital owners lobby for governments in order to raise after-tax profits, which respond differently to tax changes in the small country compared with those in the large country. Increasing taxes in the small country always reduces after-tax profits, whereas increasing taxes in the large country reduces after-tax profits by less or may even raise it. Therefore, government biased toward capital owners in the small (large) country tend to have lower (higher) taxes. If the political bias is strong and trade costs are low, the tax difference between the two countries is so wide that the small country hosts a greater share of firms than its market share. This reverse home market effect provides new insight into the literature of agglomeration and tax competition, which concludes that the larger market size and/or initial location advantage are crucial for determining the winner of competition. The implication that a smaller market size can be attractive to firms when considering politically-biased governments may help provide a better understanding of how tax competition works in the real world.

Appendices

Appendix 1: Capital-labor Ratios

In the text, the country i's world share of population is equal to its world share of capital. Our main result is unchanged if we allow the capital-labor ratio to differ between countries. Let σ_i^L (σ_i^K) denote the world share of population (capital) in country $i \in \{S, B\}$. Country S is assumed to be smaller than country B in terms of both population and capital: $\max\{\sigma_S^L, \sigma_S^K\} < \min\{\sigma_B^L, \sigma_B^K\}$.

We focus on the case where the share of population in country S is larger than its share of capital, i.e., $\sigma_S^L > \sigma_S^K$. As $\sigma_B^L = 1 - \sigma_S^L$ and $\sigma_B^K = 1 - \sigma_S^K$ hold, the inequality $\sigma_S^L > \sigma_S^K$ implies that $\sigma_B^L < \sigma_B^K$. Combining these two inequalities yield the following relationship:

$$\frac{\sigma_S^K}{\sigma_S^L} < 1 < \frac{\sigma_B^K}{\sigma_B^L},$$

which states that country S has a smaller capital-labor ratio than country B. Country S is small in terms of the three measures, i.e., the share of population, the share of capital, and the capital-labor ratio.

Noting that σ_i^L does enter the profit function of firms but σ_i^K does not, we replace σ_i in (13), (14) and (15) with σ_i^L. Accordingly, Proposition holds if σ_i is replaced with σ_i^L. If the conditions in Proposition (ii) hold, we have:

$$\sigma_S^K < \sigma_S^L < \lambda_S^*,$$
$$\lambda_B^* < \sigma_B^L < \sigma_B^K.$$

Our main result of the reverse home market effect holds for the three measures of country size.

Appendix 2: Derivation of Equilibrium Quantities and Prices

We show the details of derivations of (4) and (5) in the text. Only variables for country S are concerned and symmetric expressions hold for country B. Using the demand function defined in (2), the operating profit of a firm in country S defined in (3) can be re-written as:

$$\pi_S = (1 - Q_S/L_S)\, q_{SS} + (1 - Q_B/L_B - \tau)\, q_{SB}.$$

The firm chooses q_{SS} and q_{SB} to maximize π_S. The FOCs are given by:

$$\begin{aligned}
\frac{\mathrm{d}\pi_S}{\mathrm{d}q_{SS}} &= -q_{SS}/L_S + 1 - Q_S/L_S \\
&= -q_{SS}/L_S + p_S = 0, \\
\frac{\mathrm{d}\pi_S}{\mathrm{d}q_{SB}} &= -q_{SB}/L_B + 1 - Q_B/L_B - \tau \\
&= -q_{SB}/L_B + p_B - \tau = 0,
\end{aligned}$$

where we assume that $\mathrm{d}Q_S/\mathrm{d}q_{SS} = \mathrm{d}Q_B/\mathrm{d}q_{SB} = 1$. Rearranging these terms gives $q_{SS} = L_S p_S$ and $q_{SB} = L_B(p_B - \tau)$ as in (4).

