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**Working Paper**

## Fiscal Equalization, Tax Salience, and Tax Competition

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**Fiscal Equalization, Tax Salience,  
and Tax Competition**

*Martin Altemeyer-Bartscher*

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# Fiscal Equalization, Tax Salience, and Tax Competition

## Abstract

Jurisdictions that engage in inter-regional tax competition usually try to attenuate competitive pressures by substituting salient tax instruments with hidden ones. On this effect, we investigate the efficiency consequences of inter-regional tax competition and fiscal equalization in a federal system when taxpayers fail to optimally react on shrouded attributes of local tax policy. If the statutory tax rate is a relatively salient instrument and taxpayers pay low attention to the quality and the frequency of tax enforcement, the underlying substitution of tax instruments with the aim of reducing the perceived tax price may suppress the under-exploitation of tax bases that is typically triggered by fiscal equalization.

Keywords: fiscal equalization, tax salience, tax competition, fiscal federalism, tax-cut-cum-base-broadening policy

JEL Classification: H77, H22, H30

# **Finanzausgleich, Steuerwettbewerb und die Sichtbarkeit örtlicher Steuerinstrumente**

## **Zusammenfassung**

Im Rahmen eines interregionalen Steuerwettbewerbs versuchen Gebietskörperschaften den Wettbewerbsdruck zu dämpfen, indem sie besonders hervorstechende Steuerinstrumente durch weniger auffällige Instrumente ersetzen. Unter Berücksichtigung der unterschiedlichen Sichtbarkeit von Steuerinstrumenten durch den Steuerzahler untersuchen wir den Einfluss eines Zusammenspiels von interregionalen Finanzausgleichstransfers und Steuerwettbewerb auf die dezentrale Steuerpolitik eines föderalen Systems. Insbesondere betrachten wir einen Modellrahmen, in dem der Steuerzahler bei der Standortwahl dem örtlichen Steuersatz eine höhere Aufmerksamkeit widmet als der Prüfintensität der örtlichen Steuerverwaltung. Es wird untersucht, inwiefern das Bestreben der Gebietskörperschaften, den vom Steuerzahler wahrgenommenen Steuer-Preis zu verringern, zu einer stärkeren Ausbeutung der örtlichen Steuerbasis führen kann. Es stellt sich heraus, dass eine angemessene Verteilung der Steuerkompetenzen im föderalen Gefüge die wesentlichen Fehlanreize eines interregionalen Finanzausgleichs fast gänzlich verhindern kann, falls die oben erwähnten verhaltensökonomischen Aspekte in der lokalen Steuerpolitik eine Rolle spielen

Schlagwörter: Finanzausgleich, Steuersalienz, Steuerwettbewerb, Finanzföderalismus, Tax-cut-cum-base-broadening-Politik

JEL-Klassifikation: H77, H22, H30

# 1 Introduction

The literature on fiscal federalism has pointed out two main incentive effects of fiscal equalization on local taxing decisions. On the one hand, inter-regional transfers that equalize inter-regional fiscal capacity differences attenuate local governments' concerns about the outflow of tax bases. An appropriately designed equalizing transfer diminishes the relatively high marginal cost of raising funds and restores efficiency in an otherwise inefficient equilibrium, see Bucovetsky and Smart (2006). On the other hand, fiscal equalization can establish a source of inefficiency on its own if the true local fiscal capacity is difficult to measure. In this regard, a typical moral hazard problem may arise as local governments can influence the assessment basis of the redistributive transfer scheme and therefore tend to under-exploit their tax bases, see Barette, Huber and Lichtblau (2002) and Köthenbürger (2002).

In a model framework of fully optimizing agents that completely comprehend this piece of information, the interplay between the two aforementioned incentive effects is well understood. However, as a stylized feature in complex and nontransparent tax systems, some tax instruments attract a great amount of taxpayer attention, while others remain mostly unnoticed, see *inter alia* Chetty, Looney and Kroft (2009) and Gabaix and Laibson (2006). In this vein, we analyze the efficiency consequences of tax competition and fiscal equalization when jurisdictions decide on hidden tax instruments or on a combination of salient and hidden tax instruments. Thereby, we define tax salience in terms of the observability of the regional tax price. In comparison to the neoclassical full optimization model, the tax competition game with salience effects takes on a slightly different form. Jurisdictions have incentives to attenuate the competitive pressures by substituting tax instruments that spotlight a tax burden with other less salient ones. In this connection, the strategic variable of the tax competition game is a mix of tax instruments that cause taxpayers to perceive a tax burden as low as possible.

We analyze a federal setting with jurisdictions that decide on two tax instruments, namely, the statutory tax rate on capital employment as well as measures to enforcement taxes. In a neoclassical full optimization model, the expected tax price is equal to the expected value of successful evasion and discovery of the tax delinquents, which is in line with the tax evasion model of Allingham and Sandmo (1972), Cremer and Gahvari

(2000) and Stöwhase and Traxler (2005). Deviating from the standard model, we assume that the typical taxpayer learns signals that convey only a fragmentary picture concerning the concrete enforcement intensity. Measuring the quality of audits in a verifiable way requires detailed, high-frequency information that is difficult to observe. Moreover, taxpayers can only roughly estimate the current detection rate based on a retrospective background, a word of mouth exchange of experiences with other taxpayers, or proxy variables, such as the number of tax inspectors that are employed in the jurisdiction.

Furthermore, it should be noted that the local fiscal policy in a federal state is usually affected by a double standard. On the one hand, local governments attempt to provide evidence that local tax offices handle tax evasion in the most effective way and that the fiscal capacity is therefore fully exploited. On the other hand, they anticipate that in an inter-regional competition environment, mobile factors are possibly attracted by fragmentary tax audits that provide loopholes for tax evasion. Accordingly, the local governments' power to credibly communicate less strict tax enforcement to taxpayers is clearly limited. Chetty, Looney, and Kroft (2009) point out that taxpayers pay more attention to the variations in tax instruments that are included in the publicly displayed statutory tax rate than to other factors that indirectly influence the effective tax price, such as the intensity of tax enforcement. This is why the model framework accommodates taxpayers' beliefs concerning the tax price that differs from the actual tax due in the neoclassical model.

Investigating the efficiency consequences of local revenue policies when decision makers in regional firms imperfectly optimize tax policy variations, we develop an approach that, in line with Chetty (2009), relies on two major assumptions. First, we assume that a tax on an inter-regional mobile capital only affects welfare by its impact on the inter-regional allocation of production factors. Second, firms' factor demand is consistent with the neoclassical full optimization model when prices are fully salient. Accordingly, we decompose the efficiency consequences of taxation in the neoclassical model and the efficiency consequences that uniquely stem from tax salience effects. Correspondingly, we can show to what extent taxpayers' inattention to certain tax instruments may change results that are conventional wisdom in the neoclassical model framework.

In a federal setting with decentralized responsibility for the statutory tax rate and tax enforcement, jurisdictions lessen the pressures in the inter-regional competition for

mobile factors by granting tax discounts through a reduction of the salient tax rate and simultaneously broaden the tax base by intensifying less salient tax enforcement activities. Accordingly, with a sufficient sphere of responsibility for revenue policy, jurisdictions engage in broadening their tax bases to gain a margin for cuts of the statutory tax rates. In this regard, we address the question about the extent to which the underlying tax-cut-cum-base-broadening policy may suppress the moral hazard of fiscal equalization that typically takes the form of an under-exploitation of tax bases.

A recent study has pointed out that complex and nontransparent tax systems are an ideal breeding ground for the imperfect optimizing behavior of economic agents. In this regard, Gabaix and Laibsons (2006) point out that tax policies are shrouded attributes if the tax price is not displayed in the posted prices. This is, for example, the case for sales taxes, hotel city taxes, and vehicle excise fees as well as for social security taxes. Likewise, Chetty, Looney, and Kroft (2009), who analyzed commodity taxes in the US, show that taxes that are included in the price that is displayed on a price tag in a supermarket have a much larger impact on demand than those that must be added on by the taxpayer. Slemrod et al. (2001) analyzed a controlled experiment in Minnesota. The authors show that even letters that explicitly signal a specific audit probability do not attract the attention of taxpayers to a high extent. Moreover, there is empirical evidence that if there is only a single tax instrument under the control of a government, it is more probable that a variation of this tax instrument attracts taxpayer attention, see Cramerer, Loewenstein, and Rabin (2004) for a survey. Taxpayers more frequently lose sight of the variations of a tax instrument in a complex system with many different instruments that sometimes change simultaneously. Correspondingly, it is plausible that taxpayers ignore a change in tax enforcement intensities if the statutory tax rate, in particular, draws their attention.

