Fiscal Competition on the Local Level

May commuting be a source of fiscal crises?

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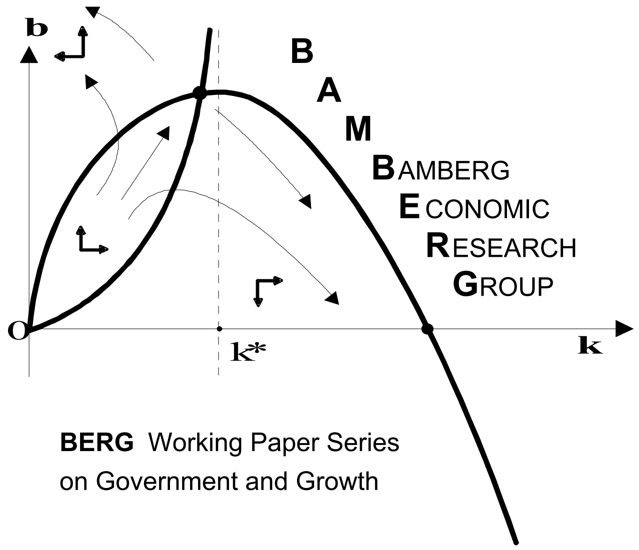

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by

Holger Kächelein*

Abstract

The paper extends the familiar standard tax competition model for the possibility of cross-border commuting by introducing an additional level of jurisdictions. For separating the impact of landownership and cross-border commuting different schemes of landownership are considered. It will be shown that the possibility of cross-border commuting increases the problem of tax competition since an additional indirect fiscal externality arises via the potential reallocation of labor. The resulting change in the supply of publicly provided goods depends crucially on the considered structure of landownership respectively on the aim of the local policy makers. If the tax burden can be exported via external possession of land, the undersupply of publicly provided goods will be reduced and in the extreme case, an oversupply may arise.

Keywords: Tax Competition, Cross-border Commuting, Fiscal Externalities

JEL Classification: H77, H71, J68

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1 Introduction

One of the key results in the extensive literature on fiscal competition is the resulting under-supply of publicly provided goods if decentralized governments which are limited in the tax instruments set act uncoordinated. Intending to attract mobile factors of production, each local government has an incentive to reduce the tax rate levied with on. If the governments are limited to taxes which are related to highly mobile factors the resulting supply of publicly provided goods will also be inefficiently low. Based on the intuition of OATES (1972), ZODROW and MIESZKOWSKI (1986a) and WILSON (1986) reproduced the result in the context of formal models. Since this time, the basic structure of fiscal competition models has been extend for several aspects, giving a more detailed view on the problem of fiscal competition[1]. One main purpose of the further analysis in competitive models has been the introduction other mobile factors of production as firms and labor. However, the introduction of "labor mobility" is usually done in the sense of household mobility. Thus, individuals may choose freely the jurisdiction of living and working for maximizing their utility. Nevertheless, households have been still limited to supply their labor force only in their community of residence and, consequently, any firm could only hire workers living at the same location. In other words the usual approach rules out the possibility of cross-border commuting. In such a structure, the governments have consequently an

[1] An overview of the fiscal competition literature gives for example: WILSON (1999). For an introduction in the theory of fiscal competition see e.g. WELLISCH (2000).

essential interest in a prospering economic activity in **their** jurisdiction as the earnings out of the labor force and local business activity are directly connected.

For the geographic situation of the United States, cross-border commuting may be a limited phenomena in metropolitan areas and therefore of reduced interest in the context of local tax competition. However, in Europe especially in Germany, the density of population is higher and therefore the distance between cities lower, even sometimes neglectable. Picking up the situation of the "Rhein-Ruhr-Gebiet" in the Northeastern part of Germany, cities are nearly spatially merged and differences between intra- and inner-city commuting are ignorable. Furthermore, in Germany costs of commuting are deductible on the income tax while for example the United States and the United Kingdom do not provide the possibility to exclude these work-related expenses from the tax base.[2] Thus, the question arises how the possibility of cross-border commuting changes the results concerning the inefficient supply of public goods.

The issue of commuting is not new in the literature of taxation. GORDON (1983) has formally illustrated the basic intuition of the fiscal externalities caused by limited taxation instruments and factor mobility, considering also the possibility of commuting. SASKAI (1991) introduced also the possibility of inter-city commuting, however focusing on optimal taxation while neglecting strategic behavior of the governments. In the context of the tax competition literature, BRAID (1996, 2000) considers labor mobility by commuting, however, concentrates on the choices of tax instruments.

As stressed by BRAID (2000), in a two-factor, constant-to-scale production model where labor as well as capital is costless mobile the provision of public goods would collapse completely if only source-based, distortionary taxes

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[2] Concerning the efficiency of deductibility of commuting costs see Wrede (2001).

were available. The reason for such a non-active government can be found in the outflow of the entire production to the community with the lowest taxation. Besides the consideration of transaction costs as in BRAID (2000) the outflow of the whole production can be avoided if the production is not linear-homogenous in the mobile factors. Thus, a third immobile factor such as a publicly provided input, a natural resource without limited ownership or land could be assumed.

However, considering land as a third factor of production in a local context involves further problems concerning the distribution of landownership. As in BRAID (1996), business land as a third factor of production may be completely owned by local residents. Therefore, the focus seems to be only shifted from labor income to land rents, without any change concerning the interest in a prospering economic activity in the jurisdiction.[3]

Nevertheless, focusing on land rents whether explicitly or implicitly seems to be not adequate. Firstly, while a representative endowment with labor for every resident is tenable, in the case of land the same assumption appears highly fragile. As in reality the distribution of land ownership is usually asymmetric, for a justifiable assumption of explicit or implicit land rent maximization by the governments, we would have to assume either an enormous influence of land owners on the decisions of the government or directly a majority of land owners versus the rest of the local residents. Both seem to be unrealistic. Secondly, especially in a local context, land ownership needs not be limited to local residents of the same community. Thus, the tax

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[3] Considering the maximization of land rents as the target function of governments is a standard assumption in models with household mobility, see e.g. BRUECKNER (1983), WILDASIN (1986), HOYT (1991a), KRELOVE (1992), HENDERSON (1994); BURBIDGE and MYERS (1994) and WILSON (1997). The usual argument for this approach is the migration reaction of households on interregional differences in the level of reachable utility. Thus, governments would have to take a reservation utility level as given and any local attempt to increase utility would lead to migration reactions which immediately equalize the utility level between the jurisdictions. For another argumentation see WILSON (1995).

burden shifted from the mobile factor to the immobile factor land could be partly interregionally exported due to the external landownership. Finally, land can also be used for the purpose of housing. For the aim of maximizing land rents, governments could also try to attract new residents implying an increased demand for land.

