

Bönke, Timm; Jochimsen, Beate; Schröder, Carsten

Conference Paper

Fiscal federalism and tax enforcement

Beiträge zur Jahrestagung des Vereins für Socialpolitik 2014: Evidenzbasierte Wirtschaftspolitik
- Session: Taxation I, No. A15-V3

Provided in Cooperation with:

Verein für Socialpolitik / German Economic Association

Suggested Citation: Bönke, Timm; Jochimsen, Beate; Schröder, Carsten (2014) : Fiscal federalism and tax enforcement, Beiträge zur Jahrestagung des Vereins für Socialpolitik 2014: Evidenzbasierte Wirtschaftspolitik - Session: Taxation I, No. A15-V3, ZBW - Deutsche Zentralbibliothek für Wirtschaftswissenschaften, Leibniz-Informationszentrum Wirtschaft, Kiel und Hamburg

This Version is available at:

<https://hdl.handle.net/10419/100394>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Fiscal federalism and tax enforcement

- Preliminary version, please do not circle or cite -

Timm Bönke, Beate Jochimsen and Carsten Schröder[^]

February 2014

Abstract. In many federations, fiscal equalization schemes soften fiscal imbalances across the member states. Such schemes usually imply that a member state internalizes only a small fraction of the additional tax revenue from an expansion of the state-specific tax base, while the remainder of the additional tax revenue is redistributed horizontally or vertically. We address the question as to which extent state-level authorities in such a federation under-exploit their tax bases. By means of a stylized model we show that the state authorities in such a federation have incentives to align the effective tax rates of the state residents to the internalized marginal return from a stricter enforcement of the tax law. We empirically test the model using two approaches. In a state-level approach, we explore whether the state-specific internalized marginal returns matter for the states' investments in tax enforcement. In a micro-econometric approach, using OLS regressions and natural-experiments, we explore whether internalized marginal returns matter for the effectiveness of the states' tax enforcement activities, captured by the tax deductions granted to tax units. All our estimates support the results from our theoretical model.

JEL-Codes: C21, H21, H77

Key words: fiscal federalism, taxation, tax-back rate, fiscal externalities

[^] Timm Bönke, Freie Universitaet Berlin, School of Business and Economics; Beate Jochimsen, Department of Economics, Berlin School of Economics and Law, and German Institute for Economic Research; Carsten Schröder, Christian-Albrechts-University of Kiel, Department of Economics, Chair of Public Economics, Social Policy and Health Economics. All correspondence to: tim.boenke@fu-berlin.de. We thank Sebastian Paul and Benjamin Beckers for research assistance and participants in research seminars at the Universities of Muenster and Duisburg-Essen for many helpful comments on earlier drafts of this paper. For the same reason, our thanks go to Johannes Bröcker, Thiess Büttner, Giacomo Corneo, Helmut Herwartz and Sarah Necker.

1 Introduction

Fiscal equalization schemes are an important feature of public finance frameworks. Countries that have implemented fiscal equalization schemes include Canada, Switzerland, Australia and Germany. In the United States, an explicit federal equalization scheme for reducing fiscal disparities between the states does not exist. However, certain vertical federal-state transfers, e.g. education programs aimed at the disadvantaged, food and nutrition programs and Medicaid, have an equalizing component.

Theoretical research on the incentives of fiscal equalization schemes and federalism in general has a long tradition. Pioneering works on the assignment of functions to different governmental layers and appropriate fiscal instruments date back to Musgrave (1959) and Oates (1972). The role of inter-regional spillover effects due to mobile tax bases or inter-regional externalities in the provision of public goods is investigated in Oates (1972), Boadway and Flatters (1982), Inman and Rubinfeld (1992), or Manasse and Schultz (1999). Other scholars investigate asymmetric information over local preferences for public goods (e.g. Cremer et al., 1996; Bucovetsky et al., 1998), over technologies for the provision of public goods (e.g. Boadway et al., 1995; Raff and Wilson, 1997; Caplan et al., 2000; Breuillé and Gary-Bobo, 2007; Akai and Silva, 2009), and over local tax bases (Bordignon et al., 2001).

The present study investigates the relationships between fiscal equalization and the enforcement of a uniform tax law, in a setting where the states are responsible for the enforcement and also carry the related costs. In such a setting, the tax enforcement of the states will typically be inefficiently low because the states can internalize only part of the benefits of the enforcement activities, determined by the state-specific tax back rates (*TBR*). *TBR* is the fraction of the marginal tax Euro collected by a state's tax authorities that is kept by the same state (as opposed to be redistributed to other states or the federal level through fiscal equalization). Another problem is that if tax enforcement activities differ across the states, the principle of equal treatment of equals is violated, undermining the tax moral of the tax payers.

We make a theoretical and an empirical contribution. We set up a stylized Samuelson (1954) type model that reflects the aforementioned characteristics, taking the German system as a real-world prototype example. The model reveals that benevolent state-level planners align the effective tax burdens of their taxpayers with the internalized marginal tax revenue (*IMR*) collected from the taxpayers. The *IMR* is the product of two variables: the marginal tax rate of a tax unit and the state-specific marginal *TBR*. The model shows that the effective tax burden of a given taxpayer will systematically vary with the tax back rate of the state the taxpayer lives

in: Provided that the substitution effect dominates the income effect, the effective tax burden of the taxpayer (the enforcement of taxation) will be positively related with *TBR*.

Even in the presence of a uniform tax tariff de jure, differences in tax enforcement activities of the states can lead to different tariffs de facto. For example, the states in Germany can steer the effective income tax burdens of their residents by the incidence and intensity of tax audits or by internal instructions to the taxmen how to deal with the complexity of the income tax law and *vague* legal definitions.¹ In a state-level approach, we explore whether the state-specific internalized marginal returns matter for the states' investments in tax enforcement. We find that, consistent with the model, states with higher marginal revenue from enforcement have more taxmen per taxpayer. Further, in a micro-econometric approach, using OLS regressions and natural-experiments, we take administrative data on individual tax returns to explore whether internalized marginal returns matter for the effectiveness of the states' tax enforcement activities, captured by the tax deductions granted to tax units. Consistent with the model, higher marginal returns from enforcement imply lower levels of tax deductions, for identical tax units de jure.

