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資本市場整合對租稅結構與公共支出之影響---一個政治經濟學的觀點(第 2 年)

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計 畫 主 持 人：賴育邦

計畫參與人員：博士班研究生-兼任助理人員：趙珮涵

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中 文 摘 要 ： 本文探討資本移動性提高對租稅政策的影響。本文的特色在於，結合利益團體模型與投票模型。在第一階段，選民決定所得稅稅率。在第二階段，利益團體可以影響資本所得的有效稅率。本文發現，在利益團體不具政治影響力時，較高的資本移動性將導致較低的所得稅稅率。然而，當政策可受到利益團體左右時，中位數選民將考慮利益團體的干擾，將選擇一個較高的所得稅稅率，其將造成較低的資本有效稅率。此結果與若干實證資料相符。

中文關鍵詞： 資本移動、財政政策、利益團體、政治經濟學、租稅競爭

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1 Introduction

How increased globalization affects countries' fiscal policies has been receiving a great deal of attention and debate. Scholars have claimed that globalization enhances the international mobility of factors of production, in particular the mobility of capital, which in turn changes countries' tax structures. Much empirical evidence has found that the increased globalization tends to raise labor taxes and reduce capital taxes (e.g., Rodrik 1998; Bretschger and Hettich 2002; Winner 2005; Adam and Kammas 2007). The conventional wisdom attributes this phenomenon to tax competition among countries for a mobile capital tax base.

The conventional tax-competition model generally assumes that tax policy is determined by a benevolent social planner. This appears inconsistent within the political realm. In democratic countries, tax policy is decided in the process of politics. The voting mechanism is an important device for determining policy. In addition to voting, special interest groups also play an important role in shaping policy. However, most of the political economy literature focuses only on either voting or lobbying, and leaves the interactions between the two aspects unaddressed. This present paper aims to investigate the interaction effects between voting and lobbying on tax policy. In particular, we examine how capital mobility affects tax policy through such effects. As demonstrated below, ignoring the interactions may lead to misguidance in policy-making.

To elaborate on the idea, we consider a large number of identical countries. Each country is populated by residents with the same labor endowment but heterogeneous capital endowments. To finance public expenditures, the government imposes a tax on these two kinds of income at a constant rate. Following the literature, the tax rate is assumed to be determined by a majority vote (Roberts 1977; Meltzer and Richard 1981; Lockwood and Makris 2006). The way in which we deviate from the voting literature is that we incorporate lobbying. Since capital income is more concentrated than labor income, individuals with a relatively abundant capital endowment have an incentive to organize a group to lobby for a preferential tax treatment on capital income. This is consistent with the frequent observation that capital income generally

receives preferential tax treatment.[1] To characterize this feature, we assume that the extent of the exemption of capital income is determined by the policy-maker, whose aim is to maximize the political contributions provided by the lobbying group.

To highlight the effect of capital mobility, we consider the closed-economy regime and the open-economy regime. In the open-economy regime, individuals can invest abroad, As demonstrated below, the openness in the capital market has a significant impact on both the decisions of voting and lobbying, which in turn affect the tax policy.

We construct a three-stage model. In the first stage, all countries simultaneously determine their income tax rates by majority voting. The median voter owns the median capital endowment, which is assumed to be less than the mean of the distribution of capital endowments. In the second stage, the rich people in each country lobby for a preferential treatment on the capital income, which determines the effective capital tax rate. In the third stage, the individuals decide their capital allocation and labor supply.

We acknowledge the possibility that the interest groups may lobby the income tax rate. However, researches have found that legislators tended to reflect the general interest in the final bill, which had high visibility, whereas they were more likely to be affected by particular parties when voting on the technical amendments, which had low visibility (e.g., Hamilton 1997, 2005).[2] Since the visibility of determining the statutory income tax rate is high, and the visibility of determining the effective tax rate of capital income is relatively low, the setting of this present paper appears reasonable.

Within this framework, we first investigate the case without lobbying. In this benchmark case, because of capital mobility, the median voter's marginal benefit from raising the income tax rate (in terms of a larger amount of publicly provided good) in the open economy is smaller than that in the closed economy. Thus, the openness in the capital market leads the median voter to choose a lower tax rate.

However, incorporating the lobby into the model can reverse the above result. The exemption on capital income will increase with the tax rate, because the rich people

[1] Warren Buffett having a lower effective tax rate than his secretary is an example.

[2] Hamilton also finds that legislators were rewarded for their positions on amendments rather than positions on final authorization or general environmental positions.

will lobby for a more preferential tax treatment to offset the increase in the tax rate. The key point is that the rich people exert different degrees of political pressure under the closed economy and the open economy. In the closed economy, the lobbyists are unable to escape tax burdens by investing overseas, so that they will exert a stronger political pressure to reduce the effective capital tax rate. In other words, an increase in the income tax rate reduces the effective capital tax rate to a greater extent in the closed economy. Because of this political effect, the median voter's marginal benefit from raising the income tax rate in the closed economy can be smaller than that in the open economy. As a result, even though the median voter's capital endowment is less than the average level, openness leads the median voter to choose a higher income tax rate. This also implies that the effective tax rate on capital income is lower in the open economy. These results provide a political-economy explanation to the phenomenon that the presence of capital mobility raises the tax burden on labor and mitigates the tax burden on capital income.

It remains a mystery why workers do not vote against the heavier labor tax burden as the economy is open, even when they constitute the majority. Our results may provide a plausible explanation of this phenomenon.

In addition to the empirical studies, this paper is related to several branches of the literature. A vast literature investigates how income taxes are determined by majority voting, including, e.g., Roberts (1977), Meltzer and Richard (1981), Hettich and Winer (1988), and others.[3] Persson and Tabellini (1992), Rodrik and van Ypersele (2001), and Lockwood and Makris (2006) analyze how capital mobility affects tax rates in voting models. Although this present paper considers a similar theme, incorporating the influence of special interest groups into the model distinguishes this present one from these three papers.