The equilibrium price clears the goods market in country S. We substitute the equilibrium quantities into the market clearing condition to get the equilibrium price:

$$\begin{aligned}
& Q_S = \lambda_S K \cdot q_{SS} + \lambda_B K \cdot q_{BS}, \\
& \to L_S(1 - p_S) = \lambda_S K \cdot L_S p_S + \lambda_B K \cdot L_S(p_S - \tau), \\
& \to 1 - p_S = K p_S - \tau K \lambda_B, \\
& \to p_S = \frac{1 + \tau \lambda_B K}{K + 1}.
\end{aligned}$$

Appendix 3: First-stage Game

At the first stage of the game between governments and capital owners, capital owners in each country propose a contribution schedule to maximize their payoffs net of the contribution. The problem of capital owners as a interest group in country i is formulated as:

$$\begin{aligned}
& \max_{C_i(T_i;T_j)} W_i^c(T_i;T_j) - C_i(T_i;T_j), \\
& \text{s.t. } \max_{T_i} G_i(T_i;T_j) = \max_{T_i} \left[\alpha_i W_i(T_i;T_j) + C_i(T_i;T_j)\right] \geq \overline{G}_i,
\end{aligned}$$

where the second line is a participation constraint of the government in country i and $\overline{G}_i = \alpha_i \overline{W}_i$ is the government's payoff under no contributions. Following Grossman and Helpman (1995), we assume that the contract between a interest group and a government in one country is implicit and thus unobservable in the other.

With the participation constraint holding equality, the interest group prefers a tax rate that maximizes its payoff:

$$\begin{aligned}&\max_{T_i} \left[W_i^c(T_i;T_j) - \{\overline{G}_i - \alpha_i W_i(T_i;T_j)\}\right] \\ &= \max_{T_i} \left[\alpha_i W_i^l(T_i;T_j) + (1+\alpha_i) W_i^c(T_i;T_j)\right].\end{aligned}$$

The FOC is given by

$$\alpha_i \frac{\mathrm{d}W_i^l}{\mathrm{d}T_i} + (1+\alpha_i)\frac{\mathrm{d}W_i^c}{\mathrm{d}T_i} = 0.$$

Let the tax rate determined by the FOC be $T_i^* = T_i^*(T_j)$. The interest group attempts to give a minimum amount of contributions so as to make their government choose T_i^*. Thus, the contribution schedule becomes $C_i(T_i;T_j) = W_i^c(T_i;T_j) - [G_i(T_i^*) - \overline{G}_i]$.

A few comments are in order. As there is only one interest group (i.e., one principal) in each country, the problem is a special case of the common agency problem analyzed by Bernheim and Whinston (1986).

Putting a political weight on the welfare of residents, rather than contributions, causes a conceptual problem, although it does not affect the analysis of the later stages of the game. In doing so, from Proposition. 1(c) in Grossman and Helpman (1994), the equilibrium tax rate must maximize the joint profit of the interest group and the government, which is given as follows:

$$W_i^c(T_i;T_j) - C_i(T_i;T_j) + W_i(T_i;T_j) + \alpha_i C_i(T_i;T_j).$$

As $\alpha_i \neq 1$ in general, the contribution term C_i does not disappear. It is optimal for the interest group to set an extreme contribution schedule ($C_i = \infty$ or $-\infty$) to maximize the joint payoff, in which case we cannot have interior equilibria and are unable to use the FOC defined above.

Appendix 4: Derivation of Equilibrium Tax Rates

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

$$\frac{\sigma_S(2K+1) - 4(K+1) + 2\sigma_S K(\beta_S - 1)}{4\tau^2 L} T_S - \frac{\sigma_S(2K+1) - 2(K+1) + 2\sigma_S K(\beta_S - 1)}{4\tau^2 L} T_B$$
$$= -\frac{2\tau(1-s)K^2 - (5\sigma_S\tau - 4\tau - 6\sigma_S + 4)K + (1-2\sigma_S)(2-\sigma_S)(2-\tau)}{4\tau(K+1)} + \frac{\sigma_S K(\beta_S - 1)}{2}, \tag{A.1}$$