This is not the first study on the interplay between fiscal equalization and taxation. Previous studies include Oates (1999); Bordignon et al. (2001); Mikesell (2003); Esteller-Moré (2005); Martinez-Vazquez and Timofeev (2005); or Libman and Feld (2007).² Most of the literature deals with fiscal equalization and locally-decided taxes. Related studies for Germany are Buettner (2006) and Egger et al. (2009). Our research question, however, is different. Our study focuses on enforcement activities of the states in a federation under a uniform tax law. We are aware of only two studies with a similar focus: the theoretical work of Traxler and Reutter (2008) and the mostly empirical work of Baretta et al. (2002). However, none of the two provides a direct econometric test on whether differences in tax enforcement incentives, captured by *IMR* at the individual level of a tax unit or *TBR* at the state level, matter for tax enforcement. The present paper seeks to fill this gap in the literature.

The remainder of the paper is organized as follows. Section 2 briefly introduces Germany's federal system and the income-tax law. Section 3 presents our theoretical model. Our database

¹ For example, the level of expenses exceeding blanket allowances and qualified as deductible, despite some guidelines, is a decision *ex aequo et bono* of the auditing taxman. An overview of several norms in the German income tax code with vague legal terms is provided in Bönke et al. (2011), Table A1 in the Appendix. For a detailed discussion see also Vogel, 2000, p. 73-75.

² Another strand of literature focuses on tax enforcement and tax administration. Influential studies include Slemrod and Yitzhaki (1991) and Mayshar (1991).

is described in Section 4. Section 5 provides the econometric analysis. Finally, Chapter 6 offers some concluding remarks.

2 Federalism in Germany

2.1 The fiscal-equalization system

Germany's federal structure is reflected by three governmental layers: the federal layer (*Bund*), the state layer (*Bundesländer*), and the local layer (*Gemeinde*). Since the German reunification in 1990, sixteen *Laender* form the state layer and about 11,500 municipalities the local layer.

Germany's federal system is cooperative: all the fiscally important taxes are set by the central government, and redistributive horizontal and vertical transfers mitigate regional fiscal imbalances so that regional levels of public goods and services are similar (Art. 107, Para. 2, 1, German Federal Constitution). Essentially, transfers are channeled from relatively wealthy states to poorer ones. The level of the transfer depends on the state-specific "fiscal capacity" and "fiscal needs." Basically, fiscal capacity is determined by tax return per inhabitant (before equalization); fiscal needs by average tax return per inhabitant over all the 16 states.

Total tax revenue of a state originates from two sources: the so-called own-source taxes and the joint taxes. Own-source taxes are administered and collected by the states (or municipalities), and the generated tax revenue exclusively benefits the state (or municipality). Inheritance, property acquisition, and lottery taxes are examples for own-source taxes. Revenues from own-source taxes, however, contribute only a small fraction to total tax revenue. The joint taxes (income, corporation and value added tax) contribute the dominant fraction. In year 2011, for example, the joint taxes made up about 70 percent of total tax revenue.³ The common characteristic of the joint taxes is that the tax revenue is shared among the three federal layers. A four-stage equalization system, overviewed in Table 1, assigns the joint taxes to the three layers:⁴

1. Initial assignment of joint taxes by means of politically determined division rules.
2. Horizontal redistribution of up to 25 percent of state-specific revenues from value added taxes (VAT). The aim of the VAT redistribution (*Umsatzsteuervorwegausgleich*) is to ensure that each state receives at least 92

³ From the remaining 30 percent, 17 percent of the revenue account for the federal layer. Federal taxes include energy taxes, motor vehicle taxes, various consumer taxes (e.g., tobacco, alcohol and insurance taxes) and the solidarity surcharge. Roughly some two percent of total tax revenue is state taxes. The remaining nine percent account for the local level in form of property, business and some local consumption taxes (Federal Ministry of Finance, 2012).

⁴ The equalization system partly changed from 2005 onwards. As our data are only available up to 2004 we describe the equalization system valid at that time. However the main mechanisms remained in place.

percent of average per capita tax revenue of all states (mainly the states' shares of income and corporate taxes and some state taxes).

3. Horizontal redistribution of fiscal revenues from financially strong states to financially weak states. A state's payments/transfers depend on deviations of its fiscal revenue per (virtual)⁵ capita and average fiscal revenue per capita over all states. Fiscal revenues of a state covers its share of income and value added tax, revenues from pure state taxes like inheritance or beer tax and 50 percent of the most important local taxes' (i.e. local business tax and property tax). The aim of the third stage ("*Finanzausgleich im engeren Sinne*") is to ensure that each state receives at least 95 percent of the average (per capita) fiscal revenue.
4. Vertical transfers from the federal to the state level. The aim of the vertical transfers ("*Fehlbetragsbundesergänzungszuweisungen*") is to improve the financial situation of those states whose fiscal revenue after stages 1 to 3 still falls below the inter-state average. The grants are uncommitted and cover at least 90 percent of the remaining gap between fiscal revenue and fiscal need. Accordingly, all states effectively end up with at least 99.5 percent of average per capita fiscal revenue.

In addition, special needs grants (*Sonderbedarfsbundesergänzungszuweisungen*) compensate for special fiscal burdens some states have to bear. These grants are given lump-sum, regardless of fiscal or economic performance.

Table 1 about here

Germany's four-stage fiscal equalization system drives a substantial wedge between states' tax revenue before and after fiscal equalization. At the margin, state-specific tax-back rates on state tax revenues (*TBR*) are usually less than 25 percent. The remainder, the marginal rate of loss ($1 - TBR$), is redistributed horizontally or vertically. Due to the complexity of the legal rules of the fiscal-equalization system, it is not feasible to express *TBR* by means of a simple closed form, say as a function of tax revenue, type of tax revenue, and number of inhabitants. All variations of such and other determinants precipitate themselves in stages 2 to 4 of the transfer system (also Baretto et al., 2002, p. 646).⁶

⁵ For some states with specific financial burdens, population size is adjusted by particular weighting factors.