Similar to our paper, Bracco et al. (2013) investigated a federal setting with political competition where jurisdictions substitute salient taxes (resident taxes) with less salient ones (user fees of municipal utilities) to take advantage of the residents' inattention in a setting with political competition. There is also a link to the paper of Alt and Lassen (2003), who looked at governments' choices in an environment with political competition between taxes or debt to finance public goods supply. They point out that governments attempt to reduce the perceived tax price by engaging in increased debt financing because



this attracts voter attention by a lesser extent than an increase of tax rates.

Chetty (2009) demonstrates that in a setting where taxpayers fail to pay attention to sales taxes, the welfare enhancing effect of inattention is often thwarted by secondary effects. Chetty shows an example where individuals that fail to react to sales taxes cannot re-optimize their consumption bundle. If the income effects play an important role, tax salience can produce a considerably high secondary cost. Analogously, a lack of response to a specific tax instrument in the frame of our model can lead to a twofold efficiency. First, the lack of response to an increase of tax enforcement intensities attenuates the exodus of capital. Second, failure to respond to a tax policy change can produce a deadweight loss in another field of the economy. Inattention to tax enforcement policies leads firms to make tax accruals that differ from the assessment note that is sent to firms by the tax office after tax audits have been effectuated. This calls for an adjustment of profits after tax audits have taken place at the end of the term that course considerable re-optimization costs.

The outline of the paper is as follows. In section 2, we set up a basic model that displays the interplay between fiscal equalization and inter-regional tax competition in a federal state with tax salience effects. As a benchmark in section 3, we derive the first best optimal tax and enforcement policy. In section 4, we consider a federal state in which jurisdictions can decide on local enforcement intensities but do not have any means to impose an individual local tax. Section 5 presents a setting in which jurisdictions can decide on both the salient statutory tax rate as well as the less salient tax enforcement intensity. In section 6, we consider some extensions of the model framework. In particular, we consider a setting in which jurisdictions bear the costs of tax audits and tax evasion produces different welfare losses that are not depicted in a Allingham and Sandmo (1972) model framework. Moreover, we analyze the efficiency consequences of fiscal equalization in a federal setting with Leviathan type governments.

## 2 The Basic Model

We consider a federation to be composed of a federal government and a large number of jurisdictions, indexed by  $i = \{1, 2, \dots, n\}$ . Each jurisdiction is inhabited by one immobile household that in-elastically supplies one working hour in a local labor market as well

as an equal capital endowment  $k$  in a federal capital market. Furthermore, households own firms that are located in their respective home region.<sup>1</sup> These firms employ *effective* labor and capital to produce a transformable good. Effective labor is defined by the product of working time and an efficiency parameter  $\theta_i$ ,  $\theta_i \in [0, 1]$ , which signifies the region-specific human capital endowment. The production output *per effective labor unit* in jurisdiction  $i$  denoted by  $y_i$  is written as:

$$y_i = f(k_i/\theta_i), \quad (1)$$

where  $k_i$  denotes the *per capita* capital employment and  $f(\cdot)$  signifies the linear-homogeneous production function with  $f_k(\cdot) > 0$ ,  $f_{kk}(\cdot) < 0$ . We assume that the exogenously given stock of capital  $nk$  is perfectly mobile within the borders of the federation while labor supply is strictly localized in jurisdiction  $i$ . Jurisdictions are small in relation to the size of the whole federation so that local policy measures do not influence the net return of capital  $r$  in the federal capital market.

A tax is imposed on local capital employment with a statutory tax rate  $\tau_i$ .<sup>2</sup> Jurisdictions are responsible for the enforcement of the capital tax. They are obliged to complete tax audits with a detection rate  $a_h$ . However; due to the complex modalities of tax audits they have a margin to enact a detection rate  $a_i$  in  $[a_l, a_h]$  with  $0 < a_l < a_h \leq 1$ . We assume that a deviation from the obliged detection rate  $a_h$  is non-verifiable for outsiders and that the costs of tax audits are fully borne by the federal government.<sup>3</sup> Firms evade an exogenously given proportion  $\sigma_i$  of their tax due with  $\sigma_i \in [0, 1]$ .<sup>4</sup> If tax evasion is detected during tax audits, firms must pay an amount of  $\sigma_i \phi k_i \tau_i$  with a penalty rate  $\phi \geq 1$  to the respective jurisdiction.

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<sup>1</sup>In the subsequent analysis it becomes obvious that cross-ownership of firm can additionally smooth private income across regions.

<sup>2</sup>In a federation with combined federal and local taxes we may alternatively assume that jurisdictions encompass the statutory tax rate  $\tau_i$  by imposing a surtax  $\frac{\tau_i}{t} - 1$  ( $\tau_i \in [\tau_l, \tau_h]$ ,  $\tau_l > 0$ ) on the tax revenue of a federal-wide tax on capital with rate  $t$ . Then, the statutory tax rate  $\tau_i$  includes two components, namely the federal-wide capital tax  $t$  as well as a region-specific surtax  $\frac{\tau_i}{t} - 1$  and the overall tax revenue is given by  $tk_i + (\frac{\tau_i}{t} - 1)tk_i = \tau_i k_i$ .

<sup>3</sup>We consider the case where audit costs are reimbursed by the federal government which has an exogenously given endowment of financial resources. In section 6 we analyze a setting with local governments that reflect audit costs in their budgets.

<sup>4</sup>In the basic model, we implicitly assume that tax compliance is determined by factors outside of the frame of the model. However, in section 6, we offer a more general model framework that assumes that  $\sigma_i$  is a function of the tax instruments  $a_i$  and  $\tau_i$ .

The tax price of capital employment expected by firms in region  $i$  is given by:

$$\rho_i = \mu(\sigma_i, a_i)\tau_i, \quad (2)$$

where the weight  $\mu(\sigma_i, a_i)$  measures the expected broadness of the capital tax base, i.e., the proportion of the tax base that is expected to be engrossed by the tax authority. This weight depends on the magnitude of tax evasion  $\sigma_i$  and the detection rate of tax audits  $a_i$ . For example, firms that engage in tax evasion in a setting with patchy tax audits expect a narrow tax base or a tax price  $\rho_i$  below the statutory tax rate  $\tau_i$ . In a neoclassical full optimization model which assumes that taxpayers can observe the enforcement intensity  $a_i$  and fully appreciate this piece of information the expected broadness of the tax base  $\mu(\sigma_i, a_i)$  measures  $1 - \sigma_i + \sigma_i a_i \phi$ .

However typically taxpayers learn signals that convey only a fragmentary picture concerning the concrete enforcement intensity  $a_i$ . In particular, they can only roughly estimate the current detection rate based on a retrospective background, a word of mouth exchange of experiences with other taxpayers, or proxy variables such as the number of tax inspectors employed in the respective jurisdiction. Furthermore, apart from the problem of incomplete observability, the salience effects of tax instrument matter. Commonly, taxpayers are more attentive to the variations of the publicly displayed statutory tax rate than to other tax instruments, such as the intensity of tax enforcement that indirectly influences the effective tax price. This is why the model framework accommodates taxpayers' beliefs concerning tax prices that differ from the actual tax due,  $1 - \sigma_i + \sigma_i a_i \phi$ . Without setting any detailed structure on the taxpayers' thoughts, we assume that  $\mu(\sigma_i, a_i)$  is a smooth function of the enforcement intensity  $a_i$  and  $\sigma_i$  with  $\mu_a(\sigma_i, a_i) \geq 0$ ,  $\mu_\sigma(\sigma_i, a_i) \geq 0$  and  $\mu_{aa} = \mu_{\sigma\sigma} = 0$ .