$$\frac{\sigma_S(2K+1) + 1 - 2K(1-\sigma_S)(\beta_B - 1)}{4\tau^2 L} T_S - \frac{\sigma_S(2K+1) + 2K + 3 - 2K(1-\sigma_S)(\beta_B - 1)}{4\tau^2 L} T_B$$
$$= -\frac{2\sigma_S\tau K^2 + (5\sigma_S\tau - \tau + 6\sigma_S + 2)K + (1-2\sigma_S)(\sigma_S+1)(2-\tau)}{4\tau(K+1)} + \frac{K(1-\sigma_S)(\beta_B - 1)}{2}, \tag{A.2}$$

where (A.1) is the best response function for government S and (A.2) for government B.

Politically-motivated Governments with Symmetric Political Weight. We first consider the case where both governments place an equal weight on their contributions. Imposing $\beta_S = \beta_B = \beta$ on (A.1) and (A.2) and solving the system of equation, we obtain the following equilibrium tax rates:

$$T_S^* = \frac{\tau K L}{K+1}\left[\tau - \frac{\beta\tau}{2} - \frac{2-\tau}{4(K+1)}\right] - \frac{\tau L(1-2\sigma_S)\Theta_S^*}{4(K+1)^2[2(3-\beta)K+5]},$$
$$T_B^* = \frac{\tau K L}{K+1}\left[\tau - \frac{\beta\tau}{2} - \frac{2-\tau}{4(K+1)}\right] + \frac{\tau L(1-2\sigma_S)\Theta_B^*}{4(K+1)^2[2(3-\beta)K+5]},$$
$$\Theta_S^* \equiv \delta\sigma_S + \epsilon, \quad \Theta_B^* \equiv \delta(1-\sigma_S) + \epsilon,$$
$$\delta \equiv -2[4K^2(K+1)\beta^2 - 2K(4K+5)\beta + 3K + 4]\tau + 4[2\beta K(3K+4) - (3K+2)],$$
$$\epsilon \equiv [4K^2(K+1)\beta^2 - 2K(2K^2-3)\beta - (6K^2+15K+8)]\tau - 4K(3K+4)\beta + 2(6K^2+15K+8),$$

as given by (13). δ and ϵ can be negative.

Politically-motivated Governments with Asymmetric Political Weight. In the general case where the political weights are different in countries, we get the following equilibrium tax rates from FOCs (A.1) and (A.2):