Moreover, Haufler (1997), Lorz (1998), and Lai (2010) investigate the effects of capital market integration on taxes by taking the influence of interest groups into consideration. These papers focus on lobbying, and neglect the facet of voting.

Another stream of the related literature is the voting model incorporating lobbying,[4]

[3]Also see Hettich and Winer (1997) for a survey.

[4]There are various lobbying models, see, e.g., Stigler (1971), Peltzman (1976), Hillman (1982),

including Hillman and Ursprung (1988), Austen-Smith (1987), Magee et al. (1989), Baron (1994), Grossman and Helpman (1996), Besley and Coate (2001), and List and Sturm (2006). However, neither stream specifically deals with the effects of capital mobility on the interaction between the voting mechanism and interest groups, which is our main concern.

The remainder of this paper proceeds as follows. In Section 2, we introduce the model underlying the analysis. In Section 3, we determine the effective capital tax. The determination of the income tax rate and the level of government spending is discussed in Section 4. In Section 5, we present the concluding remarks.

2 The model

Our basic setup is close to that of Persson and Tabellini (2000). Suppose that there is a large number (say, m) of identical countries. Each country contains N residents, who are internationally immobile. The individuals in each country have the same preferences and time endowment, but have heterogeneous capital endowments. The preferences of the ith individual are:

$$u^i = y^i + v(x^i) + H(z)\,, \tag{1}$$

where y and x denote private consumption and leisure, respectively, and $v(\cdot)$ is a well-behaved concave utility function. The variable z is the per capita supply of the publicly provided good. The function H has the properties that $H' > 0$ and $H'' < 0$ for all non-negative z, and also $\lim_{z\to 0} H'(z) = \infty$.

Each individual is endowed with a unit of time, and allocates the time between leisure and labor (ℓ):

$$x^i + \ell^i = 1. \tag{2}$$

All labor income is subject to income tax at rate t, and the income tax rate t lies between a positive minimum value $t_{\min}$, and a maximum level $t_{\max}$, which is not greater than unity. The wage rate is assumed to be unity, and thus the net labor income is equal to $(1-t)\ell^i$.

Becker (1983), Grossman and Helpman (1994), Dixit et al. (1997), and also see Austen-Smith (1997) and Helpman (1997) for surveys of related papers.

The ith individual also owns a capital endowment κ^i.[5] It will prove convenient in what follows to express κ^i as $\kappa + e^i$, where κ is the mean of the distribution of the capital endowment. The variable e^i is distributed in the population with zero mean, negative median and bounded support inside the interval $[-1, 1]$.

Following the setting of Persson and Tabellini (2000), the gross return to investment is assumed to be unity. Capital income is taxed according to the source principle at the effective rate of τ. The effective tax rate on capital income depends on both the statutory tax rate and the size of the tax base, which is related to various tax exemptions and tax deductions. We denote λ as the measure of the proportion of capital income subject to tax, and bound λ so that it must lie between some minimum level, $\lambda_{\min} > 0$, and unity. Thus, the effective capital tax rate τ can be expressed as λt. The determination of λ is discussed in Section 3.

In the case of an open economy, individuals can invest abroad. Foreign investment, however, carries some mobility costs, which refer to the extra transaction and information costs associated with investing abroad. The net capital income of the ith individual is given by:

$$(1-\tau)k^i + (1-\tau^*)f^i - M(f^i)\,, \tag{3}$$

where f^i is the foreign investment, $k^i = \kappa^i - f^i$ is the domestic investment, and τ^* denotes the foreign tax rate.[6] The mean of all residents' domestic investment is denoted by k. The mobility costs are denoted by $M(\cdot)$, with the properties that $M(0) = 0$, $M' > 0$ if $f > 0$, and $M'' > 0$. We note that due to the mobility costs, foreign investment is equal to zero in the symmetric equilibrium.

Taking together the two sources of income, the ith individual's private budget

[5] In Section 5, we briefly discuss the case of endogenous saving decisions, where κ^i is endogenously determined.

[6] More precisely, for the ith individual in country 1, foreign investment is equal to $f^i = \sum_{j=2}^m f_j^i$, where f_j^i is the ith individual's investment in country j. Moreover, his net income from foreign investment is equal to $\sum_{j=2}^m (1-\tau_j) f_j^i$, where τ_j is country j's capital tax rate. Since all countries' capital tax rates are the same in equilibrium, for ease of exposition, we denote $\tau_j = \tau^*$ for all j. Thus, the ith individual's net income from foreign investment can be expressed as $(1-\tau^*)\sum_{j=2}^m f_j^i$, which is equal to $(1-\tau^*)f^i$.

constraint in the open economy is given by:

$$\begin{aligned} y^i &= (1-t)\ell^i + (1-\tau)k^i + (1-\tau^*)f^i - M(f^i) \\ &= (1-t)\ell^i + (1-\tau)\kappa^i + (\tau-\tau^*)f^i - M(f^i)\,. \end{aligned} \tag{4}$$

In the closed economy, since individuals are restricted to investing domestically, f^i is equal to zero. Thus, the ith individual's private budget constraint becomes:

$$y^i = (1-t)\ell^i + (1-\tau)k^i\,. \tag{5}$$

Then we turn to the individual's decisions on labor supply and investment. Solving the ith individual's optimization problem gives the following expression for his optimal labor supply:

$$\ell^i = \ell(t), \quad \text{for all } i. \tag{6}$$

where $\ell(t) = 1 - v'^{-1}(1-t)$. The concavity of $v(\cdot)$ implies that $\partial\ell/\partial t < 0$. Note that the identical time endowment ensures that all individuals' labor supply is the same.

In the open economy, the optimization of the ith individual implies that the investment abroad is as follows:

$$f^i = M'^{-1}(\tau - \tau^*). \tag{7}$$

Equation (7) shows that the foreign investment is the same for every individual, i.e., $f^i = f^j = f$, irrespective of how wealthy he is. The comparative-static exercise reveals that $\partial f/\partial\tau = -\partial f/\partial\tau^* = 1/M'' > 0$, namely, the foreign investment increases with τ but decreases with τ^*.