⁶ Appendix 1 in Baretto et al. (2002) for details.

Because official data on state-specific *TBRs* are not available, we have set up a computer program that translates the German fiscal equalization law into formulas. The basic logic of the program is as follows. In a first round, the program quantifies, for each period and state, the tax revenues after equalization. Official statistics from Germany's Federal Ministry of Finance on the state-specific tax revenues by type of tax (before fiscal equalization), number of state inhabitants, etc. serve as the database. The German fiscal equalization law is far too complex to give all the details. However, we want to point out that the results from the first round reproduce official statistics and are therefore consistent.⁷ In a second round, the program quantifies the change of a state's tax returns after equalization resulting from a marginal change in the same state's de facto income-tax base. The tax-back rate of the state is unity minus the ratio of the change of the state's tax returns after equalization and the marginal change in the income tax base.⁸

The state-specific *TBRs* from our computations are summarized in Table 2.⁹ Results are assembled in three columns. Each column relates to a particular year. The selection of the years is guided by the micro-level income tax data, available for the assessment years 1998, 2001, and 2004.

The numbers in Table 2 indicate that *TBRs* are quantitatively small (usually varying around 25 percent), but with some marked differences across states. The numbers also indicate that for most states *TBR* exhibits hardly any variation over time. However, there are three exceptions: Schleswig-Holstein, Bavaria, and Hamburg, with Schleswig-Holstein being the most remarkable case: with about 57 percent, its *TBR* in 1998 was exceptionally high.¹⁰ Based on the inter-temporal changes of *TBR*, we can classify two groups of states: one group consisting of 13 states with *TBRs* and thus incentives of tax enforcement being constant over time; another group of three states with *TBRs* and thus incentives changing over time. This classification will serve as the basis for three natural experiments.

Table 2 about here

⁷ All the computer codes can be provided by the authors upon request.

⁸ *TBR* is the same for a marginal change in income and corporate tax revenue, while it can be different for other types of taxes.

⁹ For selected years, we can cross-check the *TBRs* from our simulations with *TBRs* from previous literatures (Lichtblau and Huber, 2000; Baretta et al., 2002): *TBRs* from ours and their simulations coincide.

¹⁰ The sharp rise of Schleswig-Holstein's marginal rate of loss ($1 - TBR$) in 1998 is also documented in Lichtblau and Huber (2000). Simulations for marginal rate of loss instead of *TBR* are also provided in Bönke et al. (2011).

Interestingly, the relationship between a state's *TBR* and its fiscal capacity is highly non-linear, not even one-directional. For example, in 1998 the *TBR* of a 'poor' net-recipient state like the Saarland and a 'rich' net-contributor state are almost the same. This is for the following reason: for net contributor states, *TBR* reflects that higher tax revenue implies higher payment obligations; for net recipient states, *TBR* reflects that higher tax revenue implies lower transfer entitlements.¹¹ *TBR* is the lowest, if the state's fiscal capacity coincided with the average capacity over all states. In this constellation, the *TBR* equals the initial assignment rule of the joint taxes (stage 1), and only then a state can it experience a big swing in the *TBR* (like Schleswig-Holstein in 1998).

Figures 1a-c show the responsiveness of *TBR* to a state's per capita income tax revenue before fiscal equalization. Each Figure relates to one of the three observation periods 1998, 2001, and 2004, and provides sixteen graphs, one for each state. The abscissa gives (fictitious) variations from actual per capita income tax revenue before fiscal equalization. Accordingly, the actual *TBR* can be inferred from a graph where the same deviation is zero. Moving from the "0"-threshold to the right (left) complies with a fictitious increase (decrease) of per capita income tax revenue before equalization. Because the increase (decrease) changes the fiscal capacity of the state relative to average fiscal capacity, its *TBR* changes.

The graphs indicate two regularities: the relationship between a state's *TBR* and its per capita income tax revenue before equalization is highly non-linear and not one-directional, and that it usually takes non-negligible variations of per-capita tax revenue to change the *TBR*.¹²

The two regularities imply that for state authorities voluntarily steering *TBR* is basically impossible. Accordingly, we view *TBR* as an exogenous variable and as a yardstick against which the tax declarations are audited. The interpretation of *TBR* as an exogenous is further justified for the reason that the *TBR* of a particular year is always determined *before* the tax declarations for the same year are audited. This is because horizontal and vertical transfers in a particular year, say assessment year 1998, hinge upon *cash* tax revenues. Income tax declarations from 1998, however, are handled by the tax authorities as off spring 1999.

Figures 1a-1c about here

¹¹ Plachta (2008) provides a detailed description of the German financial constitution.

¹² Only if a state's fiscal capacity, by coincidence, is rather close to the interstate average, realistic variations of income tax revenue have a profound impact on *TBR*.

2.2 *The process of income taxation*

The legislation of joint taxes and the responsibility concerning the enforcement of the income tax law are assigned to different governmental layers. The tax-setting autonomy is allocated at the central level. Particularly, the central level defines both tax-tariffs and tax bases, while the states have no tax setting autonomy – even if pure state taxes are concerned.¹³ Accordingly, the states' possibilities to steer income tax revenues and effective income tax burdens of their residents *directly* are heavily restricted. The responsibility of tax enforcement, however, is delegated to the states.

The de-central settlement of tax enforcement responsibility at the state-level and the monocacy of state financial executives open up opportunities for a politically motivated practice of tax laws. This is because only basic standards guide the tax enforcement activities of the states. Effectively, the state governments decide on the endowment of tax collecting agencies with personnel and IT, or on the training of taxmen. The state governments also give internal instructions providing the taxmen with guidelines how to deal with particular vague paragraphs in the income tax law. Indeed, a report of the Federal Audit Office (2006, p. 78f.) remarks: “some countries give the impression that the hiring of tax auditors is not interesting due to fiscal equalization; net contributor states had to pay the dominant part of eventual additional tax revenue in the fiscal equalization system, while transfers were reduced for the net recipient state.” In a summarizing statement of the same report it is argued that differences in the personnel endowments of tax offices undermine the “uniformity of taxation in Germany” (Federal Audit Office, 2006, p. 122).

