Lobbying and Tax Competition in an Agglomeration Economy [*†]

Hayato Kato [‡]

First draft: March 7, 2014
This version: August 7, 2014

Abstract

This paper analyzes tax competition between politically-motivated governments in an economy with agglomeration forces. The 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 in both countries or the government in the smaller country care about contributions heavily, the smaller country attracts a more than proportionate share of firms by setting a lower tax rate. The result implies that the well-known home market effect, which means that countries with large market size are attractive for firms, may be reversed as a result of tax competition played by politically-interested governments.

Keywords: Tax competition; Lobbying; Market size; Home market effect; Economic geography;
JEL classification: F15; F22; H20; H30

[*] I deeply acknowledge Jota Ishikawa and Taiji Furusawa for their continuous guidance and encouragement. I appreciate Masahiro Endoh and Martin Richardson for their helpful comments. Thanks are also due to Jie Ma, Naoto Jinji, Gang Li, Michael Pflüger, Pascalis Raimondos-Møller and Anthony Venables. This paper has been presented at the 2014 Australasian Trade Workshop hosted by Curtin University, the BBL seminar at Kyoto University, the 2014 Spring Meeting of the Japan Society of International Economics at Hosei University and the 2014 Asia Pacific Trade Seminar at Sogang University. Financial support from Grant-in-Aid for JSPS Fellows is gratefully acknowledged.

[†] The latest version is available at the author's SSRN website

[‡] Graduate School of Economics, Hitotsubashi University, Naka 2-1, Kunitachi, Tokyo, 186-8601 Japan. E-mail address: ed132002@g.hit-u.ac.jp

1 Introduction

Tax competition on investment is recognized to have involved a number of countries throughout the world and have been accelerated since the late 1990s (OECD (1998)). A notable observation is that small countries and regions in terms of their economic size and population size such as Hong-Kong, Ireland and Singapore tend to undertake a more aggressive tax reduction than large countries such as Germany, Japan and the U.S. do.[*1] Although results of empirical studies on firms' location choice and taxes are inconclusive, some empirical evidences show that low corporate tax rate is effective in attracting foreign direct investments (Bellak and Leibrecht (2009)), which implies that small countries with a low corporate tax rate are expected be become the winners of tax competition.

Among a number of factors that accelerates tax competition, it is worth noting the recent movement of lobbying by gigantic multinational firms to further reduction of taxes. Although there is little clear evidence how amount of contributions are spent on tax issues due to the limited accessibility of data, Drutman (2012) suggests that a fallen tax burden on large U.S. companies in recent years seems to be obtained through their lobbying efforts. And the fact that the total lobbying spending in the U.S. has become two-fold during 2001 ($1.64 billion) to 2013 ($3.21 billion) indirectly indicate the current accelerated movement of tax lobbying.[*2] Governments cannot ignore the interests of such large firms in deciding their tax policy.

Motivated by these observations, this article examines the impact of lobbying activities on the outcomes, mainly the industrial configuration, of tax competition. Specifically, based on a simple variant of new economic geography model characterized by increasing returns to scale and mobile capital (Ludema and Wooton (2000); Thisse (2010)), capital tax competition between two governments is analyzed. Governments choose their tax (or subsidy) rate on capital strategically in order to maximize their objective. Tax revenues are repatriated to the domestic residents, who consists of capital owners and non-capital owners (workers). Capital owners invest their capital both in firms located in the smaller country and in firms located in the larger country. Capital or firms decide its location responding to the after-tax (operating) 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 the total willingness to pay of residents in one country is larger than that in the other country. The country in which the residents' demand for an industrial good is higher can be thought to have a larger market size. By introducing size asymmetries of countries, it becomes possible to capture a part of tax competition in reality. Second, capital owners engage in lobbying activities to extract fa-

[*1] Corporate tax rates of these countries in 2013 are 16.5%(Hong-Kong), 12.5%(Ireland), 17% (Singapore), 33.33%(Germany), 38.01%(Japan), and 40%(the U.S.). Source: KPMG (`http://www.kpmg.com/global/en/services/tax/tax-tools-and-resources/pages/corporate-tax-rates-table.aspx`).

[*2] Source: Lobbying Database, *Open Secrets* (`http://www.opensecrets.org/lobby/index.php`)

vorable policies from governments. Building on the common agency approach explored by Bernheim and Whinston (1986) and Grossman and Helpman (1994), the objective of governments is formulated in a such way that they consider not only the aggregate welfare of their domestic residents but also the *political contributions* by capital owners when deciding their tax rate. As a result, the resulting tax policy and distribution of firms are biased toward the interests of the special interest groups, which seems plausible in the real world where lobbying by firms influences policy decision-making processes.

The main result of the present analysis is as follows. If the governments in both countries or at least in the smaller country care about the contributions by their domestic capital owners heavily, tax competition results in the concentration of firms in the smaller country. The result implies that the 'home market effect', which means the country with a larger market size is attractive for industry, could be *reversed* when considering a non-cooperative policy game between politically-interested governments.

The mechanism behind this is rather intuitive. For a firm in the larger country, the (operating) profits from domestic sales out of its total profits is relatively large compared to the profits from export sales because the firm can exploit the advantage of the larger market without incurring transportation costs. In contrast, for a firm in the smaller country, the profits from exporting is of a higher importance than that for a firms in the larger country because of the smallness of the domestic market. Both total profits of a firm in the smaller country and that in the larger country get higher as more firms are clustering in the smaller country, which makes there less competitive. Therefore, from the viewpoint of a single firm, industrial agglomeration in the smaller country is desirable in that a firm can take advantage of its location.[*3] Owners of firms try to improve the value of investment portfolio (a weighted sum of the total profits of a firm in both countries) through their lobbying activities. The tax rate in the smaller country turns out to be lower than that in the larger country and the smaller country hosts a more than proportionate share of firms. The result that the smaller country gains industrial agglomeration is roughly consistent with some empirical evidences and casual observations mentioned before.

1.1 Relation to the literature

This paper is related to several strands of the literature, but the most related one is analyses of tax competition in the new economic geography framework (Kind et al. (2000); Ludema and Wooton (2000); 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.[*4] Most of these studies deal with symmetric market size and simply assume the welfare maximizing governments, while this

[*3] The following analysis focuses on interior spatial distributions so that the (after-tax) total profit is equalized between countries and full agglomeration is never achieved.

[*4] This conclusion depends on static (simultaneous or sequential) settings of the game which most of the studies deal with. Kato (2014) examines a tax game in an infinite horizon and shows that rather than the initial condition, whether or not governments commit to their policies is important for the spatial outcome.

paper allows size asymmetry and politically-biased governments.