Individual i's domestic investment k^i is equal to:

$$k^i = \kappa^i - f^i = \kappa + e^i - f\,. \tag{8}$$

The domestic investment differs across individuals by the term e^i. The above equation also shows that $\partial k^i/\partial\tau = \partial k^j/\partial\tau$, both of which are equal to $-\partial f/\partial\tau < 0$, indicating that an increase in τ has the same degree of adverse impact on all individuals' domestic investment.

In the closed economy, the ith individual's domestic investment is restricted to $k^i = \kappa^i$. The comparative-statics exercise indicates that

$$\frac{\partial k^i}{\partial\tau} = 0\,. \tag{9}$$

The tax revenues are used to finance the provision of z. In the open-economy scenario, the per capita government budget constraint is:

$$z = t\ell + \tau k + \tau F^*/N\,. \tag{10}$$

The variable F^* is the investment from abroad. An increase in τ reduces F^*, i.e., $\partial F^*/\partial \tau < 0$. In the closed-economy scenario, since the foreign investment is prohibited, the government budget constraint becomes

$$z = t\ell + \tau k\,. \tag{11}$$

As indicated previously, in the symmetric equilibrium of the open economy, the mobility cost of capital leads k^i to equal κ^i, and F^* becomes zero.[7] In other words, although the capital markets are integrated, no capital reallocation takes place. Bretschger and Hettich (2002) argue that an adequate measure of openness should refer to the potential to move capital abroad rather than actual capital flows. Thus, the result that openness does not cause capital to be reallocated is not so odd as it first seems. Moreover, we note that in spite of (10) having the same expression as (11) in the symmetric equilibrium, the effects of policy changes on the provision of z with capital mobility are quite different from those without capital mobility. This distinction is important in the analysis that follows.

3 The lobbying game

In this model, events unfold as follows. First, all countries simultaneously determine their income tax rates (t) by majority voting. Secondly, a group organized by rich people in each country lobbies for the proportion of capital income subject to tax, λ. Finally, given λ and t, individuals in all countries simultaneously decide their capital allocation and labor supply, and all the governments provide the public goods.

One might ask why the capitalists do not lobby for lower income tax rate. As indicated in the Introduction, since the (statutory) income tax rate has high visibility,

[7] As indicated by Lewis (1995), there is much evidence to show that "domestic investors continue to hold almost all of their wealth in domestic assets" (p. 1914). Therefore, zero foreign investment in the symmetric equilibrium may not be far from the real world situation.

it would be much more costly for the capitalists to lobby for the tax rate than to lobby for λ. Thus, we specify that the capitalists only lobby for λ.

To obtain a subgame perfect Nash equilibrium, we solve the game backwards. In Section 2, we have obtained the decisions of the individuals in stage 3, and now we move on to the second stage.

With (4) and the results obtained in Section 2, the ith individual's gross-of-contributions utility function is given by:

$$u^i = (1-t)\ell + v(1-\ell) + (1-\tau)(\kappa + e^i) + (\tau - \tau^*)f - M(f) + H(z)\,. \tag{12}$$

This utility function is linear in the parameter e^i, so that it belongs to the class of intermediate preferences (Grandmont, 1978). Thus, individuals' preferences for the tax rate are single-peaked, and their ideal tax rate can be sorted by the parameter e^i.

Equation (12) shows that the benefit of reducing λ is positively related to individuals' capital endowments, so that rich people have a stronger incentive to lobby for a smaller λ.[8] Thus, we assume that people with abundant capital endowments organize a group to lobby for a preferential tax treatment on capital income.[9] If lobbying did not exist, then a default of λ would be implemented. To fix the idea, we assume that the default value of λ is equal to unity, meaning that the two kinds of income are subject to the same tax treatment.

Specifically, suppose that there is a positive critical level of e, e^κ, such that an individual whose capital endowment is greater than e^κ will join the lobbying group. We define L as the set that consists of individuals whose capital endowment is greater than e^κ. Assuming e^κ to be greater than zero implies that κ^κ is greater than κ, the mean of the distribution of the capital endowment. The cardinality of the set L is n^κ, which is less than N.

[8]Partially differentiating (12) with respect to λ gives $-t(\kappa + e^i - f) < 0$. This shows that the ith individual's utility decreases with λ, and that the adverse impact of λ on his utility is positively related to e^i.

[9]The model does not explain the process of lobby formation; see, e.g., Mitra (1999) for endogenous lobby formations. Although we do not discuss the process of lobby formation, we can think of the situation that each member of the lobbying group need to pay an organization cost δ. For the individuals with abundant capital endowment, the benefit from a decline in λ is larger than δ. For other people, δ exceeds the benefit from a decline in λ. This can justify why only individuals with abundant capital endowments will engage to lobbying.

The political contributions are assumed to be evenly shared by the members of the organized group. Thus, if $i \in L$, then individual i's net utility function is equal to $u^i - c$, where c denotes the political contributions borne by each member of the lobbying group. If $i \notin L$, then individual i's net utility function is given by (12).

Moreover, if individual i is a member of the lobbying group, then his domestic investment becomes $k^i = \kappa^i - c - f^i$. Because the lobbying decision occurs in the earlier stage, individual i treats c as given when making the investment decision.

We also assume that the difference between e^κ and e', the maximum value of e owned by the individuals who are not in L, is so large that the situation where $e^\kappa - c < e'$ does not exist. This assumption guarantees that the net capital income of each member of the lobbying group is greater than the capital income of any non-member.