Further indications of a politically motivated tax practice have been provided in previous literature:

1. Vogel (2000, 128-155) as well as Schick (2011) find systematic differences in tax revenue per audit and state specific tax auditing frequencies. In the city state¹⁴ Hamburg, for example, many income millionaires are resident. The auditing rate of these millionaires' income tax returns, however, is substantially lower than in other states (Schick, 2011).
2. A report of the Federal Audit Office (2006, p. 13) documents that in a random sample of 21 tax offices the number of tax audits per taxman and year varies between 972 and 2,720. It is also documented that the complete and equal auditing of tax

¹³ Except the rate of the property acquisition tax that can be determined by the states since 2006.

¹⁴ Three German cities (Berlin, Bremen, Hamburg) are also independent federal states.

declarations is no longer secured, and that systematic errors are made in the audits of special expenses in Hamburg (p. 35f.). According to the Audit Office of Berlin (2001), tax returns of employees are not audited with sufficient care, and taxmen refrain from a careful consideration of tax declarations in order to meet thresholds regarding the number of daily audits.

3. To harmonize tax audits, recently a risk management system has been implemented in all tax offices. The system evaluates roughly 2,500 positions in income tax returns, and indicates potential incongruities between the positions. Harmonization was not achieved, because the states modified the detection algorithms independently, and because tax offices responded differently to potential incongruities (Federal Audit Office, 2009, p. 176-179; Federal Audit Office 2012, p. 30). If the system selects a tax return for special audit, it is not secured that this auditing is appropriately conducted. Instead, according to several State Audit Offices, the error rate rates from 12 percent (North Rhine Westphalia) to 52 percent (Brandenburg).
4. Vogel (2000) provides evidence that certain tax payers had been treated preferentially by the states. Examples include generous interpretation of amortization rules or the postponement of tax payments.

In sum, the states bear the full costs related to the enforcement of the income tax law (e.g., related to the endowment of tax offices), but they internalize only part of the resulting tax revenues (due to the redistributive fiscal equalization scheme). Due to the decentralized administration, the means of the central level to control the tax collection process are limited. So the states have both the opportunity and the incentive to align tax enforcement activities with their own objectives, and in this respect *TBR* may play a prominent role. As outlined above, several state-level indicators suggest differences in state-specific tax enforcement levels. However, the empirical evidence is basically anecdotic and also lacks a rigorous econometric testing.

3 A stylized model

Our model relies on Samuelson's (1954) static public good model. Consider a country with $j = 1, \dots, J$ federal states and let a state j have three sources of revenues: income-tax revenue,¹⁵ equalizing grants, and lump sum transfers, feasible for the provision of a state-wide public good

¹⁵ We abstain from modeling other tax types or the possibility of public debt to keep the analysis simple. The reasons and incentives for raising public debt are discussed in Jochimsen and Nuscheler (2011).

provided at the level g_j . Transfer rules determining the equalizing grants, Z_j , and the lump sum transfers \bar{B}_j , and also the tax tariff, τ , are set by a central planner (whose goal might be the maximization of overall societal welfare). These rules, characterized by $[\tau, (Z_1, \dots, Z_J), (\bar{B}_1, \dots, \bar{B}_J)]$, are decided before taxes have actually been collected, and before public goods have been provided. Consistent with the situation in Germany we assume that tax enforcement is delegated to the federal states who interpret $[\tau, (Z_1, \dots, Z_J), (\bar{B}_1, \dots, \bar{B}_J)]$ as exogenous (henceforth indicated by vertical bars). We further assume that the tax units resident in a state j , $i_j = 1, \dots, I_j$, are immobile (and so are the incomes, tax bases).¹⁶

Using the public good as the numéraire, in a static one-period model the public budget constraint of state j is given by,

$$g_j \leq T_j + Z_j + \bar{B}_j, \quad (1)$$

with

$$T_j = \sum_{i_j=1}^{I_j} \bar{r} \cdot t_{i_j}(\tau, y_{i_j}, \Delta_{i_j}), \quad (2)$$

where T_j denotes income tax revenue after the initial assignment of taxes according to division rules in stage 1 of Germany's fiscal equalization system. The term $\bar{r} \approx 0.575$ gives the share from income tax revenue assigned to the state level (including the state's municipalities), and $t_{i_j}(\tau, y_{i_j}, \Delta_{i_j})$ is the effective tax burden imposed on tax unit i_j . The effective tax burden of i_j hinges on the progressive tax tariff, τ , on i_j 's gross taxable income, y_{i_j} , and the level of granted deductions, Δ_{i_j} . We assume that gross taxable income is exogenous from the taxman's point of view.

The second term in the state's budget constraint is the net equalizing transfers,

$$Z_j = Z_j[(T_1(\cdot), I_1), (T_2(\cdot), I_2), \dots, (T_J(\cdot), I_J), \bar{F}]. \quad (1)$$

For net-recipient (net-contributor) states, i.e. for states with a below-average (above-average) per-capita fiscal capacity, the net equalizing transfer is positive (negative). \bar{F} accounts for further particular regulations inherent in Germany's fiscal equalization system. Across the states, equalizing transfers add up to zero, i.e.,

¹⁶ The assumption that citizens do not change residences across state borders as response to moderate differences in effective income tax rates is supported by a recent empirical study for Switzerland (see Liebig et al., 2007). Young and Varner (2011) verify this claim for one state in the US. However, Kleven et al. (2013) find evidence of high mobility of top income earners across borders. Such top-income households are not contained in the micro-data used in our empirical analysis.

$$\sum_{j=1}^J Z_j = 0. \quad (2)$$

The third term in the state's budget constraint (1), \bar{B}_j are lump sum vertical transfers, i.e. special needs grants.