The purpose of the paper is to analyze more closely the impact of cross-border commuting on the decision of benevolent local governments. A special aspect is thereby to separate the impact of cross-border commuting on the supply of public goods from the considered structure of land-ownership. Therefore, the paper contains different schemes of land endowment and considerable target-functions of the government. In the second section, the structure of the model is presented and the general rule for the efficient supply of the public provided good is stated. In section 3 is shown that the presented model contains the standard tax competition model of ZODROW/MIESZKOWSKI as a special case and the basic intuition of tax competition models will be illustrated. In section 4, the possibility of cross-border commuting will be introduced whereby different schemes of land-ownership are taken into consideration. Section 5 brings the results together and gives an idea of possible extensions.

2 Basic Model

Consider a world economy consisting of M regions. Within each region living N households, which are spread equally on J identical communities $j = 1,...,J$. In the following we focus on the community i with $i := j,m$, thus i describe the community j in the region m and the total number of communities is given by $I = M \times J$. Concentrating on the efficiency aspect at the symmetric case, the communities are identical in per–capita endowments, technologies, preferences and amount of immobile households.

The representative individual's utility in i correspond to a strictly quasi-concave function $U^i \equiv U(x_i, z_i)$, where x_i denotes the consumption of a private (numeraire) good and z_i the per-capita level of a publicly provided good which can be consumed by an individual residing in i. Note that the publicly provided good is completely rival in consumption.[4] Each household has three potential sources of income: wage income out of an inelastic supply of labor and non-labor income out of interest payments and land rents.

The supply of business land L_i is fixed in any community; however, the distribution of land ownership will be considered separately in each chapter. Both capital K and labor N are perfectly mobile within each region, but capital is also interregional mobile and can move between the regions. Thus, we can interpret each region as a valley, where within the distance between firms is relatively low, whilst daily commuting from one region to another is prohibitively expensive.

The factors are used to produce a homogeneous private good x by a constant return to scale production technology. The production function, represented by $F^i \equiv F(N^i, K^i, L^i)$, satisfies the usual assumptions[5], whereby N^i, K^i, L^i symbolize the factor inputs while N_i, K_i, L_i are aggregated factor endowments of the community i. Since the production is characterized by linear homogeneity without any pure public input, we need not to consider firms explicitly. Supposing profit maximization in the production, at competitive markets the use of labor, land, and capital is ruled by:

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[4] In the given symmetric structure of communities, the assumption of a publicly provided private good could also be dropped for a pure local public good without any changes in the results as we neglect household mobility.

[5] The function is twice continuously differentiable for each variable; marginal products are positive $F_S^i > 0$ and diminishing $F_{SS}^i < 0, S = K, L, N$. Furthermore $F_{NN}^i F_{KK}^i - F_{NK}^i F_{NK}^i > 0$ holds, so that F is strictly concave in N and K. Finally all factors are complements $F_{\alpha\beta}^i > 0; \alpha, \beta = K, L, N; \alpha \neq \beta$.

(1) $$F_N^i =: \frac{\partial F(N^i, K^i, L^i)}{\partial N^i} = w^i ,$$

(2) $$F_K^i =: \frac{\partial F(N^i, K^i, L^i)}{\partial K^i} = \rho^i ,$$

(3) $$F_L^i =: \frac{\partial F(N^i, K^i, L^i)}{\partial L^i} = l^i ,$$

where w^i, l^i and ρ^i are the (gross) factor prices of labor, land, and capital at the community i. A global capital market equilibrium is realized if the exogenous given global supply of capital is equal to the total demand for capital – given by:

(4) $$\sum_{j=1}^{J}\sum_{m=1}^{M} K_{j,m} = \sum_{j=1}^{J}\sum_{m=1}^{M} K^{j,m} \Leftrightarrow \sum_{i=1}^{I} K_i = \sum_{i=1}^{I} K^i .$$

Each labor market has to be cleared on the regional level, so a labor market equilibrium is achieved if the following equation holds

(5) $$\sum_{j=1}^{J} N_{j,m} = \sum_{j=1}^{J} N^{j,m} \text{ for all } m \text{ in } M .$$

The land market has to be cleared on the local level; hence, a land market equilibrium is attained if the following equation holds

(6) $$L_i = L^i \text{ for all } i \text{ in } I .$$

To facilitate the structure the land market equilibrium given by equation (6) will be directly considered in the production function. Since capital is completely mobile, the net interest rate on capital r must be equal in all communities and regions with $r := r^i, \forall i \in I$. Neglecting commuting costs, the wage rate w^m within a region must be equalized in an equilibrium with $w^m := w^{m,j}, \forall j \in J$.

Each of the communities is ruled by a benevolent government with the aim of maximizing residences' utility. Assuming a representative household, we need not to distinguish between the labor supply of the local residence and the number of households thus N_i is used for both. Municipal policy variables are the business capital tax rate τ_i and the provision of a publicly provided good Z_i. There are no spillover effects in the provision of Z_i and one unit of the private good can be costless transformed into one unit of the public good.[6] Therefore, the budget constraint of the local governments is given by:

(7) $$\tau K^i = Z_i \text{ with}$$

(8) $$\tau_i = \rho_i - r$$

Taking into account the EULER-theorem and the fact that households consume their entire income, aggregated consumption of private goods is given by:

(9) $$x_i N_i = F(N^i, K^i, L_i) + r\left(K_i - K^i\right) + w^m\left(N_i - N^i\right) - l^i L_i + y^i N_i - K^i \tau_i .$$

For having the possibility to show the implication of different structures of land ownership, we define y^i as the household's income out of landownership.

Equation (9) is general enough to show the implications of the standard tax competition models with immobile labor as well as the impact of commuting in a decentralized region under different schemes of landownership.

Independent of the assumption concerning cross-border commuting, the level of publicly provided goods is efficient if the modified SAMUELSON-rule holds. Therefore, the marginal rate of substitution of the public services z_i for the private good x_i must be equal to one independent of the location:

(10) $$MRS_{z_i x_i} \equiv \frac{\partial U^i}{\partial z_i} \Big/ \frac{\partial U^i}{\partial x_i} = 1; \quad i \forall I$$

6 The Marginal Rate of Transformation is equal to one: $MRT_{xz} = 1$.

3 The standard tax competition model as the regional case

Let us start with the standard case of separated labor markets without any tax exports, which refers closely to the model structure of ZODROW and MIESZKOWSKI (1986a). For this we set by definition $J \equiv 1$. Hence, the demand for labor in each jurisdiction must be identical with the labor supply of the local residents:

(11) $$N^i \equiv N_i$$

Furthermore, we assume that the households own only land in the region of living. Under these assumptions, we can express the income out of the immobile factor as residual and the aggregated consumption in the local community reduce to:

(12) $$x_i N_i = F(K^i, N_i, L_i) + r\left(K_i - K^i\right) - K^i \tau_i$$

since $y^i = \sum_{j=1}^{J} l^{mj} L^{mj} \Big/ \sum_{j=1}^{J} N_{mj} \Leftrightarrow N_i y^i = l^i L^i ; J = 1$.