It will prove convenient in what follows to express the aggregate welfare of the lobbyists. The aggregate gross-of-contributions welfare of the lobbyists is given by

$$\begin{aligned} W^\kappa &= \sum_{j \in L} u^j \\ &= n^\kappa[(1-t)\ell + v(1-\ell) + (\tau - \tau^*)f - M(f) + H(z)] + (1-\tau)\left[n^\kappa \kappa + \sum_{j \in L} e^j\right]. \end{aligned} \tag{13}$$

The lobbyists' welfare depends on the two policy variables, λ and t, and we express W^κ as $W^\kappa(\lambda, t)$.[10]

The lobbyists seek to influence λ by offering a contribution schedule $C(\lambda; t)$ to the policy-maker.[11] The contribution schedule $C(\lambda; t)$ maps every λ into a level of political contribution. Since t is determined in stage one, the contribution schedule is conditional on t. The lobbyists aim at maximizing their net welfare, $V^\kappa = W^\kappa - C$, and the goal of the policy-maker is to maximize the political contributions $C(\cdot)$ by choosing λ.

Whether the lobbyists contribute depends on the relationship between $V^\kappa(\lambda < 1, t)$ and $V^\kappa(\lambda = 1, t)$, namely, the welfare of the organized group in the case without

[10] Since there are a large number of countries, individuals take the foreign tax rates as given, and we omit these variables in the expression.

[11] Thus, c is equal to $C(\cdot)/n^\kappa$.

lobbying.[12] If $V^\kappa(\lambda < 1, t) \leq V^\kappa(\lambda = 1, t)$, then the lobbyists are not willing to contribute, and the equilibrium λ is set at unity. On the other hand, if $V^\kappa(\lambda < 1, t) > V^\kappa(\lambda = 1, t)$, then the lobbyists are willing to contribute. The former situation serves as a benchmark case, and the latter one is our focus. In Section 4, we show that the two scenarios can lead to opposite voting results.

The political contribution schedule is assumed to be differentiable, at least around the equilibrium point λ°. The maximization of $C(\cdot)$ for the policy-maker requires the first-order condition: $\partial C(\lambda^\circ; t)/\partial\lambda = 0$. Moreover, according to Grossman and Helpman (1994), the contribution schedule is *locally truthful* around the equilibrium point. In other words, around the equilibrium point, the lobbyists set their contribution schedule so that the marginal change in the contribution for a small change in λ equals the impact on the lobbyists' gross welfare of the policy change. More precisely,[13]

$$\frac{\partial C^\circ(\lambda^\circ; t)}{\partial\lambda} = \frac{\partial W^\kappa(\lambda^\circ, t)}{\partial\lambda}\,. \tag{14}$$

Combining (14) with the condition that $\partial C(\lambda^\circ; t)/\partial\lambda = 0$ gives $\partial W^\kappa(\lambda^\circ, t)/\partial\lambda = 0$, which characterizes the equilibrium λ.

According to (14), we can refer to $\partial W^\kappa/\partial\lambda$ as the lobbyists' political pressure to lobby λ. Differentiating (13) with respect to λ gives the lobbyists' political pressure as follows:

$$\frac{\partial W^\kappa}{\partial\lambda} = -n^\kappa t\hat{k} + n^\kappa H'\frac{\partial z}{\partial\lambda}\,, \tag{15}$$

where $\hat{k} = \sum_{j\in L} k^j/n^\kappa$ denotes the mean of the lobbyists' domestic investment.

The first term on the right-hand side of (15) measures the effect of λ on the private consumption, which we refer to as the *private-consumption effect*. Since a reduction in λ increases the capitalists' net capital income and thus their private consumption,

[12] Since the organized group is not willing to contribute when λ is set at unity, $V^\kappa(\lambda = 1, t)$ is equal to $W^\kappa(\lambda = 1, t)$.

[13] According to Grossman and Helpman (1994), $\{C^\circ, \lambda^\circ\}$ is a subgame-perfect Nash equilibrium of the lobbying game, if (i) λ° maximizes $C^\circ(\lambda; t)$, and (ii) λ° maximizes $V^\kappa(\lambda, t) + C^\circ(\lambda; t)$. Condition (i) stipulates that, given the contribution schedule provided by the lobbyists, the policy-maker chooses λ to maximize political contributions received. Condition (ii) states that the equilibrium λ should maximize the joint welfare of the lobbyists and the policy-maker. Condition (i) implies that $\partial C^\circ(\lambda^\circ; t)/\partial\lambda = 0$, and condition (ii) implies that $\partial V^\kappa(\lambda^\circ, t)/\partial\lambda + \partial C^\circ(\lambda^\circ; t)/\partial\lambda = 0$. Taken together, the two conditions ensure that $\partial V^\kappa(\lambda^\circ, t)/\partial\lambda = 0$. Because $V^\kappa(\cdot) = W^\kappa(\cdot) - C(\cdot)$, we immediately have (14).

the private-consumption effect is negative. This effect induces the organized group to lobby for a lower λ under both cases of an open economy and a closed economy.

The second term reflects the welfare effect of λ on the publicly provided good, which depends on $\partial z/\partial\lambda$. We refer to this effect as the *public-consumption effect*. In the open economy, $\partial z/\partial\lambda$ is equal to:

$$\frac{\partial z}{\partial \lambda} = tk(1-\varepsilon) + \frac{tF^*}{N} + t\frac{\tau}{N}\frac{\partial F^*}{\partial \tau}\,, \tag{16}$$

where $\varepsilon = -(\partial k/\partial\tau)\cdot(\tau/k) \geq 0$ is the demand elasticity of k with respect to τ. We assume that ε is less than unity to ensure that the economy is on the upward-sloping part of the Laffer curve.[14] Recall that F^* is equal to zero in equilibrium. Although the first and the third terms in (16) have the opposite signs, we focus on the case where the term on the domestic investment is dominant, implying that $\partial z/\partial\lambda > 0$ and the public-consumption effect is positive.[15] The positive public-consumption effect induces the lobbyists to lobby for a higher λ.