For a tax unit resident in state j , we assume that preferences are characterized by an additive utility function of the form,

$$u_{i_j} = f(c_{i_j}) + h(g_j), \quad (3)$$

with c_{i_j} denoting the level of a private good, the numéraire, and with g_j denoting the level of a state-level public good. Accordingly, we abstain from modeling public good spillover effects.

The budget constraint of a tax unit is,

$$c_{i_j} \leq y_{i_j} - t_{i_j}(\bar{\tau}, y_{i_j}, \Delta_{i_j}). \quad (4)$$

Suppose $[\tau, (Z_1, \dots, Z_J), (\bar{B}_1, \dots, \bar{B}_J)]$ and an interior solution exists. Further, suppose state planners “act as benevolent maximiser of their citizens' welfare” (Edwards and Keen, 1995, p. 113). Finally suppose the welfare of the residents of a state is described by a Bentham social welfare function, $W_j = \sum_{i_j=1}^{I_j} u_{i_j}$.

The optimization problem of the benevolent planner of a state j is,

$$\begin{aligned} L_j(g_j, \Delta_{1j}, \dots, \Delta_{I_j}) = & \\ & \sum_{i_j=1}^{I_j} \left(f(y_{i_j} - t_{i_j}(\tau, y_{i_j}, \Delta_{i_j})) + h(g_j) \right) \\ & + \lambda \left[g_j - \bar{r} \sum_{i_j=1}^{I_j} t_{i_j}(\tau, y_{i_j}, \Delta_{i_j}) + \sum_{k \neq 1} Z_k(\cdot) - \bar{B}_j \right] \end{aligned} \quad (5)$$

The solution is,

$$\frac{I_j \cdot \frac{\partial h}{\partial g_j}}{\frac{\partial f}{\partial c_{i_j}} \cdot \frac{\partial t_{i_j}(\cdot)}{\partial \Delta_{i_j}}} = \left[\bar{r} \frac{\partial t_{i_j}(\cdot)}{\partial \Delta_{i_j}} - \sum_{k \neq 1} \frac{\partial Z_k}{\partial T_j} \cdot \frac{\partial T_j}{\partial t_{i_j}(\cdot)} \cdot \frac{\partial t_{i_j}(\cdot)}{\partial \Delta_{i_j}} \right]^{-1} \quad \forall i_j = 1, \dots, I_j \quad (6)$$

$$\Leftrightarrow I_j \cdot \frac{\frac{\partial h}{\partial g_j^*}}{\frac{\partial f}{\partial c_{i_j}}} = \left[\bar{r} - \sum_{k \neq j} \frac{\partial Z_k}{\partial t_{i_j}(\cdot, \Delta_{i_j}^*)} \right]^{-1} \quad \forall i_j = 1, \dots, I_j$$

The benevolent planner of state j chooses $(\Delta_{i_j}^*, \dots, \Delta_{I_j}^*, g_j^*)$ so that the optimality condition (6) holds. The optimality condition is a modification of the standard Samuelson condition for the provision of public goods.

The left hand side is the sum of rates of substitution between the public and the private good, known from the standard Samuelson condition. The expression in brackets on the right hand side is the effect of a marginal variation of the tax base of resident i_j , Δ_{i_j} , on the public budget of state j : the internalized marginal tax revenue, IMR_{i_j} . The IMR_{i_j} comprises two terms. The first term gives the additional tax revenue resulting from a marginal tax-base variation that is not vertically redistributed: the product of the marginal tax rate, $\partial t_{i_j} / \partial \Delta_{i_j}$, times the income tax share assigned to the state level, $\bar{r} \approx 0.575$. However, state 1 can internalize only part of this amount. The remainder, $\sum_{k \neq j} \frac{\partial Z_k}{\partial T_j} \cdot \frac{\partial T_j}{\partial t_{i_j}(\cdot)} \cdot \frac{\partial t_{i_j}(\cdot)}{\partial \Delta_{i_j}} > 0$, constitutes a positive fiscal externality for the other 15 states.

Notice that the concept of $IMR_{i_j} = TBR_j \cdot \frac{\partial t_{i_j}(\cdot)}{\partial \Delta_{i_j}}$ is related to the concept of the tax back rate, $TBR_j = \bar{r} - \sum_{k \neq j} \frac{\partial Z_k}{\partial T_j}$. However, only the IMR_{i_j} reflects that the marginal internalized return from a marginal expansion of the tax base (by granting less tax deductions to tax unit i_j) depends on a state-level and a micro-level component: the state's tax-back and the marginal tax rate of the taxpayer whose tax base is expanded.

Equation (6) has immediate implications for the optimal level of deductions, $\Delta_j^* = \sum_{i_j=1}^{I_j} \Delta_{i_j}^*$, from the viewpoint of the benevolent planner in state j . Suppose two taxpayers with identical tax-relevant characteristics living in two states 1 and 2, taxpayers 1_1 and 1_2 . Further suppose states' tax-back rates differ, $TBR_1 > TBR_2$. Under ceteris paribus conditions, condition (8) implies that then the level of tax deductions granted to taxpayer 1_1 should be lower than for taxpayer 1_2 . This is because the internalized returns from tax enforcement are higher in state 1

compared to state 2.¹⁷ For example, the states can steer the effective tax burdens by the fraction of tax returns that is audited, or by the ‘generosity’ of the taxmen concerning the granting of tax deductions.

Equation (6) also indicates that the state planner does not consider the effect of tax enforcement on the budgets of the other states: Every variation of granted tax deductions alters the state’s tax revenue ex ante to fiscal equalization, and thus the revenues of all other states. This fiscal externality implies an inefficient level of tax enforcement in terms of overall costs and benefits to society. The following empirical sections challenge equation (6) with empirical evidence.