As stated, the local government wants to maximize the utility of its residents. Governments play thereby a NASH-game in tax rates, with the assumption that all policy makers set their tax rates simultaneously, taking the tax rates of the other jurisdictions as given.[7] Choosing the tax rate, the level of publicly provided goods is also determined by the budget constraint.

(13) $$\underset{\tau_i}{Max} \quad U_i = U\left(x_i, z_i\right)$$

$$s.t. \qquad x_i N_i = F(K^i, N_i, L_i) + r\left(K_i - K^i\right) - K^i \tau_i$$

$$\tau_i K^i = Z_i$$

The first order condition is therefore given by:

(14) $$\frac{\partial U_i}{\partial x_i}\left[\frac{\partial r}{\partial \tau_i}\left(K_i - K^i\right) - K^i\right] + \frac{\partial U_i}{\partial z_i}\left[K^i + \tau_i \frac{\partial K^i}{\partial \tau_i}\right] = 0$$

[7] As shown by Wildasin (1988), the alternative approach, using the public expenditures as the strategic variable, does not imply in general the same equilibrium.

Since in the symmetric case of identical regions the second term in the first bracket is zero, equation (14) simplifies to

(14)' $$MRS_{z_i,x_i} = \left(1+\varepsilon_{K_i\tau_i}\right)^{-1}, \text{ with}$$

(15) $$\varepsilon_{K_i\tau_i} = \frac{\tau_i}{K^i}\frac{\partial K^i}{\partial \tau_i} \leq 0$$

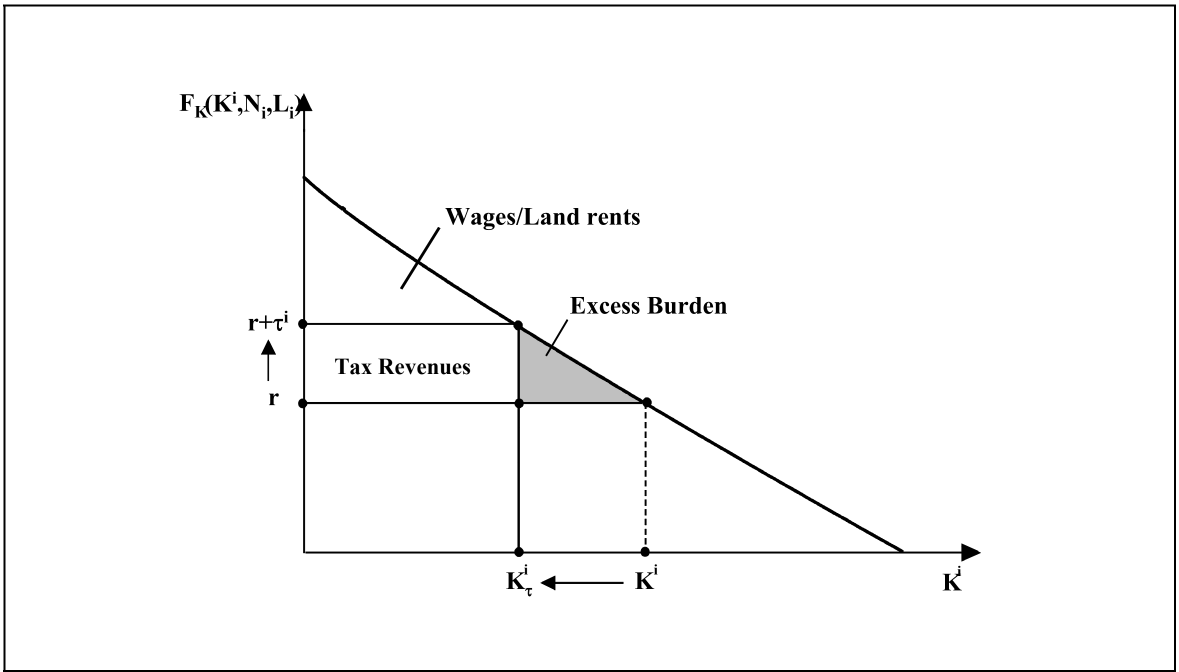
Hence, only if the government is not afraid of driving away productive capital by an increase of the tax rate, the decentralized decision will be efficient. Otherwise for $-1 < \varepsilon_{K_i\tau_i} < 0$, the decentralized supply of the publicly provided good will always be inefficiently low as the marginal rate of substitution is higher than unity, $MRS_{z_i,x_i} > 1$.

The tax elasticity of capital is thereby influenced by the number of regions. Before starting with a finite number of regions, let us first consider the case of a given world market interest rate, which is the same as increasing the number of regions to infinity $M \to \infty$. Then, taking into account a cleared capital market (4), the tax elasticity of capital can be restated as

(16) $$\varepsilon_{\tau_i K_i} = \frac{\tau_i}{K_i}\frac{\partial K_i}{\partial \tau_i} = \frac{\tau_i}{K_i}\frac{1}{F^i_{KK}}; \text{ with } F^i_{KK} = \frac{\partial^2 F^i}{\partial K^i \partial K^i}.$$

From the point of view of a single jurisdiction, the cost of financing the public activity has two components. The first cost component is the normal revenue effect, arising always with any tax activity. Secondly, the local municipality takes further into account that any source based taxes on a mobile base as capital provokes a reduced employment of the taxed mobile factor in the own jurisdiction. Thus, the outflow of the mobile factor decreases the local economic activity and therefore the local income out of the immobile factors. Hence, the burden of the tax is shifted from the mobile factor to the immobile factor of production. As MACDOUGALL (1960) and RICHMAN (1963) have shown, the burden is not only completely shifted to the immobile factors; the outflow of capital causes further an excess burden. The implication of the reduced capital employment on the residual income out of the immobile factors is shown in Figure 1.