To the author's knowledge, there are few studies that address political economic issues in the context of agglomeration and tax competition. Ottaviano and Ypersele (2005) and Haufler and Wooton (2010) analyze tax competition in a mobile ('footloose') capital version of the new economic geography model as in this paper. They show that in the interior equilibrium, country with a large factor endowments still hosts a larger share of firms as a result of tax competition. The market size is still matter for determining industrial location and the reversal of the home market effect never happens in their analysis because these two papers consider only benevolent governments. Borck et al. (2012) study a subsidy game between governments with political preference in asymmetric regions. Their focus is quite different from that of the present analysis in that they look only at the situation where initial industrial location matters, i.e., corner solutions (the core-periphery equilibria).[*5] By focusing on interior solutions where initial distribution of firms is irrelevant to outcomes, the present analysis isolates pure effects of the market size (plus effects of political consideration).

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 neoclassical framework. They show that the smaller region levies a lower tax rate and has a higher capital-labor ratio than the larger region because the tax base in the former responds more elastically to the tax differential than that in the latter. The contribution of the present paper is to provide another rationale for the advantages of small countries in a different light from that cast by the traditional tax competition literature.

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 pressure groups. Section 4 presents analytical and numerical results. Section 5 concludes.

2 The model

In this section, I construct a linear version of the new economic geography model with the specification of Thisse (2010).[*6] The economy consists of two countries, home (h) and foreign (f). Each country has two factors of production, labor and capital, whose amount is identical between two countries. That is, suppose that the world amount of labor is L and that of capital is K, country $i \in \{h, f\}$ has $L_i = L/2$ and $K_i = K/2$. However, as will be seen shortly, the two countries differ in their consumers' preferences. Agents are divided into two groups, workers and capital owners. Workers supply their

[*5] They point out a possibility that the smaller region that attains full agglomeration in the beginning maintains its position. The key factors to this result are inter-and intra-industry spillovers and a heavier weight of regional governments on the workers' welfare.

[*6] To the author's knowledge, Ludema and Wooton (2000) are the first to present the model. I follow the presentation of Thisse (2010). Qualitative results are quite similar to a 'footloose capital' version of Ottaviano et al. (2002), which is analyzed in depth by Baldwin et al. (2003) Chapter 5 and Ottaviano and Ypersele (2005).

labor services inelastically, while capital owners, whose fraction among agents are assumed to be negligible, do capital services inelastically. Capital owners can invest their assets both on domestic firms and foreign firms so that the amount of capital in a country can be different from the number of firms located there. Namely, the share of firms in country i, denoted by $\lambda_i \in [0, 1]$, differ from one-half in general. I assume capital owners in both countries have an diversified portfolio that is proportional to the share of firms in each country. Suppose π_i is the reward to one unit of capital invested in country i, the total capital income of country i then amounts to $\Pi K_i = [\lambda_i \pi_i + (1 - \lambda_i)\pi_j]K_i$.

There are two industries which 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 increasing returns technology and imperfect competition. One unit of K is needed to set up a modern firm, and it can produce any amount of goods without marginal costs. In contrast, the traditional sector is characterized by constant return to scale technology and perfect competition. In the sector, the production of one unit of z requires one unit of L. I 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

Agents in country i share common preferences. They consume both the modern and traditional goods:

$$u_i = \left(\beta_i - \frac{q_i}{2}\right) q_i + z_i, \quad i \in \{h, f\}, \tag{1}$$

where $\beta_i > 0$ is a demand shift parameter, which differs from country to country, i.e., $\beta_h \neq \beta_f$. I interpret β_i as the *market size* of country i.[*7] Aggregating across individuals, total utility in country i is given by:

$$U_i = L_i u_i = \left(\beta_i - \frac{Q_i}{2L_i}\right) Q_i + Z_i, \quad i \in \{h, f\}, \tag{2}$$

where $Q_i \equiv L_i q_i$ is the total 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:

$$p_h = \beta_h - 2Q_h/L, \tag{3-h}$$
$$p_f = \beta_f - 2Q_f/L. \tag{3-f}$$

[*7] In the literature of new economic geography, the market size of a country is typically defined as the amount of factors the country owns, while assuming identical preferences among countries. Here factor endowments are the same between two countries ($L_h = L_f = L/2$ and $K_h = K_f = K/2$), but a part of preferences is different ($\beta_h \neq \beta_f$). I deviate from the standard definition in the literature in order to derive intuitive analytical results and avoid messy expressions. In fact. the same qualitative results hold if I follow the standard definition.

Note that $L_h = L_f = L/2$. The slope of the demand curves in both countries are the same, but their intercept can be different. The larger country i is one that has a greater intercept of demand curve ($\beta_i > \beta_j,\ i \neq j \in \{h, f\}$).

2.2 Supply Side

In the traditional sector, the production of one unit of z requires one unit of L. As discussed before, because of no trade costs and the choice of numéraire, the price of the good between two countries is equalized to unity. Constant returns to scale production implies that the wage rate in both countries becomes also unity, i.e., $w_h = w_f = 1$.

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

$$\pi_h = p_h q_{hh} + (p_f - \tau) q_{hf}, \tag{4-h}$$
$$\pi_f = (p_h - \tau) q_{fh} + p_f q_{ff}. \tag{4-f}$$

where q_{ij} denotes the amount of production by a firm in country i, sold in country j ($i, j \in \{h, f\}$). One unit of capital builds one firm so that capital market clearing conditions requires that the number of firms in country h is $\lambda_h K$ and that in country f is $\lambda_f K \equiv (1-\lambda_h)K$, where λ is determined endogenously. Total demand in a country are met by total supply by firms in both countries:

$$Q_h = \lambda_h K q_{hh} + (1 - \lambda_h) K q_{fh}, \tag{5-h}$$
$$Q_f = \lambda_h K q_{hf} + (1 - \lambda_h) K q_{ff}. \tag{5-f}$$

Each firm engages in Cournot competition both in domestic and foreign markets. Substituting the demand function (3) into the operating profit (4) and taking the F.O.C.s with respect to the quantity in both markets yield:

$$q_{hh} = L_h p_h, \qquad q_{fh} = L_f (p_f - \tau), \tag{7-h}$$
$$q_{fh} = L_h (p_h - \tau), \quad q_{ff} = L_f p_f. \tag{7-f}$$

where

$$p_h = \frac{\beta_h + (1 - \lambda_h) K \tau}{K + 1}. \quad p_f = \frac{\beta_f + \lambda_h K \tau}{K + 1}. \tag{8}$$

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

Exporting is profitable for firms as long as the mill price $p_i - \tau$ is positive. In other words, trade costs must be sufficiently small:

$$\tau < \tau_{trade} \equiv \frac{\min\{\beta_h, \beta_f\}}{K + 1}. \tag{9}$$

This inequality is assumed to hold throughout the analysis.

By substituting equilibrium prices and quantities into (4), the equilibrium operating profit can be calculated as follows:

$$\pi_h = \frac{L\left[\beta_h + (1-\lambda_h)K\tau\right]^2}{2(K+1)^2} + \frac{L\left[\beta_f - \{1+(1-\lambda_h)K\}\tau\right]^2}{2(K+1)^2}, \tag{10-h}$$

$$\pi_f = \frac{L\left[\beta_h - (1+\lambda_h K)\tau\right]^2}{2(K+1)^2} + \frac{L\left(\beta_f + \lambda_h K\tau\right)^2}{2(K+1)^2}. \tag{10-f}$$

Free entry and exit make excess profits zero so that the operating profits become equal to the factor rewards to capital. Now π_i can also be regarded as the rental rate of capital invested in country i.