$$
\begin{aligned}
T_S^{**} &= \frac{\tau K L}{K+1}\left[\tau - \frac{\beta_S \tau}{2} - \frac{2-\tau}{4(K+1)}\right] \\
&\qquad - \frac{\tau L(1-2\sigma_S)\Theta_S^{**}}{4(K+1)^2[\{6-(\beta_S+\beta_B)\}K+5][2\{3-(\beta_S\sigma_S+\beta_B(1-\sigma_S))\}K+5]}, \\
T_B^{**} &= \frac{\tau K L}{K+1}\left[\tau - \frac{\beta_B \tau}{2} - \frac{2-\tau}{4(K+1)}\right] \\
&\qquad + \frac{\tau L(1-2\sigma_S)\Theta_B^{**}}{4(K+1)^2[\{6-(\beta_S+\beta_B)\}K+5][2\{3-(\beta_S\sigma_S+\beta_B(1-\sigma_S))\}K+5]}, \\
&\Theta_S^{**} \equiv \zeta\sigma_S^2 + \eta\sigma_S + \theta, \qquad \Theta_B^{**} \equiv \zeta(1-\sigma_S)^2 + \eta(1-\sigma_S) + \iota, \\
&\zeta \equiv 4K(\beta_S-\beta_B)(2-\tau)[\{6-(\beta_S-\beta_B)\}K+5], \\
&\eta \equiv -2[\{6-(\beta_S+\beta_B)\}K+5] \\
&\qquad \times [4\beta_S\beta_B\tau K^3 + 2\{4(\beta_S+\beta_B+\beta_S\beta_B) - 3(\beta_S+\beta_B)\}K^2 \ldots \\
&\qquad\qquad \cdots + \{(3\beta_S+7\beta_B-3)\tau + 2(3-6\beta_B-2\beta_S)\}K + 2(2-\tau)], \\
&\theta \equiv -8\tau(6\beta_S - 3\beta_B - 4\beta_S\beta_B + \beta_S\beta_B^2)K^4 \\
&\qquad - [4(31\beta_1 - 29\beta_B - 13\beta_S\beta_B + 2\beta_S\beta_B^2 + 2\beta_B^2 + 9)\tau + 12(\beta_B-1)(6-\beta_S-\beta_B)]K^3 \\
&\qquad + 2[(84\beta_B - 51\beta_S + 9\beta_S\beta_B - 5\beta_B^2 - 60)\tau + 8\beta_S\beta_B - 93\beta_B - 15\beta_S + 8\beta_B^2 + 120]K^2 \\
&\qquad + [(73\beta_B - 27\beta_S - 123)\tau + 2\{123 - 8(\beta_S + 6\beta_B)\}]K + 40(2-\tau), \\
&\iota \equiv \theta - 2K(\beta_S-\beta_B)[4\tau(\beta_S\beta_B-9)K^3 + 2\{2(\beta_S+\beta_B+\beta_S\beta_B-30)\tau + 3(6-(\beta_S+\beta_B))\}K^2 \\
&\qquad + \{4\sigma_S(\sigma_S-1)(6-(\beta_S+\beta_B))(2-\tau) + (5(\beta_S+\beta_B)-135)\tau + 2(39-4(\beta_S+\beta_B))\}K \\
&\qquad + 40(\sigma_S^2-\sigma_S+1) - 10(2\sigma_S^2 - 2\sigma_S + 5)\tau],
\end{aligned}
$$

which are reduced to (13) if $\beta_S = \beta_B = \beta$. The tax differential and the resulting distribution of firms become:

$$
\begin{aligned}
&T_S^{**} - T_B^{**} = -\frac{\tau L[2\tau K\{\beta_S\sigma_S - \beta_B(1-\sigma_S)\} + 3(3\sigma_S\tau - 4\sigma_S - \tau + 2)]}{2[\{3-(\beta_S\sigma_S+\beta_B(1-\sigma_S))\}K+5]}, \\
&\lambda_S^{**} = (num)/(den), \\
&(num) \equiv \Big(2K[\beta_S\sigma_S(\sigma_S\tau - 2\sigma_S + 1) + \beta_2(1-\sigma_S)(\sigma_S\tau - 2\sigma_S - \tau - \tau K + 1)] \ldots \\
&\qquad\qquad \cdots + (3K+2)[(2-\tau)\sigma_S - 1] + (K+1)(3K+1)\tau\Big), \\
&(den) \equiv \tau K[\{6-(\beta_S\sigma_S+\beta_B(1-\sigma_S))\}K+5].
\end{aligned}
$$

We use λ_S^{**} for the simulation analysis in Appendix 7.

Appendix 5: Three Effects on Tax Rates

We show that the equilibrium tax rates can be decomposed into three effects, namely, the consumer-surplus effect, the profit-income effect and the tax-revenue effect as explored in Section 4.2. For the sake of illustration, we restrict our attention to the no-lobbying case and put weights ω_{CS} and ω_π on the corresponding components of welfare:

$$W_i = \omega_{CS} CS_i L_i + \omega_\pi (\pi_i - T_i) K_i + T_i \lambda_i K, \quad i \in \{S, B\}.$$