4 Database and key figures

4.1 Germany’s “Factually Anonymous Income Tax Statistic”

Germany’s *Income Tax Statistic (Lohn- und Einkommensteuerstatistik)* provides income-tax returns from about 30 million tax units per assessment year. It conveys information on taxable income, family situation, income sources, granted deductions and exemptions, revenues and sources of revenues, income tax burden, etc. From all the tax units, a 10 percent stratified random sample is made available for scientific purposes, the so-called *Factually Anonymous Income Tax Statistic* (Faktisch anonymisierte Lohn- und Einkommensteuerstatistik, FAST). As the amount of observations is - with annually roughly 3 million tax units - rather high we assume that the data are representative both for the national and for the state level.

FAST is provided in form of three cross-sectional scientific-use-files, covering data for the assessment years 1998, 2001, and 2004. These three cross sections form our database. Unfortunately, more recent data are not available. This is for two reasons. First, tax units have an extensive period to file their income tax statements before the statements are audited and processed by the tax collecting authority. For complex income tax statements the whole process can easily take up to five years. Second, once the taxation process is completed, the data must be assembled by the state statistical offices and forwarded to the federal statistical office, where the scientific use files are prepared.

FAST allows the identification of gross taxable income before any type of deductions (y_i) and taxable income. The difference of the two income concepts is the sum of all granted deductions

¹⁷ The argumentation requires that the substitution effect always dominates the income effect. It must also be ensured that variations of discretionary deductions and corresponding changes in income tax revenue have at most a small effect on *TBR*. As Figures 1a-c indicated, this is not a too strong assumption. As pointed out in Section 2.1, in the empirical examination *TBR* are indeed exogenous.

(Δ_i) and serves as the indicator of enforcement: the higher is granted deductions (Δ_i), controlled for all tax relevant characteristics of the tax unit, the lower is the level of enforcement.

4.2 Descriptive figures from income tax statistics

Figures 2a-c give the state- and period specific distributions of effective internalized marginal revenues ($IMR_{i,j}$). Each figure comprises sixteen graphs. In each graph, a state specific distribution of IMR (solid line) is benchmarked against the German average (dashed line). The differences between the two distributions mirror differences in the state-specific income distributions and TBR s.

Figures 2a-2c about here

In order to compare the concept of $IMR_{i,j}$ and TBR_j , Table 3 provides state-wide average for years 1998, 2001 and 2004 of $IMR_{i,j}$, $av_j(IMR_{i,j}) = \frac{1}{I_{j,year}} \sum_{i_{j,year}=1}^{I_{j,year}} IMR_{i,j,year}$: the average of the individual marginal tax rates of the residents in a state (as provided in Table A1) times the state's TBR_j (provided in Table 2). The higher $av_j(IMR_{i,j})$, the higher is the internalized revenue and the incentive to secure an effective tax enforcement. As can be seen from Table 3, $av_j(IMR_{i,j})$ differ substantially across states, ranging from 1.85 percent in 2004 in Mecklenburg-Western Pomerania to 17.65 percent in Schleswig-Holstein in 1998. They also change over time. This is mainly for two reasons: changes in tax back rates and changes in marginal tax rates. Changes in the marginal tax rates again have two predominant causes: shifts in the distributions of tax-relevant characteristics (especially taxable income) and income tax reforms altering marginal tax rates. Indeed, the income tax law has been changed during the observation period. Particularly, the marginal tax rate for the top income bracket has been lowered from 53 in 1998 to 45 percent in 2004.

Table 3 about here

Further descriptive statistics of FAST variables used in adjacent regression analyses are summarized in Table A1 in the Appendix. By year and state, the table provides means and standard deviations of the gross taxable income before any deductions, $y_{i,j}$, and total deductions

defined as the difference between gross taxable income and the actual fixed tax base, Δ_{ij} . All monetary amounts are expressed in year 2004 prices. The table also gives the mean marginal tax rates and the number of weighted and non-weighted observations. Due to the factual anonymisation information on the process of taxation and state of residency is incomplete for several tax units, particularly for very rich ones. These units had to be discarded from the database, leaving us with a pooled sample of roughly six million observations (two million per cross section).

Gross taxable income before any deductions is the central micro-level conditioning variable in the empirical analysis. It has a profound impact on the level of deductions, and it is exogenous from the viewpoint of states' taxmen. Across the states, average gross taxable income is the highest for Baden-Wurttemberg and Hesse, and the lowest in Thuringia. Over time, average price adjusted gross taxable incomes varies only little.

Granted tax deductions is the central endogenous variable in the empirical analysis. Averages deductions for tax units in year 1998, for example, range between €5,466 (Brandenburg) and €7,186 (Baden-Wurttemberg). It is, however, not necessarily true that deductions are higher in richer than in poorer states. As an example, in 2004 average gross taxable income in Bavaria is about €1,500 lower than in Hesse, but average deductions in Bavaria are about €140 higher.

5 Econometric analysis

5.1 Regressions using state-level variables

We start our analysis with a model using state-level aggregates in the spirit of studies such as Barette et al (2002). The basic idea of such a model is to econometrically explain the state-wide level of tax enforcement by *TBR*, after controlling for other state-level variables. Particularly, we measure tax enforcement by an input variable, the staffing of tax offices: the state-wide number of income tax returns divided by the number of full time equivalent employees in the financial administration. The smaller the ratio, so the argument, the better the endowment of the tax offices, and the higher is the enforcement level.

The state-level approach has two central weaknesses. First, economies of scale in tax administration are not well understood. In the presence of increasing returns to scale, highly populated states might enforce the tax law more effectively with the same staffing of tax offices compared to low populated states. Second, the approach does not control for differences in the distributions of individual *IMRs* across states (but uses a state-wide indicator). However, equation (6) indicates that the distribution of *IMRs* across a state's tax payers matters for tax

enforcement. For these two reasons, results from a state-level regression approach should be viewed only as a preliminary naïve attempt to study the incentives of Germany's federal system on the tax policies of the states.