Figure 1: Excess Burden of a source based capital tax



Following HOYT (1991b), also a more general result with an endogenous interest rate can be stated. The capital market equilibrium given by equation (4) implies for a change of the tax rate in the region i:

(17) $$\frac{dK^i}{d\rho^i}+\sum_{m=1}^{M}\frac{dK^m}{d\rho^i}\frac{dr}{d\tau_i}=0 \Leftrightarrow \frac{1}{F_{KK}}+\sum_{m=1}^{M}\frac{1}{F_{KK}}\frac{dr}{d\tau_i}=0\,.$$

In the given symmetric case of identical communities the condition (17) reduces to

(18) $$\frac{dr}{d\tau_i}=-\frac{1}{I} \Leftrightarrow \frac{dr}{d\tau_i}=-\frac{1}{M} \quad \text{since } J\equiv 1\,.$$

Thus, the change of the capital allocation out of the viewpoint of the community i as a reaction on a change of the tax rate in i is given by

(19) $$\frac{dK^i}{d\tau_i}=\frac{dK^i}{d\rho^i}\frac{d\left(\tau_i+r\right)}{d\tau_i}=\frac{1}{F_{KK}^i}\left(1-\frac{1}{M}\right).$$

Insert in equation (14) and rearranged we get:

(20) $$MRS_{z_i,x_i} = \left(1 + \frac{\tau_i}{F_{KK}K_i}\left(1 - \frac{1}{M}\right)\right)^{-1}.$$

Hence, only iff the capital market is restricted to one region $M = 1$, the representative policy makers will choose an efficient allocation of private and publicly provided goods. With an increase of the relevant capital market area the tax rate on capital will be decreased and therefore the supply of public provided goods becomes inefficiently low.

Nevertheless, from the point of view of the whole economy, the excess burden does not arise. Since in the given symmetric case, any jurisdiction will increase the tax rate for the same amount and the capital supply is globally fixed, the capital allocation stays unchanged. Thus, the single jurisdiction sticks in a "prisoner's dilemma" [BOADWAY and WILDASIN (1984), p. 504] which is usually seen as a justification for harmonized capital tax rates or other tax instruments especially connected to the immobile factors of production.

However, what happens if the labor market area does not fit exactly with the jurisdictions' border? For examining the implication of overlapping labor markets, we will consider the case of more then one community in each region in the following section.

4 Extended tax competition models with cross-border commuting

4.1 Landownership in each any every community or maximizing the utility of the majority

We will start with the extreme case in which the majority of voters are workers without any land endowment as assumed by BECK (1983). Thus, the government wants to maximize the utility of a representative worker. For simplicity, we consider that the number of landowners is very small compared to the number of worker or, alternatively, we completely abstract from the presence of local landowners at the jurisdiction. For the purpose of generality, we assume that the representative worker possesses also capital. The results of this approach are identical with them of a representative household possessing land in each and every jurisdiction.[8]

As we focus on the impact of commuting, the direct fiscal externality out of the tax exporting via the land rents has to be limited. Thus, the expected reduction of the land rent must always be smaller than the expected reduction of the tax revenues via the tax base: $L_i F_{LK} dK^i / d\tau_i > \tau_i \, dK^i / d\tau_i$.

Neglecting the income out of land rents, equation (9) reduces to

(21) $$x_i N_i = rK_i + w^m N_i .$$

With the aim to maximize the utility of the local workers, the government plays as before a NASH-game in tax rates, with the assumption that all other local authorities do not react on a change of the variable. This leads with the given maximization problem:

(22) $$\underset{\tau_i}{Max} \quad U_i = U\left(x_i, z_i\right)$$

$$s.t. \qquad x_i N_i = rK_i + w^m N_i$$

$$\tau_i K^i = Z_i$$

to the following first order condition:

(23) $$\frac{\partial U_i}{\partial x_i}\left[\frac{\partial r}{\partial \tau_i}K_i + \frac{\partial w^m}{\partial \tau_i}N_i\right] + \frac{\partial U_i}{\partial z_i}\left[K^i + \tau_i \frac{\partial K^i}{\partial \tau_i}\right] = 0 ,$$

which is equal to:

(24) $$MRS_{z_i, x_i} = -\left(\frac{\partial r}{\partial \tau_i} + \frac{\partial w^m}{\partial \tau_i}\frac{N_i}{K_i}\right)\left(1 + \varepsilon_{\tau_i K_i}\right)^{-1},$$

with

[8] The uniformity takes up the results of BRADFORD (1978) and ZODROW and MIESKOWSKI (1986b). For the proof see Appendix B.

(25) $$\frac{dr}{d\tau_i} = -\frac{1}{I} < 0,$$

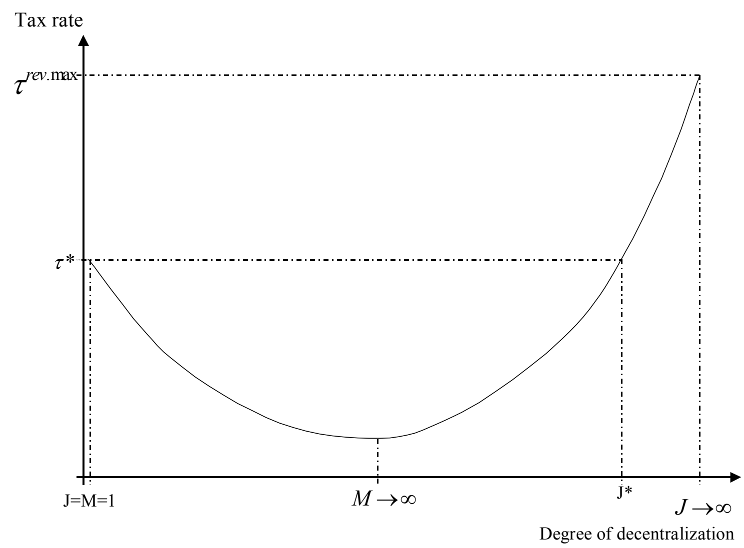
(26) $$\frac{dw^m}{d\tau_i} = \frac{F_{NK}}{F_{KK}} \frac{M-1}{I} < 0.$$[9]

For an increase of I, meaning more regions M or more jurisdictions J, the capital market power of the community shrinks and the effect of the change in the tax rate on the global interest rate will be reduced, which reflects equation (25).

Since the wage rate is fixed on the regional level, only an increased number of jurisdictions in a region reflected by J, which is equal to an increase of I whilst M stays unchanged, will decrease the labor market power of the community.

Thus, an increasing globalization implies an raising M, and as a reaction of the local policy makers, the supply of public goods will be reduced.

Figure 2: Optimal degree of decentralization



[9] For the derivations see Appendix A.