The marginal effect of an increased share of domestic firms on their total profit depends on the difference of the market size:

$$\frac{\mathrm{d}\pi_i}{\mathrm{d}\lambda_i} = \frac{\tau K L[\beta_j - \beta_i - \tau - 2K\tau(1-\lambda_i)]}{(K+1)^2}, \quad i \neq j \in \{h, f\}, \tag{11}$$

where $\lambda_j \equiv 1 - \lambda_i$. If country i is larger ($\beta_i > \beta_j$), the effect is definitely negative. For firms in the larger country, the impact of an influx of firms, which intensifies the domestic competition, is always a bad news because the profit from serving the large domestic market out of the total profit is more important than the profit from exporting to the small foreign market. If country i is smaller ($\beta_i < \beta_j$), the negative impact is less severe than the previous case and the effect can be positive when the size asymmetry is huge. Since the contribution of the profit from exporting is more important for firms in the smaller country than for firms in the larger country, the industrial clustering in the domestic market mitigates the competitiveness of the foreign market and enhances export profits.

From (11), it can be easily verified that $\pi_i(\lambda_i)$ has an U-shaped relationship with λ_i and takes its minimum at

$$\lambda_i^m = \frac{2K+1}{2K} + \frac{\beta_i - \beta_j}{2\tau K}, \quad i \neq j \in \{h, f\}.$$

If $\beta_i > \beta_j$, λ_i^m is greater than one so that $\pi_i(\lambda_i)$ is decreasing in λ_i within the interval $[0, 1]$. If $\beta_i < \beta_j$, λ_i^m is smaller than that in the former case and gets even smaller as the difference of the market size expands. In fact, for firms in the smaller country, an increased competitiveness in the domestic market has an positive effect for them when the size difference is so huge that export profits account for a large fraction of the total profit.

The (operating) profit of a firm in country h as a function of the firm share is illustrated under a specific parameter values in Figs. 1 and 2.

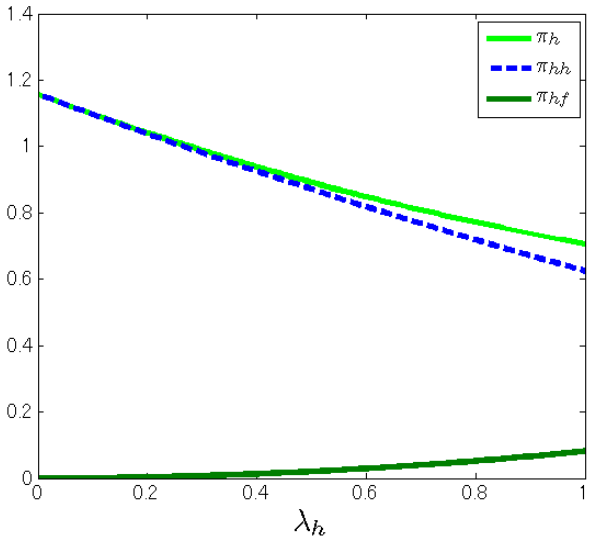

Fig. 1. Profits of a firm located in the larger country.
Note : $\beta_h = 3,\ \beta_f = 1.3,\ \tau = 0.2165,\ K = 5,\ L = 5.$

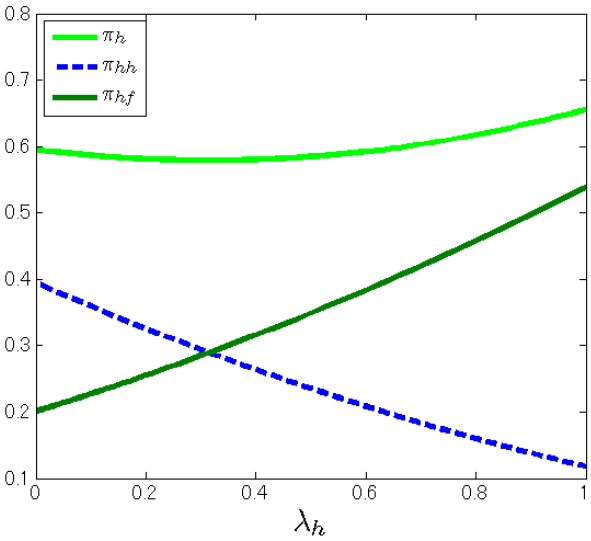

Fig. 2. Profits of a firm located in the smaller country.
Note : $\beta_h = 1.3,\ \beta_f = 3,\ \tau = 0.2165,\ K = 5,\ L = 5.$

2.3 Location equilibrium

Capital owners in each country try to invest their internationally-mobile capital in the country that offers a higher rental rate, This implies that the rental rate of capital in both countries should be

equalized:

$$\pi_h(\lambda_h) = \pi_f(1-\lambda_h), \tag{12}$$

as long as λ_h is in the interior interval $(0,1)$. If firms are completely agglomerated in one country $\lambda_h \in \{0,1\}$, this equality does not hold. The equality of factor rewards (12) gives an unique distribution of firms:

$$\lambda_i^* = \frac{1}{2} + \frac{\beta_i - \beta_j}{2\tau K}, \quad i \neq j \in \{h, f\}. \tag{13}$$

If country i is smaller, λ_i^* is less than one-half. Considering the fact that the amount of capital is equally distributed between the two countries, the smaller country becomes the exporter of capital, while the larger country becomes the importer of capital. The result is the so called "home market effect" (Krugman (1980)). Intuition behind this is easy to grasp. Suppose $\beta_i < \beta_j$ and consider the case where each country owns a share of firms that equals its capital endowment, i.e., $\lambda_i = 1/2$. Locating in the larger market saves trade costs so that firms there earn more from exporting and thus obtain a higher total profit, given the equal distribution of firms. In fact, calculations reveal $\pi_i(\lambda_i = 1/2) < \pi_j(1-\lambda_i = 1/2)$. Because of the reward difference, capital will seek to move into the larger country ($1-\lambda_i \Uparrow$) until when the difference disappears. In equilibrium, the distribution of firms becomes unequal in order to maintain the equalization of the factor rewards.