We implement two state-level panel regressions. In both regressions, the dependent variable is the inter-temporal change in the staffing of tax offices: the number of income tax returns divided by the number of full time equivalent employees in the financial administration. Staffing is available to us for the years 1998, 2001 and 2004. As staffing will respond to changes in tax enforcement incentives with some delay, the inter-temporal change in staffing in state j is: $\Delta staffing_j = staffing_{j,2004} - staffing_{j,1998}$.¹⁸ The definition of all the explanatory variables follows the same logic. Hence, the state-level regression is,

$$\Delta staffing_j = \beta_0 + \beta_1 \Delta INCENT_j + \beta_2 \Delta GDP_j + \beta_3 \Delta POP_j + \beta_4 CITY_j + \varepsilon_j. \quad (7)$$

The change in tax enforcement incentives, $\Delta INCENT_j$, is measured alternatively as (a) change in tax-back rates, $\Delta TBR_j = TBR_{j,2004} - TBR_{j,1998}$ (specification S1.1); (b) change in average rate of internalized marginal revenues, $\Delta av_j (IMR) = av_{j,2004} (IMR_{i_j}) - av_{j,1998} (IMR_{i_j})$ (specification S1.2). Further control variables include the change in gross domestic product per capita, ΔGDP_j , the change in population density per square kilometer, ΔPOP_j , and a city-state dummy, $CITY$. All underlying values for the construction of the variable are provide in Table A2 in the Appendix.

The results of the two specifications are displayed in Table 4. In the first specification, the regression coefficient of ΔTBR carries the expected sign (a higher incentive for enforcing the tax law means that fewer taxpayers are audited per full time employee in a state's financial administration). However, the coefficient is insignificant. One possible explanation provides the optimality condition (8): tax enforcement depends on the tax back rate together with the distribution of individual marginal tax rates. Accordingly, tax-back rates alone are not an ideal indicator for the incentive of a state to enforce the tax law.¹⁹ Specification S1.2 considers the interaction of tax back rates and individual marginal tax rates by averaging the IMR s of all taxpayers in a state. Now the regression coefficient pertaining $\Delta av(IMR)$ carries the expected negative sign and is significant at a 10 percent level.

¹⁸ The results for three year differences support our findings from the six year differences regarding sign and magnitude of effects but are not significant at the 10 percent level.

¹⁹ This would to some extent explain the results in Baretti et al. (2002) who fail to find a robust link between the marginal rate of loss and the level of tax enforcement.

In sum, the results of the state-level approach do not reject our research hypothesis that higher internalized returns of taxation lead to higher tax enforcement activities at the state level. However, a state-level analysis misses the complexity of the condition (8): it is the distribution of *IMRs* over all the taxpayers in a state and not an average statistic that determines tax enforcement activities. Not controlling for differences in the distributions of the tax-relevant characteristics of the tax units in regression analysis could simply lead to spurious correlations. Considering the distributions of tax-relevant characteristics at the micro level of tax units is thus crucial for estimating how fiscal equalization impacts tax enforcement activities of the states.²⁰ This can be best achieved by conducting a micro level analysis at tax unit level.

Table 4 about here

5.2 Micro-econometric analysis

5.2.1 Regression approach

The micro-level regression analysis is conducted with OLS. The dependent variable is the natural logarithm of total deductions. Suppressing individual, period, and state-level subscripts, the OLS regression is,

$$\ln(\Delta) = \alpha_0 + \boldsymbol{\beta}'\mathbf{Incentives} + \boldsymbol{\gamma}'\mathbf{Year} + \boldsymbol{\delta}'\mathbf{Char} + \boldsymbol{\theta}'\mathbf{Source} + \boldsymbol{\vartheta}'(\mathbf{Source} \cdot \mathbf{Year}') + \boldsymbol{\mu}'\mathbf{State} + \varepsilon \quad (8)$$

The bold expressions denote vectors. *Incentives* includes a changing set of variables that mirror the tax enforcement incentives. Altogether four specifications are tested. In specification S2.1, *Incentives* comprises a single variable: the taxpayer-specific internalized marginal tax revenue, *IMR*. The specification thus complies with the optimality condition (6) from the theoretical model. According to the model, we should expect a negative regression coefficient: The higher the incentive to enforce the tax law, the lower should be the granted tax deductions. In specification S2.2, *Incentives* includes two variables: *IMR* and the marginal tax rates of each taxpayer. This set up tests for the role of *IMR* after controlling for individual marginal tax rates. In specifications S2.3, *Incentives* solely includes the state-specific *TBRs* (but not the tax payer specific marginal tax rates. In specification S2.4 *Incentives* comprises the two components of *IMR* as separate variables: state-specific *TBRs* and individual marginal tax

²⁰ Studies building on macro data, instead, proxy such and other issues with auxiliary variables like an inequality index (e. g. Goodspeed, 2002).

rates. Specification 2.4 is thus the most flexible specification. Particularly, it even allows *TBRs* and individual marginal tax rates to have opposing effects on the level of granted tax deductions. Of course, to isolate the effect of *Incentives* on granted tax deductions it is important to control for other potential determinants of granted tax deductions. To control for period effects, the vector *Year* includes two period dummies for years 2001 and 2004. *Char* comprises the characteristics of the tax unit: the number of tax-relevant children, age, marital status and church membership. *Source* is a vector of seven dummies. Each dummy indicates if the tax unit gained an income from a particular income source. This is because the German income tax law distinguishes seven different income sources, and for each there apply particular regulations. A dummy is one if the taxpayer has some positive income from the particular income source; else it is zero. To capture changes in the tax law, we interact the income source dummies with the two period dummies for 2001 and 2004. Finally, the vector *State* comprises fifteen state dummies (base category is Baden-Wuerttemberg). Results from the four OLS regressions are summarized in Table 5.

