The Effects of Tax Competition
When Politicians Create Rents
to Buy Political Support

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Abstract

We set up a probabilistic voting model to explore the hypothesis that tax competition improves public sector efficiency and social welfare. In the absence of tax base mobility, distortions in the political process induce vote-maximising politicians to create rents to public sector employees. Allowing tax base mobility may be welfare-enhancing up to a point, because the ensuing tax competition will reduce rents. However, if tax competition is carried too far, it will reduce welfare by causing an underprovision of public goods. Starting from an equilibrium where tax competition has eliminated all rents, a coordinated rise in capital taxation will always be welfare-improving. For plausible parameter values it will even be welfare-enhancing to carry tax coordination beyond the point where rents to public sector workers start to emerge.

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THE EFFECTS OF TAX COMPETITION WHEN POLITICIANS CREATE RENTS TO BUY POLITICAL SUPPORT

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1. Tax competition and Leviathan

The globalisation of economic activity has sharpened the international debate on the costs and benefits of tax competition. Critics argue that such competition will lead to an underprovision of public goods as governments undercut each others' tax rates in an attempt to attract mobile tax bases. The theoretical foundations for this view were laid by Oates (1972), Zodrow and Mieszkowski (1986), Wilson (1986), Wildasin (1989), Janeba and Peters (1999), among others. In the opposite camp it is argued that tax competition helps to reduce government waste and to discipline rent-seeking politicians and bureaucrats. According to Public Choice theorists such as Brennan and Buchanan (1977, 1980), government is an ever-expanding Leviathan that needs to be tamed, and one way of 'starving the beast' is to allow interjurisdictional competition for mobile tax bases.[1]

This sceptical view of government which welcomes tax competition seems to have gained ground in recent years.[2] At least it is a fact that attempts at international tax coordination via institutions such as the EU and the OECD have met with little success. A popular version of the argument that tax competition increases public sector efficiency assumes that self-serving politicians and bureaucrats are somehow able to divert the taxpayer's money away from uses that benefit the general public and into uses that are pure waste from society's viewpoint. It is then argued that tax competition hampers this diversion of resources away from

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[1] In early contributions Hayek (1939) and Tiebout (1956) argued that fiscal decentralization may result in an efficient outcome if certain conditions on the set of available tax instruments and technologies are fulfilled. Notably, Cai and Treisman (2005) show in a Leviathan type tax competition model with asymmetric regions that decentralization of taxing powers may result in an adverse outcome where politicians in poorly endowed regions spend a larger share of the budget on nonproductive activities.

[2] The World Bank (2004, p. 53) vividly argues that decentralization 'permits a degree of institutional competition between centers of authority that can ... reduce the risk that governments will expropriate wealth'. The OECD (2002) also puts much emphasis on policy recommendations to decentralize public decision making.

beneficial public use, since growing mobility of tax bases raises the marginal cost of public funds, thereby hardening voter resistance to government waste.

Edwards and Keen (1996) attempted to synthesize the conflicting views on tax competition. In their analysis politicians maximise an objective function of the form $V(R, U)$, where R is the rent appropriated by the politicians themselves (which is modelled as pure waste), and U is the welfare of the representative citizen. Thus politicians trade off the interests of voters against rents to themselves. Combining this objective function with a standard model of tax competition where the marginal source of public funds is a source-based tax on mobile capital, Edwards and Keen demonstrated that tax competition will have two offsetting effects on consumer welfare. On the one hand it will tend to raise welfare by reducing the volume of rents appropriated by politicians. On the other hand it will tend to cause an underprovision of public goods by raising the marginal cost of public funds. On balance, Edwards and Keen found that if the elasticity of the tax base with respect to the tax rate is lower than the politicians' marginal propensity to spend public funds on 'waste', tax competition will be preferable to tax coordination, and vice versa.

Several other authors including Oates and Schwab (1988), Fuest (2000), Rauscher (2000), Eggert (2001) and Sato (2003) have analysed the effects of tax competition in Leviathan models where policy makers appropriate part of the tax revenue for their own purposes. In an interesting extension of this literature, Janeba and Schjelderup (2002) have studied how tax competition affects the ability of politicians to appropriate rents under alternative political institutions such as parliamentary democracies and presidential-congressional systems. Further, Besley and Smart (2007) have studied the effects of various fiscal restraints (including tax competition which increases the marginal cost of public funds) in a setting where imperfectly informed voters face the challenge of distinguishing Leviathan-type politicians from benevolent political candidates. While all of these studies have generated valuable insights, the policy objective function assumed in the Leviathan literature is problematic for three reasons. First, the modelling of rents as pure waste goes against the fundamental normative principle that the welfare of all citizens (including rent-seekers) should be allowed to count in the social welfare function. Second, in Leviathan models rent creation always reduces political support for the policy maker because rents are achieved at the expense of the welfare of voters. This may be a reasonable way of modelling the kind of

rent-seeking that takes the form of unnecessary and wasteful luxury for government officials, but in most western democracies this type of rent is probably of minor quantitative importance relative to total income. Instead it appears that rents are typically created with the purpose of obtaining political support from the recipients. Thus, whereas the Leviathan literature assumes that rent creation always reduces the policy maker's political backing, it seems more realistic to assume that rents are generated because they increase the likelihood that those who are responsible for creating them will remain in government office.[3] Third, a variable such as the fraction of public revenue that is wasted - which plays a crucial role in the Leviathan literature - is not very operational from an empirical perspective. The concept of government waste is very subjective; what seems waste to one person may be a useful government activity in the eyes of another person. To be able to subject political economy models of tax competition to empirical testing, it seems desirable to develop measures of 'political distortions' that are more objective and hence easier to identify empirically.[4]

In this paper we present a political economy framework allowing an analysis of the effects of tax competition and tax coordination on rent seeking and social welfare in a setting where rents are created as part of a political strategy to maximise the expected number of votes. Instead of considering rents as pure waste, we thus treat them as a means of redistributing income in favour of politically influential groups. Our model allows for a political distortion in favour of public sector workers, say, due to the existence of strong public sector trade unions. As an empirical matter, we do not actually postulate that public sector workers have a disproportionate influence on the political process, but we explore the implications

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[3] Ansolabehere and Snyder (2006) provide evidence from the United States that governing political parties at the state level do in fact skew the distribution of public funds in favour of areas that provide them with the strongest electoral support.

[4] In an interesting recent paper Angelopoulos et al. (2006) incorporate rent-seeking into an otherwise standard Dynamic Stochastic General Equilibrium model of the European economies. The calibrated version of this model allows an estimate of the fraction of time spent on unproductive rent-seeking activities aimed at diverting public revenues into private hands. In the model of Angelopoulos et al. this fraction turns out to be large. However, as the authors recognize themselves, the ability of a standard DSGE model to generate realistic employment fluctuations (with a plausible labour supply elasticity) is improved whenever one introduces a third use of time in addition to leisure and market work. In the authors' model rent-seeking represents such a third use of time, but a similar improvement in the model's ability to fit the data might have been achieved by introducing another alternative use of time such as home production (see, e.g., Greenwood et al. (1995)).

of this assumption because it is implicit in the reasoning of many advocates of tax competition.

In our model the often vague concept of 'political distortion' has a very precise meaning. Our indicator of the degree of political distortion depends on the size of the public sector lobby and on the relative political influence of an individual lobby member, measured by the derivatives of the voting function maximised by politicians. The greater the sensitivity of the voting behaviour of a lobby member to a change in economic benefits offered to him, the greater is his political influence relative to the influence of a voter outside the lobby.[5]

If a political distortion in favour of (some) public sector workers exists, the weight given to the interests of this group in the policy maker's objective function will exceed the share of the voting population belonging to this group. We study the link between such a political distortion and public sector efficiency. We then investigate whether tax competition is an effective means of reducing rents to (favoured) public sector workers and how it affects social welfare. Because we assume a utilitarian social welfare function, our normative analysis captures concerns about equity as well as efficiency. From an equity perspective the political distortion causes a social welfare loss by driving a wedge between the marginal utility of consumption for public and private sector workers. In efficiency terms the political distortion generates a welfare loss by causing the marginal rate of substitution between public and private goods to differ across the two groups of workers and by creating a wedge between the marginal rate of substitution and the marginal rate of transformation between public and private goods. We thus account for both of the standard criticisms against rent-seeking, i.e., the objections that it is unfair as well as inefficient.

Our model offers a synthesis of the traditional Public Finance view of tax competition and the view of the Public Choice school. In line with the Public Finance view, we find that tax competition causes an underprovision of public goods, but we also find that it tends to destroy rents, as emphasized by the Public

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[5]To limit the scope of the paper, we do not consider whether tax competition leads to less corruption and whether it can be used to generate valuable information to voters. Much empirical work on the efficiency effects of fiscal federalism has focused on the relationship between fiscal decentralisation and corruption. In a cross-country panel study using the International Country Risk Guide's corruption index, Fissman and Gatti (2002) find a significant negative relationship between corruption and decentralization. Huther and Shah (1998) obtain similar results using similar indicators of corruption constructed by the World Bank.

Choice school. While rent destruction increases social welfare, the underprovision of public goods causes a welfare loss. Using a quantitative version of our model, we show that an increase in tax base mobility will initially tend to be welfare-increasing, but beyond a certain point which will depend on the size of the political distortion, a further increase in tax base mobility will be welfare-reducing as the underprovision of public goods becomes more serious. We also show analytically that when individual countries are too small to affect the world interest rate, some amount of international tax coordination will be welfare-improving under very mild conditions. Indeed, we find that it may be welfare-enhancing to carry tax coordination beyond the point where rents to public sector workers start to emerge.