Suppose $\sigma_S = 1/2$, where the market-size effect does not emerge, we can compute equilibrium tax rates as follows:

$$T_S = T_B = \frac{4\tau KL}{K+1}\left[\tau - \frac{\omega_\pi \tau}{2} - \frac{\omega_{CS}(2-\tau)}{4(K+1)}\right].$$

If the government solely care about the tax revenue, the two weights are zero ($\omega_{CS} = \omega_\pi = 0$) 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 ($-\omega_{CS}(2-\tau)/[4(K+1)]$) come from the after-tax profit income ($(\pi_i - T_i)K_i$) and from the consumer surplus ($CS_i L_i$), respectively. Hence, we name the second term a *profit-income effect* and the third term a *consumer-surplus effect*.

Appendix 6: Redistribution of tax revenues to capital owners

In the text, taxes collected from capital owners are assumed to be transferred to workers, not to capital owners. If we allow for the transfer to capital owners as well as workers, we obtain the qualitatively same results.

Supposing that in each country, $100 \cdot \gamma\%$ of tax revenues are redistributed to residents, while the remaining $100 \cdot (1-\gamma)\%$ of them are to capital owners, where $\gamma \in [0, 1]$ represents an exogenously given share. The aggregate welfare of each group in country $i \in \{S, B\}$ can be re-written as

$$
\begin{aligned}
W_i^l &= (CS_i + 1)L_i + \gamma T_i \lambda_i K + \overline{Q}_{oi},\\
W_i^c &= [\lambda_S(\pi_S - T_S) + \lambda_B(\pi_B - T_B)]K_i + (1-\gamma)T_i\lambda_i K.
\end{aligned}
$$

As a result of tax competition, the equilibrium share of firms is given by

$$
\begin{aligned}
&\lambda_S^{***} = \sigma_S + \frac{(1-2\sigma_S)\Phi}{\tau\Omega K},\\
&\quad \Omega \equiv 2\beta[2K + 3 - 3\gamma(K+1)] + 6\gamma(K+1) - 1 > 0,\\
&\quad \Phi \equiv \Phi_1\beta + \Phi_0,\\
&\quad \Phi_1 \equiv \tau(K+1)[K + 1 - \gamma(3K+1)] + 2[\gamma(K+1) - 1],\\
&\quad \Phi_0 \equiv \gamma\tau(K+1)(3K+1) - 2\gamma(K+1) - K < 0.
\end{aligned}
$$

We note that $\Phi_1 > 0$ holds if $\tau > \underline{\tau}^{***} \equiv \min\{\underline{\tau},\ 1/(K+1)^2\}$, where $\underline{\tau} \equiv 2(1-2\sigma_S)/(K - 2\sigma_S + 1)$ as defined in the text.

It can be verified that under small trade costs, i.e., $\underline{\tau}^{***} < \tau < \tau^{***} \equiv 2/(3K+1)$, the firm share in country S exceeds its market share if the political weight is high:

$$
\begin{aligned}
&\beta > \beta^{***} \equiv -\Phi_0/\Phi_1,\\
&\to \lambda_S^{***} > \sigma_S,
\end{aligned}
$$

confirming the reverse-home-market effect. If the political weight is small ($\beta < \beta^{***}$) and/or trade costs are large ($\tau > \tau^{***}$), country S hosts a smaller share of firms than its market share, i.e., $\lambda_S^{***} < \sigma_S$. The main message of Proposition is unchanged.

It can also be seen that under small trade costs ($\tau < \tau^{***}$), an increase in γ reduces the threshold, i.e., $\mathrm{d}\beta^{***}/\mathrm{d}\gamma < 0$. Put it differently, as capital owners get more redistribution ($\gamma \Downarrow$), the reverse-home-market is less likely to be observed (i.e., the required condition is tightened: $\beta^{***} \Uparrow$). As discussed in Section 4.2, once the tax-revenue effect comes in, capital owners in both countries prefer a higher tax rate. Then the equilibrium tax gap becomes narrower, reducing relocation from country B to country S.