For the purpose of a better presentation and clarity in the below analysis, the firms' actual expectations concerning the tax prices are related to the firms expectations in the hypothetical reference case with fully optimizing agents that can fully observe tax instruments  $\tau_i$  and  $a_i$ . Accordingly, we measure the degree of firms' attention to the tax instrument  $a_i$  by the ratio between the marginal impact of  $a_i$  on the expected tax price  $\rho_i$  as it happens and as it would be in the hypothetical full optimization reference case:

$$\xi_a^i = \frac{\mu_a(\sigma_i, a_i)}{\sigma_i \phi}. \quad (3)$$

Analogously, the degree of firms' attention to the tax instrument  $\tau_i$  is defined by the ratio between the marginal impact of  $\tau_i$  on  $\rho_i$  as it happens and as it would be in full the optimization reference case:

$$\xi_\tau^i = \frac{\mu(\sigma_i, a_i)}{1 - \sigma_i + \sigma_i a_i \phi}. \quad (4)$$

The degree of attention to the statutory tax rate crucially depends on beliefs that firms form w.r.t. the enforcement policy  $a_i$  as demonstrated by equation (4).

In a perfect competition environment firms in region  $i$  choose input factors that maximize expected profit based on their expected tax price (2):

$$\pi_i = f(k_i/\theta_i) - (\mu(\sigma_i, a_i)\tau_i + r)k_i - w_i, \quad (5)$$

where  $w_i$  is the wage rate in jurisdiction  $i$ . In the optimum the expected user costs of inputs equal its marginal products:

$$f_k(k_i/\theta_i) = \mu(\sigma_i, a_i)\tau_i + r, \quad (6)$$

$$f(k_i/\theta_i) - k_i(\mu(\sigma_i, a_i)\tau_i + r) = w_i. \quad (7)$$

The balance between the actual tax due that is displayed in a particular assessment note and the tax accruals that are made by a firm before the tax audit has taken place is defined by  $q_i = (\xi_\tau^i - 1)(1 - \sigma_i + \sigma_i a_i \phi)\tau_i k_i$ . Due to the fact that the production function is linear-homogenous and the firms' investment decision are based on the expected user cost of capital the profit after tax audits come to  $\pi_i = q_i$ . Profits  $\pi_i$  belong to the owners of the firms, i.e. the household that lives in the region  $i$ . Using equation (6) we can derive firms' demand of input capital contingent on the expected tax price:

$$k_i(\rho_i, \theta_i) = \theta_i f_k^{-1}(\rho_i + r). \quad (8)$$

The comparative static analysis of (8) yields the tax base elasticity:

$$\eta_i = \frac{\theta_i}{f_{kk}(k_i)} \frac{(1 - \sigma_i + \sigma_i a_i \phi)\tau_i}{k_i}. \quad (9)$$

Jurisdictions intend to maximize utility of the domestic household using an appropriate policy. The utility of a household that lives in region  $i$  is characterized by the following quasi-linear function:

$$U_i(z_i, x_i) = V_i(z_i) + x_i, \quad (10)$$

where  $z_i$  is a local public good provided by jurisdictions and  $x_i$  is the private good consumption. Households' total income in region  $i$  is entirely used for private good consumption. It is composed of labor income, profit participation, and capital income:

$$x_i = w_i + \pi_i + rk. \quad (11)$$

Furthermore, the budget constraint of jurisdiction  $i$  is given by:

$$z_i = k_i(\rho_i, \theta_i)(1 - \sigma_i + \sigma_i a_i \phi) \tau_i + s_i, \quad (12)$$

where  $s_i$  is a transfer payment from an inter-jurisdictional equalizing program, which equalizes differences in jurisdictions' tax bases. We consider a simple redistribution scheme with a constant equalizing rate  $\alpha$  that takes a value in  $[0, 1]$ :

$$s_i = \alpha \left( \sum_{j=1}^n \frac{k_j(\rho_j, \theta_j)}{n} - k_i(\rho_i, \theta_i) \right) \bar{\tau}, \quad (13)$$

where the transfer payment  $s_i$  to jurisdiction  $i$  depends on the difference between the specific size of the tax base in jurisdiction  $i$  and the average size of tax bases in the federation. The difference between the local tax base and the federal average tax base is weighed by the federal average value of statutory tax rates  $\bar{\tau} = \frac{\sum_{i=1}^n k_i \tau_i}{\sum_{i=1}^n k_i}$  to compute the transfer payments. The transfer payments can be neither directly pegged on the enforcement intensity  $a_i$ , nor on the capital employment  $k_i$ .

The timing of the game is sketched as follows:

- At *stage 0* nature draws fiscal power  $\theta_i$  in each jurisdiction that cannot be observed by any agent in the game.
- At *stage 1* the statutory tax rate  $\tau_i$  and the intensity of tax enforcement activities  $a_i$  are determined.
- At *stage 2* firms chose input factors based on the expected tax price  $\rho_i$ .
- At *stage 3* jurisdictions determine the intensity of tax audits.
- At *stage 4* local tax offices execute tax audits and subsequently sent tax assessment notes to firms.
- At *stage 5* the inter-regional redistribution program is effectuated.

### 3 The Reference Solution

As a benchmark, we consider a social planner who determines the statutory tax rates  $\tau_i$ , transfer payments  $s_i$ , and enforcement intensity  $a_i$  in each jurisdiction to maximize the federal welfare, i.e., the sum of local welfare. Assuming that taxpayers fully optimize  $a_i$  and  $\tau_i$ , the welfare maximizing problem of jurisdiction  $i$  is written as:

$$\begin{aligned} \{(\tau_1, \dots, \tau_n), (s_1, \dots, s_n), (a_1, \dots, a_n)\} &\in \arg \max \sum_{i=1}^n (V_i(z_i) + x_i) \\ \text{s.t. (11) and (12)} \\ \sum_{i=1}^n s_i &= 0 \quad \forall i. \end{aligned}$$

The first order condition w.r.t. the statutory tax  $\tau_i$  is written as:

$$k_i(1 - \sigma_i + \sigma_i a_i \phi) = V'_i(z_i) k_i(1 - \sigma_i + \sigma_i a_i \phi) + \sum_{j=1}^n V'_j(z_j) \tau_j (1 - \sigma_j + \sigma_j a_j \phi) \frac{\partial k_j}{\partial \tau_i} \quad \forall i. \quad (14)$$

The first order condition w.r.t. the enforcement intensities  $a_i$  is written as:

$$k_i \sigma_i \phi \tau_i = V'_i(z_i) k_i \sigma_i \phi \tau_i + \sum_{j=1}^n V'_j(z_j) \tau_j (1 - \sigma_j + \sigma_j a_j \phi) \frac{\partial k_j}{\partial a_i}, \quad \forall i. \quad (15)$$

The first order condition w.r.t. the transfer payments  $s_i$  is written as:

$$V'_i(z_i) = V'_j(z_j), \quad \forall i, j. \quad (16)$$

The clearing conditions for the federal capital market are given by:

$$\sum_{j=1}^n \frac{\partial k_j}{\partial \tau_i} = 0, \quad \forall i, j \quad (17)$$

$$\sum_{j=1}^n \frac{\partial k_j}{\partial a_i} = 0, \quad \forall i, j. \quad (18)$$

Inserting equations equation (16), (17) and (18) into equations (14) and (15) yields:

$$V'_i(z_i) = 1, \quad \forall i. \quad (19)$$

By equation (16), differences of fiscal power across regions are fully equalized by the transfer scheme  $s_i$ , so that each jurisdiction provides the same amount of local public

goods. Besides, equation (19) show that the social planner implements a combination of a statutory tax rates and an enforcement intensity  $(\tau_i, a_i)$  such that each firm in the federation is confronted with the same tax price  $\rho_i$  irrespective of the local fiscal power  $\theta_i$ . Differences in regional tax prices cause an efficiency enhancing relocation of capital that reduces overall returns to capital. The optimization problem exhibits a degree of freedom. The social planner can choose different combinations  $(\tau_i, a_i)$  to produce a tax price  $\rho_i$  that fulfills condition (19). Taking into account that jurisdictions are entrusted to enact an enforcement intensity  $a_h$  the optimal statutory tax rate is unambiguously determined. For a given tax enforcement  $a_h$  the first order condition of the first best optimal statutory tax rate  $\tau_i^*$  is written as:

$$V'_i(k_i(\mu(\sigma_i, a_h)\tau_i^*)(1 - \sigma_i + \sigma_i a_h \phi)\tau_i^*) = 1, \quad \forall i \quad (20)$$