This is represented by the falling curve in Figure 2. As pronounced in section 3, without cross-border commuting $J = 1$ the resulting supply of public goods will only be efficient if the regions cooperates or there exists only one region $M = 1$. However, compared to the standard model presented in section 3, the inefficiency is reduced, as the community takes only the impact on the labor income into account and neglect the reduction of the land rents.

So which impact of cross-border commuting may be expected? Starting from the case of many regions $M \to \infty$ with $dr/d\tau_i|_{M\to\infty} = 0$, an increase in the number of the jurisdictions in each region implies also, that the impact of the local policy on the regional labor market decreases. Assuming $J \to \infty$, neither the interest rate nor the regional wage rate is influenced by a change in the tax rate at the community i: $dw^m/d\tau_i\big|_{J\to\infty} = 0$. Without any influence on the income, neither on the wage nor on the interest rate, the first bracket of equation (23) is zero, thus for maximizing the utility of the local resident, the policy makers have only to maximize the tax revenues. Thus, the benevolent government behaves in the same way as a Leviathan State. Since the revenue maximizing tax rate is higher than the optimal one, there must be an optimal degree of decentralization J^* even for the case of a full-integrated capital market. Furthermore, for every degree of integration on the capital market M should also exist an appropriate degree of decentralization within the region (M, J^*), ensuring an PARETO-optimal supply of publicly provided goods.

However, as noted already the possibility of tax exporting by the neglecting income out of land reduces the inefficiency even without commuting. In the following, we will therefore consider different schemes of land ownership for having the possibility to compare the results and to separate the impacts. Firstly, we will assume that each household owns also land, however, only in the region of living. In a next step, the landownership will be further limited to the jurisdiction of residence and thereby we can separate the impact of commuting and external land ownership. It will be shown that in fact cross-border-commuting leads to a decrease of the supply of public goods as the problem of tax competition increase.

4.2 Land ownership is limited to the region of residence

To neglect completely an income out of land possession seems quite restrictive and the assumption of an equal share of land in every community unrealistic. Hence, we will now assume that the representative household owns also land. However, as mentioned in the introduction, on the local level the possession of land outside of the own community of living but limited to region seems to be reasonable. As before, the local government wants to maximize the utility of the local residents and governments play a NASH-game in tax rates. Now, using the assumption of a linear homogenous production function, the aggregated consumption given by equation (5) can be rearranged for having the following maximization problem of the local government:

(27)
$$\max_{\tau_i} \quad U_i = U\left(x_i, z_i\right)$$

$$s.t. \qquad x_i N_i = w^m N_i + rK_i + y^i N_i$$

$$y^i = \sum_{j=1}^{J} l^{mj} L^{mj} \Big/ \sum_{j=1}^{J} N_{mj}$$

$$\tau_i K^i = Z_i$$

The first order condition is therefore given by:

(28)
$$\frac{\partial U_i}{\partial x_i}\left[\frac{\partial r}{\partial \tau_i}K_i + \frac{\partial w^m}{\partial \tau_i}N_i + \frac{1}{J}\frac{\partial \sum_{j=1}^{J} l^{mj} L_{mj}}{\partial \tau_i}\right] + \frac{\partial U_i}{\partial z_i}\left[K^i + \tau_i \frac{\partial K^i}{\partial \tau_i}\right] = 0$$

Inserting the changes of factor incomes in equation (28) and rearranged we get[10]

$$(29) \qquad MRS_{z_i,x_i} = \left[J\left(1+\varepsilon_{K_i\tau_i}\right)\right]^{-1}$$

As expected, the representative community can scatter the reduction of the factor income over the communities in the same region. To what extension the tax burden can be exported depends on the number of jurisdictions in the region. However, the possibility of an indirect tax export would also arise in the case of a two-factor model with capital and land combined with the assumption of an external landownership.

Nevertheless, the assumption of cross-border commuting has an additional impact on the tax elasticity. For the general result with an endogenous interest rate, we start again at the capital market equilibrium. Given equation (4) and using the same procedure as before, the impact on the capital allocation as a reaction on a change in the tax rate in i is out of the viewpoint of the community i:

$$(30) \qquad \frac{dK^i}{d\tau_i} = \frac{dK^i}{d\rho^i}\frac{d\left(\tau_i + r\right)}{d\tau_i} + \frac{dK^i}{d\rho^i}\frac{d\rho^i}{dN^i}\frac{dN^i}{dw^i}\frac{dw^i}{d\tau_i}.$$

Thus, additionally to the direct impact as in the standard model of ZODROW and MIESZKOWSKI, we have to consider a supplementary mechanism via the possibility of cross-border commuting.[11]

$$(31) \quad MRS = \underbrace{\frac{1}{J}}_{\substack{\text{Direct Fiscal-}\\ \text{Externality via}\\ \text{Tax Export}}} \left[1 + \underbrace{\tau_i \frac{1}{F_{KK}K_i}\left(1-\frac{1}{I}\right)}_{\substack{\text{Usual Indirect}\\ \text{Fiscal-Externality}}} + \underbrace{\tau_i \frac{1}{F_{KK}K_i}\frac{\left(J-1\right)}{J}\frac{\left(F_{NK}\right)^2}{F_{NN}F_{KK}-\left(F_{NK}\right)^2}}_{\substack{\text{Second Indirect Fiscal-Externality}\\ \text{via Cross-Border-Commuting}}} \right]^{-1}$$

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[10] For the detailed derivation see Appendix D.

[11] See Dahlby (1996) p. 398 for the distinction of direct and indirect fiscal externality.

The impact on the tax base via cross-border-commuting is for $J > 0; F_{NK} \neq 0$ definitively negative and leads, as the usual indirect fiscal externality, to a reduction of the tax base. The reason for the change in the tax elasticity of capital can be explain as follows. As an outflow of capital would also reduce the wage rate in the community, the labor force will partly shift to other communities in the region. This reduction of labor input at the community i cuts further the productivity of capital in the jurisdiction.

The last point will be to show that the stated direct fiscal externality in form of a tax export is completely introduced by the considered structure of landownership. In the next chapter, we will therefore limit the possession of land to the jurisdiction of residence.

4.3 Land ownership is limited to the community of residence

For the case of a limited landownership to the community of residence, the income out of land rents is equal to the local land rents $y^i N_i = l^i L^i$.