Appendix 7: Welfare Analysis

This appendix examines welfare implications. We compare the socially desirable outcome to that under tax competition. We consider a social planner who chooses the industry allocation λ_S to maximize the sum of national welfare of the two countries $W \equiv W_S + W_B$. The social planner implements the policy through lump-sum transfers among agents while taking as given the equilibrium market prices (5) and quantities (4).

Figure A1 shows the global welfare along with the distribution of firms that attains the optimum λ_S^o, the one under benevolent governments λ_S^n and the one under politically-interested governments λ_S^*. λ_S^n is larger than λ_S^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. Under lobbying-free governments, country B hosts some fraction of foreign capital from country S as well as its domestic capital. Thus, the taxes imposed by B affect the reward to capital coming from S, as well as the reward to domestic capital. Because there is a negative externality from B to S and a positive externality from S to B, country S chooses a tax rate that is too low, while country B charges a tax rate that is too high from the global welfare point of view. The large tax difference generates arbitrage opportunities for capital owners and consequently yields an inefficiently equalized distribution.

As we have seen in the previous sections, the relationship between λ_S^n and λ_S^* is clear: when the governments are heavily biased in favor of capital owners and trade barriers are low, λ_S^* is greater than σ_S ($> \lambda_S^n$) and the more so, the higher political weight β.

We summarize this as follows:

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

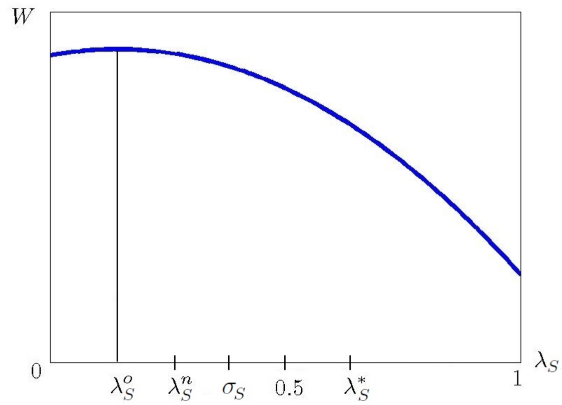

Figure A1. Global welfare.

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

$$
\begin{aligned}
W(\lambda_S) &\equiv W_S(\lambda_S) + W_B(\lambda_B \equiv 1-\lambda_S) \\
&= [\sigma_S CS_S(\lambda_1) + (1-\sigma_S)CS_B(\lambda_S)]L + [\pi_S(\lambda_S) - T_S]K_S + [\pi_B(\lambda_S) - T_B]K_B \\
&\quad + T_S\lambda_S K + T_B(1-\lambda_S)K \\
&= [\sigma_S CS_S(\lambda_S) + (1-\sigma_S)CS_B(\lambda_S)]L \\
&\quad + [\{\pi_S(\lambda_S) - T_S\} - \{\pi_B(\lambda_S) - T_B\}](\sigma_S - \lambda_S)K + \pi_S(\lambda_S)\lambda_S K + \pi_B(\lambda_S)(1-\lambda_S)K \\
&= [\sigma_S CS_S(\lambda_S) + (1-\sigma_S)CS_B(\lambda_S)]L + \pi_S(\lambda_S)\lambda_S K + \pi_B(\lambda_S)(1-\lambda_S)K.
\end{aligned}
$$

From the third line to the forth, we use the fact that $\pi_S - T_S = \pi_B - T_B$. Solving the FOC of the social planner's problem for λ_S gives the globally optimal level of industry allocation:

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

We can check that the second-order condition trivially holds: $\mathrm{d}^2W/\mathrm{d}\lambda_S^2 = -\tau^2K^2L(2K+3)/(K+1)^2 < 0$. We have $\lambda_S^o < \lambda_S^n$ for all $\tau \in (\underline{\tau}, \overline{\tau})$ and $\lambda_S^n < \lambda_S^*$ 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 order the spatial outcomes in this way: $\lambda_S^o < \lambda_S^n < \lambda_S^*$.