## 4 Centralized Tax Autonomy and Decentralized Tax Enforcement

Consider the case where jurisdictions decide on the intensity of tax enforcement measures and the federal government imposes a federal-wide tax on capital  $t$ . In compliance with condition (20)  $t$  is the first best optimal the statutory tax rate provided that the enforcement intensity is equal to  $a_h$ . Jurisdictions choose a tax instrument  $a_i$  that maximizes local welfare:

$$\begin{aligned} & \max_{a_i} V(z_i) + x_i \\ & \text{s.t. (11) to (13).} \end{aligned}$$

The first order condition is written as:

$$V'_i(z_i) \leq \frac{1}{(1 - \alpha)(1 + \eta_i \xi_a^i)} = MCF_a^i, \quad (21)$$

where the LHS of (21) represents the marginal utility of the local public goods supply and the RHS is the marginal cost of funding through the use of  $a_i$  (hereafter denoted by  $MCF_a^i$ ), which indicates the incidence of the capital tax on labor proportional to the increment of local government revenues.

In the neoclassical full optimization reference case without fiscal equalization ( $\xi_a^i = 1$ ,  $\xi_\tau^i = 1$ ,  $\alpha = 0$ ), expression (21) represents the equilibrium condition of a standard tax

competition game in line with Zodrow and Mieszkowski (1986) and Wilson (1986). Local welfare maximizing jurisdictions perceive a marginal costs  $MCF_a^i$  that are higher than one because of they do not consider the underlying positive fiscal spillover effects to other regions. Therefore, they choose enforcement intensities below the efficient level  $a_h$ . The first order condition (21) exhibits an interior solution  $(a_i, \tau_i^*)$  with  $a_l \leq a_i < a_h$  if the lower bound of enforcement intensities  $a_l$  and the statutory tax rate take sufficiently low values.<sup>5</sup>

The efficiency consequences of federal equalization in the neoclassical model is two-fold. On the one hand, the transfer scheme compensates for a decline in the tax base that stems from an inter-regional relocation of capital and therefore internalizes inter-regional fiscal spill over effects up to the proportion  $\alpha$ . On the other hand, it constitutes an additional source of inefficiency as jurisdictions impact the basis of assessment of transfers via enforcement policy  $a_i$ . Local governments anticipate that a proportion of  $\alpha$  of the additional tax revenue that originates from the broadening of the local tax base through a more intense tax enforcement will pour out of the local government budget into the common pool of the federal redistribution program. Correspondingly, the marginal loss of eligibility for transfers that goes along with an intensification of tax enforcement boosts the marginal cost of funding concerning  $a_i$ , so that the respective equilibrium tax enforcement intensities are lower than in the special case without fiscal equalizing.<sup>6</sup>

If the enforcement policy has hidden attributes and firms pay less attention to the intensity of tax enforcement than to statutory tax rates ( $\xi_\tau^i < \xi_a^i$ ), the demand of input capital becomes more inelastic to the local enforcement policy. This is why jurisdictions face less pressure to hamper the exodus of mobile capital by reducing  $a_i$  and perceive

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<sup>5</sup>In accordance with Cremer and Gahvari (2000) the strategic variable in inter-regional competition setting is the broadness of the tax base that is controlled by jurisdictions via the tax enforcement policy. In Zodrow and Mieszkowsky (1986), Wildasin (1989) and other related models the strategic variable is the statutory tax rate. However, in accordance with the standard tax competition model the background of inter-regional competition in this paper is the mobile production factor capital.

<sup>6</sup>In the neoclassical model with a federation with decentralized tax enforcement policy and harmonized tax rates, tax base equalization has the same efficiency consequences as a tax equalization scheme that is pegged on the local tax revenue. Köthenbürger (2002) analyzes the efficiency consequences of both tax base equalizing as well as tax revenue equalizing in a federal setting with jurisdictions that control  $\tau_i$  while  $a_i$  is exogenously given. Accordingly, jurisdictions can control the entitlement to benefit from the transfers in a tax revenue equalizing program but not the entitlement of a tax base equalizing program. In contrast, in the setting displayed in this section of the paper, jurisdictions that decide on  $a_i$  while  $\tau_i$  is exogenously given can undermine redistribution schemes that depend on the tax base.



lower marginal costs of funding through  $a_i$  than in the neoclassical full optimization case. In the border line case with  $\xi_a^i = 0$  firms' capital demand in region  $i$  is completely inelastic with respect to enforcement policy  $a_i$ , so that the efficiency consequences of a more capital tax enforcement are equivalent to the imposition of a tax on an inelastic labor supply or a residence tax as tax avoidance reactions stay away.

**Proposition 1** *A federation with decentralized tax enforcement, harmonized tax rates, and partial fiscal equalization the equilibrium enforcement intensities  $a_i$  are higher, if firms pay less attention to  $a_i$ .*

**Proof:** See Appendix.

As exposed above, the marginal impact of  $\tau_i$  on the expected tax price  $\rho_i$  depends on firms' beliefs w.r.t.  $a_i$ . In general, firms can correctly rationalize that jurisdictions have inefficiently low incentives to engage in tax enforcement due to the high marginal loss of eligibility for transfers by the use of  $a_i$  in the frame of the model that is depicted in this section. Therefore, it is plausible that a word of mouth spreads the information that jurisdictions choose a low enforcement intensity. Jurisdictions have no incentives to deviate from  $a_l$ , due to condition (21).

## 5 Decentralized Tax Autonomy and Decentralized Tax Enforcement

Consider a federal constitution that assigns the responsibility of both tax instruments  $a_i$  and  $\tau_i$  to the local government level. Then the local welfare maximization problem is written as:

$$\begin{aligned} \max_{a_i, \tau_i} V(z_i) + x_i \\ \text{s.t. (11) to (13).} \end{aligned}$$

The first order condition of welfare-maximizing tax policy writes:

$$V'_i(z_i) \leq \frac{1}{(1 + (1 - \alpha)\eta_i\xi_\tau^i)} = MCF_\tau^i, \quad (22)$$

where the RHS of the first order condition (22) depicts the marginal cost of funding by the use of  $\tau_i$ , that is denoted by  $MCF_\tau^i$ . The first order condition of the welfare-maximizing enforcement policy is equivalent to (21).

In the neoclassical reference model without fiscal equalization ( $\xi_\tau^i = 1, \xi_a^i = 1, \alpha = 0$ ), there is neutrality in the use of  $\tau_i$  and  $a_i$  because of the two tax instruments entail the same marginal cost of funding ( $MCF_\tau^i = MCF_a^i$ ). However, with a positive equalizing rate the value of  $MCF_\tau^i$  is lower than  $MCF_a^i$ . The two tax instruments affect the assessment basis of the inter-regional redistribution scheme in different ways. In section 4, we have demonstrated that jurisdictions' tax enforcement policies influence the entitlement to benefit from transfers. In contrast, the assessment basis of the transfer scheme that is based on a standardized tax rate  $\bar{\tau}$  does not alter if the statutory tax rate is changed apart from a variation of the tax bases that stems from an inter-regional relocation of capital. Accordingly, there is a comparative advantage in using the statutory tax rate as a funding instrument.