Our analysis highlights the importance of two key parameters. The first one is the elasticity of the tax base with respect to the tax rate, reflecting the degree of international tax base mobility. The second one is our measure of the size of the political distortion, capturing the relative size and political influence of the public sector lobby. This measure plays the same role in our model as that played by the marginal propensity to 'waste' tax revenue in the model of Edwards and Keen (1996). Indeed, the present paper may be seen as an attempt to provide a stronger political economy foundation for the key results in the Edwards-Keen paper. We do this by embedding a probabilistic voting model of the type described by Persson and Tabellini (2000, ch. 3) in an economic setting similar to the one studied by Edwards and Keen. Our paper may also be seen as an extension of some ideas in Wilson (1989) who studies optimal constraints on the tax base in a world where the tax rate is controlled by a policy maker who diverts resources from spending on public goods towards a favoured group of consumers. Such behaviour by the policy maker could be interpreted as an attempt to buy votes from an influential interest group, but unlike us, Wilson (op.cit.) does not explicitly model the political process, and he does not consider the effects of tax competition.

In section 2 we set up our model. Section 3 analyses how the political equilibrium is influenced by tax competition while section 4 studies how international tax coordination affects rent seeking and social welfare. Section 5 summarises our main conclusions, and three technical appendices document the results reported in the text.

2. The model

We consider a world economy consisting of n symmetric countries. Residents in each country can either work in the private or in the public sector, and they consume private goods as well as a pure public good. Labour is the only input into the production of the public good, while private goods are produced by means of capital and labour. Capital is perfectly mobile across countries, whereas labour is immobile internationally. There are no international spillovers from the supply of public goods, i.e., public goods consumption is non-rival only in the domestic sphere. To allow for interjurisdictional competition for mobile tax bases, we assume that public expenditure is financed by a source-based tax on capital.[6] All countries produce the same good, so national tax policies have no effects on the commodity terms of trade.

Politicians choose the level of taxation, the number of public sector employees and the public sector wage rate with the purpose of maximising the probability of being voted into office. Voters are split into public sector employees and private sector employees. By increasing the economic welfare of the members of a particular group, politicians can increase the expected number of votes from that group. The model enables us to specify the exact conditions under which rents to public sector employees will arise. A central issue to be explored is whether tax competition will tend to reduce such rents and move public sector employment closer to its socially optimal level.

Below we present the details of the model.

2.1. Tastes and technology

We use the subscript g for variables relating to a government sector employee and the subscript p for variables referring to a private sector employee. All agents have identical preferences, and the total utility U_j of a worker employed in sector j is

$$U_j = u\left(C_j\right) + g\left(G\right), \qquad j = g, p; \tag{2.1}$$

$$u' > 0, \qquad u'' < 0, \qquad g' > 0, \qquad g'' < 0,$$

[6]Thus we assume that residence-based capital income taxation cannot be enforced, due to a lack of effective international information sharing among tax authorities.

where C_j is private consumption and G is the non-rival consumption of the public good. Note that since individual working time is assumed to be institutionally fixed, there is no need to allow for the disutility of work in the utility function (2.1).

The total population and labour force is normalised to unity and the fraction of the labour force employed in the public sector is denoted by α, $0 < \alpha < 1$. Total capital input into private sector production is $(1 - \alpha) k$, where k is the capital-labour ratio, and the total output of private goods (Y) is given by the linearly homogeneous production function

$$Y = F \left((1 - \alpha) k, 1 - \alpha \right), \tag{2.2}$$

implying that the average productivity of a private sector worker is

$$y \equiv \frac{Y}{1 - \alpha} = F \left(k, 1 \right) \equiv f \left(k \right), \qquad f' > 0, \qquad f'' < 0. \tag{2.3}$$

The public good is produced by a simple linear technology with labour as the only input:

$$G = \alpha. \tag{2.4}$$

At the start of the period considered, each country in the world is endowed with a fixed total capital stock $\overline{k}$. All countries are assumed to be symmetric, with identical labour forces, capital endowments, tastes and technologies.

2.2. The first-best allocation

For later reference it will be useful to characterize the first-best allocation of resources in our simple world economy, assuming that the social planner in the representative country wishes to maximise the utilitarian social welfare function

$$SW = \alpha \left[u \left(C_g \right) + g \left(\alpha \right) \right] + (1 - \alpha) \left[u \left(C_p \right) + g \left(\alpha \right) \right]. \tag{2.5}$$

One condition for global optimality is global production efficiency which requires that capital's marginal product be equalized across countries. With identical countries this is achieved when investment in each country equals the country's fixed capital endowment. Hence optimality is attained when the social welfare

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function (2.5) is maximised with respect to C_g, C_p, and α, subject to the resource constraint

$$\alpha C_g + (1 - \alpha) C_p = F\left(\overline{k}, 1 - \alpha\right). \tag{2.6}$$

Denoting the marginal product of private sector labour input by F_L, the first-order conditions for the solution to this problem can be shown to imply

$$u'\left(C_g\right) = u'\left(C_p\right) \quad \Longrightarrow \quad C_g = C_p = C, \tag{2.7}$$

$$\frac{g'\left(\alpha\right)}{u'\left(C\right)} = F_L\left(\overline{k}, 1 - \alpha\right). \tag{2.8}$$

Equation (2.7) states that private consumption levels must be equalized so as to equalize the marginal utility of consumption across the two groups of workers. This condition may be said to reflect policy concerns about equity. Equation (2.8) is the Samuelson condition for the optimal supply of public goods, stating that the sum of the marginal rates of substitution between private and public goods should equal the marginal rate of transformation (recall that the total population is normalised to unity, so the left-hand side of (2.8) is the sum of the marginal rates of substitution). Clearly, (2.8) captures policy concerns about efficiency.

We will now study whether the market-based allocation will differ from this first-best optimum.

2.3. The market economy

Competitive profit-maximising firms invest up to the point where capital's marginal product equals the cost of capital, implying

$$f'\left(k\right) = r + \tau, \tag{2.9}$$

where r is the after-tax interest rate and τ is a source-based unit tax on capital. From (2.9) it follows that capital intensity is given by

$$k = k\left(r + \tau\right), \qquad k' = 1/f'' < 0. \tag{2.10}$$

Moreover, (2.9) and the linear homogeneity of the production function imply that the private sector real wage (w) is

$$w(r+\tau) = f(k(r+\tau)) - (r+\tau)k(r+\tau), \qquad w' = -k. \tag{2.11}$$

Capital is perfectly mobile across countries. With source-based capital taxation, this means that all the n countries in the world face the same after-tax interest rate r. A global capital market equilibrium is attained when

$$(1-\alpha)k(r+\tau) + (n-1)(1-\widehat{\alpha})\widehat{k}(r+\widehat{\tau}) = n\overline{k}, \tag{2.12}$$

where $(1-\alpha)k(r+\tau)$ is capital demand in the domestic country under consideration, and $(1-\widehat{\alpha})\widehat{k}(r+\widehat{\tau})$ is capital demand in each of the $n-1$ identical foreign countries. Thus the left-hand side of (2.12) measures the global demand for capital which must equal the fixed global capital supply, $n\overline{k}$. By implicit differentiation of (2.12) we may find the isolated effects of domestic tax and spending policies on the after-tax interest rate, exploiting the symmetry assumption that all countries end up choosing the same policies in equilibrium:[7]

$$\frac{\partial r}{\partial \tau} = -\frac{(1-\alpha)k'}{(1-\alpha)k' + (n-1)(1-\widehat{\alpha})\widehat{k}'} = -\frac{1}{n}, \tag{2.13}$$

$$\frac{\partial r}{\partial \alpha} = \frac{k}{(1-\alpha)k' + (n-1)(1-\widehat{\alpha})\widehat{k}'} = \frac{k}{n(1-\alpha)k'}. \tag{2.14}$$

When choosing their fiscal policy platforms, politicians account for these policy effects on the interest rate.

To focus on the potential conflicts of interest between private and public sector employees, we assume that capital endowments are equally distributed across the working population. Recalling that the total labour force is normalised at unity, this means that each worker owns the amount of capital $\overline{k}$. Denoting the public sector wage rate by W, the private consumption of the two types of workers is then given by

$$C_g = W + r\overline{k}, \qquad C_p = w + r\overline{k}. \tag{2.15}$$

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[7]The symmetry assumption implies that $\alpha = \widehat{\alpha}$ and $\tau = \widehat{\tau}$ in equilibrium so that $(1-\alpha)k'(r+\tau) = (1-\widehat{\alpha})\widehat{k}'(r+\widehat{\tau})$.

2.4. The political economy of fiscal policy

The policy variables in our model are W, α and τ. We wish to provide a simple framework in which these variables are chosen by politicians competing for votes. Inspired by Baron (1994) and Persson and Tabellini (2000, ch. 3), we describe the political process by a probabilistic voting model with lobbyism. In our particular version of this model, voters are split into 'insiders' and 'outsiders'. The insiders are all employed in the public sector and all belong to a lobby (say, a trade union) which enforces the wage rate W throughout the public sector in order to prevent underbidding from outsiders. The outsiders are those voters who do not belong to the lobby. These individuals are employed either in the public or in the private sector. Thus the 'marginal' workers in the public sector are outsiders although they are paid the same wage as the insiders. As we shall see below, in the absence of tax competition the public sector wage rate will generally exceed the private sector wage. We assume that the marginal high-paying public sector jobs that are not already filled by the insiders are allocated by a lottery among all outsiders. Flexible wage adjustment in the private labour market ensures that those unlucky outsiders who do not 'win' an attractive public sector job are all able to find private sector employment.[8]

Our categorization of public sector workers into insiders and outsiders is motivated by the observation that some groups of civil servants are often employed on long-term contracts providing a high degree of job security whereas other public sector workers are appointed on short-term contracts offering less job protection. Our distinction between public sector insiders who have full job security and the marginal public sector workers who can easily be dismissed captures this observed difference in the terms of employment in a stylised way. Note that the stronger attachment of insiders to the public sector could explain why this group has formed a lobby to protect their interests whereas the marginal workers with a looser link to the public sector do not enter the lobby.[9]

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[8]In practice, getting an attractive public sector job might sometimes involve help from 'friends in high places', potentially opening the door to corruption. In this way the rents earned in public sector jobs would tend to be redistributed to other agents, but presumably rent creation could still be used to buy political support, as in the model set up here.