As can be seen in (13), if the two countries differ in size (suppose $\beta_i < \beta_j$), reducing trade costs makes the distribution more unequal ($\tau \Downarrow \rightarrow \lambda_i^* \Downarrow$). In other words, as economic integration proceeds, the inherent market feature becomes more important in the determination of the quantities and prices than the industrial distribution (see (8) and (9)). To assure an interior outcome, trade costs should be sufficiently large (suppose still $\beta_i < \beta_j$):

$$\tau > \tau_{cluster}^* \equiv \frac{\beta_j - \beta_i}{K}. \tag{14}$$

The sufficient condition of international trade is thus $\tau_{cluster}^* < \tau_{trade}$, which requires the difference of the intercepts not to be large:

$$\frac{\beta_j}{\beta_i} < \frac{2K+1}{K+1}. \tag{15}$$

In the case of $\beta_i > \beta_j$, the country indexes in (14) and (15) are flipped. The following lemma summarizes the results:

Lemma. *Assume that there are no governments and that the difference of the market size is not extremely large, i.e.,* $(K+1)/(2K+1) < \beta_h/\beta_f < (2K+1)/(K+1)$. *There are two patterns of industrial configuration:*
(i) if $0 < \tau < \tau_{cluster}^*$, *all firms are clustered in the larger country, (e.g.,* $\lambda_f^* = 1 - \lambda_h^* = 1$ *when* $\beta_h < \beta_f$*).*
(ii) if $\tau_{cluster}^* < \tau < \tau_{trade}$, *though incomplete specialization happens, the larger country hosts a greater share of firms than its capital endowment (e.g.,* $1/2 < \lambda_f^* < 1$ *when* $\beta_h < \beta_f$*).*

3 Tax competition with lobbying groups

I now introduce taxes and governments into the economy. The governments in country $i \in \{h, f\}$ imposes a lump-sum tax T_i on each firm operating in country i, and total tax revenue is thus $T_i \cdot \lambda_i K$. Tax rates are allowed to be *negative.* The arbitrage condition requires the equalization of the after-tax factor rewards:

$$\pi_h(\lambda) - T_h = \pi_f(\lambda) - T_f.$$

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

$$\lambda_i(T_h, T_f) = \lambda_i^* - \frac{K+1}{2\tau^2 KL}(T_i - T_j), \quad i \neq j \in \{h, f\}, \tag{16}$$

where λ_i^* is the equilibrium share of firms when there are no governments and is given by (13). The higher the tax rate in a country is, the fewer firms it obtains ($T_i \Uparrow \rightarrow \lambda_i \Downarrow$). Collected tax revenues are redistributed to the domestic residents.

3.1 Politically-motivated governments

Before discussing the objective of the governments, I compute the welfare of residents. As was mentioned in the beginning of Section 2, 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 that they have a fully diversified portfolio, the welfare of the capital owners in country i is represented as:

$$W_{i,capital} = \Pi K_i \equiv [\lambda_i(\pi_i - T_i) + (1 - \lambda_i)(\pi_j - T_j)]K/2, \quad i \neq j \in \{h, f\}. \tag{17}$$

which is common between the two countries since $K_h = K_f = K/2$.

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:

$$p_i q_i + z_i = 1 + \frac{T_i \lambda_i K}{L/2} + \bar{z}_i. \tag{18}$$

Remember that the wage rate is unity and that $L_h = L_f = L/2$. The national budget constraint is obtained by aggregating (18) across workers. By inserting the constraint into the aggregate utility (2) and evaluating it at the equilibrium quantities (7) and prices (8), the aggregate welfare of workers in country i is given by:

$$W_{i,worker} = (S_i + 1)L/2 + T_i \lambda_i K + \overline{Z}_i, \tag{19}$$

where S_i is the consumer surplus of an individual:

$$S_i = \frac{(\beta_i - p_i)^2}{2}. \tag{20}$$

The total welfare of the residents in country i is $W_i = W_{i,capital} + W_{i,worker}$.

The problem of the governments is formulated as in Grossman and Helpman (1994, 1995). The governments care not only about the aggregate welfare of their residents but also campaign contributions. a denotes a weight that the governments place on the former relative to the latter. Here only capital owners can organize a lobbying groups and make contributions C to their domestic government. Formation of the group incurs a cost, denoted F, which is considered as necessary efforts to overcome free-rider problems that members of organized group face.[*8] The objective function of the government in country i is

$$G_i(T_i;\ T_j) = \mathbf{1}_i C_i(T_i;\ T_j) + a_i[W_i(T_i;\ T_j) - \mathbf{1}_i F], \tag{21}$$

where $\mathbf{1}_i$ is an indicator function that takes one when capital owners in country i engage in lobbying activities.

Tax competition with political pressure is analyzed in the following three stage game. First, capital owners in each country as a special interest group (SIG) decide whether or not they form a lobbying group. If they are organized, they choose a contribution schedule that depends on the domestic tax rate ($C_i(T_i)$) given the tax rate of the rival country (T_j). Second, each government makes a decision whether it receives or rejects the contributions. The tax rates are non-cooperatively chosen so as to maximize the objective of the governments (20). Finally, relocation of firms occurs in a response to the factor-rewards differential.

As in Grossman and Helpman (1994, 1995), I focus on the truthful contribution schedules:

$$C_i(T_i;\ T_j) = \max\left\{W_{i,capital}(T_i;\ T_j) - F - \overline{B}_i,\ 0\right\}, \tag{22}$$

where $\overline{B}_i$ is a constant equal to a difference between the objective of the government when it ignores the contributions and that when it receives them. Substituting (22) into (21) reveals that the the governments choose a tax rate that maximizes the joint payoff of themselves and their domestic SIGs:

$$\max_{T_i} G_i(T_i;\ T_j) = \max_{T_i}\ \left[W_{i,capital}(T_i;\ T_j) - F - \overline{B}_i + a_i\left\{W_i(T_i;\ T_j) - F\right\}\right]. \tag{23}$$

The problem can be solved backwardly. First, I compute the (interior) equilibrium distribution of firms given the tax rates as in (16). Second, I derive the F.O.C. of each government by differentiating (21) with respect to T_i given T_j and equating it to zero. Finally, the two F.O.C.s are evaluated at the truthful schedule (if SIGs make contributions) as in (23) and I solve the systems of equations for the tax rate of each country.

4 Results

In this section, I assume that SIGs in both countries are active. Notwithstanding the simple structure of the present model, the model has two dimensions of heterogeneity: one is the market size β_i and

[*8] This additional cost assures that contributions are positive.

the other is the welfare weight a_i. Even though I can derive equilibrium outcomes in an explicit form, it is difficult to confirm, for example, interior solutions and specify the parameter ranges associated with the results. However, I can establish clear statements in the special case, namely the case where the governments in both countries are equally politically-motivated and SIGs there make contribution. First the special case is studied. And then the general case where the welfare weight differ from countries is examined with the aid of numerical simulation.

4.1 The welfare weights are common

To focus on meaningful solutions, a few restrictions to parameters are needed. The welfare weight a is not extremely small:

$$a > \frac{2K}{4K+5} \equiv \underline{a}. \tag{A1}$$

As will be seen, the equilibrium distribution of firms exhibits a hyperbola in terms of the weight. (A1) is necessary to focus on the right of the hyperbola.