**Proposition 2** *A neoclassical model framework with decentralized tax enforcement, decentralized tax autonomy, and fiscal equalization offers a corner solution  $(a_l, \tau_i)$ .*

**Proof:** Jurisdictions choose the lower bound  $a_l$  if the marginal costs  $MCF_a^i$  exceed  $MCF_\tau^i$ . In a setting with  $\xi_\tau^i = \xi_a^i = 1$  and the equalizing rate  $\alpha$ , the following inequality holds:

$$\frac{1}{(1 + (1 - \alpha)\eta_i)} < \frac{1}{(1 - \alpha)(1 + \eta_i)}. \quad (23)$$

Consider now firms that pay less attention to  $a_i$  than to  $\tau_i$  ( $\xi_\tau^i > \xi_a^i$ ). In this case, it is more difficult for jurisdictions to attract mobile capital by provoking low detection rates  $a_i$  than by setting a lower statutory tax rate  $\tau_i$ . Consequently, the marginal costs  $MCF_\tau^i$  exceed  $MCF_a^i$ , so that in equilibrium jurisdictions choose the upper bound  $a_h$ . However, in a setting with a positive equalizing rate, the loss of eligibility for transfers involved by the use of  $a_i$  hinders the competitive edge rooted in taxpayers' inattention to tax enforcement. Jurisdictions have no incentives to deviate from the efficient enforcement intensity  $a_h$  if the latter effect is greater than the first one.

**Proposition 3** *It is not beneficial for jurisdiction  $i$  to narrow the tax base by cutting enforcement intensities below  $a_h$  if the equalizing rate does not exceed the following critical value:*

$$\alpha_i^c = \frac{\eta_i(\xi_a^i - \xi_\tau^i)}{1 + \eta_i(\xi_a^i - \xi_\tau^i)}. \quad (24)$$

**Proof:** Jurisdictions have a comparative advantage in using  $a_i$  as a funding instrument if the following condition holds:

$$\frac{1}{(1 + (1 - \alpha)\eta_i\xi_\tau^i)} \geq \frac{1}{(1 - \alpha)(1 + \eta_i\xi_a^i)}, \quad (25)$$

where the LHS depicts  $MCF_\tau^i$  and the RHS is  $MCF_a^i$ . Inequality (25) holds if  $\alpha < \alpha_i^c$ .

There is a simple economic intuition behind expression (25). The right-hand side of (25) depicts the difference between the incidences of the instrument  $\tau_i$  as well as of the tax instrument  $a_i$  which fall upon labor. The respective difference of  $\tau_i$  and  $a_i$  takes a positive value if firms pay less attention to  $a_i$  than to  $\tau_i$ . Correspondingly, it is beneficial for jurisdictions to substitute  $\tau_i$  with  $a_i$  up to the corner solution  $a_h$  if the reduction of the respective incidence on labor by the use of the less salient instrument  $a_i$  is greater than the loss of eligibility for transfers that stems from the use of  $a_i$ . Jurisdictions are indifferent about the use of  $\tau_i$  or  $a_i$  if the equalizing rate takes the critical value  $\alpha_i^c$ . The blue line in *Figure 1* illustrates that jurisdiction  $i$ 's enforcement policy decision is a discontinuous function of the equalizing rate  $\alpha$ . If the equalizing rate falls short of the critical value  $\alpha_i^c$ , there is a comparative advantage in using policy measure  $a_i$  in comparison to  $\tau_i$  because the respective loss of eligibility for transfers carries little weight. Therefore, the local welfare maximization problem exhibits a corner solution with an enforcement intensity  $a_h$  if  $\alpha < \alpha_i^c$ . If, however, the equalizing rate passes the critical value  $\alpha_i^c$ , the marginal loss of eligibility for transfers is a more important argument in the local governments' decision than the decrement of the tax incidence on labor by the use of  $a_i$ . This is why jurisdiction  $i$  chooses an enforcement intensity  $a_l$  if  $\alpha > \alpha_i^c$ .<sup>7</sup>

In this vein, the critical equalizing rate depends on the firms' degree of attention  $\xi_a^i$  as well as on the elasticity of the tax base  $\eta_i$ . Differentiation of equation (25) w.r.t.  $\xi_a^i$  shows that the critical equalizing rate is a decreasing function of the firms' degree of attention to  $a_i$ :

$$\frac{\partial \alpha_i^c}{\partial \xi_a^i} = \frac{\eta_i}{(1 + \eta_i(\xi_a^i - \xi_\tau^i))^2} < 0. \quad (26)$$

Moreover, differentiation of equation (26) w.r.t.  $\eta_i$  shows that the critical equalizing rate is an increasing function of  $\eta_i$ . The tax incidence on labor increases with a more elastic

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<sup>7</sup>If the marginal loss of eligibility is rather low and tax enforcement is a hidden tax instrument firms can correctly anticipate that jurisdictions engage in a *tax-cut-cum-base-broadening* policy.

factor demand and therefore the salience effect is of more importance.

$$\frac{\partial \alpha_i^c}{\partial \eta_i} = \frac{\xi_a^i - \xi_\tau^i}{(1 + \eta_i(\xi_a^i - \xi_\tau^i))^2} > 0. \quad (27)$$

Accordingly, we can state the following proposition:

**Proposition 4** *In a federation with elastic local tax bases and partial fiscal equalization the critical equalizing rate  $\alpha_i^c$  is*

- *a decreasing function of the taxpayers' degree of attention to  $a_i$  and*
- *an increasing function of the elasticity of the tax base.*

Using proposition 4, the scope for incentive-compatible redistribution can be enlarged if a mobile tax base is assigned to jurisdictions. In the stylized model of this paper, we assume that there is a single tax on perfectly mobile capital. However, in an extended version of the model with different tax bases, proposition 4 delivers an argument for local taxation of mobile resources for a strong integration of markets within the federal system.

Jurisdictions' tax policies are ambiguously influenced by fiscal equalization for two reasons. First, with an increase of the equalizing rate, fiscal spillover effects are internalized by a higher extent so that jurisdictions have more high-powered tax incentives. Second, jurisdictions with a heterogeneous fiscal power attempt to compensate for unbalanced tax base differences by adjusting local tax rates in a setting with partial equalization. Jurisdictions with low (high) fiscal power increase (decrease) their statutory tax rate after a marginal increase of  $\alpha$  to even out deficiencies in the local public goods supply. Therefore, the sign of the tax adjustment effect due to a variation of  $\alpha$  is undetermined. Accordingly, the green line in *Figure 1* represents the tax decision function of a low-type jurisdiction. In contrast, jurisdictions with a relatively high fiscal power have a tax policy decision function that decreases in  $\alpha$ , see the red line in *Figure 1*. The jump discontinuity in the tax policy decision function, which stems from the discontinuity in the enforcement policy decision function, which is a substitutive instrument. A formal proof is given in the Appendix.

The critical equalizing rate depends on the fiscal power  $\theta_i$ . Local governments with lower fiscal power choose a higher tax rate. The tax base elasticity augments with an

increasing tax rate. Using proposition 4, the critical equalizing rate is relatively high if the tax base is elastic. Therefore, we can state the following proposition:

**Proposition 5** *The critical value  $\alpha_i^c$  is relatively high (low) for jurisdictions with relatively low (high) fiscal power.*

**Proof:** In the Appendix we show that the marginal impact of  $\theta_i$  on tax incentives is positive. Differentiation of equation (9) w.r.t.  $\tau_i$  shows that the tax elasticity is an increasing function of  $\tau_i$ .

Proposition 5 makes clear that a transfer scheme that exhausts the scope of the incentive-compatible inter-regional redistribution takes a non-linear form. The type-dependent equalizing rates constitutes a decreasing function of local fiscal power  $\theta_i$ . Hence, jurisdictions with relatively low fiscal power can be insured against a fiscal capacity below some predetermined minimum value. Accordingly, in the non-linear transfer scheme those jurisdictions with a relatively low types are forced to raise extremely high statutory tax rates to provide a sufficient supply of public goods. As the equalizing rate is a decreasing function in  $\theta_i$ , the transfer scheme is not self-financing, i.e. the sum of regional transfer payments  $\sum_{i=1}^n s_i$  takes a negative value. Then, an additional fiscal resource (e.g. a horizontal payment from the central government) must be used to set up a non-linear transfer scheme that fulfills proposition 5.

## 6 Extensions of the model

In this section we change some assumptions that are made in the basic model with decentralized tax enforcement policy and decentralized tax policy. In particular, we assume that audits are costly, tax evasion goes along with an additional welfare loss, and jurisdictions are directed by Leviathan type governments.