[9]Apart from the empirical motivation, there is also a technical reason why we do not assume that all public sector workers automatically become members of the lobby. If they did, one can show that the voting function introduced below would become non-differentiable at the current level of public sector employment when public sector jobs are allocated by a lottery. This non-differentiability would introduce technical complications in our formal analysis.

As already mentioned, though some groups of public sector employees do seem to have relatively strong trade unions in many OECD countries, we do not actually claim that civil servants always and everywhere earn rents. Whether this is the case is an empirical issue, although one that is probably hard to settle, given the difficulties of measuring rents. In our model rents take the form of a relatively high public sector wage rate, but the wage rates in the model should be interpreted as wages *per unit of effort* for wage differentials to be an appropriate indicator of rents. Thus, even if empirical studies were to reveal that public sector wage rates do not exceed the wages for similar groups of workers in the private sector, this would not necessarily imply the absence of rents in the public sector. In any case, our assumption that (organised) public sector voters constitute a strong interest group is made because it seems to be implicit in the reasoning of many of those who advocate tax competition as a remedy against rent seeking. Our purpose is to investigate whether fiscal competition could indeed be an appropriate means of curbing an excessive political influence of public sector workers, without passing a verdict on whether such an excess influence actually exists.[10]

Let us proceed to the details of the political process. Our model assumes the existence of two political parties (A and B) competing for government office. The timing of events is as follows: 1) Each party announces a fiscal policy package consisting of a public sector wage rate, a capital tax rate and a level of public sector employment, taking the number of insiders and the policy platform chosen by the other party as given. 2) Elections are held. 3) The pre-announced policy of the winning party is implemented, and the 'marginal' public sector jobs are allocated by a lottery among outsiders right after the election. If the policy chosen by party B implies a utility level U_g^* for a public sector employee and an expected utility U_o^{e*} for an outsider, party A chooses a fiscal policy package that will maximise its expected number of votes (V) given by

$$V = \alpha_i p_i \left(U_g - U_g^* \right) + (1 - \alpha_i) p_o \left(U_o^e - U_o^{e*} \right), \tag{2.16}$$

$$0 \leq \alpha_i < 1, \qquad p_i' > 0, \qquad p_o' > 0, \qquad p_i' > p_o',$$

[10]Falch and Strøm (2005) find evidence from Norway that various indicators of the political strength of public sector employees have a positive impact on public sector wage rates. However, these authors do not investigate whether public sector workers are generally better paid than corresponding groups of workers in the private sector.

where α_i is the predetermined fraction of voters belonging to the public sector insider lobby; p_i is the probability that a public sector insider will vote for party A; p_o is the probability that an outsider will vote for that party; U_g is the utility of a public sector worker in case party A's policy is implemented, and U_o^e is the expected utility that an outsider would obtain from the implementation of the policy package offered by party A. In other words, the greater an insider's economic welfare implied by the policy of party A, the greater is the likelihood that he will support that party, given the policy package offered by party B. In a similar way, party A can increase its support from outsiders by choosing a fiscal policy platform that increases the (expected) economic welfare of members of that goup of voters. Maximisation of V, given U_g^* and U_o^{e*}, gives party A's best response to the policy chosen by party B. The latter party faces a fully symmetric optimisation problem, yielding an identical best-response function. In Nash equilibrium the two parties therefore end up choosing the same fiscal policy platforms, so we may confine attention to the behaviour of party A.

Since the marginal public sector jobs offered to outsiders are allocated by lottery, we have

$$U_o^e = \left(\frac{\alpha - \alpha_i}{1 - \alpha_i}\right) U_g + \left[1 - \left(\frac{\alpha - \alpha_i}{1 - \alpha_i}\right)\right] U_p, \tag{2.17}$$

where U_p is the utility of a private sector employee under party A's proposed policy; $(\alpha - \alpha_i)$ is the number of public sector jobs that party A offers to outsiders, and $1 - \alpha_i$ is the number of outsiders competing for those jobs. Thus, at the time of voting, $(\alpha - \alpha_i) / (1 - \alpha_i)$ is the probability that an outsider will gain access to a high-paying public sector job if party A wins the election.

The literature on probabilistic voting has clarified the (sufficient) conditions guaranteeing that the functions $p_i(\cdot)$ and $p_o(\cdot)$ are continuous and differentiable, as assumed in (2.16). For example, these assumptions will be met if political parties differ on some ideological issue, and if the ideological preferences of voters are distributed uniformly across some spectrum spanning the ideological platforms of the two parties (see Persson and Tabellini (2000), ch. 3). In probalistic voting models with lobbying, it has also been shown that the sensitivity of expected votes with respect to economic benefits is higher when the benefits are offered to members of a lobby than when they are granted to unorganised voters (see Baron (1994), Lorz (1998), and Persson and Tabellini (2000), sec. 3.5). This

is the justification for the assumption $p'_i > p'_o$ made in (2.16). The intuition is that lobbies provide (additional) information on the implications of political party programs for their members, and that they may contribute to the election campaigns of parties catering to the economic interests of their members.

When choosing their policy platforms, politicians face two constraints. The first one is the government budget constraint which requires that the revenue from capital taxation must cover the cost of the wages to public sector employees:

$$\tau \left(1 - \alpha\right) k \left(r + \tau\right) = \alpha W. \tag{2.18}$$

The second constraint is that in order to be able to attract workers to the public sector, these workers must be offered a utility level at least as high as that enjoyed by workers in the private sector. This in turn requires that

$$W \geq w. \tag{2.19}$$

In two ways the political setup described above tries to account for the views of those advocates of tax competition who argue that the public sector tends to employ too many people on overly generous conditions. First, by assigning excessive political influence to public sector insiders (as reflected in our assumption that $p'_i > p'_o$), our model includes an incentive for politicians to offer rents to this group of voters. Second, when a political candidate offers high public sector wages, he may also be inclined to promise more jobs in the public sector, since (2.16) and (2.17) imply that this will increase an outsiders's expected economic gain from voting for that candidate.[11] On the other hand, a relatively high public sector wage rate makes the creation of public sector jobs more expensive by requiring a higher tax rate. Hence politicians must trade off the political gain from high public sector wages and public sector job creation against the political cost of having to raise taxes. The next section analyses the resulting political equilibrium.

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[11] When $W > w$, we have $U_g > U_p$, so from (2.17) we get $\frac{\partial U_o^e}{\partial \alpha} = \left(\frac{U_g - U_p}{1 - \alpha_i}\right) > 0$. It then follows from (2.16) that $\frac{\partial V}{\partial \alpha} = U_g - U_o > 0$.

3. Political equilibrium, tax competition and rents

3.1. Political equilibrium

In political equilibrium the fiscal policy variables W, α, and τ are set so as to maximise the voting function (2.16) subject to the government budget constraint (2.18) and the recruitment constraint (2.19). The first-order conditions for the solution to this problem are derived in section A.1 of the appendix. When the constraint $W \geq w$ is not strictly binding, these conditions can be shown to imply that

$$u'_g = \left(\frac{\alpha}{\alpha + \delta}\right)\left(\frac{1 - \frac{\alpha}{n}}{1 - \frac{\alpha}{n} - \varepsilon}\right) u'_p, \qquad \varepsilon \equiv -\left(\frac{n-1}{n}\right)\frac{\tau k'}{k}, \qquad \delta \equiv \alpha_i \left(\frac{p'_i - p'_o}{p'_o}\right), \tag{3.1}$$

$$\frac{g'(\alpha)}{u'_g} + \frac{u_g - u_p}{u'_g(1 + \delta)} = \left(\frac{\alpha + \delta}{\alpha + \alpha\delta}\right)\left[1 + \frac{\alpha(n-1)}{(1-\alpha)(n-\alpha)}\right]\left(\frac{W}{w}\right)F_L, \tag{3.2}$$

where $u_g \equiv u\left(W + r\overline{k}\right)$ and $u_p \equiv u\left(w + r\overline{k}\right)$ are the total utilities of private consumption for public and private sector workers, respectively; u'_g and u'_p are the corresponding marginal utilities; ε is the numerical elasticity of the tax base with respect to the tax rate,[12] and the parameter δ is a measure of the degree of 'distortion' in the political system. This distortion is the product of the size of the public sector lobby (α_i) and the 'excess' sensitivity of lobby member votes to the economic benefits offered by politicians, $(p'_i - p'_o)/p'_o$. Given our assumptions that $0 \leq \alpha_i < 1$ and $p'_g > p'_p$, we have $0 \leq \delta < 1$. The more δ exceeds zero, the greater is the political influence of public sector insiders relative to that of other voters.

To understand the effects of tax competition on public sector efficiency, it is useful to start by considering the case of autarky where no international capital mobility is allowed. The world economy will then function like a closed economy which we may model by setting the number of countries $n = 1$. For this benchmark case we establish the following

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[12] Note that ε is a general-equilibrium elasticity, allowing for the impact of a change in the domestic tax rate on the world interest rate. Specifically, the tax base elasticity is defined as

$$\varepsilon \equiv -\frac{d(k(r+\tau))}{d\tau}\frac{\tau}{k} = -\frac{k' \cdot \left(d\tau + \frac{\partial r}{\partial \tau}d\tau\right)}{d\tau}\frac{\tau}{k} = -\left(\frac{n-1}{n}\right)\frac{\tau k'}{k}.$$

where we have used the symmetry assumption plus equation (2.13) to derive the last equality.