In order to ensure the range of trade costs where interior solutions are achieved, namely, $\tau^L_{cluster} < \tau_{trade}(\tau^L_{cluster}$ will be defined shortly) the difference of the market size should not be extremely large:

$$\begin{cases} 1/\beta_1 < \beta_h/\beta_f < \beta_1, & \text{if } \ \underline{a} < a < 2K/(K+2), \\ 1/\beta_2 < \beta_h/\beta_f < \beta_2, & \text{if } \ 2K/(K+2) < a. \end{cases} \tag{A2}$$

$$\text{where } \ \beta_1 \equiv \frac{a(3K^2+2K-2)+2K}{(K+1)[2K-a(K+2)]}, \quad \beta_2 \equiv \frac{a(5K^2+8K+2)-2K(K+1)}{(K+1)[a(K+2)-2K]}.$$

4.1.1 Interior solutions

First, I show the analytical results in which the equilibrium share of firms is in between $[0, 1]$. From the government's objective (23), I calculate the marginal impacts of a domestic tax increase on the government's objective in country i:

$$\begin{aligned} \frac{\mathrm{d}G_i}{\mathrm{d}T_i} &= \frac{\mathrm{d}}{\mathrm{d}T_i}\left[\frac{aL(S_i+1)}{2} + aT_i\lambda_i K + \frac{(1+a)\Pi K}{2}\right] \\ &= \frac{aL}{2}\frac{\mathrm{d}S_i}{\mathrm{d}T_i} + aK\left(\lambda_i + T_i\frac{\mathrm{d}\lambda_i}{\mathrm{d}T_i}\right) + \frac{(1+a)K}{2}\frac{\mathrm{d}\Pi}{\mathrm{d}T_i}, \quad i \in \{h, f\}, \end{aligned} \tag{24}$$

where λ_i is given by (16), Π by (17) and:

$$\frac{\mathrm{d}\lambda_i}{\mathrm{d}T_i} = -\frac{K+1}{2\tau^2 KL} = -\frac{\mathrm{d}\lambda_j}{\mathrm{d}T_i} < 0, \tag{25}$$

$$\frac{\mathrm{d}S_i}{\mathrm{d}T_i} = \frac{\partial S_i}{\partial \lambda_i}\frac{\mathrm{d}\lambda_i}{\mathrm{d}T_i} = \frac{\tau K^2(\beta_i - \tau\lambda_j)}{(K+1)^2}\left(-\frac{K+1}{2\tau^2 KL}\right) = -\frac{K(\beta_i - \tau\lambda_j)}{2\tau L(K+1)} < 0, \tag{26}$$

$$\frac{\mathrm{d}\pi_i}{\mathrm{d}T_i} = \frac{\partial \pi_i}{\partial \lambda_i}\frac{\mathrm{d}\lambda_i}{\mathrm{d}T_i} = \frac{1}{2} + \frac{T_i - T_j}{2\tau^2 L}, \quad \frac{\mathrm{d}\pi_j}{\mathrm{d}T_i} = \frac{\partial \pi_j}{\partial \lambda_j}\frac{\mathrm{d}\lambda_j}{\mathrm{d}T_i} = -\frac{1}{2} + \frac{T_i - T_j}{2\tau^2 L}, \tag{27}$$

$$\begin{aligned}\frac{\mathrm{d}\Pi}{\mathrm{d}T_i} &= \left[\frac{\mathrm{d}\lambda_i}{\mathrm{d}T_i}(\pi_i - T_i) + \frac{\mathrm{d}\lambda_j}{\mathrm{d}T_i}(\pi_j - T_j)\right] + \left[\lambda_i\left(\frac{\mathrm{d}\pi_i}{\mathrm{d}T_i} - 1\right) + \lambda_j\frac{\mathrm{d}\pi_j}{\mathrm{d}T_i}\right] \\ &= -\frac{1}{2} + \frac{T_i - T_j}{2\tau^2 L}, \quad i \neq j \in \{h, f\}.\end{aligned} \tag{28}$$

(25) shows that an increased tax rate in a country induces firms there to relocate to the other country and the negative impact expands as trade costs fall. In (26), an increase in the domestic tax rate negatively affects the consumer surplus of the residents there because the outflow of firms resulted from the increased tax rate causes the domestic price to get high. (27) reveals that the change of the domestic profit differ from that of the exporting profit. Without the tax differential ($T_i - T_j = 0$), an increased tax rate in a country drives its domestic firms away, which mitigates competition among them and thereby raises their profits ($\mathrm{d}\pi_i/\mathrm{d}T_i = 1/2$), while at the same time it reduces the profits of foreign firms ($\mathrm{d}\pi_i/\mathrm{d}T_j = -1/2$) since competition there becomes tougher. (28) shows that the effect of an tax increase on the portfolio is basically negative but that negative effect can be mitigated or even be reversed as the tax wedge increases.[*9]

Setting (24) zero for both countries yields a system of equations with respect to T_h and T_f, which in turn gives the equilibrium tax rates:

$$T_i^L = \frac{\tau L[\tau K\{a(4K+5) - 2K\}\{a(2K+3) - 2(K+1)\} + \Theta_i]}{4a(K+1)^2[a(4K+5) - 2K]}, \quad i \neq j \in \{h, f\}$$
$$\text{where } \Theta_i \equiv a\left[6a(\beta_i - \beta_j) + 2K^2(\beta_i + \beta_j) + aK(7\beta_i - 17\beta_j) + 2aK^2(\beta_i - 5\beta_j)\right].$$

The difference of the equilibrium tax rate is given by:

$$T_i^L - T_j^L = \frac{3a\tau L(\beta_i - \beta_j)}{(4K+5)a - 2K}, \quad i \neq j \in \{h, f\}. \tag{29}$$

If the two countries are of equal size ($\beta_h = \beta_f$), the tax gap vanishes and the resulting share of firms are the same as in the case without the two governments. If the two countries differ in size, since the denominator of the second term in (29) is positive under assumption (A1), it can be found that the smaller country, say, country i with $\beta_i < \beta_j$, always levies a lower tax rate ($T_i^L < T_j^L < 0$). Intuitively,

[*9] In contrast to the effects on the price of the portfolio (the second big bracket in (28)), the effects on changing a composition of the portfolio (the first big bracket in (28)) have no effect as long as the after-tax rewards are identical between the two countries ($\pi_h - T_h = \pi_f - T_f$).

this result can be explained by the fact that extra tax revenues from firms by increasing the domestic tax rate are more in the larger country than in the smaller country.