### 6.1 Tax audits are costly

In section 4 and 5 we have implicitly assumed that audit cost are born by the federal government level or compensated by an inter-regional cost-sharing program. Consider now a federation where jurisdictions bear the tax audit costs by their own, in line with Stöwhase and Traxler (2005).

**Assumption 1** *Tax audits in region  $i$  entail costs  $ga_i$ , where  $g$  is a positive cost parameter. These cost are solely born by jurisdiction  $i$ . The tax base equalizing scheme  $s_i$  do not foresee any sharing of audit costs across jurisdictions.*

Due to assumption 1 the budget constraint of jurisdiction  $i$  alters as follows:

$$z_i = k_i(1 - \sigma_i + \sigma_i a_i \phi) \tau_i + s_i - ga_i. \quad (28)$$

Introducing the modified budget constraint (28) into the local welfare maximizing problem of jurisdiction  $i$  yields the following first order condition w.r.t. the enforcement intensities:

$$V'_i(z_i) \leq \frac{1}{(1 - \alpha)(1 + \eta_i \xi_a^i) - \frac{g}{k_i \sigma_i \phi \tau_i}}. \quad (29)$$

The optimal choice of the statutory tax rate remains invariant of the cost parameter  $g$ . Solving equations (29) and (22) simultaneously, we can compute the critical equalizing rate  $\alpha_i^c$  under assumption 1:

$$\alpha_i^c = \frac{\eta_i \left( \xi_a^i - \xi_\tau^i - \frac{g}{k_i \sigma_i \phi \tau_i} \right)}{1 + \eta_i (\xi_a^i - \xi_\tau^i)}. \quad (30)$$

**Proposition 6** *If jurisdictions have to bear tax audit costs  $ga_i$  the following two properties hold:*

- *The critical equalizing rate  $\alpha_i^c$  is a decreasing function of marginal audit costs.*
- *Local governments' incentives to engage in tax enforcement are not affected by tax costs audit costs if the equalizing rate is below the critical value  $\alpha_i^c$ .*

Proof: Differentiation of equation (30) w.r.t.  $g$  shows that the critical equalizing rate is a decreasing function of the marginal tax audit costs. Moreover, if  $\alpha < \alpha_i^c$  holds, the reduction of the incidence on labor by the use of the tax instrument  $a_i$  outweighs the loss of eligibility for transfers by the use of  $a_i$  as well as the marginal audits cost.

A full reimbursement of audit costs by the federal government or an inter-regional cost sharing arrangement can violate the fiscal equivalence in another way. If the cost of tax audits are not reflected in their budgets local governments possibly do not have an incentive to maintain a tax administration at minimal costs. According, by proposition 6, a reimbursement of the audit costs is only recommended if tax audit costs depreciate the critical equalizing rate by a high extent, so that there is a conflict between the implementation of an efficient enforcement policy and an equalization of fiscal disparities.

## 6.2 Tax evasion causes an additional deadweight loss in the federal economy

In sections 4 and 5 tax evasion has no impact on federal welfare other than an insufficiently low supply of public goods due to a low exploitation of the fiscal capacity. Now we assume that tax evasion causes an additional deadweight loss in the economy that directly enters into the federal welfare function.

**Assumption 2** *Tax evasion causes an additional welfare loss:*

- *Federal welfare is characterized by the following function:*

$$\sum_{i=1}^n (V_i(z_i) + x_i) - \frac{\gamma}{2} \left( \sum_{i=1}^n \sigma_i (1 - a_i) t k_i \right)^2, \quad (31)$$

where  $\gamma$  is a positive constant.

- *Jurisdictions do not take into account the additional welfare loss. They maximize the local welfare function (2).*

Using assumption 2, jurisdictions face the same decision problem as in section 5. Accordingly, if the equalizing rate is below  $\alpha_i^c$ , the equilibrium enforcement policy is the corner solution  $a_h$ . Then the local enforcement policy coincides with the federal welfare maximizing enforcement policy that includes the additional welfare loss. If, however, the transfer scheme entails an equalizing rate higher than the critical value  $\alpha_i^c$  jurisdictions choose the corner solution  $a_l$ . Therefore, they do not tackle tax evasion in an efficient way.

**Proposition 7** *It is more appropriate to condition an inter-regional redistribution scheme on the local tax revenue than on the local tax base if the equalizing rate is higher than  $\alpha_i^c$  and assumption 2 holds.*

Proof: We consider an inter-regional redistribution scheme that depends on the local tax revenue:

$$s_i = \alpha \left( \sum_{j=1}^n \frac{\tau_j k_j(\rho_j, \theta_j)}{n} - \tau_i k_i(\rho_i, \theta_i) \right). \quad (32)$$

Substituting expression (13) with (32) the first order condition of the local welfare maximizing problem w.r.t.  $a_i$  and  $\tau_i$  is given by:

$$V'_i(z_i) \leq \frac{1}{(1-\alpha)(1+\eta_i\xi_a^i)}, \quad (33)$$

$$V'_i(z_i) \leq \frac{1}{(1-\alpha)(1+\eta_i\xi_\tau^i)}. \quad (34)$$

Solving (33) and (34) simultaneously it becomes obvious that a corner solution  $(a_h, \tau_i)$  is implemented if  $\xi_a^i$  exceeds  $\xi_\tau^i$ .

If a transfer scheme is based on tax revenue instead of the tax base, jurisdictions face the same loss of eligibility for transfers irrespective of the use of the tax instrument. Then the low incidence of tax enforcement that falls upon labor constitutes a clear comparative advantage of the tax instrument  $a_i$  up to a level  $a_h$ . Nevertheless, in the presence of tax revenue equalizing, local governments choose an inefficiently low statutory tax rate as tax revenue equalizing entails a high loss of eligibility for transfers by the use of  $\tau_i$ . Therefore, tax revenue equalizing should only come to operation if the equalizing rate is higher than  $\alpha_i^c$  and an addition welfare loss of tax evasion plays a role.

### 6.3 Governments are revenue maximizer

In the previous section we have assumed that jurisdictions act in the interest of their inhabitants. In particular jurisdictions have taken into account the reduced incidence of taxation on labor due to salience effects. In this section we consider a Leviathan type government that has some discretionary power to act in its own interest and therefore maximize its disposable revenue.

**Assumption 3** *Jurisdictions intend to maximize its disposable revenue.*

According to assumption 3 the revenue maximization problem writes:

$$\max_{a_i, \tau_i} k_i(1 - \sigma_i + \sigma_i a_i \phi) \tau_i + s_i. \quad (35)$$

$$\text{s.t. (13).}$$

The first order conditions w.r.t.  $a_i$  and  $\tau_i$  of the revenue maximization problem of writes:

$$1 - \eta_i \xi_a^i \geq 0, \quad (36)$$



$$1 - (1 - \alpha_i)\eta_i\xi_\tau^i \geq 0. \quad (37)$$

As the revenue maximizing local governments do not factor the incidence of the capital tax that falls upon local labor the RHS of equations (36) and (37) are equal to zero. By equation (36) and in line with Stöwhase and Traxler (2005), the equalizing rate of the redistribution scheme  $\alpha$  do not have an impact on the equilibrium enforcement policy as the marginal loss of eligibility for transfers by the use of  $a_i$  coincide with the internalization of fiscal spillover effects. In contrast local governments' incentives for tax policy  $\tau_i$  depends on the equalizing rate as the a change of the statutory tax rate does not alter the assessment basis of the transfer apart form the effects of a inter-regional relocation of capital. Solving equations (36) and (37) simultaneously yields the critical equalizing rate:

$$\alpha_i^c = 1 - \frac{\xi_a^i}{\xi_\tau^i}. \quad (38)$$

**Proposition 8** *The critical equalizing rate  $\alpha_i^c$  does not depend on the elasticity of the tax base if local governments are revenue maximizer.*

Local governments use the tax instrument  $a_i$  up to the level  $a_h$  if the attenuated exodus of capital by the use of  $a_i$  exceeds the loss of eligibility for transfers by the use of  $a_i$ . However, in a setting with revenue maximizing governments, the attenuation of the pressures of tax competition through both tax back effects of fiscal equalization as well as taxpayers inattention amplify disruptions in local fiscal policy.