Again, the local government wants to maximize the utility of the local residents and governments play a NASH-game in tax rates. Now, the aggregated consumption given by equation (5) can be reduced for having the following maximization problem of the local government:

$$(32) \qquad \underset{\tau_i}{Max} \quad U_i = U\left(x_i, z_i\right)$$

$$s.t. \qquad x_i N_i = F\left(K^i, N^i, L_i\right) + r\left(K_i - K^i\right) + w^m\left(N_i - N^i\right) - \tau_i K^i$$

$$\tau_i K^i = Z_i$$

The first order condition is therefore given by:

$$(33) \qquad \frac{\partial U_i}{\partial x_i}\left[\frac{\partial r}{\partial \tau_i}\left(K_i - K^i\right) + \frac{\partial w^m}{\partial \tau_i}\left(N_i - N^i\right) - K^i\right] + \frac{\partial U_i}{\partial z_i}\left[K^i + \tau_i \frac{\partial K^i}{\partial \tau_i}\right] = 0$$

As in the symmetric case of identical regions the second and the third term in the first bracket are zero, equation (33) simplifies to

(34) $$MRS_{z_i,x_i} = \left(1+\varepsilon_{K_i\tau_i}\right)^{-1}.$$

Thus, the shift of the tax burden to other communities in the region was completely caused by the considered distribution of land; but the tax elasticity of capital is still higher than in the standard case without commuting:

(35) $$\varepsilon_{K_i\tau_i} = \frac{\tau_i}{K^i}\frac{\partial K^i}{\partial \tau_i} = \tau_i \frac{1}{F_{KK}K}\left[\left(1-\frac{1}{I}\right)+\frac{(J-1)}{J}\frac{\left(F_{NK}\right)^2}{F_{NN}F_{KK}-\left(F_{NK}\right)^2}\right].$$

Which is equal to equation (19) for $J=1$. Therefore, we can state :

Decentralization, implying overlapping labor market areas, decreases the supply of public goods and increases the inefficiency. Only if the decentralization entails an external landownership at the same time, the inefficient low supply of publicly provided goods at resulting equilibrium may be increased.

The result is only in the first moment ambiguous. Since labor becomes a mobile factor like capital, the impact must be the same. If the factor labor is inter-jurisdictional mobile, it can shift, in the same way as capital, the burden to the remaining immobile factor land.

5 Conclusion

The paper extends the familiar standard tax competition model for the possibility of commuting by introducing a new level of jurisdictions in the sense of a local government on the level of communities. For separating the impact of landownership and cross-border commuting, different schemes of landownership have been considered. It has been shown that the possibility of cross-border commuting increases the problem of tax competition as an additional indirect fiscal externality arises via the potential reallocation of labor. With the possibility of cross-border commuting, the change in the supply of publicly provided goods - whether an increase or a decrease - depends crucial on the assumed structure of landownership. If the tax burden can be exported via external possession of land the undersupply of publicly provided goods will be reduced and in the extreme case, an oversupply may arise. If the land possession is limited to local residents, cross-border commuting will increase the problem of an undersupply of the public activity, as an additional indirect fiscal externality arises.

Different aspects have been neglected in the paper, which open a wide area for future research. Besides of land there might be also a public input considered which prosper capital and labor productivity as well. Furthermore, up to this point household mobility, asymmetric endowments, and land for the purpose of housing are completely neglected.

6 Annex

For increasing the readability, the following convention concerning the indices is introduced:
$\bar{j} := m\bar{j}$ for any other jurisdiction than i in the **same region**.
$\bar{m} := \bar{m}j$ for any jurisdiction in an **other region** than i.

Annex A

The labor market equilibrium in the region m is defined by the following three equations:

(A1) $$w^i = F_N^i$$

(A2) $$w^{\bar{j}} = F_N^{\bar{j}}$$

(A3) $$\sum_{j=1}^{J} N_j = \sum_{j=1}^{J} N^j$$

While the capital market is in an equilibrium if the following four equations hold:

(A4) $$r^i = F_K^i - \tau_i$$

(A5) $$r^{\bar{j}} = F_K^{\bar{j}} - \tau_{\bar{j}};$$

(A6) $$r^{\bar{m}} = F_K^{\bar{m}} - \tau_{\bar{m}}$$

(A7) $$\sum_{m=1}^{M}\sum_{j=1}^{J} K^{mj} = \sum_{m=1}^{M}\sum_{j=1}^{J} K_{mj}$$

The land market has to be cleared on the local level which implies:

(A8) $$l^i L^i = F - K^i F_K^i - N^i F_N^i \text{ with}$$

(A9) $$L^i = L_i$$

The impact of a change in the tax rate in i is given by:

(A10) $$\frac{dw^i}{d\tau_i} = F_{NN}^i \frac{dN^i}{d\tau_i} + F_{NK}^i \frac{dK^i}{d\tau_i}$$

(A11) $$\frac{dw^{\bar{j}}}{d\tau_i} = F_{NN}^{\bar{j}} \frac{dN^{\bar{j}}}{d\tau_i} + F_{NK}^{\bar{j}} \frac{dK^{\bar{j}}}{d\tau_i}$$

(A12) $$\sum_{j=1}^{J} dN^j \big/ d\tau_i = 0 \Leftrightarrow \frac{dN^{\bar{j}}}{d\tau_i} = \frac{1}{1-J}\frac{dN^i}{d\tau_i}$$

(A13) $$\frac{dr^i}{d\tau_i} = F_{KK}^i \frac{dK^i}{d\tau_i} + F_{KN}^i \frac{dN^i}{d\tau_i} - 1$$

(A14) $$\frac{dr^{\bar{j}}}{d\tau_i} = F_{KK}^{\bar{j}} \frac{dK^{\bar{j}}}{d\tau_i} + F_{KN}^{\bar{j}} \frac{dN^{\bar{j}}}{d\tau_i}$$

(A15) $$\frac{dr^{\bar{m}}}{d\tau_i} = F_{KK}^{\bar{m}} \frac{dK^{\bar{m}}}{d\tau_i}$$

(A16) $$\sum_{m=1}^{M}\sum_{j=1}^{J} dK^{mj} \big/ d\tau_i = 0 \Leftrightarrow \frac{dK^i}{d\tau_i} = (1-J)\frac{dK^{\bar{j}}}{d\tau_i} + J(1-M)\frac{dK^{\bar{m}}}{d\tau_i}$$

For the derivation of the expected change in the labor allocation $dN^i \big/ d\tau_i ; dN^{\bar{j}} \big/ d\tau_i$, we start by (A10) and add (A11), considering $w^m := w^i = w^{\bar{j}}$ and $F_{NN} := F_{NN}^i = F_{NN}^{\bar{j}}$, $F_{NN} := F_{NK}^i = F_{NK}^{\bar{j}}$ and rearrange slightly to obtain:

(A17) $$\left(\frac{dK^i}{d\tau_i} - \frac{dK^{\bar{j}}}{d\tau_i}\right) = \frac{F_{NN}}{F_{NK}}\left(\frac{dN^{\bar{j}}}{d\tau_i} - \frac{dN^i}{d\tau_i}\right)$$

Then by equating (A13) and (A14) under consideration of $r := r^i = r^{\bar{j}}$ and $F_{KK} := F_{KK}^i = F_{KK}^{\bar{j}}$, $F_{KN} := F_{KN}^i = F_{KN}^{\bar{j}}$ we obtain:

(A18) $$F_{KK}\left(\frac{dK^i}{d\tau_i} - \frac{dK^{\bar{j}}}{d\tau_i}\right) - 1 = F_{KN}\left(\frac{dN^{\bar{j}}}{d\tau_i} - \frac{dN^i}{d\tau_i}\right)$$

Substituting (A17) in (A18) and then considering (A12), we found:

(A19) $$\frac{dN^i}{d\tau_i} = \frac{1-J}{J}\frac{F_{NK}}{F_{NN}F_{KK} - \left(F_{KN}\right)^2} < 0$$

For the expected change in the labor allocation outside of i, we need only to consider the cleared labor market (A12) in (A19) to obtain:

(A20) $$\frac{dN^{\bar{j}}}{d\tau_i} = \frac{1}{J}\frac{F_{NK}}{F_{NN}F_{KK} - \left(F_{KN}\right)^2} > 0$$

For the expected change in the capital allocation $dK \big/ d\tau_i$, we substitute (A12) in (A14) to obtain:

(A21) $$\frac{dr^{\bar{j}}}{d\tau_i} = F_{KK}\frac{dK^{\bar{j}}}{d\tau_i} + F_{KN}\frac{1}{1-J}\frac{dN^i}{d\tau_i},$$

then equated with (A13) and rearranged, we found:

(A22) $$\frac{dr}{d\tau_i} = \frac{1}{J}\left\{F_{KK}\left[\frac{dK^i}{d\tau_i} + (J-1)\frac{dK^{\bar{j}}}{d\tau_i}\right] - 1\right\}.$$

Combining this with (A16) implies:

(A23) $$\frac{dr}{d\tau_i} = F_{KK}(1-M)\frac{dK^{\bar{m}}}{d\tau_i} - \frac{1}{J},$$

adding (A15) and taking into account that $F_{KK} = F_{KK}^{\bar{m}}$ holds, leads to

(A24) $$\frac{dK^{\bar{m}}}{d\tau_i} = -\frac{1}{MJ}\frac{1}{F_{KK}} > 0.$$

Combining (A14), (A15), (A20), and (A24) leads after reordering to:

(A25) $$\frac{dK^{\bar{j}}}{d\tau_i} = -\frac{1}{J}\frac{1}{F_{KK}}\left(\frac{1}{M} + \frac{\left(F_{NK}\right)^2}{F_{NN}F_{KK} - \left(F_{NK}\right)^2}\right) > 0$$

which is equal with:

(A26) $$\frac{dK^{\bar{j}}}{d\tau_i} = \frac{1}{J}\left(\frac{1}{F_{KK}}\frac{M-1}{M} - \frac{F_{NN}}{F_{NN}F_{KK} - \left(F_{NK}\right)^2}\right)$$

Finally for the expected change in the capital allocation in i, we combine (A16), (A24) and (A25) for obtaining after rearranging:

(A27) $$\frac{dK^i}{d\tau_i} = \frac{1}{F_{KK}}\left[\left(\frac{\left(J-1\right)}{J}\frac{\left(F_{NK}\right)^2}{F_{NN}F_{KK} - \left(F_{NK}\right)^2}\right) + \frac{\left(I-1\right)}{I}\right] < 0$$

Or by considering (A26) instead of (A25):

(A28) $$\frac{dK^i}{d\tau_i} = \frac{\left(J-1\right)}{J}\frac{F_{NN}}{F_{NN}F_{KK} - \left(F_{NK}\right)^2} + \left(\frac{1}{F_{KK}}\frac{M-1}{I}\right) < 0$$

For the impact on the interest rate $dr/d\tau_i$ we need only to substitute (A24) in (A23), to get:

(A29) $$\frac{dr}{d\tau_i} = -\frac{1}{MJ} < 0.$$

For the expected change in the wage rate $dw^m/d\tau_i$, we start with (A11) under consideration of (A12):

(A30) $$\frac{dw^m}{d\tau_i} = F_{NN}\frac{1}{1-J}\frac{dN^i}{d\tau_i} + F_{NK}\frac{dK^{\bar{j}}}{d\tau_i},$$

then substituting (A10), (A16) and (A24) we derive at:

(A31) $$\frac{dw^m}{d\tau_i} = \frac{M-1}{I}\frac{F_{NK}}{F_{KK}} < 0$$

Annex B:

In this appendix it will be shown, that the assumption of an absent landlord is equal to the case of a representative household possessing land in each and every jurisdiction.

(B1) $$\underset{\tau_i}{Max} \quad U_i = U\left(x_i, z_i\right)$$

$$s.t. \quad x_i N_i = F(K^i, N^i, L_i) + r\left(K_i - K^i\right) + w^m\left(N_i - N^i\right) - l^i L_i + N_i y - \tau_i K^i$$

$$0 = F(K^i, N_i, L_i) - \left(r + \tau_i\right)K^i - w^m N^i - l^i L_i$$

$$y = \frac{\sum_{m=1}^{M}\sum_{j=1}^{J} l^{jm} L^{jm}}{\sum_{m=1}^{M}\sum_{j=1}^{J} N_{jm}}$$

$$\tau_i K^i = Z_i$$

The first order condition is therefore given by:

(B2) $$\frac{\partial U_i}{\partial x_i}\left[\frac{\partial r}{\partial \tau_i}K_i + \frac{\partial w}{\partial \tau_i}N_i + \frac{L_i}{I}\frac{\partial \sum_{m=1}^{M}\sum_{j=1}^{J} l^{mj}}{\partial \tau_i}\right] + \frac{\partial U_i}{\partial z_i}\left[K^i + \tau_i \frac{\partial K^i}{\partial \tau_i}\right] = 0$$

Thus, we have to show, that $d\sum_{m=1}^{M}\sum_{j=1}^{J} l^{mj} L^{mj} \Big/ d\tau_i = 0$ hold in the case of a symmetric factor endowment in all jurisdictions with $N^i = N^{\bar{j}} = N^{\bar{m}}$, $K^i = K^{\bar{j}} = K^{\bar{m}}$, $L^i = L^{\bar{j}} = L^{\bar{m}}$.