In the closed economy, the absence of capital mobility implies that $\varepsilon = 0$ and $F^* = 0$, which gives:

$$\frac{\partial z}{\partial \lambda} = tk\,. \tag{17}$$

Two things should be noticed. First, the public-consumption effect causes the organized group to lobby for a higher λ, regardless of whether the economy is open or closed. Secondly, comparing (17) with (16) reveals that, because of capital mobility, the positive effect of λ on z in the open economy is smaller than that in the closed economy.

To maximize the political contributions received, the policy-maker should balance the private-consumption effect and the public-consumption effect, as indicated in (14). We focus on the case with an interior solution. Inserting (16) into (15) gives the first-order condition for λ° in the open economy as follows:

$$\frac{\partial W^\kappa}{\partial \lambda} = tn^\kappa \left\{ -\hat{k} + H'\left[k(1-\varepsilon) + \frac{\tau}{N}\frac{\partial F^*}{\partial \tau} \right] \right\} = 0\,. \tag{18}$$

[14] Much of the literature estimates the elasticity of foreign direct investment with respect to the tax treatment as being about -0.6 (see, e.g., the survey of Hines (1999)), which justifies this assumption.

[15] The situation $\partial z/\partial\lambda < 0$ seems less likely to occur, and it leads (15) to be negative, indicating that the organized group will lobby for $\lambda_{\min}$, so that an interior solution for λ is ruled out.

Since the tax rate is determined in the first stage, the equilibrium λ depends on t, as shown in (18). The effect of t on λ° plays an important role in determining the tax rate, which becomes clear in the next section.

By solving the first-order condition, we obtain H' in the open-economy equilibrium as follows:

$$H'(z) = \frac{\hat{k}}{k(1-\varepsilon) + \frac{\tau}{N}\frac{\partial F^*}{\partial \tau}}\,. \tag{19}$$

The variable H' can be interpreted as the marginal rate of substitution between the public consumption and the private consumption.

The first-order condition for λ° in the closed economy is given by:

$$\frac{\partial W^\kappa}{\partial \lambda} = tn^\kappa \left[-\hat{k} + H'k\right] = 0\,. \tag{20}$$

Solving (20) gives H' in the closed-economy equilibrium as follows:

$$H'(z) = \frac{\hat{k}}{k}\,. \tag{21}$$

We are concerned with the relationship for λ under the two regimes. Comparing (20) with (18) shows that, with a given t, the private-consumption effect is the same under the two regimes,[16] whereas the public-consumption effect is smaller in the open economy, because of the capital mobility.[17] This implies that, other things being the same, the equilibrium λ is smaller in the open economy. Thus, we have the following result:

Proposition 1. *Other things being equal, openness results in a greater extent of exemption of the capital income, i.e., a smaller* λ.

4 The effects of openness

4.1 The voting equilibrium

In this section we move on to the first stage, in which the income tax rate is determined by a majority vote. One may wonder why the tax base or the effective tax rate of the

[16] The private-consumption effect is equal to $-tn^\kappa \hat{k}$, and we recall that $\hat{k}$ is the same under the equilibrium of the open economy and the closed economy.

[17] Given that t and λ give rise to the same level of z, and thus the same H' in the equilibrium of the two cases. This result together with (16) and (17) shows that the public-consumption effect is smaller in the open economy.

capital income is not determined trough a majority voting. We should know that the statutory tax rate is relatively easy to understand, while the effective tax rate is not. The effective tax rate depends on a number of technical details, so that it is nearly impossible to determine the effective tax rate through a majority voting. This may justify why only the tax rate is determined through voting.

As indicated previously, individuals' preferences for the income tax rate can be sorted by the parameter e^i. Because of this, the median voter theorem shows that the outcome of a majority vote reflects the preferences of the individual with the median e, which is denoted by e^m. We have assumed that $e^m < 0$ and $e^\kappa > 0$, which implies that the median voter does not join the lobbying group.

The median voter anticipates that his decision will affect the lobbyists' behavior. Thus, when deciding the ideal tax rate, t^m, the median voter will take the effect of t on λ° into consideration. The ideal tax rate of the median voter can be solved by maximizing u^m, subject to $\lambda^\circ(t)$. Given $\lambda^\circ(t)$, differentiating u^m with respect to t gives the following equation:

$$\frac{du^m}{dt} = \frac{\partial u^m}{\partial t} + \frac{\partial u^m}{\partial \lambda}\frac{\partial \lambda^\circ}{\partial t} = -\ell - (\lambda + t)k^m + H'\frac{dz}{dt}\,. \tag{22}$$

The first two terms on the right-hand side of (22) reflect the decline in the private consumption due to an increase in t. These two terms can be regarded as the marginal cost of raising t for the median voter. On the other hand, the last term on the right-hand side of (22) measures the change in the public consumption associated with an increase in t. This term represents the median voter's marginal benefit from raising t. Given $\lambda^\circ(t)$, the total effect of t on z is given by:

$$\frac{dz}{dt} = \frac{\partial z}{\partial t} + \frac{\partial z}{\partial \lambda}\frac{\partial \lambda^\circ}{\partial t}\,. \tag{23}$$

To highlight the effect of lobbying, let us first examine a benchmark case where there is no lobbying, so that the default value of λ, $\lambda = 1$, is implemented. In this case, since the indirect effect of t on λ is zero, dz/dt is equal to $\partial z/\partial t$. In the open economy, the effect of t on z is given by:

$$\frac{\partial z}{\partial t} = \ell(1-\eta) + \lambda k(1-\varepsilon) + \frac{1}{N}F^* + \frac{t}{N}\frac{\partial F^*}{\partial \tau}\,, \tag{24}$$

where $\eta = -(\partial \ell / \partial t) \cdot (t/\ell) > 0$ is the elasticity of labor supply with respect to t. The elasticity of labor supply is assumed to be less than unity, which is consistent with the empirical findings. Inserting (24) into (22) and solving the first-order condition for the median voter's ideal tax rate gives the following result:

$$H'(z) = \frac{\ell + k^m}{\ell(1-\eta) + \lambda k(1-\varepsilon) + \frac{t}{N}\frac{\partial F^*}{\partial \tau}} \,. \tag{25}$$