Proposition 1: *When there is no lobby for insiders in the public sector and hence no political distortion, the political equilibrium implies a first-best allocation.*

Proof: See Appendix 2.

A political equilibrium without capital mobility will thus guarantee a first-best allocation when there are no political distortions. In this case all voters are equally responsive to the economic benefits offered by political candidates, so vote-maximizing politicians have an incentive to act like a utilitarian social planner who attaches an equal weight to the welfare of each individual citizen.

What happens if we allow political distortions in favour of public sector workers while maintaining the autarky assumption? In that case we obtain

Proposition 2: *Starting from an undistorted political equilibrium under autarky, the introduction of a small political distortion in favour of public sector workers will drive the public sector wage rate above the wage rate in the private sector. It will also drive up the tax rate but will leave public sector employment unaffected.*

Proof: See Appendix 2.

According to Proposition 2 the formation of a lobby for (some of the) public sector workers will induce politicians to create rents to civil servants. Not surprisingly, the tax rate will have to rise to finance the increase in public sector wages. However, the number of public sector jobs will stay the same because of two offsetting political incentives. On the one hand, the emergence of rents to public sector employees provides an incentive for a political candidate to boost public sector employment, since he can thereby capture more votes from outsiders by increasing their chances of getting an attractive public sector job. On the other hand, the emergence of the lobby makes public goods more expensive by driving up the public sector wage rate. Ceteris paribus, this rise in the cost of public goods provision induces politicians to offer fewer public sector jobs. When there is no lobby initially, it turns out that these two countervailing political incentives exactly neutralize each other.

3.2. Tax competition, rent destruction and public goods provision

Consider next the role of tax competition, i.e. the case where $n > 1$ so that the tax base elasticity becomes positive, due to international capital mobility. From (3.1) we can show

Proposition 3: *Tax competition will completely eliminate rents to public sector employees if*

$$\varepsilon > \left(\frac{\delta}{\alpha + \delta}\right)\left(1 - \frac{\alpha}{n}\right). \tag{3.3}$$

Proof: See Appendix 2.

The condition in (3.3) is very intuitive: the higher is the tax base elasticity ε, the higher is the marginal cost of public funds, so the more costly (in economic and political terms) it is for politicians to raise taxes to finance rents to public sector employees. Hence, if the political distortion in favour of public sector insiders is not too high, tax competition will prevent rent creation.

However, while tax competition may be an institutional defence against rent seeking, as emphasized by the Public Choice school, it will also distort the supply of public goods, as claimed by the traditional Public Finance school. This is reflected in

Proposition 4: *When tax competition among small jurisdictions is sufficiently strong to eliminate all rents, public goods will be underprovided and the supply of public goods will satisfy the condition*

$$\frac{g'(\alpha)}{u'} = \left(\frac{1}{1-\alpha}\right)\left(\frac{1}{1 - \varepsilon(1-\alpha)}\right)F_L. \tag{3.4}$$

Proof: See Appendix 2.

Under tax competition public goods are underprovided (i.e. $g'(\alpha)/u' > F_L$) since the international mobility of capital causes the tax base to be elastic from the individual country's perspective whereas from the viewpoint of the world economy as a whole it is in fact inelastic. However, under autarky the supply of

public goods is also distorted, due to the bias in the political process. Specifically, under autarky ($n = 1$) equations (3.1) and (3.2) imply

$$\frac{g'(\alpha)}{u'_g} = \left(\frac{1}{1+\delta}\right)\left[\left(\frac{\alpha+\delta}{\alpha}\right)\left(\frac{W}{w}\right)F_L - \left(\frac{u_g - u_p}{u'_g}\right)\right], \qquad (3.5)$$

$$\frac{g'(\alpha)}{u'_p} = \left(\frac{1}{1+\delta}\right)\left[\left(\frac{W}{w}\right)F_L - \left(\frac{\alpha}{\alpha+\delta}\right)\left(\frac{u_g - u_p}{u'_g}\right)\right]. \qquad (3.6)$$

It is not immediately clear from (3.5) and (3.6) whether autarky will lead to underprovision or overprovision of public goods, due to the offsetting political incentives for public sector job creation explained in the previous section. To explore this issue further, suppose utility functions display constant relative risk aversion so that $u(C) = C^{1-\sigma}/(1-\sigma)$. It then follows from (2.15) and (3.1) that for $n = 1$,

$$\frac{W}{w} = \frac{1}{(1+\kappa)\left(\frac{\alpha}{\alpha+\delta}\right)^{1/\sigma} - \kappa}, \qquad \kappa \equiv \frac{r\overline{k}}{W}, \qquad (3.7)$$

where κ is the ratio of (after-tax) capital income to wage income for a public sector worker. Suppose further that $\kappa = 0.25$, $\delta = 0.12$, $\sigma = 5$ and $\alpha = 0.2$. From (3.7) we then get $W/w = 1.13$ (i.e. a 13 percent wage premium to public sector workers), and from (3.5) and (3.6) we find

$$\frac{g'(\alpha)}{u'_g} = 1.49 \cdot F_L \qquad \text{and} \qquad \frac{g'(\alpha)}{u'_p} = 0.93 \cdot F_L. \qquad (3.8)$$

These numbers imply that, from the viewpoint of public sector workers, public goods will be underprovided, whereas they will be slightly overprovided from the viewpoint of private sector workers. By comparison, with $\alpha = 0.2$ and a plausible tax base elasticity like $\varepsilon = 0.3$, equation (3.4) implies that

$$\frac{g'(\alpha)}{u'} = 1.64 \cdot F_L \qquad (3.9)$$

under tax competition, reflecting that, for all workers, public goods will be seriously underprovided. This numerical example suggests that for most citizens the wedge between the marginal rate of substitution and the marginal rate of transformation between private and public goods will tend to be considerably larger under tax competition than under autarky, indicating a more serious distortion of public goods supply under the former regime. Thus tax competition

will most likely involve a trade-off between efficiency-enhancing rent destruction and a welfare-reducing bias in favour of private consumption at the expense of public consumption.

Of course this numerical example is incomplete since it takes variables like α, κ and ε as given whereas in fact they depend endogenously on the policy regime chosen. In the next section we turn to a numerical general equilibrium analysis which allows for these endogeneities.

3.3. Is tax competition good or bad? A numerical general equilibrium analysis

To illustrate how rents, public goods provision and social welfare may evolve as the number of competing jurisdictions increases, we simulate a calibrated version of our model, assuming a Cobb-Douglas production function

$$y = Ak^\beta, \qquad A > 0, \quad 0 < \beta < 1, \tag{3.10}$$

and preferences of the form

$$u(C) = \frac{C^{1-\sigma_c}}{1-\sigma_c}, \quad g(\alpha) = \frac{\theta\alpha^{1-\sigma_g}}{1-\sigma_g}, \quad \sigma_c > 0, \quad \sigma_g > 0, \quad \theta > 0, \tag{3.11}$$

where the parameter θ reflects the preference for public goods. The complete model implied by these specifications is summarized in Appendix 3. Assuming plausible parameters like $\beta = 0.25$ and $\sigma_c = \sigma_g = 5$;[13] postulating a political distortion $\delta = 0.12$; setting $\theta = 1$, and calibrating the parameters A and $\overline{k}$ to ensure a realistic relative size of the public sector (and a realistic effective capital income tax rate $\tau/(r+\tau)$), we obtain the simulation results reported in Table 1.[14] The last column shows the level of social welfare relative to the welfare level SW^a attained under autarky, and the first row in the table shows the situation prevailing under autarky.

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[13]In an intertemporal context, our parameter σ_c would be identical to the inverse of the intertemporal elasticity of substitution in private consumption. Based on the estimates of the latter parameter by Hall (1988), σ_c should be at least 5, whereas the estimates presented in Attanasio and Weber (1995) imply values of σ_c between 2.2 and 4.7.

[14]To compute the full solution to this non-linear system, we used ConOpt 3.0 in GAMS and checked robustness using MINOS5.

Table 1. Simulated effects of tax competition

n	ε	$\frac{W}{w}$	α	$\frac{\tau}{r+\tau}$	$\frac{SW-SW^a}{|SW^a|}$
1	0	1.1538	0.1349	0.5396	0
2	0.3006	1.0704	0.1231	0.4508	0.0095
3	0.3800	1.0451	0.1200	0.4275	0.0068
4	0.4166	1.0329	0.1185	0.4166	0.0045
5	0.4377	1.0257	0.1177	0.4104	0.0030
6	0.4515	1.0209	0.1171	0.4063	0.0018
7	0.4611	1.0176	0.1167	0.4035	0.0009
8	0.4682	1.0151	0.1165	0.4013	0.0002
9	0.4737	1.0131	0.1162	0.3997	-0.0003
10	0.4781	1.0116	0.1161	0.3984	-0.0008
20	0.4972	1.0047	0.1153	0.3927	-0.0029
30	0.5037	1.0024	0.1150	0.3908	-0.0036
50	0.5087	1.0006	0.1148	0.3893	-0.0042
100	0.5131	1	0.1147	0.3887	-0.0044
10000	0.5181	1	0.1147	0.3887	-0.0045

Calibration: $\delta = 0.12$, $\sigma_c = \sigma_g = 5$, $\beta = 0.25$, $\theta = 1$, $\overline{k} = 0.1$, $A = 0.1$.