## 7 Concluding remarks

We have analyzed the efficiency consequences of federal equalizing programs and inter-regional tax competition in a setting where taxpayers fail to fully optimize on local governments' tax policy. With behavioral effects, inter-regional competition for mobile tax bases may take a slightly different form. Jurisdictions do not simply cut tax rates in order to attract mobile resources from neighboring regions but choose an appropriate policy mix that conveys a low tax burden to taxpayers. In particular, the perceived tax burden is reduced if jurisdictions substitute relatively salient tax instruments with less salient ones.

Especially, we consider a federal setting where jurisdictions decide on the statutory tax rate that attracts taxpayers attention by a high extent, as well as measures to enforce taxes that are difficult to observe by taxpayers and remain rather unnoticed. We show that there is a comparative advantage in using the less salient tax enforcement activities as a tax instrument as it dampens the pressures of tax competition. It becomes obvious that an appropriate assignment of revenue functions to the local government level and with an adequate inter-regional transfer scheme resolves the moral hazard problem that typically goes along with fiscal equalization.

## 8 Appendix

### 8.1 Reaction function of jurisdictions

Market-clearing in the federal capital market requires that the exogenously given aggregate capital supply  $kn$  equals the aggregate capital demand  $\sum_{i=1}^n k_i$ . Differentiation of the market clearing condition w.r.t.  $h_i = \tau_i, a_i$  yields:

$$\frac{\partial r}{\partial h_i} = -\frac{k'_i(\rho_i) \frac{\partial \rho_i}{\partial h_i}}{\sum_{j=1}^n k'_j(\rho_j) \frac{\partial \rho_j}{\partial r}}. \quad (39)$$

Respectively, an increase of  $h_i = \tau_i, a_i$  leads to an outflow of capital from region  $i$  to the remaining regions  $j$  different to  $i$ :

$$\frac{\partial k_i}{\partial h_i} = \frac{\theta_i}{f_{kk}(k_i)} \left( \frac{\partial \rho_i}{\partial h_i} + \frac{\partial \rho_i}{\partial r} \frac{\partial r}{\partial h_i} \right), \quad \frac{\partial k_j}{\partial h_i} = \frac{\theta_j}{f_{kk}(k_j)} \frac{\partial \rho_j}{\partial r} \frac{\partial r}{\partial h_i}. \quad (40)$$

If jurisdictions are price-takers with respect to the interest rate  $r$  due to a high number of  $n$  expressions (39) and (40) can be reformulated as follows:

$$\lim_{n \rightarrow \infty} \frac{\partial r}{\partial h_i} = 0, \quad \lim_{n \rightarrow \infty} \frac{\partial k_i}{\partial h_i} = \frac{\theta_i}{f_{kk}(k_i)} \frac{\partial \rho_i}{\partial h_i}, \quad \lim_{n \rightarrow \infty} \frac{\partial k_j}{\partial h_i} = 0. \quad (41)$$

### 8.2 Jurisdictions' margin to use tax enforcement policy as a strategic tax instrument

In this section we derive local governments' margin to choose an enforcement policy that furnishes evidence for the upper bound  $a_h$ . Jurisdiction  $i$  with type  $\theta_i$  that enacts a policy  $(\tau_i, a_h)$  earns the following tax revenue:

$$k_i(\mu_i(\sigma_i, a_h)\tau_i, \theta_i)(1 - \sigma_i + \sigma_i a_h \phi) = \theta_i f_k^{-1} \left( \mu_i(\sigma_i, a_h)\tau_i + r \right) (1 - \sigma_i + \sigma_i a_h \phi). \quad (42)$$

However, the same jurisdiction can produce a tax revenue that mimics a fiscal power  $\tilde{\theta}_i$  by enacting a policy  $(\tau_i, a_i(\tilde{\theta}_i, \theta_i, \tau_i))$ :

$$k_i(\mu_i(\sigma_i, a_h)\tau_i, \tilde{\theta}_i)(1-\sigma_i+\sigma_i a_h\phi) = \theta_i f_k^{-1}\left(\mu_i(\sigma_i, a_i(\tilde{\theta}_i, \theta_i, \tau_i))\tau_i+r\right)(1-\sigma_i+\sigma_i a_i(\tilde{\theta}_i, \theta_i, \tau_i)\phi), \quad (43)$$

where the LHS of equation (43) expresses the tax revenue earned by a  $\tilde{\theta}_i$ -type jurisdiction that enacts a policy combination  $(\tau_i, a_h)$  and the RHS is the tax revenue earned by a  $\theta_i$ -type jurisdiction that chooses a combination  $(\tau_i, a_i(\tilde{\theta}_i, \theta_i, \tau_i))$ . The enforcement intensity  $a_i(\tilde{\theta}_i, \theta_i, \tau_i)$  that mimics a fiscal power  $\tilde{\theta}_i$  in a jurisdiction with fiscal power  $\theta_i > \tilde{\theta}_i$ , a statutory tax rate  $\tau_i$ , a tax base elasticity  $\eta_i > -1$ , and  $\xi_a^i \leq 1$  takes a value below  $a_h$ . We differentiate equation (43) w.r.t.  $\tilde{\theta}_i$ :

$$\left. \frac{da_i(\tilde{\theta}_i, \theta_i)}{d\tilde{\theta}_i} \right|_{\tilde{\theta}_i=\theta_i} = \frac{\frac{1}{\theta_i} k_i(\tau_i, \tilde{\theta}_i)(1-\sigma_i+\sigma_i a_h\phi)}{k_i(\tau_i, \tilde{\theta}_i)(\sigma_i\phi) + \frac{\partial k_i}{\partial a_i}(1-\sigma_i+\sigma_i a_i(\tilde{\theta}_i, \theta_i)\phi)}. \quad (44)$$

Rearranging yields:

$$\left. \frac{da_i(\tilde{\theta}_i, \theta_i)}{d\tilde{\theta}_i} \right|_{\tilde{\theta}_i=\theta_i} = \frac{1}{\theta_i} \frac{1}{\frac{\sigma_i\phi}{(1-\sigma_i+\sigma_i a_i\phi)} + \eta_i \frac{\mu_a}{(1-\sigma_i+\sigma_i a_i\phi)}}. \quad (45)$$

### 8.3 Comparative static analysis (enforcement intensity)

We assume an interior solution. Then, the first order condition for the welfare maximizing statutory tax rate is given by:

$$G^i(a_i, \xi_a^i) = V_i(z_i) - MCF_a^i = 0$$

Differentiation of  $G^i(a_i, \xi_a^i)$  w.r.t.  $a_i$ , and  $\xi_a^i$  yields  $G_a^i < 0$  and  $G_{\xi_a^i}^i < 0$ . Accordingly, we can derive the marginal impact of the degree of attention to  $a_i$  on enforcement incentives:

$$\frac{da_i}{d\xi_a^i} = -\frac{G_{\xi_a^i}^i}{G_a^i} < 0. \quad (46)$$

### 8.4 Comparative static analysis (statutory tax rate)

We assume an interior solution. Then, the first order condition for the welfare maximizing statutory tax rate is given by:

$$F^i(\tau_i, \alpha, \theta_i) = V_i'(z_i) \left( k_i(1-\sigma_i+\sigma_i a_i\phi) + (1-\alpha) \frac{\partial k_i}{\partial \tau_i}(1-\sigma_i+\sigma_i a_i\phi)\tau_i \right) - k_i(1-\sigma_i+\sigma_i a_i\phi) = 0.$$