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

$$\lambda_S^o = \tilde{\lambda}_S - \frac{K+1}{2\tau^2 KL}(T_S^o - T_B^o)$$
$$\text{or} \quad T_S^o - T_B^o = -\frac{\tau L(1-2\sigma_S)(2-\tau)}{2K+3},$$

where $\tilde{\lambda}_S$ is defined in (8) and the absolute levels of taxation are indeterminate. Comparing this to the tax differential under benevolent governments gives

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

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

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

Appendix 8: Asymmetric Political Weight

Our main analysis assumed that the political weight is common to the two governments, i.e., $\beta_S = \beta_B = \beta$. Here, 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., $\sigma_S = 1/2$. The equilibrium tax rate in country $i \in \{S, B\}$ 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 weight and is stronger as the weight gets higher. The tax differential becomes:

$$T_S^{**} - T_B^{**} = -\frac{\tau^2 KL(\beta_S - \beta_B)}{[6-(\beta_S+\beta_B)]K+5}.$$

Since the denominator is positive as long as $\beta_i < \overline{\beta}$ holds as we have assumed in the previous analysis. the tax difference is negative if $\beta_S > \beta_B$. 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 choosing a lower tax rate attracts more firms than its market share:

$$\lambda_S^{**} = \frac{1}{2} + \frac{(K+1)(\beta_S - \beta_B)}{2[\{6-(\beta_S+\beta_B)\}K+5]} > \sigma_S,$$

as long as $\beta_S > \beta_B$ holds.

Having made clear the role of asymmetric 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. A2 and A3 show the equilibrium share of firms based in country S (z-axis) for various levels of political weights along with the horizontal plane representing the country S's size: $\sigma_S = 0.4$. Other parameter values are $K = 3$; $\tau = 0.25$ for Figure A2 and $K = 3$; $\tau = 0.14$ for Figure. A3, respectively. The diagonal line linking the north corner to the south corresponds to the case of symmetric weight. As β_S moves from low to high given a particular level of β_B, the share of firms based in country S increases. Moreover, country S with a higher political weight is likely to host a more than proportionate share of firms ($\lambda_S^{**} > \sigma_S$). The emergence of the reverse home market effect remains unchanged in the general situation.

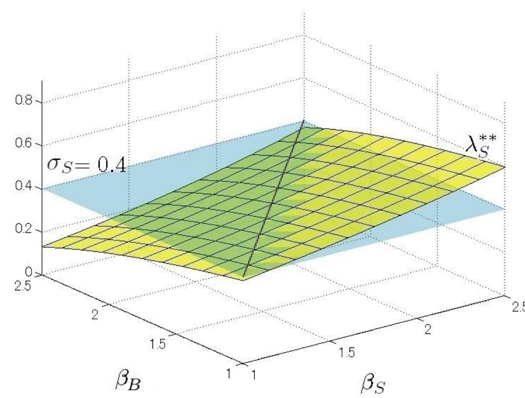

Figure A2. Equilibrium share of firms when trade costs are high.

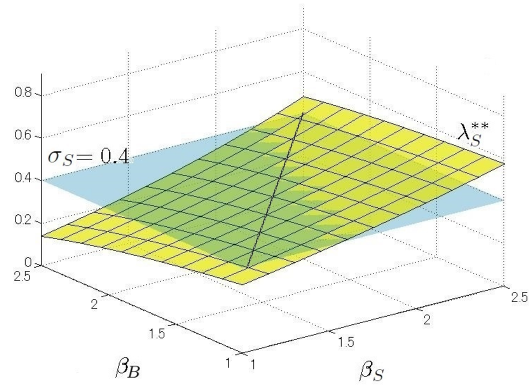

Figure A3. Equilibrium share of firms when trade costs are low.

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