In the closed economy, the effect of t on z is given by:

$$\frac{\partial z}{\partial t} = \ell(1-\eta) + \lambda\kappa \,. \tag{26}$$

We solve H' as follows:

$$H'(z) = \frac{\ell + k^m}{\ell(1-\eta) + \lambda k} \,. \tag{27}$$

Comparing (25) with (27) shows that the equilibrium z in the open economy (denoted by z_{op}) is smaller than that in the closed economy (denoted by z_{cl}), because $H'(z_{op}) > H'(z_{cl})$ and $H''(\cdot) < 0$. Since in the equilibrium (10) and (11) have the same expression, we obtain $t = z/(\ell + k)$, so that the relationship $z_{cl} > z_{op}$ ensures that the equilibrium t in the closed economy (t_{cl}) is greater than the equilibrium t in the open economy (t_{op}). This implies that, in the absence of lobbying, openness leads to the median voter choosing a lower tax rate.

Proposition 2. *In the absence of lobbying, the equilibrium tax rate in the open economy is lower than that in the closed economy; in other words, openness leads to a lower tax rate.*

The intuition underlying this result is as follows. As indicated in (22), the marginal cost of raising t is the same under both the open-economy equilibrium and the closed-economy equilibrium. The marginal benefit from raising t in the open economy is smaller than that in the closed economy, because capital mobility results in a smaller amount of tax revenue from raising t. A smaller marginal benefit leads the median voter to choose a lower tax rate in the open economy.

We then turn to the scenario where λ is subject to lobbying, which implies that λ° depends on t. Again, we begin with the case of an open economy. The effect of t on

λ° in the open economy is given as follows:[18]

$$\frac{\partial \lambda^\circ}{\partial t} = \left(\frac{-1}{t\beta}\right)\left\{\lambda\beta + \left[k(1-\varepsilon) + \frac{\tau}{N}\frac{\partial F^*}{\partial \tau}\right]\ell(1-\eta)H''\right\}, \tag{28}$$

where

$$\begin{aligned}\beta &= \frac{1}{n^\kappa t^2}\frac{\partial^2 W^\kappa}{\partial \lambda^2} \\ &= \left\{-\frac{\partial k}{\partial \tau} + H'\left[(1-\varepsilon)\frac{\partial k}{\partial \tau} + \frac{1}{N}\frac{\partial F^*}{\partial \tau} + \frac{\tau}{N}\frac{\partial^2 F^*}{\partial \tau^2}\right] + \left[k(1-\varepsilon) + \frac{\tau}{N}\frac{\partial F^*}{\partial \tau}\right]^2 H''\right\}.\end{aligned}$$

The second-order condition for the median voter's optimization requires that β be negative. With $\partial z/\partial \lambda > 0$, the sum of the terms in the curly brackets of (28) is less than zero, and thus $\partial \lambda^\circ/\partial t$ is negative.

The negative relationship between t and λ° can be explained as follows. An increase in t unambiguously enlarges the private-consumption effect,[19] causing the policy-maker to choose a lower λ. On the other hand, the effect of t on the public-consumption effect, $n^\kappa H' \cdot \partial z/\partial \lambda$, is ambiguous. The comparative-static result shows that the increase in the private-consumption effect is dominant, and thus λ° decreases with t.

Inserting (16), (24), and (28) into (23) gives the total effect of t on z as follows:

$$\frac{dz}{dt} = \underset{(-)}{\left[\frac{\ell(1-\eta)}{\beta}\right]}\left\{\underset{(-)}{[(1-\varepsilon)H' - 1]}\frac{\partial k}{\partial \tau} + \underset{(-)}{H'}\ \underset{(+)}{(1+\psi)}\underset{(-)}{\left(\frac{1}{N}\frac{\partial F^*}{\partial \tau}\right)}\right\}, \tag{29}$$

where

$$\psi = \frac{\partial(\partial F^*/\partial \tau)}{\partial \tau}\frac{\tau}{\partial F^*/\partial \tau}.$$

Unlike in the benchmark case, the presence of lobbying leads the effect of t on z to be ambiguous. In addition to the direct effect, $\partial z/\partial t > 0$, an increase in t also induces the policy-maker to choose a lower λ, which in turn reduces the tax revenues. This indirect effect works against the direct effect of raising t, giving rise to an ambiguous sign of dz/dt.[20]

[18]The effect of t on λ° can be derived by totally differentiating (18), which gives $\partial \lambda^\circ/\partial t = -(\partial^2 W^\kappa/\partial \lambda \partial t)/(\partial^2 W^\kappa/\partial \lambda^2)$. The second derivative of W^κ with respect to λ is equal to $t\beta$, and $\partial^2 W^\kappa/\partial \lambda \partial t$ is equal to the terms in the braces of (28).

[19]Differentiating $n^\kappa t\hat{k}$ with respect to t gives $n^\kappa \hat{k}[1 + (\partial \hat{k}/\partial \tau)(\tau/\hat{k})]$. The relationships that $\varepsilon = (\partial k/\partial \tau)(\tau/k) < 1$, $\partial \hat{k}/\partial \tau = \partial k/\partial \tau$, and $\hat{k} > k$ imply the above equation is positive, indicating that $n^\kappa t\hat{k}$ increases with t.

[20]In Appendix 1, we show that if $M''' \geq 0$ or $|\psi| < 1$, then dz/dt is greater than zero.

With (29), we can now derive the equilibrium tax rate by using (22). Inserting (29) into (22) brings about three possible results. First, dz/dt is positive, and the marginal benefit from raising t is so large that an interior solution of t exists. In this case, t^m is greater than $t_{\min}$. Secondly, dz/dt is positive, whereas the marginal benefit from raising t is not large enough to outweigh the marginal cost. Thirdly, dz/dt is equal to or less than zero. In the last two scenarios, the median voter's welfare decreases with t, and thus t^m is equal to $t_{\min}$.