The second column in the table shows that the elasticity of the tax base gradually increases with the number of competing jurisdictions. As tax competition grows more intense, the relative public sector wage rate W/w gradually declines, and when the number of jurisdictions becomes sufficiently large, rents are completely eliminated, i.e., the recruitment constraint $W \geq w$ becomes binding. Tax competition also reduces the size of the public sector, but not dramatically so, since our assumed values of σ_c and σ_g imply a relatively low degree of substitutability between public and private goods. Given the limited impact on resource allocation in our example, it is not surprising that the welfare effect of tax competition is rather modest, as shown in the last column in Table 1.

Notice the interesting profile of the welfare change: as the number of countries rises from one to some small number, social welfare rises above the autarky level, because the positive effect of rent destruction dominates the negative effect of lower public goods provision. However, as the number of countries increases from eight to nine, implying an increase in the tax base elasticity from 0.4682 to 0.4737, the welfare gain from tax competition is turned into a slight loss, as the negative

Figure 1: The borderline between welfare-increasing and welfare-reducing tax competition (I)
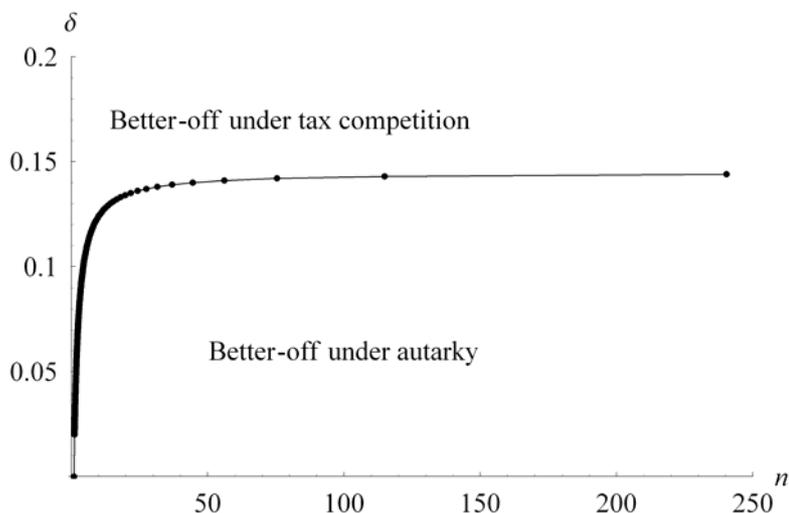
efficiency effect of reduced public service provision starts to dominate. Indeed, in this particular example the maximum welfare gain from tax competition is attained already when the number of countries is two, at a tax base elasticity of about 0.3. Given our calibration, this tax base elasticity represents the optimal intensity of tax competition.

Of course these results are sensitive to the choice of parameter values. One critical parameter is the degree of political distortion, δ. As the value of this parameter increases, it takes a higher intensity of tax competition - reflected in the number of countries and the associated elasticity of the tax base - before the negative welfare effect of reduced public goods provision starts to dominate the positive welfare effect of rent destruction. This is illustrated in figures 1 and 2 which show the combinations of the political distortion and the number of competing jurisdictions (and the implied tax base elasticity) that will lead to exactly the same level of welfare as that attained under autarky, given the other parameter values stated in the note to Table 1. For parameter combinations above the graphs in the two figures, tax competition is welfare-improving, whereas in the area below the graphs it is welfare-reducing. As one would expect, the figures illustrate that tax competition is more desirable the greater the political distortion in favour of public sector voters.

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Figure 2: The borderline between welfare-increasing and welfare-reducing tax competition (II)
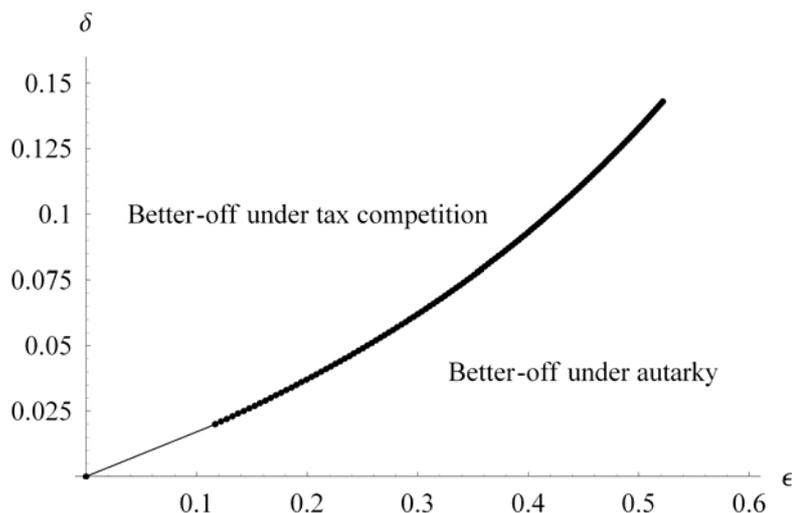
If a diagram like Figure 2 could be constructed from a more elaborate model incorporating a more realistic description of the structure of the economy, it might provide useful input into the debate on the welfare effects of tax competition. To illustrate the idea, suppose the tax base elasticity has been estimated to be 0.20, corresponding to a marginal cost of public funds $1/(1-\varepsilon)$ equal to 1.25. According to Figure 2, the size of the political distortion would then have to exceed 0.04 for tax competition to be welfare-improving. If the public sector lobby is a trade union comprising, say, 10 percent of the work force ($\alpha_i = 0.1$), a value of $\delta \equiv \alpha_i (p'_i - p'_o)/p'_o = 0.04$ would imply that $(p'_i - p'_o)/p'_o$ would have to exceed 0.4, that is, the political influence of public sector insiders would have to exceed the influence of other voters by more than 40 percent. Even if the exact value of δ is very hard to estimate empirically, it may be possible to pass a qualified judgement on whether a political distortion of such a magnitude is plausible.

4. Tax coordination, rents and welfare

The analysis in the previous section indicates that, in the presence of political distortions, it may be welfare-improving to allow tax competition among large

jurisdictions where the tax base is only modestly elastic. However, section 3.2 showed that tax competition among *small* jurisdictions is likely to cause a substantial underprovision of public goods. This suggests that an internationally coordinated rise in taxation could be welfare-improving even if the political process is biased in favour of public sector workers. Thus, an interesting question is whether tax coordination will raise social welfare and whether it will do so even if it leads to the emergence of rents? In this main section we take a closer look at these issues, focusing on the case where individual jurisdictions are small.

4.1. Tax coordination without rent creation

When the capital tax rate is fixed by some international agreement on tax coordination, politicians in the individual small country cannot influence $k = k(r + \tau)$ and $w = w(r + \tau)$ since they now take τ as well as r as given. However, they must still find the politically optimal combination of W and α, subject to the constraints (2.18) and (2.19). If a political candidate offers to raise the public sector wage rate by the amount dW, it follows from (2.1), (2.16) and (2.17) that the resulting marginal political benefit (MPB) in terms of the expected increase in votes will be

$$MPB = \left[\alpha_i p_i' u_g' + (\alpha - \alpha_i) p_o' u_g' \right] dW. \tag{4.1}$$

Since the tax rate is fixed by international agreement, a rise in the public sector wage rate can only be financed through a cut in the number of public sector jobs. According to (2.1), (2.16) and (2.17), the marginal political cost (the expected loss of votes) associated with a reduction $|d\alpha|$ in public sector employment is

$$MPC = \left\{ \left[\alpha_i p_i' + (1 - \alpha_i) p_o' \right] g'(\alpha) + p_o'(u_g - u_p) \right\} |d\alpha|. \tag{4.2}$$

In the absence of constraints on wage-setting, an optimising politician will want to equate the above expressions for the marginal political benefits and costs. However, in a tax competition equilibrium where condition (3.3) holds, it follows from the proof of Proposition 3 stated in Appendix 2 that the public sector recruitment constraint $W \geq w$ is in fact strictly binding. Using this insight, and noting that (3.3) reduces to $\varepsilon > \delta / (\alpha + \delta)$ for $n \to \infty$, we can establish

Proposition 5: *Starting from a tax competition equilibrium where $\varepsilon > \delta/(\alpha + \delta)$ so that all rents have been eliminated and the public sector recruitment constraint $W \geq w$ is strictly binding, the government of a small country will want to spend all of the extra revenue from an internationally coordinated rise in taxation on additional public goods provision and will not want to create rents to public sector employees.*

Proof: See Appendix 2.

According to Proposition 5, under the plausible assumption that $\varepsilon > \delta/(\alpha + \delta)$, tax competition in the initial political eqilibrium preceding the international agreement has reduced public goods provision to such an extent that it is not politically expedient for national governments to use any of the revenue from tax coordination on rent creation.

The initial increase in public sector employment allowed by an internationally coordinated rise in τ and the resulting effects on factor prices may be found from the capital market equilibrium condition (2.12) and the government budget constraint (2.18), using that $W = w(r + \tau)$ initially:[15]

$$\frac{d\alpha}{d\tau} = \frac{\varepsilon k}{w\alpha \left[\alpha + \varepsilon\alpha^{-1}(1 - \alpha)^2\right]} > 0, \tag{4.3}$$

$$\frac{dr}{d\tau} = -\left(\frac{1 + \varepsilon\alpha^{-1}(1 - \alpha)^2}{\alpha + \varepsilon\alpha^{-1}(1 - \alpha)^2}\right) < -1, \tag{4.4}$$

$$\frac{dW}{d\tau} = \frac{dw}{d\tau} = -k \cdot \left(1 + \frac{dr}{d\tau}\right) = \frac{k(1 - \alpha)}{\alpha + \varepsilon\alpha^{-1}(1 - \alpha)^2} > 0. \tag{4.5}$$

The derivative (4.5) gives the increase in the public sector wage rate that politicians must grant to keep satisfying the recruitment constraint, but without offering any rents to public sector workers. The remaining part of the increase in tax revenue is spent on additional public sector employment, as witnessed by (4.3). Using these results, we can prove

Proposition 6: *Starting from a tax competition equilibrium where $\varepsilon > \delta/(\alpha + \delta)$ so that all rents have been eliminated, an internationally coordinated rise in taxation will unambiguously increase social welfare.*

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[15]We use the fact that, with symmetric countries and a harmonised capital tax rate which is controlled by some international authority, the capital market equilibrium condition (2.12) simplifies to equation (4.7) below.