Differentiation of  $F^i(\tau_i, \alpha, \theta_i)$  w.r.t.  $\tau_i$ ,  $\alpha$ , and  $\theta_i$  yields:

$$\begin{aligned}
F_\tau^i &= V_i'(z_i) \left( \frac{\partial k_i}{\partial \tau_i} (1 - \sigma_i + \sigma_i a_i \phi) + (1 - \alpha) \frac{\partial^2 k_i}{\partial \tau_i^2} (1 - \sigma_i + \sigma_i a_i \phi) \tau_i \right) \\
&+ V''(z_i) \left( k_i (1 - \sigma_i + \sigma_i a_i \phi) + (1 - \alpha) \frac{\partial k_i}{\partial \tau_i} (1 - \sigma_i + \sigma_i a_i \phi) \tau_i \right)^2 - \frac{\partial k_i}{\partial \tau_i} (1 - \sigma_i + \sigma_i a_i \phi) \\
F_\alpha^i &= V_i''(z_i) \frac{\partial z_i}{\partial \alpha} \left( k_i (1 - \sigma_i + \sigma_i a_i \phi) + (1 - \alpha) \frac{\partial k_i}{\partial \tau_i} (1 - \sigma_i + \sigma_i a_i \phi) \tau_i \right) - V_i'(z_i) \left( \frac{\partial k_i}{\partial \tau_i} (1 - \sigma_i + \sigma_i a_i \phi) \tau_i \right) \\
F_\theta^i &= V_i'(z_i) \left( \frac{\partial k_i}{\partial \theta_i} (1 - \sigma_i + \sigma_i a_i \phi) + (1 - \alpha) \frac{\partial^2 k_i}{\partial \tau_i \partial \theta_i} (1 - \sigma_i + \sigma_i a_i \phi) \tau_i \right) - \frac{\partial k_i}{\partial \theta_i} (1 - \sigma_i + \sigma_i a_i \phi)
\end{aligned}$$

The marginal impact of  $\alpha$  on local tax incentives writes:

$$\frac{d\tau_i}{d\alpha} = - \frac{F_\alpha^i(\tau_i, \alpha)}{F_\tau^i(\tau_i, \alpha)}. \quad (47)$$

Equation (47) takes a negative value if the efficiency parameter  $\theta_i$  is high and a positive value if  $\theta_i$  is low. The denominator of (47) is negative due to the semi-negative definiteness of the optimization problem, while the sign of the numerator is undetermined. The term  $\frac{\partial z_i}{\partial \alpha}$  depicts the impact of the equalizing rate on the local government budget. It takes a positive value if jurisdiction  $i$  has a relatively low fiscal power (due to higher contributions from other regions) and it takes a negative value if jurisdiction  $i$  has relatively high fiscal power (higher contributions to the federal redistribution scheme are required). The second term represents the internalization of fiscal spillovers. It takes a positive value. Accordingly, expression (47) takes a positive value for jurisdictions with a relatively low fiscal power. If jurisdictions have a sufficiently high fiscal power the numerator has a negative value as the effect due to the compensation of unbalances fiscal capacity differences exceeds the spill over internalization effect. Moreover, the marginal impact of  $\theta_i$  on local tax incentives writes:

$$\frac{d\tau_i}{d\theta_i} = - \frac{F_\theta^i(\tau_i, \alpha)}{F_\tau^i(\tau_i, \alpha)}. \quad (48)$$

Equation (48) takes a positive value as the numerator on the RHS is always positive.

## References

Allingham, M., and A. Sandmo (1972), Income tax evasion: a theoretical analysis, *Journal of Public Economics*: 1, pp. 323-338.

Alt, J.E. and D.D. Lassen (2003), Fiscal Transparency and Fiscal Policy Outcomes in OECD Countries, *EPRU Working Paper Series*, Economic Policy Research Unit (EPRU), University of Copenhagen.

Baretti, C., B. Huber and K. Lichtblau (2002), A tax on tax revenue: the incentive effects of equalizing transfers: evidence from Germany, *International Tax and Public Finance* : 9, pp. 631-649.

Bracco, E. and F. Porcelli, and M. Redoano (2013), Political Competition, Tax Salience and Accountability: Theory and Some Evidence from Italy, *CESifo Working Paper Series*: 4167.

Bucovetsky, S. and M. Smart (2006), The Efficiency Consequences of Local Revenue Equalization: Tax Competition and Tax Distortions. *Journal of Public Economic Theory*: 8: 1, pp.119-44.

Büttner, T. (2006), The incentive effect of fiscal equalization transfers on tax policy, *Journal of Public Economics*: 90: 3, pp. 477-497.

Cramerer, C.F., G. Loewenstein, and M. Rabin (2004) *Advances in Behavioral Economics*, Princeton University Press, Princeton.

Cremer, H. and F. Gahvari (2000), Tax Evasion, Fiscal Competition and Tax Coordination and Economic Integration, *European Economic Review*: 44, pp. 1633-1657.

Chetty, R., A. Looney, and K. Kroft (2009), Salience and Taxation: Theory and Evidence, *American Economic Review*: 99: 4, pp. 1145-77.

Chetty, R. (2009), The Simple Economics of Salience and Taxation, *NBER Working Paper*, No. 15246.

Dahlby, B. (2003), The Incentive Effect of Fiscal Equalization, in: Booth, P. (ed.): *Equalization: Welfare Trap or Helping Hand?*, Halifax.

Finkelstein, A. (2009), E-ztax: Tax Salience and Tax Rates, *The Quarterly Journal of Economics*: 124: 3, pp. 969-1010.

Gabaix, X. and D. Laibson (2006), Shrouded Attributes, Consumer Myopia, and Information Suppression in Competitive Markets, *Quarterly Journal of Economics*: 121: 2, pp. 505-54.

Köthenbürger, M. (2002), Tax Competition and Fiscal Equalization. *International Tax and Public Finance*: 9: 4, pp. 391-408.

Slemrod, J., M. Blumenthal, and C. Christian (2001), Taxpayer response to an in-

creased probability of audit: evidence from a controlled experiment in Minnesota, *Journal of Public Economics*,: 79, pp. 455-483.

Smart, M. (1998), Taxation and the deadweight loss in a system of intergovernmental transfers, *Canadian Journal of Economics*: 31, pp. 189-206

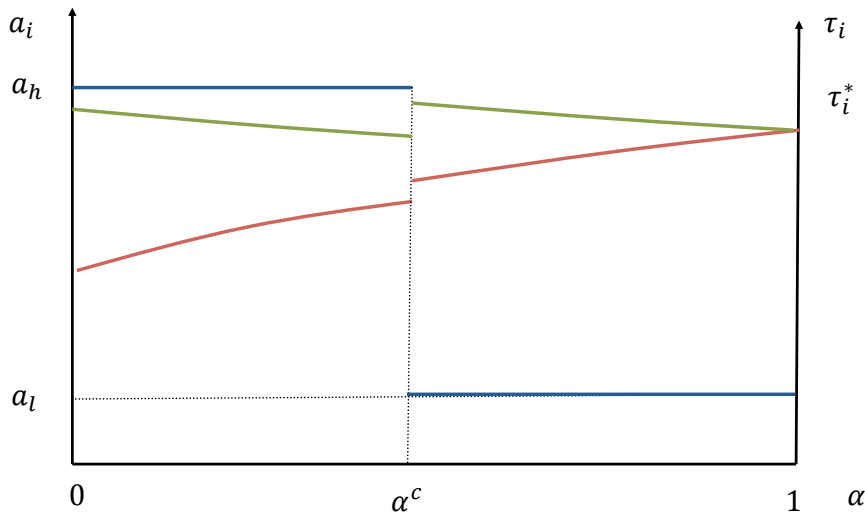
Stöwhase, S. and C. Traxler (2005), Tax Evasion and Auditing in a Federal Economy. *International Tax and Public Finance*: 12: 4, pp. 515-532.

Wilson, J. D. (1986), A Theory of Interregional Tax Competition, *Journal of Urban Economics*: 19, pp. 296-315.

Yitzhaki, S. (1974), A note on Income Tax Evasion: A Theoretical Analysis, *Journal of Public Economics*: 3, pp. 201-202.

Zodrow, G. R. and P. Mieszkowski (1986), Pigou, Tiebout, Property Taxation, and the Underprovision of Local Public Goods, *Journal of Urban Economics*: 19, pp. 356-370.

*Figure 1*



**Remark to Figure 1:** The *blue* line signifies the decision function of jurisdiction  $i$  concerning the tax enforcement policy  $a_i$  contingent on the equalizing rate  $\alpha$ . Whereas

the *red* (*green*) line illustrates the decision function concerning the statutory policy  $a_i$  contingent on the equalizing rate  $\alpha$ , presuming that jurisdiction  $i$  has high (low) fiscal power.