To confirm rigorously that the larger country sets its tax rate higher, I check how the governments in countries with different size have different motives when they both start with a same tax rate ($T_h = T_f = \overline{T}$, for all possible $\overline{T}$). Suppose country i is smaller and sets its tax rate at the same level as country j, then comparing its marginal effects in country i with the counterparts in country j yields:

$$\begin{aligned}\frac{\mathrm{d}G_i}{\mathrm{d}T_i} - \left.\frac{\mathrm{d}G_j}{\mathrm{d}T_j}\right|_{T_i=T_j=\overline{T}} &= \frac{aL}{2}\left(\frac{\mathrm{d}S_i}{\mathrm{d}T_i} - \frac{\mathrm{d}S_j}{\mathrm{d}T_j}\right)\Bigg|_{T_i=T_j=\overline{T}} + aK[\lambda_i^* - (1-\lambda_i^*)] \\ &= \frac{a(4K+3)(\beta_i - \beta_j)}{4\tau(K+1)}, \quad i \neq j \in \{h, f\}, \end{aligned} \tag{30}$$

where λ_i^* is given by (13). This is negative for all possible $\overline{T}$ as long as $\beta_i < \beta_j$. If the tax gap is zero though countries are asymmetric, there are no difference between the countries as to the loss of tax revenues caused by the erosion of tax base ($T_h(\mathrm{d}\lambda_h/\mathrm{d}T_h) = T_f(\mathrm{d}(1-\lambda_h)/\mathrm{d}T_f)$ at $T_h = T_f = \overline{T}$) and the damage to the total capital rewards ($\mathrm{d}\Pi/\mathrm{d}T_h = \mathrm{d}\Pi/\mathrm{d}T_f$ at $T_h = T_f = \overline{T}$). Thus, only the negative effect on the consumer surplus ($\mathrm{d}S_i/\mathrm{d}T_i$) and the extra tax revenue (λ_i^*) emerge in (30) and the latter positive effect is dominant. The fact that the marginal effects of an increased tax rate in the smaller country are biased more negatively implies that it has stronger incentives to lower its tax rate. The larger country can exploit more tax revenues from the domestic firms due to the home market effect ($\lambda_j^* \equiv 1 - \lambda_i^* > 1/2$) and is less eager to lower its tax rate though a higher tax rate hurts the surplus of its residents.

By substituting (29) into (16), the equilibrium share of firms can be calculated as:

$$\lambda_i^L = \frac{1}{2} + \frac{(\beta_i - \beta_j)[a(K+2) - 2K]}{2\tau K[a(4K+5) - 2K]}, \quad i \neq j \in \{h, f\}. \tag{31}$$

In order for the share to lie in between $[0, 1]$, trade costs should be sufficiently large. For example, if $\underline{a} < a < 2K/(K+2)$ and $\beta_i < \beta_j$, then τ must be smaller than $\tau_{cluster}^L \equiv (\beta_i - \beta_j)[a(K+2) - 2K]/[(K+1)\{a(K+2) - 2K\}]$. $\tau_{cluster}^L$ in other cases can be readily defined. Assumption (A2) ensures that $\tau_{cluster}^L < \tau_{trade}$. $\tau < \tau_{cluster}^L$ is assumed to be hold.

Now the equilibrium distribution depends on a political factor, i.e., the welfare weight a. Suppose country i is smaller ($\beta_i < \beta_j$), since the denominator of the second term in (31) is positive under assumption (A1), λ_i^L is greater than one-half if a is small enough ($\underline{a} < a < 2K/(K+2) \equiv a^L$). This means that, in contrast to the conclusion from the standard new economic geography model, the *smaller* country hosts a more than proportionate share of firms when both countries put a much heavier weight on the welfare of capital owners. The possibility of the *reversal* of the home market effect can be explained by the fact that the impacts of an increased tax rate on the per-unit capital income Π are different between the smaller country with a lower tax rate and the larger country with a higher tax rate. From (28), Π decreases more for the smaller country as its tax rate goes up. As discussed

just before, when both countries choose the common tax rate, an increased tax rate in a country has an positive effect on the domestic profit ($\mathrm{d}\pi_i/\mathrm{d}T_i = 1/2$) and has an negative effect on the export profit ($\mathrm{d}\pi_j/\mathrm{d}T_i = -1/2$), and the overall effect is negative ($\mathrm{d}\Pi/\mathrm{d}T_i = -1/2$). When the two countries choose different rates, which is true in equilibrium, however, the former positive effect gets weaker and the latter negative effect becomes more severe in the smaller country with a lower tax rate. Since the attribution of the exporting profit to the total profit are more important for firms in the smaller country than for firms in the larger country, firms in both countries prefer industrial agglomeration in the smaller country. Governments motivated by political contributions from capital owners implement a tax policy that enhances such a configuration. The discussion is summarized in the following:

Proposition 1. *Consider tax competition between the governments that have an equal weight a on the voters' welfare relative to the campaign contributions. Assume (A1), (A2) and* $\tau^L_{cluster} < \tau_{trade}$*, two cases may arise:*
(i) if the weight is small ($\underline{a} < a < a^L$*), the smaller country hosts a larger share of firms than the share of capital endowment (e.g.,* $1/2 < \lambda^L_h < 1$ *when* $\beta_h < \beta_f$*).*
(ii) if the weight is large ($a^L < a$*), the smaller country hosts a smaller share of firms than the share of capital endowment (e.g.,* $0 < \lambda^L_h < 1/2$ *when* $\beta_h < \beta_f$*). In both cases, the smaller country levies a lower tax rate than the larger country.*

Figs. 3 and 4 illustrates the share of firms and the tax rates in different levels of the welfare weight, respectively.

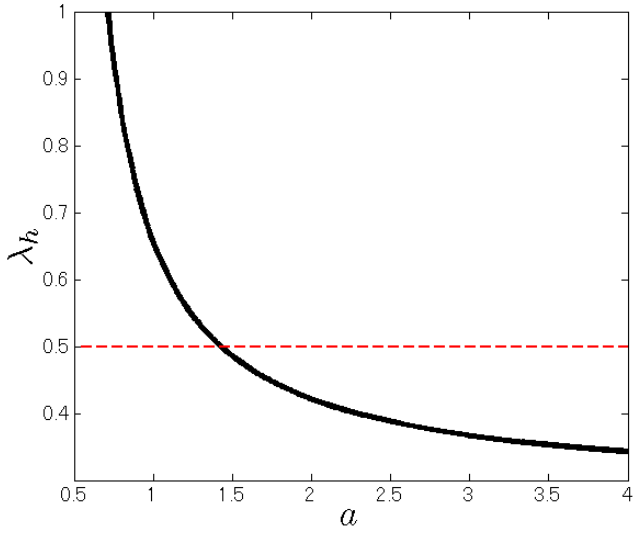

Fig. 3. The distribution of firms under the common welfare weight.
Note : $\beta_h = 1.3,\ \beta_f = 3,\ \tau = 0.2165,\ K = 5,\ L = 5.$

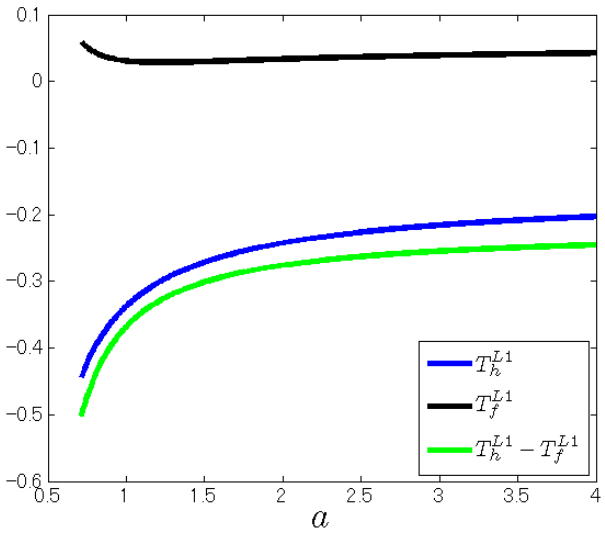

Fig. 4. Tax rates under the common welfare weight.
Note : $\beta_h = 1.3,\ \beta_f = 3,\ \tau = 0.2165,\ K = 5,\ L = 5.$