Then we move on to the case of the closed economy. Comparing the equilibrium t under the two cases reveals the effect of openness on the tax structure. As in the case of the open economy, dz/dt is essential to the determination of t. The direct effect of t on z has been given in (26). Moreover, the effect of t on λ° becomes:[21]

$$\frac{\partial \lambda^\circ}{\partial t} = \left(\frac{-1}{t\beta}\right)\left[\lambda\beta + k\ell(1-\eta)H''\right], \tag{30}$$

where

$$\beta = \frac{1}{n^\kappa t^2}\frac{\partial^2 W^\kappa}{\partial \lambda^2} = k^2 H'' < 0\,.$$

Equation (30) reveals that λ° decreases with t. The reasoning behind this result is similar to that in the open economy, and we do not repeat it here.

Then, inserting (17), (26), and (30) into (23) gives the total effect of t on z as follows:[22]

$$\frac{dz}{dt} = \ell(1-\eta) + \lambda k - (tk)\left[-\frac{\lambda}{t} - \frac{\ell(1-\eta)}{tk}\right] = 0\,. \tag{31}$$

Equation (31) shows that the indirect effect of t on z exactly offsets the direct effect, and thus the amount of z is invariant with t,[23] which implies that the marginal benefit from raising t is equal to zero. This result along with a positive marginal cost of increasing t leads the median voter to choose the tax rate at the level of $t_{\min}$ in the closed economy.

Taken together, the equilibrium tax rate under the two regimes gives rise to two possible outcomes. First, $t_{op} > t_{\min}$ and $t_{cl} = t_{\min}$. This outcome reveals that openness

[21] Inserting $F^* = 0$, $\varepsilon = 0$, and $\partial k/\partial \tau = 0$ into (28) gives (30).

[22] Alternatively, we can obtain the same result by inserting $\varepsilon = 0$, $\partial k/\partial \tau = 0$, and $\partial F^*/\partial \tau = 0$ into (29), because the absence of capital mobility eliminates these two terms.

[23] This result is due to the fixed capital stock. If the capital stock is an endogenous variable, then dz/dt may not be equal to zero in the closed economy. We briefly discuss this issue in Section 5.

leads the median voter to choose a higher tax rate, which is opposite to the result in the case without lobbying. The opposite result occurs because the indirect effect offsets the direct effect of t on z. In the closed economy, the lobbyists are unable to escape the increased tax burdens by investing abroad, which results in a larger decline in private consumption.[24] As a result, the larger decline in the private consumption leads the lobbyists to exert a greater downward political pressure on λ in the closed economy.[25] This result along with the larger effect of λ on z, which is due to the absence of capital mobility, brings about a smaller marginal benefit of raising t for the median voter in the closed economy. In other words, when we consider the influence of lobbying, capital mobility enlarges, rather than reduces, the marginal benefit of raising t for the median voter, and thus openness results in a higher tax rate.

We are also concerned with the effect of t on the effective capital tax rate. The effective capital tax rate is the product of t and λ. Although an increase in t indirectly lowers τ through reducing λ, it also directly increases τ, and thus the net effect of t on τ needs further exploration. The net effect of t on τ is given as follows:

$$\frac{d\tau^{\circ}}{dt} = \lambda + t\frac{\partial\lambda^{\circ}}{\partial t} = \left(\frac{-1}{\beta}\right)\left[k(1-\varepsilon) + \frac{\tau}{N}\frac{\partial F^{*}}{\partial \tau}\right]\ell(1-\eta)H''\,. \tag{32}$$

The sign of (32) is generally ambiguous, whereas comparing (32) with (16) shows that $d\tau^{\circ}/dt$ and $\partial z/\partial\lambda$ have opposite signs.[26] Since $\partial z/\partial\lambda > 0$ is the regular case, $d\tau^{\circ}/dt$ seems more likely to be negative. As a result, an increase in t reduces the effective capital tax rate.

The second possible outcome is that t_{op} and t_{cl} are the same, and both are equal to $t_{\min}$. Although the income tax rate is the same under the two regimes, Proposition 1 has shown that λ in the open economy is smaller than that in the closed economy, indicating that openness reduces the effective tax rate on capital income.

We also note that in these two outcomes of the income tax rate, openness unambiguously results in a smaller ratio of the effective capital tax rate and the labor tax

[24] For the lobbyists, the decline in the private-consumption effect in the closed economy is $n^{\kappa}\hat{k}$, and that in the open economy is $n^{\kappa}\hat{k}(1-\varepsilon)$.

[25] Since the effect of t on the public-consumption effect is ambiguous, and dz/dt has the same sign as the effect of t on the private-consumption effect, we focus on the effect of t on the private-consumption effect in the explanation.

[26] In equilibrium, (32) can be rewritten as $(-1/\beta)\cdot\partial z/\partial\lambda\cdot\ell(1-\eta)H''$. Given $\beta<0$ and $H''<0$, $d\tau^{\circ}/dt$ and $\partial z/\partial\lambda$ have opposite signs.

rate (τ/t). This implies a change in the tax-mix from the relatively elastic capital tax base to the relatively inelastic labor tax base. This finding is consistent with the empirical evidence provided by, e.g., Adam and Kammas (2007) and Schwarz (2007). Although the conventional normative explanation arrives at the same prediction, we provide an alternative explanation to this phenomenon by accounting for the political effect. The setting seems more consistent within the political realm.

We summarize the above results as follows:

Proposition 3. *Openness may increase the income tax rate (t) and reduce the effective tax rate on capital income (τ). Moreover, openness results in a smaller ratio of the effective capital tax rate and the labor tax rate (τ/t).*

5 Concluding remarks

The effects of openness on tax policy have become the focus of much debate. Much of the existing political-economy literature deals with this issue by specifying that tax policy is determined by a majority voting mechanism. In addition to the voting mechanism, we believe that special interest groups also play an important role in shaping tax policy. To elaborate on this notion, we incorporate a special interest group into the voting model, and highlight the interaction effects of voting and lobbying on the tax policy.