Proof: See Appendix 2.

Since public goods are underprovided in the initial equilibrium, and since Proposition 5 established that none of the extra revenue from tax coordination will be spent on rents, it is not surprising that some amount of coordination will raise social welfare. Indeed, as long as $g'/u' > F_L$ and $MPC > MPB$, i.e., as long as public goods are underprovided and politicians have no incentive to spend the revenue from tax coordination on rent creation, welfare will be boosted by further coordinated tax increases.

4.2. Tax coordination with rent creation

But could tax coordination improve social welfare even if it is carried beyond the point where rents start to emerge? To investigate this, we must derive the effects of further tax coordination on W, α and r when the supply of public goods has already been raised to a level where politicians would like to spend part of a further revenue increase on rents. In that situation politicians will offer a fiscal policy package (W, α) that satisfies the political optimum condition $MPC = MPB$. Using (4.1) and (4.2) and noting from the government budget constraint (2.18) that $dW/|d\alpha| = W/\alpha (1 - \alpha)$ when the individual country takes τ as given, we find that this condition implies

$$(1 + \delta) g'(\alpha) + u \left(W + r\overline{k}\right) - u \left(w (r + \tau) + r\overline{k}\right) =$$
$$(\alpha + \delta) u' \left(W + r\overline{k}\right) \left(\frac{W}{\alpha (1 - \alpha)}\right). \tag{4.6}$$

When the public sector recruitment constraint is no longer binding, the effects of tax coordination on W, α and r in the representative small country may be found from the simultaneous system consisting of the government budget constraint (2.18), the political equilibrium condition (4.6) and the capital market equilibrium condition

$$(1 - \alpha) k (r + \tau) - \overline{k} = 0 \tag{4.7}$$

which follows from (2.12) when all countries are forced to change their capital tax rate in a coordinated manner. In analysing this system, we assume that countries start out from a situation where the public sector recruitment constraint has just ceased to be strictly binding so that $W = w$ in the initial equilibrium. The effects

of a coordinated rise in τ on W, α and r are given in equations (A.13) through (A.15) in Appendix 1. Using those results we obtain

Proposition 7: *Once tax coordination has raised public sector employment to the point where the recruitment constraint $W \geq w$ is no longer strictly binding, the following condition is necessary and sufficient to ensure that politicians will use part of the revenue from further tax increases to offer rents to public sector workers:*

$$\delta + \alpha \left[1 + \alpha + \gamma \sigma_c (\alpha + \delta) \right]$$

$$+ \varepsilon \left(\frac{\alpha}{1 - \alpha} \right) \left[\frac{1 + \delta}{1 - \alpha} + \gamma \sigma_c (\alpha + \delta) + \left(\frac{\alpha + \delta}{\alpha} \right) \left(\frac{\sigma_g}{1 + \delta} - 1 \right) \right] > 0. \qquad (4.8)$$

Proof: See Appendix 2.

A sufficient (but far from necessary) condition for (4.8) to hold is that $\sigma_g \geq 1 + \delta$. As mentioned in footnote 13, empirical estimates of the coefficient of relative risk aversion in private consumption (σ_c) are typically far above unity, so if the corresponding CRRA parameter for public consumption (σ_g) is not much smaller, it will most likely exceed $1 + \delta$ (since δ will not realistically be far above one). Moreover, even if $\sigma_g < 1 + \delta$, all the other positive terms on the left-hand side of (4.8) are likely to ensure that the condition will hold. For all plausible parameter values it then follows from Proposition 7 that once tax coordination is carried beyond a certain point, it will start to generate rents to public sector workers. Clearly this accords with the Public Choice view that tax coordination stimulates rent seeking. However, this does not necessarily mean that a further coordinated tax increase is undesirable once rents start to emerge. More precisely, we have

Proposition 8: *When tax coordination has raised public sector employment to the point where the recruitment constraint $W \geq w$ is no longer strictly binding, a further coordinated rise in the level of taxation will increase social welfare if and only if the following condition is met:*

$$\gamma \sigma_c (\alpha + \delta) \left[\frac{\alpha + \delta}{\alpha + \alpha \delta} - (1 - \alpha) \right] > \delta + \alpha (2 - \alpha) + \left(\frac{\alpha + \delta}{1 + \delta} \right) \left(\frac{\alpha^2 + \delta}{\alpha (1 - \alpha)} \right). \qquad (4.9)$$

Proof: See Appendix 2.

Condition (4.9) may very well be satisfied. For example, suppose that $\rho = 0.12$, $\gamma = 0.8$ and $\alpha = 0.13$. The inequality in (4.9) will then hold for all values of σ_c above 3.74. The empirical estimates in Hall (1988) imply that σ_c is at least 5 and possibly much higher, while the estimates by Attanasio and Weber suggest that σ_c lies in the interval between 1.5 and 4.7. Hence tax coordination may be welfare-improving even when it generates rents (recall from Proposition 7 that a coordinated rise in taxation will almost surely create rents when the recruitment constraint ceases to bind). The reason for this result is that public goods are still underprovided in the initial equilibrium, so if politicians spend part of the extra tax revenue on an increase in public goods supply - as indeed they will, given the parameter values assumed in the numerical example above - the resulting positive welfare effect may outweigh the loss from the distortions caused by the introduction of rents.[16]

5. Summary and conclusions

In this paper we have set up a probabilistic voting model to explore the hypothesis that tax competition improves public sector efficiency and social welfare when a political distortion favours public sector employees. In our model the political distortion induces politicians to create rents through high wages to public sector workers in the absence of tax base mobility. If tax competition is introduced via the lifting of capital controls, it will reduce the rents to public sector workers and may well destroy them completely when the number of competing jurisdictions becomes sufficiently large. However, tax competition will also cause an under-provision of public goods by increasing the marginal cost of public funds. Our analysis indicated that, in the presence of a political distortion favouring public sector workers, a modest degree of tax competition involving a relatively low tax base elasticity is likely to be welfare-improving, whereas unfettered tax competition among small jurisdictions is likely to be welfare-reducing, compared to a hypothetical situation without tax base mobility. In particular, if tax competition is sufficiently strong to eliminate all rents, a coordinated rise in capital taxation

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[16]To see that public goods are underprovided initially, note from (A.18) in Appendix 2 that the political equilibrium condition $MPB = MPC$ implies $g'/u' > F_L$. The fact that a coordinated rise in τ will increase public goods provision (and not just induce a rise in rents) follows from (A.13) in Appendix 1 by inserting the assumed parameter values.

will always be welfare-improving by offsetting the underprovision of public goods. We also found that it may be welfare-enhancing to carry tax coordination beyond the point where rents to public sector workers start to emerge.

Overall our analysis suggests that while the advocates of tax competition are right in claiming that tax base mobility serves to reduce rent-seeking, it is a double-edged sword that also tends to distort the supply of public goods, as argued by supporters of tax coordination. Up to a certain point tax competition may play a useful efficiency-enhancing role, but if it becomes too intense it is likely to be welfare-reducing. Indeed, in a calibrated version of our model we were able to identify an optimal intensity of tax competition, as measured by the elasticity of the tax base with respect to the tax rate.

Throughout this paper we assumed that the political system tends to favour the interests of those who derive their income from the public sector. By making this assumption we deliberately stacked the deck in favour of the hypothesis that tax competition improves public sector efficiency. However, one can easily imagine conditions which would be less favourable to this hypothesis. For example, if the owners of 'big business' have a disproportionate political influence, it seems quite likely that capital will be undertaxed (and that public goods may consequently be underprovided) even in the absence of tax competition. Studying the effects of tax competition in such circumstances would be an interesting topic for future research.

Appendices

Appendix 1. Documentation of results reported in sections 3.1, 3.2 and 4.2

This appendix explains the derivation of the results reported in sections 3.1, 3.2 and 4.2, except the proofs of propositions 1 through 8 which are stated in Appendix 2.