4.1.2 Full agglomeration

Next I consider corner solutions where trade costs are so small: $\tau < \tau^L_{cluster}$ that all the firms are agglomerated in one country. Suppose country i is small: $\beta_i < \beta_j$. If the welfare weight is small enough $\underline{a} < a < a^L$, λ_i^L defined in (31) exceeds unity. In this case, the equalization of after-tax reward is no longer valid and country i attracts all the firms. Since it holds that $\Pi = \pi_i(\lambda_i = 1) - T_i$ and $\mathrm{d}\lambda_i/\mathrm{d}T_i = \mathrm{d}\lambda_i/\mathrm{d}T_j = 0$, the marginal impacts of a tax increase on the government objective are reduced to: $\mathrm{d}G_i/\mathrm{d}T_i = K(a-1)/2$ and $\mathrm{d}G_j/\mathrm{d}T_j = 0$. When $1 < a < a^L$, the government in the smaller country has an incentive to increase its tax rate so that it does so until the after-tax rewards are equalized: $\pi_i(\lambda_i = 1) - T_i^L = \pi_j(1 - \lambda_i = 0) - T_j^L$, or:

$$\begin{aligned} T_i^L(\lambda_i = 1) - T_j^L(1 - \lambda_i = 0) &= \pi_i(\lambda_i = 1) - \pi_i(1 - \lambda_i = 0), \\ &= \frac{\tau L(\beta_i - \beta_j - \tau K)}{K+1}. \quad i \neq j \in \{h, f\}. \end{aligned}$$

The tax equilibrium tax rates are determined in the difference term and the absolute values are indeterminate. The difference is unambiguously negative, which means that the smaller country sets its tax rate lower. When $\underline{a} < a < 1$, it can be seen that $T_i(\lambda_i = 1) = -\infty$ and $T_j(1 - \lambda_i = 0)$ is an arbitrary value.

If, on the other hand, the welfare weight is large enough $a^L < a$, λ_i^L becomes negative so that the larger country j attains the full agglomeration. As in the previous case where $1 < a < a^L$, considering the fact that $\Pi = \pi_j(1-\lambda_i = 1) - T_j$ and $\mathrm{d}G_j/\mathrm{d}T_j = K(a-1)/2 > 0$, the government in the larger country raises its tax rate to the level where firms relocation cannot occur: $\pi_i(\lambda_i = 1) - T_i^L = \pi_j(1-\lambda_i = 0) - T_j^L$,

or:

$$T_i^L(\lambda_i = 0) - T_j^L(1 - \lambda_i = 1) = \pi_i(\lambda_i = 0) - \pi_i(1 - \lambda_i = 1),$$
$$= \frac{\tau L(\beta_i - \beta_j + \tau K)}{K + 1}. \quad i \neq j \in \{h, f\}.$$

Because it holds that $\tau < \tau^L_{cluster} < (\beta_i - \beta_j)/K$, the difference is negative. In sum:

Proposition 2. *Consider tax competition between the governments that have an equal weight a on the voters' welfare relative to the campaign contributions. Assume (A1), (A2) and $\tau < \tau^L_{cluster}$, then two cases may arise:*
(i) if the weight is small ($\underline{a} < a < a^{L1}$), the smaller country achieves the full agglomeration (e.g., $\lambda_h^L = 1$ when $\beta_h < \beta_f$) while the smaller country levies a higher tax rate than the larger country.
(ii) if the weight is large ($a^L < a$), the larger country achieve the full agglomeration (e.g., $\lambda_f^L = 1 - \lambda_h^L = 1$ when $\beta_h < \beta_f$).
In both cases, the smaller country levies a lower tax rate than the larger country.

4.2 Numerical results

Finally, I examine the most general case where SIGs in both countries are active and the welfare weight of each government is different ($a_h \neq a_f$) by relying on numerical simulation. The equilibrium share of firms can be obtained analytically:

$$\lambda_i^L = \frac{1}{2} + \frac{(\beta_i - \beta_j)[K(a_i + a_j) - (K + 2)a_i a_j] + \tau K(K + 1)(a_i - a_j)}{2\tau K[K(a_i + a_j) - (4K + 5)a_i a_j]}, \quad i \neq j \in \{h, f\}.$$

Figs 5 and 6 illustrate λ_h^{L3} in various levels of the market size β_h and the political weight a_h. In both figures, λ_h is proportional to β_h in general. However, the proportional relationship collapses when a_h is sufficiently small. The market size is crucial in determining the equilibrium distribution when either of the governments is rather benevolent. When both governments are deeply involved in political posturing, the pressure from capital owners are reflected well in the resulting outcome. Especially in Fig. 5 where the foreign government are deeply affected by lobbying (small a_f), the reversal of the home market effect ($1/2 < \lambda_h < 1$ if $\beta_h < \beta_f = 2$; $0 < \lambda_h < 1/2$ if $\beta_h > \beta_f = 2$) is widely observed under small values of a_h, which corresponds to Proposition 1. In Fig. (6) where the foreign government pay little attention to political campaign (large a_f), the reversal is also observed only when β_h is smaller and a_h is around its minimum. λ_h always exceeds one-half when $\beta_h > \beta_f$ as Proposition 2 states.

The numerical simulation confirms that the home market effect is less likely to hold as the governments in both countries or at least the one in the smaller country become more biased toward the interests of capital owners.

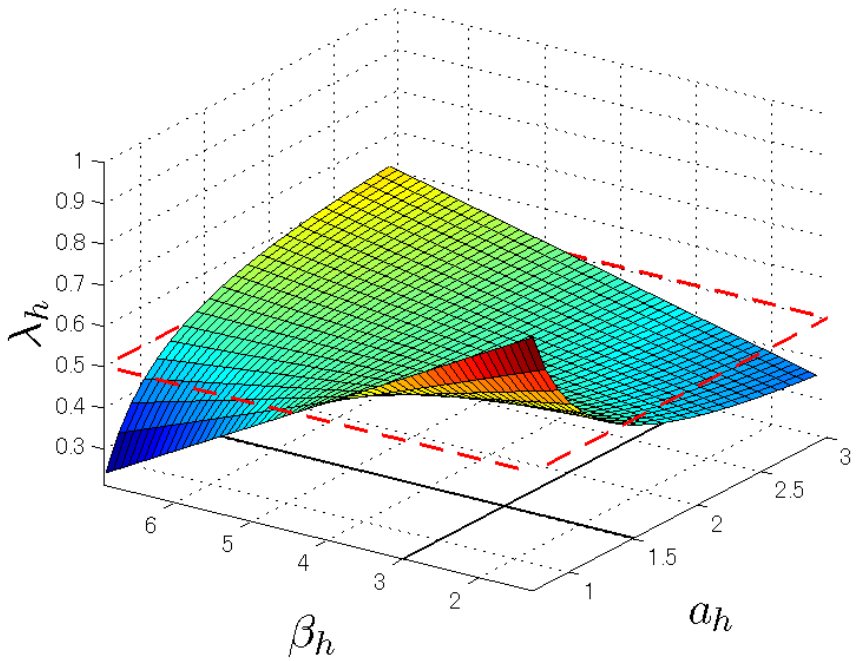

Fig. 5. Location patterns when the welfare weight of the foreign government is small.