In the case without lobbying, capital mobility reduces the marginal benefit from raising the tax rate, inducing the median voter to choose a lower tax rate. The opposite outcome may occur in the presence of lobbying. Capital mobility weakens the political pressure exerted by the rich people to enlarge the exemption on the capital income, because they can avoid the tax burden by investing abroad. This may cause the marginal benefit from increasing the tax rate in the open economy to be greater than that in the closed economy. If so, then openness results in a higher tax rate, which in turn lowers the effective tax rate on capital income. This result, which seems consistent with the political realm, provides a plausible explanation for the empirical evidence.

We have assumed that the capital endowments of individuals are fixed. An extension of this paper is to endogenize individuals' saving decisions. Suppose that indi-

vidual i receives an endowment $1 + e^i$. The sequence of events is the same as before, except that individuals can decide how much of the endowments to consume, and the remainder is the saving, which constitutes the capital endowment in the basic model. In addition to lobbying for a large exemption on the capital income, this modification provides individuals with an alternative way to decrease their tax burdens in the closed economy, that is, they can save less to lower their tax burdens. Thus, the endogenous saving decision reduces the organized group's political pressure to lower λ. Unlike in the case with fixed capital endowments, the tax revenues are no longer independent of the tax rate in the closed economy, because of the smaller political pressure. This brings about a positive marginal benefit from increasing the tax rate. In spite of this, it is still possible that the marginal benefit in the open economy is greater than that in the closed economy, because individuals have more options to evade tax burdens in the open economy. As a result, the results remain qualitatively unchanged with this modification.

Appendix

1. *If $M''' \geq 0$ or $|\psi| < 1$, then dz/dt is greater than zero.*

   Proof. In (29), the signs of two terms are ambiguous: $(1-\varepsilon)H' - 1$ and ψ. Inserting (25) into $(1-\varepsilon)H' - 1$ gives

   $$(1-\varepsilon)H' - 1 = \frac{(\hat{k} - k)(1-\varepsilon) - \frac{\tau}{N}\frac{\partial F^*}{\partial \tau}}{k(1-\varepsilon) + \frac{\tau}{N}\frac{\partial F^*}{\partial \tau}}\,. \tag{33}$$

   The denominator of (33) is positive by assumption. The facts that $\hat{k} > k$ and $\partial F^*/\partial \tau < 0$ imply that the numerator is positive. Thus, $(1-\varepsilon)H' - 1$ is greater than zero.

   As to the sign of ψ, recall that $F^* = Nf^*$ and $\partial f^*/\partial \tau = -1/M''$. Thus, $\partial(\partial F^*/\partial \tau)/\partial \tau = -NM'''/(M'')^3$. If $M''' \geq 0$, then $\psi \geq 0$. With $\psi \geq 0$ and $(1-\varepsilon)H' - 1$ being greater than zero, dz/dt is positive. On the other hand, if $M''' < 0$, then $\psi < 0$. Supposing that $|\psi| < 1$, the result that $dz/dt > 0$ still remains. □

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國科會補助計畫衍生研發成果推廣資料表

日期:2013/10/22

國科會補助計畫	計畫名稱: 資本市場整合對租稅結構與公共支出之影響---一個政治經濟學的觀點
	計畫主持人: 賴育邦
	計畫編號: 100-2410-H-004-076-MY2　　學門領域: 公共經濟學

無研發成果推廣資料

100 年度專題研究計畫研究成果彙整表

計畫主持人：賴育邦	計畫編號：100-2410-H-004-076-MY2
計畫名稱：資本市場整合對租稅結構與公共支出之影響---一個政治經濟學的觀點	

成果項目			量化			單位	備註（質化說明：如數個計畫共同成果、成果列為該期刊之封面故事...等）
			實際已達成數（被接受或已發表）	預期總達成數(含實際已達成數)	本計畫實際貢獻百分比		
國內	論文著作	期刊論文	0	0	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	0	0	100%		
		專書	0	0	100%		
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（本國籍）	碩士生	0	0	100%	人次	
		博士生	100	100	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		
國外	論文著作	期刊論文	0	100	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	0	0	100%		
		專書	0	0	100%	章/本	
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（外國籍）	碩士生	0	0	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		

其他成果 (無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。)	本文已投稿到國際期刊。

	成果項目	量化	名稱或內容性質簡述
科教處計畫加填項目	測驗工具(含質性與量性)	0	
	課程/模組	0	
	電腦及網路系統或工具	0	
	教材	0	
	舉辦之活動/競賽	0	
	研討會/工作坊	0	
	電子報、網站	0	
	計畫成果推廣之參與（閱聽）人數	0	

國科會補助專題研究計畫成果報告自評表

請就研究內容與原計畫相符程度、達成預期目標情況、研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）、是否適合在學術期刊發表或申請專利、主要發現或其他有關價值等，作一綜合評估。

1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估

■達成目標

□未達成目標（請說明，以 100 字為限）

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說明：

2. 研究成果在學術期刊發表或申請專利等情形：

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3. 請依學術成就、技術創新、社會影響等方面，評估研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）(以 500 字為限)

本文結合利益團體與投票模型，試圖探討兩者間的互動，以及對政策的影響。本文發現，當理性的選民，預期到利益團體會影響政策時，選民的選擇亦將有所不同。如文中所建構的模型顯示，當資本的移動性增加時，在利益團體不能影響政策的情況下，中位數選民將會選擇較低的所得稅稅率。一旦政策受利益團體左右時，較高的資本移動性，反而會導致較高的所得稅，與較低的有效資本稅稅率。此結果與許多國家的現狀相符。本文應可對政策分析提供解釋，及進一步的理解。