The Lagrangian corresponding to the maximisation problem specified at the start of section 3.1 is

$$L = \alpha_i p_i \left(u \left(W + r\overline{k} \right) + g \left(\alpha \right) - U_g^* \right)$$

$$+ \left(1 - \alpha_i \right) p_o \left(\left(\left(\frac{\alpha - \alpha_i}{1 - \alpha_i} \right) u \left(W + r\overline{k} \right) + \left(\frac{1 - \alpha}{1 - \alpha_i} \right) u \left(w \left(r + \tau \right) + r\overline{k} \right) + g \left(\alpha \right) - U_o^{e*} \right) \right)$$

$$+ \lambda \left[\tau \left(1 - \alpha \right) k \left(r + \tau \right) - \alpha W \right] + \eta \left[W - w \left(r + \tau \right) \right],$$

where η is the Kuhn-Tucker multiplier associated with the recruitment constraint $W \geq w$. Using (2.13), (2.14) and the fact that $\left(1 - \alpha \right) k = \overline{k}$, we find the first-order conditions for maximisation with respect to W, α and τ to be

$$\partial L / \partial W = 0 \quad \Longrightarrow \quad \left[\alpha_i p_i' + \left(\alpha - \alpha_i \right) p_o' \right] u_g' - \alpha \lambda + \eta = 0, \qquad (A.1)$$

$$\partial L / \partial \alpha = 0 \quad \Longrightarrow \quad \left[\alpha_i p_i' + \left(1 - \alpha_i \right) p_o' \right] g' + p_o' \left(u_g - u_p \right) - \lambda \left(\tau k + W \right)$$

$$+ \frac{k}{n \left(1 - \alpha \right) k'} \left[\overline{k} \alpha_i u_g' \left(p_i' - p_o' \right) + \overline{k} \alpha p_o' \left(u_g' - u_p' \right) + \lambda \tau \left(1 - \alpha \right) k' + \eta k \right] = 0, \quad (A.2)$$

$$\partial L / \partial \tau = 0 \quad \Longrightarrow \quad \lambda \left(1 - \alpha \right) \left(k + \tau k' \right) + \eta k - \left(1 - \alpha \right) k p_o' u_p'$$

$$- \frac{1}{n} \left[\overline{k} \alpha_i u_g' \left(p_i' - p_o' \right) + \overline{k} \alpha p_o' \left(u_g' - u_p' \right) + \lambda \tau \left(1 - \alpha \right) k' + \eta k \right] = 0. \qquad (A.3)$$

When the recruitment constraint is not strictly binding, we have $\eta = 0$. Using the government budget constraint $\tau k = \left(\frac{\alpha}{1 - \alpha} \right) W$ to eliminate τk, the reader may verify that (A.1) through (A.3) then lead to (3.1) and (3.2) in section 3.1.

To see when the public sector recruitment constraint $W \geq w$ will be binding, we insert (A.1) into (A.3) and use the definition $\delta \equiv \alpha_i \left(p_i' - p_o' \right) / p_o'$. Focusing on

the case with a large number of countries where $n \longrightarrow \infty$, and assuming that the recruitment constraint is in fact binding so that $u'_g = u'_p = u'$, we then obtain

$$\eta \equiv u'p'_o (1 - \alpha) \left(\frac{\varepsilon (\alpha + \delta) - \delta}{1 - \varepsilon (1 - \alpha)} \right). \tag{A.4}$$

which will indeed be positive (thus validating the assumption that $u'_g = u'_p = u'$) when the weak condition (3.3) is met. Substituting (A.1) and the government budget constraint $\tau k = \left(\frac{\alpha}{1-\alpha} \right) W$ into (A.2), and recalling that $u_g = u_p$ and $W = w = F_L$ for $\eta > 0$, we find by using (A.4) that the marginal rate of substitution between private and public goods (g'/u') is given by equation (3.4) in section 3.2.

Consider next the case of autarky and suppose that $W > w$ so that $\eta = 0$. Setting $n = 1$ and noting from the government budget constraint that $W = \tau \overline{k}/\alpha$ under autarky, we may then write (3.1) and (3.2) in the form

$$\alpha u' \left(w \left(r \left(\alpha, \tau \right) + \tau \right) + r \left(\alpha, \tau \right) \overline{k} \right) - (\alpha + \delta) u' \left(\frac{\tau \overline{k}}{\alpha} + r \left(\alpha, \tau \right) \overline{k} \right) = 0, \tag{A.6}$$

$$\alpha^2 g' (\alpha) (1 + \delta) + \alpha^2 \left[u \left(\frac{\tau \overline{k}}{\alpha} + r \left(\alpha, \tau \right) \overline{k} \right) - u \left(w \left(r \left(\alpha, \tau \right) + \tau \right) + r \left(\alpha, \tau \right) \overline{k} \right) \right]$$

$$- (\alpha + \delta) \tau \overline{k} u' \left(\frac{\tau \overline{k}}{\alpha} + r \left(\alpha, \tau \right) \overline{k} \right) = 0, \tag{A.7}$$

where the derivatives of the function $r \left(\alpha, \tau \right)$ are given by (2.13) and (2.14). Taking total differentials of (A.6) and (A.7), evaluating the derivatives in an initial equilibrium where $\delta = 0$ (so that $W = w$, $u_g = u_p$ and $u'_g = u'_p$ initially), and defining $\widehat{\varepsilon} \equiv -\tau k'/k$, we get (using (2.13) and (2.14) with $n = 1$ plus the facts that $\tau \overline{k} = \alpha w$ and $g' = u'w$ in the initial undistorted equilibrium):

$$\begin{bmatrix} wu'' \left[1 + \frac{1}{\widehat{\varepsilon}} \left(\frac{\alpha}{1-\alpha} \right)^2 \right] & -\overline{k} u'' \\ \alpha g'' - \frac{wu'}{\widehat{\varepsilon}} \left(\frac{\alpha}{1-\alpha} \right)^2 + w^2 u'' \left[1 + \frac{\alpha}{\widehat{\varepsilon}} \left(\frac{\alpha}{1-\alpha} \right) \right] & -wu'' \overline{k} (1 - \alpha) \end{bmatrix} \begin{bmatrix} d\alpha \\ d\tau \end{bmatrix} =$$

$$\begin{bmatrix} u' \cdot d\delta \\ wu' (1 - \alpha) \cdot d\delta \end{bmatrix}$$

Applying Cramer's rule to this system, we find that

$$\frac{\partial \alpha}{\partial \delta} = 0, \tag{A.11}$$

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$$\frac{\partial \tau}{\partial \delta} = \frac{\frac{u'g'}{\widehat{\varepsilon}}\left(\frac{\alpha}{1-\alpha}\right)^2 - \alpha u'\left(g'' + w^2 u''\right)}{u''\overline{k}\left[\alpha\left(g'' + w^2 u''\right) - \frac{g'}{\widehat{\varepsilon}}\right]} > 0. \tag{A.12}$$

Thus the introduction of a small political distortion will drive up the tax rate but leave public sector employment unchanged, as reported in section 3.1.

We turn now to the effects of tax coordination with rent creation discussed in section 4.2. Assume that the equilibrium value of W implied by (2.18), (4.6) and (4.7) will indeed satisfy the recruitment constraint $W \geq w$. From these equations and the assumption that $W = w$ initially, one can then show that

$$\frac{d\alpha}{d\tau} = \frac{(\varepsilon/\tau)(1-\alpha)\left\{(\alpha+\delta)\left[1 - \gamma\sigma_c(1-\alpha)\right] - \alpha(1-\alpha)\right\}}{\Delta}, \tag{A.13}$$

$$\frac{dW}{d\tau} = \left(\frac{\overline{k}\varepsilon(1-\alpha)}{\alpha\Delta}\right)\left\{\left(\frac{\alpha+\delta}{\alpha}\right)\left(1 - \frac{\sigma_g}{1+\delta}\right) - \left(\frac{1+\delta}{1-\alpha}\right) - \gamma\sigma_c(\alpha+\delta)\right\}$$

$$\qquad - \left(\frac{\overline{k}}{\Delta}\right)\left[\alpha + \gamma\sigma_c(\alpha+\delta)\right], \tag{A.14}$$

$$\frac{dr}{d\tau} = \left(\frac{\varepsilon(1-\alpha)}{\Delta}\right)\left\{2 - \alpha + \left(\frac{\alpha+\delta}{\alpha}\right)\left[\frac{\alpha}{1-\alpha} + \gamma\sigma_c + \frac{\sigma_g}{1+\delta}\right]\right\}$$

$$\qquad + \left(\frac{1}{\Delta}\right)\left[\gamma\sigma_c(\alpha+\delta) - \delta\right], \tag{A.15}$$

$$\Delta \equiv -\varepsilon\overline{k}(1-\alpha)\left\{2 - \alpha + \left(\frac{\alpha+\delta}{\alpha}\right)\left[\frac{\alpha}{1-\alpha} + \gamma\sigma_c + \frac{\sigma_g}{1+\delta}\right]\right\}$$

$$\qquad - \alpha\left[\alpha + \gamma\sigma_c(\alpha+\delta)\right] < 0, \tag{A.16}$$

$$\gamma \equiv \frac{W}{W + r\overline{k}}, \qquad \sigma_c \equiv -C\frac{u''}{u'}, \qquad \sigma_g \equiv -\alpha\frac{g''}{g'},$$

where σ_c is the coefficient of relative risk aversion in private consumption (which is identical for private and public sector workers in the initial equilibrium) and σ_g is the coefficient of relative risk aversion in public consumption. As mentioned, these results hold provided $W \geq w$. If this condition is satisfied initially, it will continue to be met if $dW \geq dw$. Noting from (2.11) that $dw/d\tau = -k\left(1 + \frac{dr}{d\tau}\right)$ and using (A.14) and (A.15), we find

$$\frac{dW}{d\tau} - \frac{dw}{d\tau} = \left(\frac{-k}{\Delta}\right)\left\{\delta + \alpha\left[1 + \alpha + \gamma\sigma_c(\alpha+\delta)\right]\right\}$$

$$- \left(\frac{\varepsilon k(1-\alpha)}{\alpha\Delta}\right)\left[\frac{1+\delta}{1-\alpha} + \gamma\sigma_c(\alpha+\delta) + \left(\frac{\alpha+\delta}{\alpha}\right)\left(\frac{\sigma_g}{1+\delta} - 1\right)\right]. \tag{A.17}$$

The proof of Proposition 7 given in Appendix 2 utilises (A.16) and (A.17).