Note : $a_f = 1.5,\ \beta_f = 3,\ \tau = 0.2165,\ K = 5,\ L = 5.$

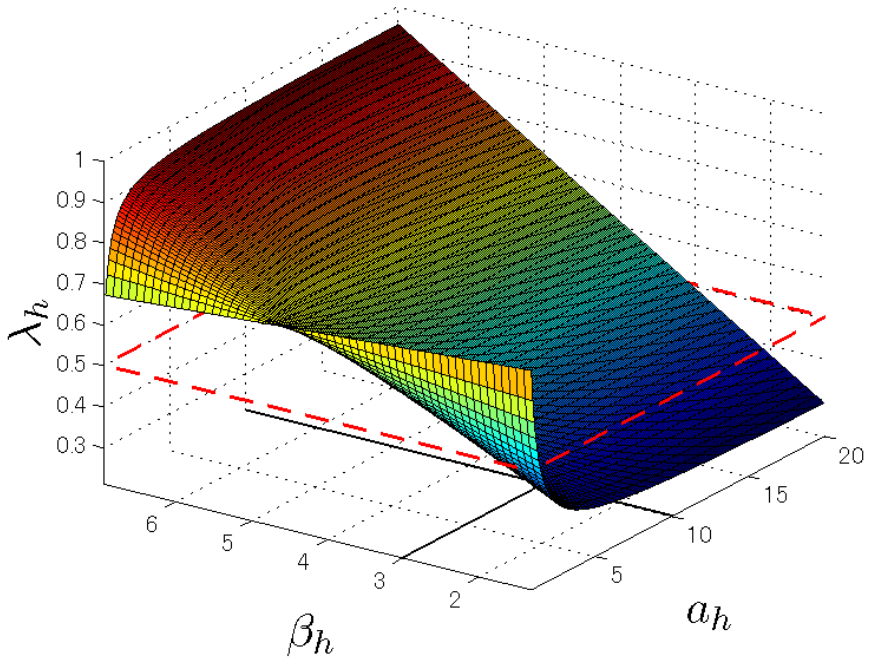

Fig. 6. Location patterns when the welfare weight of the foreign government is large.

Note : $a_f = 10,\ \beta_f = 3,\ \tau = 0.2165,\ K = 5,\ L = 5.$

5 Conclusion

This article has analyzed a tax game between two countries of asymmetric size taking into account a political economic issue. Political process is modeled as a (multiple)Principle(s)-Agent relationship between the governments and the capital owners as in Bernheim and Whinston (1986) and Grossman and Helpman (1994, 1995). It is shown that if at least the government in the smaller country are biased toward the interests of capital owners, the smaller country attracts a more than proportionate share of firms (the reverse home market effect). The important source of the profit of a firm in the smaller country is from exporting to the larger foreign country, while that of a firms in the larger country is from serving the domestic larger market. Therefore, capital owners, who invest in firms in both countries, prefer the concentration of firms in the smaller country in which case the rewards to both capital invested in the smaller country and in the larger country tend to be high. The interests of capital owners are well reflected in the spatial outcome of tax competition if the governments care about the welfare of capital owners heavily.

The reversal of the home market effect is a new insight in the literature of agglomeration and tax competition, where the larger market size or the initial locational advantage is crucial for becoming the winner of competition. The implication that the smaller market size can be an advantage in agglomeration economies when considering politically-biased governments may be helpful in understanding how tax competition works in reality.

References

Baldwin, R. E., Forslid, R., Martin, P., Ottaviano, G. I., and Robert-Nicoud, F. (2003). *Economic Geography and Public Policy*. Princeton University Press, Princeton, NJ.

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

Bellak, C. and Leibrecht, M. (2009). Do low corporate income tax rates attract FDI? – evidence from central- and east european countries. *Applied Economics*, 41(21):2691–2703.

Bernheim, B. D. and Whinston, M. D. (1986). Menu auctions, resource allocation, and economic influence. *Quarterly Journal of Economics*, 101(1):1–31.

Borck, R., Koh, H.-J., and Pflüger, M. (2012). Inefficient lock-in and subsidy competition. *International Economic Review*, 53(4):1179–1204.

Borck, R. and Pflüger, M. (2006). Agglomeration and tax competition. *European Economic Review*, 50(3):647–668.

Bucovetsky, S. (1991). Asymmetric tax competition. *Journal of Urban Economics*, 30(2):167–181.

Drutman, L. (2012). Lobby more, pay less in taxes. Sunlight Foundation, `http://sunlightfoundation.com/blog/2012/04/16/lobby-more-pay-less-in-taxes/`.

Grossman, G. M. and Helpman, E. (1994). Protection for sale. *American Economic Review*, 84(4):833–850.

Grossman, G. M. and Helpman, E. (1995). Trade wars and trade talks. *Journal of Political Economy*, 103(4):675–708.

Haufler, A. and Wooton, I. (2010). Competition for firms in an oligopolistic industry: The impact of economic integration. *Journal of International Economics*, 80(2):239–248.

Kato, H. (2014). The importance of government commitment in attracting firms: A dynamic analysis of tax competition in an agglomeration economy. mimeo, available at SSRN: `http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2374674`.

Kind, H. J., Knarvik, K. H. M., and Schjelderup, G. (2000). Competing for capital in a 'lumpy' world. *Journal of Public Economics*, 78(3):253–274.

Krugman, P. R. (1980). Scale economies, product differentiation and the pattern of trade. *American Economic Review*, 70:950–959.

Ludema, R. D. and Wooton, I. (2000). Economic geography and the fiscal effects of regional integration. *Journal of International Economics*, 52(2):331–357.

OECD (1998). *Harmful Tax Competition: An Emerging Global Issue*. OECD, Paris.

Ottaviano, G. I., Tabuchi, T., and Thisse, J.-F. (2002). Agglomeration and trade revisited. *International Economic Review*, 43(2):409–436.

Ottaviano, G. I. and Ypersele, T. V. (2005). Market size and tax competition. *Journal of International*

Economics, 67(1):25–46.

Thisse, J.-F. (2010). Toward a unified theory of economic geography and urban economics. *Journal of Regional Science*, 50(1):281–296.

Wilson, J. D. (1991). Tax competition with interregional differences in factor endowments. *Regional Science and Urban Economics*, 21(3):423–451.