The total change of land rents can be rewritten as:

(B3) $$\frac{d\sum_{m=1}^{M}\sum_{j=1}^{J} l^{mj} L^{mj}}{d\tau_i} = L^i\left(\frac{dl^i}{d\tau_i} + \left(J-1\right)\frac{dl^{\bar{j}}}{d\tau_i} + \left(M-1\right)J\frac{dl^{\bar{m}}}{d\tau_i}\right).$$

Under consideration of the EULER-Theorem we obtain for the representative jurisdiction i:

(B4) $$\frac{dl^i}{d\tau_i} = -\left(\frac{dw^m}{d\tau_i}N^i + \frac{dr}{d\tau_i}K^i + K^i\right),$$

for all other jurisdictions within the same region m:

(B5) $$\frac{dl^{\bar{j}}}{d\tau_i} = -\left(\frac{dw^m}{d\tau_i}N^{\bar{j}} + \frac{dr}{d\tau_i}K^{\bar{j}}\right),$$

and finally for all other jurisdictions outside of m:

(B6) $$\frac{dl^{\bar{m}}}{d\tau_i} = -\left(\frac{dw^{\bar{m}}}{d\tau_i} N^{\bar{m}} + \frac{dr}{d\tau_i} K^{\bar{m}}\right).$$

Using (A24), (A29), (A31), and the impact on the wage rate outside of the region m:

(B7) $$\frac{dw^{\bar{m}}}{d\tau_i} = F_{NK}^{\bar{m}} \frac{dK^{\bar{m}}}{d\tau_i},$$

(B4)-(B6) can be restated as:

(B4)’ $$\frac{dl^i}{d\tau_i} = \frac{1}{I}\left[\left(M-1\right)\frac{F_{NK}}{F_{KK}} N^i + \left(I-1\right) K^i\right],$$

(B5)’ $$\frac{dl^{mj}}{d\tau_i} = \frac{1}{I}\left[\left(M-1\right)\frac{F_{NK}}{F_{KK}} N^{\bar{j}} - K^{\bar{j}}\right],$$

(B6)’ $$\frac{dl^{mj}}{d\tau_i} = \frac{1}{I}\left(\frac{F_{NK}}{F_{KK}} N^{\bar{m}} + K^{\bar{m}}\right).$$

Insert in (B3) finishes the proof. □

Annex C

Combining the first order condition given by equation (B2) with (A29), (A31) and (A27) implies:

(C1) $$MRS_{z_i,x_i} = \frac{\frac{1}{F_{KK}K^i}\frac{1}{I}\left[(1-M)F_{NK}N_i + F_{KK}K_i\right]}{1+\tau_i\frac{1}{F_{KK}K^i}\left(1-\frac{1}{I}\right)+\tau_i\frac{1}{F_{KK}K^i}\left[\frac{(J-1)}{J}\frac{(F_{NK})^2}{F_{NN}F_{KK}-(F_{NK})^2}\right]}$$

(C2) $$MRS_{z_i,x_i} = \frac{\frac{1}{J}+\frac{M-1}{I}\frac{F_{LK}L_i}{F_{KK}K^i}}{1+\tau_i\frac{1}{F_{KK}K^i}\left(1-\frac{1}{I}\right)+\tau_i\frac{1}{F_{KK}K^i}\left[\frac{(J-1)}{J}\frac{(F_{NK})^2}{F_{NN}F_{KK}-(F_{NK})^2}\right]}$$

Thus for $J \to \infty$, $MRS_{z_i,x_i} \to 0$ holds.

For the non-overlapping labor market area, we get with $J = 1$:

(C3) $$MRS_{z_i,x_i} = \frac{1+F_{LK}L_i\frac{1}{F_{KK}K^i}\left(1-\frac{1}{M}\right)}{1+\tau_i\frac{1}{F_{KK}K^i}\left(1-\frac{1}{M}\right)},$$

which implies for the limited tax export $L_iF_{LK}dK^i/d\tau_i > \tau_i\, dK^i/d\tau_i \Leftrightarrow L_iF_{LK} < \tau_i$:

$$MRS_{z_i,x_i}\Big|_{J=1,M=1} = 1,\; MRS_{z_i,x_i}\Big|_{J=1,M\to\infty} = \frac{F_{KK}K^i + F_{LK}L_i}{F_{KK}K^i + \tau_i} > 1,\; \frac{\partial MRS_{z_i,x_i}}{\partial M}\Big|_{J=1} > 0,$$

Taking both together and taking into account that (C2) decreases monotonically in J, we get directly to the point that there must be a J^* which insures for any $M > 1$ even for $M \to \infty$ that $MRS_{z_i,x_i} = 1$ holds. □

Annex D

This appendix provides a more detailed derivation of equation (28) in the text: The first order condition can be rearranged to

(D1) $$MRS_{z_i,x_i} = \frac{\frac{\partial r}{\partial \tau_i} K_i + \frac{\partial w^m}{\partial \tau_i} N_i + \frac{1}{J} \frac{\partial \sum_{j=1}^{J} L_{mj} q^{mj}}{\partial \tau_i}}{K^i + \tau_i \frac{\partial K^i}{\partial \tau_i}}$$

Then inserting (A31), (A29), (B4)', (B5)' in the numerator and (A27) in the denominator we get after rearranging slightly:

(D2) $$MRS_{z_i,x_i} = \frac{\left[\frac{1}{I} K_i + \frac{1-M}{I} \frac{F_{NK}}{F_{KK}} N_i + \frac{1-M}{I} \left(\frac{F_{NK}}{F_{KK}} N_i - K_i \right)\right]}{K^i + \tau_i \frac{1}{F_{KK}} \left[\frac{(J-1)}{J} \left(\frac{1}{M} + \frac{(F_{NK})^2}{F_{NN} F_{KK} - (F_{NK})^2} \right) + \frac{(M-1)}{M} \right]}$$

Using three times the characteristic of the production function that $F_{NK} N + F_{LK} L + F_{KK} K = 0$ holds, leads to:

(D3) $$MRS_{z_i,x_i} = \frac{\frac{1}{J}}{1 + \tau_i \frac{1}{F_{KK} K} \left(1 - \frac{1}{I} \right) + \tau_i \frac{1}{F_{KK} K} \left[\frac{(J-1)}{J} \frac{(F_{NK})^2}{F_{NN} F_{KK} - (F_{NK})^2} \right]}$$

(D4) $$MRS_{z_i,x_i} = \frac{1}{J\left(1 + \varepsilon_{\tau_i K_i}\right)}.$$

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