Appendix 2. Proofs of propositions

Proof of Proposition 1: In the absence of a lobby we have $\alpha_i = 0$ and hence $\delta = 0$. Moreover, for $n = 1$ we have $\varepsilon = 0$. We then see from (3.1) that $u'_g = u'_p$, implying $U_g = U_p$, as required for a first-best allocation. Further, $u'_g = u'_p$ implies that $W = w$, so public sector workers earn no rents and the recruitment constraint (2.19) is just satisfied. Finally, with $n = 1$, $\delta = 0$ and $W = w$ (and hence $u_g = u_p$), equation (3.2) collapses to the Samuelson rule (2.8) for the optimal provision of public goods. ∎

Proof of Proposition 2: From (3.1) it follows that for $n = 1$ a positive value of δ will drive u'_g below u'_p. This in turn requires $W > w$. Moreover, according to equations (A.11) and (A.12) in the appendix we have

$$\frac{\partial \tau}{\partial \delta} > 0, \qquad \frac{\partial \alpha}{\partial \delta} = 0 \qquad \text{for} \quad n = 1 \text{ and } \delta = 0 \text{ initially.} \qquad \blacksquare$$

Proof of Proposition 3: Condition (3.3) is equivalent to

$$\left(\frac{\alpha}{\alpha + \delta} \right) \left(\frac{1 - \frac{\alpha}{n}}{1 - \frac{\alpha}{n} - \varepsilon} \right) > 1.$$

According to (3.1) this would imply $u'_g > u'_p$, but since this would require $W < w$, it would violate the recruitment constraint $W \geq w$. Hence the best thing politicians could do would be to offer the private sector wage to public sector employees, implying the absence of rents. ∎

Proof of Proposition 4: In the case where $n \to \infty$ and there are no rents so that $W = w$ and $u'_g = u'_p = u'$, (3.4) follows from equations (A.1) through (A.4) in Appendix 1. The fraction g'/u' is the marginal rate of substitution between private and public goods, and F_L is the marginal rate of transformation. Since $\left(\frac{1}{1-\alpha} \right) \left(\frac{1}{1-\varepsilon(1-\alpha)} \right) > 1$, it follows immediately from (3.4) that $g'/u' > F_L$, implying that public goods are underprovided relative to the first-best allocation. ∎

Proof of Proposition 5: For a given tax rate it follows from the government budget constraint (2.18) that $dW/|d\alpha| = W/\alpha(1-\alpha)$, and when all rents have been

destroyed, we have $W = w = F_L$, $u'_g = u'_p = u'$ and $u_g = u_p$. Inserting these relationships into (4.2) and dividing the resulting expression by (4.1), we get

$$\frac{MPC}{MPB} = \left(\frac{g'(\alpha)}{u' F_L} \right) \left(\frac{\alpha (1 - \alpha)(1 + \delta)}{\alpha + \delta} \right). \tag{A.18}$$

A tax competition equilibrium without rents satisfies (3.4) which may be substituted into (A.18) to give

$$\frac{MPC}{MPB} = \frac{\alpha + \alpha \delta}{\alpha + \delta - \varepsilon (\alpha + \delta)(1 - \alpha)}. \tag{A.19}$$

The expression on the right-hand side of (A.19) must be greater than one since we are assuming $\varepsilon > \delta / (\alpha + \delta)$. With $MPC > MPB$, an unconstrained politician would want to *cut* the public sector wage rate in order to *expand* public sector employment, but the binding recruitment constraint $W \geq w$ prevents him from doing so. When tax coordination allows individual countries to raise more revenue, politicians will therefore want to spend *all* of the increased revenue on expanding public sector employment, apart from any revenue that may be needed to continue satisfying the recruitment constraint. ∎

Proof of Proposition 6: Using (2.11) and (2.15), the social welfare function (2.5) may be written as

$$SW = \alpha u \left(W + r \overline{k} \right) + (1 - \alpha) u \left(w (r + \tau) + r \overline{k} \right) + g(\alpha)$$

which may be differentiated to give (using $\overline{k} = k(1 - \alpha)$):

$$\frac{dSW}{d\tau} = \left(g' + \overbrace{u_g - u_p}^{= 0 \text{ initially}} \right) \cdot \frac{d\alpha}{d\tau} + \alpha u'_g \cdot \frac{dW}{d\tau} + \alpha \overline{k} \left(\overbrace{u'_g - u'_p}^{= 0 \text{ initially}} \right) \frac{dr}{d\tau} - \overline{k} u'_p. \tag{A.20}$$

Inserting (4.3) through (4.5) into (A.20) and remembering that $u_g = u_p$, $u'_g = u'_p$ and $dW = dw$ initially, we find by using (3.4) that

$$\frac{dSW}{d\tau} = \left(\frac{u' k \varepsilon (1 - \alpha)^2}{\alpha^2 + \varepsilon (1 - \alpha)^2} \right) \left[\left(\frac{1}{1 - \alpha} \right) \left(\frac{1}{1 - \varepsilon (1 - \alpha)} \right) - (1 - \alpha) \right] > 0. \qquad ∎$$

Proof of Proposition 7: Since we know from (A.16) that $\Delta < 0$, it follows directly from (A.17) that condition (4.8) in Proposition 7 is necessary and sufficient to ensure that $\frac{dW}{d\tau} - \frac{dw}{d\tau} > 0$. ∎

Proof of Proposition 8: Inserting (A.13) and (A.14) into (A.20), one finds the following welfare effect of a further coordinated increase in the capital tax rate at the point where the recruitment constraint just ceases to bind (so that we still have $u_g = u_p$ and $u'_g = u'_p = u'$ initially):

$$
\left(\frac{-\alpha\Delta}{u'\varepsilon(1-\alpha)} \right) \left(\frac{dSW}{d\tau} \right) = \gamma\sigma_c(\alpha+\delta) \left[\frac{\alpha+\delta}{\alpha+\alpha\delta} - (1-\alpha) \right]
$$

$$
- \left[\delta + \alpha(2-\alpha) + \left(\frac{\alpha+\delta}{1+\delta} \right) \left(\frac{\alpha^2+\delta}{\alpha(1-\alpha)} \right) \right] \tag{5.1}
$$

Since $\Delta < 0$ according to (A.16), it follows directly from (5.1) that the condition (4.9) stated in Proposition 8 is necessary and sufficient to guarantee that $dSW/d\tau > 0$. ∎

Appendix 3. The model used for simulations in section 3.3

Using the specifications in (3.10) and (3.11) to derive expressions for $k(r+\tau)$, $u_g - u_p$, u'_g, u'_p, and $g'(\alpha)$, we obtain the following model describing the situation where the public sector recruitment constraint $W \geq w$ is not strictly binding, i.e., the situation where public sector workers generally earn rents:

$$
W + r\overline{k} - \left(w + r\overline{k} \right) \left\{ \frac{(\alpha+\delta)\left[1 - \frac{\alpha}{n} - \varepsilon\right]}{\alpha\left(1 - \frac{\alpha}{n}\right)} \right\}^{1/\sigma_c} = 0 \tag{A.21}
$$

$$
\frac{\theta\left(W + r\overline{k}\right)^{\sigma_c}}{\alpha^{\sigma_g}} + \left(\frac{1}{1-\sigma_c} \right) \left[W + r\overline{k} - \left(w + r\overline{k} \right) \left(\frac{W + r\overline{k}}{w + r\overline{k}} \right)^{\sigma_c} \right]
$$

$$
- \left(\frac{\alpha+\delta}{\alpha+\alpha\delta} \right) \left[1 + \frac{\alpha(n-1)}{(1-\alpha)(n-\alpha)} \right] W = 0 \tag{A.22}
$$

$$
\varepsilon = \left(\frac{n-1}{n} \right) \left(\frac{t}{1-\beta} \right) \tag{A.23}
$$

$$
t = \frac{\tau}{r+\tau} \tag{A.24}
$$

$$
k = \left(\frac{\beta A}{r+\tau} \right)^{1/(1-\beta)} \tag{A.25}
$$

$$w = (1 - \beta) A k^{\beta} \tag{A.26}$$

$$\tau (1 - \alpha) k - \alpha W = 0 \tag{A.27}$$

$$(1 - \alpha) k - \overline{k} = 0 \tag{A.28}$$

$$SW = \frac{\alpha \left(W + r\overline{k} \right)^{1-\sigma_c}}{1 - \sigma_c} + \frac{(1 - \alpha) \left(w + r\overline{k} \right)^{1-\sigma_c}}{1 - \sigma_c} + \frac{\theta \alpha^{1-\sigma_g}}{1 - \sigma_g} \tag{A.29}$$

Equations (A.21) and (A.22) correspond to the political equilibrium conditions (3.1) and (3.2), while (A.25) and (A.26) are the capital demand function and the private sector wage rate implied by profit maximisation, respectively. (A.19) is the government budget constraint, and (A.20) is the international capital market equilibrium condition in a setting with symmetric countries. Equation (A.23) gives the tax base elasticity implied by the Cobb-Douglas production function, and the auxiliary variable t in (A.24) is the effective capital income tax rate. The final equation (A.29) calculates the level of social welfare. The nine equations (A.21) through (A.29) determine the nine endogenous variables W, w, r, α, τ, k, ε, t and SW, given the values of the parameters $\overline{k}$, A, δ, σ_c, σ_g, θ, β and n.

As indicated, the model above is valid only as long as the public sector recruitment constraint is not binding. When this constraint becomes binding, equation (A.21) must be replaced by the condition $W = w$, and (A.22) simplifies to

$$\frac{\theta \left(W + r\overline{k} \right)^{\sigma_c}}{\alpha^{\sigma_g}} - \left(\frac{\alpha + \delta}{\alpha + \alpha \delta} \right) \left[1 + \frac{\alpha (n - 1)}{(1 - \alpha)(n - \alpha)} \right] w = 0 \tag{A.30}$$

In the case of tax competition among small jurisdictions ($n \to \infty$) equation (A.30) may be written as

$$\frac{\theta \left(W + r\overline{k} \right)^{\sigma_c}}{\alpha^{\sigma_g}} - \left(\frac{1}{1 - \alpha} \right) \left(\frac{1}{1 - \varepsilon (1 - \alpha)} \right) w = 0 \tag{A.31}$$

which is just a version of (3.4) in the text.

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