Table 5 about here

Table 5 provides a summary of the regressions. The covariates of interest are subsumed under *Incentives*. All four regression specification, convey the same consistent story: the higher the incentive to enforce the tax law, the lower is the level of granted tax deductions (controlled for all other aforementioned covariates). According to specification S2.1 the regression coefficient for *IMR* equals -1.227. Assuming that average granted deduction amount to 6,000 Euro (see Table A1), the coefficient indicates that rising the internalized tax revenue (*IMR*) by 5 percentage points lowers granted tax deduction by 360 Euro. According to specification S2.2, this inverse relationship between *IMR* and tax deductions is confirmed even after additionally controlling for individual marginal tax rates. Specifications S2.3 and S2.4 show that both components of the *IMR*, *TBR* and marginal tax rates, matter for granted tax deductions, and for both components the inverse relationship is reconfirmed.

5.2.2 Natural experiments

As outlined above, there are two groups of states: one group where *TBRs* vary over time (Schleswig-Holstein, Bavaria, and Hamburg); another group where *TBRs* are about constant over time. Accordingly, tax-enforcement incentives (captured by *TBR*) change in the former

but not in the latter group. Since *TBR* is an exogenous variable from the viewpoint of the states, the setting is like a natural experiment: residents of the former states are the “treated,” and residents of the latter are the “controls.”

The econometric device to isolate the effect of the treatment is the difference-in-differences estimator (DiD). The DiD estimator is the difference between two differences: the difference in tax deductions before and after treatment among the treated, and the same difference among the controls. The control group should be composed of tax units resident in states with an intertemporally stable *TBR* with tax-relevant characteristics similar to the treated.

Schleswig-Holstein experienced with a decrease of about 45 percentage points between 1998 and 2001 the most pronounced change of its *TBR*, and thus might be viewed as the ideal candidate for implementing the DiD approach. Two further potential candidates are Bavaria and Hamburg. Bavaria’s 2001 *TBR* is about 4.2 percentage points lower than in 1998; Hamburg’s *TBR* doubles between 2001 and 2004. The treatment in Schleswig-Holstein and Bavaria should lower the states’ incentives because it lowered the share of a marginal tax Euro that can be internalized. Accordingly, the two states’ DiD estimators should carry a positive sign. With the same logic, the DiD estimator for Hamburg should be negative.

For establishing experimental conditions it is important to find adequate control states (with *TBR* varying little over time) and to identify tax units where the treatment or non-treatment is certain. To isolate the effect of the *TBR* we restrict our control and treatment groups to tax units in the top income bracket ($y_i > 60.000$ respectively $y_i > 120.000$ for joint filers). First, this enables us to look exclusively at the *TBR* for identifying the treated tax units (hence high income tax units face the identical marginal tax rate and the *IMR* is the equal within in each state). Second, this ensures that the fundamental change in the income tax tariff between 1998 and 2004 does not artificially alter the distributions of marginal tax rates within each state and prohibits us from constructing the appropriate treatment and control samples. Still, the top income tax bracket is affected. Between 1998 and 2004, the top marginal tax rate was lowered from 53 to 45 percent. This, however, should be captured by a common time trend and poses no problem. Furthermore, the characteristics of the treated in the control group (residents of the control states) have to be reproduced. The standard procedure to achieve this goal is statistical matching. After the matching, the effect of the treatment on the treated is estimated over the common support, S , i.e. the part of the distribution of characteristics X that is both represented among the treated and the controls. As our analysis relies on repeated cross-sections, we have implemented the statistical matching over three groups: the treated and the non-treated in the

initial period before treatment, t_0 , and the non-treated at t_1 (Blundell and Costa-Dias, 2008, p. 58). Then the difference-in-differences (DiD) estimator after matching is (Blundell and Costa-Dias, 2008, p. 59),

$$\hat{\alpha} = \sum_{i \in T_1} \left\{ \left[\Delta_{it_1} - \sum_{k \in T_0} \tilde{w}_{ikt_0}^T \Delta_{it_0} \right] - \left[\sum_{k \in T_0} \tilde{w}_{ikt_1}^C \Delta_{it_1} - \sum_{k \in T_0} \tilde{w}_{ikt_0}^C \Delta_{it_0} \right] \right\} w_i. \quad (9)$$

In equation (11), (T_0, T_1) denote the treatment before and after treatment and (C_0, C_1) the respective control groups; \tilde{w}_{ikt}^C denotes the weight attributed to tax unit k belonging to group G in period t when comparing with the treated tax unit i ; w_i reconstructs the outcome distribution for the treated in the base sample.

To implement the difference-in-differences estimator (11), propensity scores must be estimated using both the treated and the controls. In case of multiple cross-sections, the dependent variable, the dummy variable d indicating the base sample after treatment, is set to one if the tax unit is treated and the observation period is t_1 ($G = T_1$) and to zero otherwise. Then the two control groups ($G = C_0, C_1$) and the treated before treatment ($G = T_0$) are matched to the treated after treatment separately. Accordingly, the common support S comprises the treated units for whom a counterfactual tax unit is found in all three control samples (Blundell and Costa Dias, 2008).

The natural experiments underlying our DiD approach encompass Schleswig-Holstein 1998-2001, Bavaria 1998-2001, and Hamburg 2001-2004.

As outlined above, the DiD approach relies on four groups T_0, T_1, C_0 and C_1 :

1. Treated tax units in the period posterior to treatment, t_1 , form the base samples, denoted T_1 . We have three base samples: Tax units residing in Schleswig-Holstein in 2001, in Bavaria in 2001, and in Hamburg in 2004.
2. Each of the three base samples is statistically matched with three samples: (a) tax units resident in the treated state in the period ex ante to treatment, t_0 , sample T_0 ; (b) tax units resident in the control states in period t_0 , sample C_0 ; (c) tax units resident in the control states in period t_1 , C_1 .

The tax units forming the two samples C_0 and C_1 are residents of those states who exhibited vary little variation in TBR between t_1 and t_0 .²¹

²¹ For Bavaria and Schleswig Holstein the control sample is drawn from tax units residing in non-city states. Hence, Lower Saxony, North Rhine-Westphalia, Hesse, Rhineland-Palatine, Baden-Württemberg, Saarland, Brandenburg, Mecklenburg-Western Pomerania, Saxony, Saxony-Anhalt and Thuringia serve as pool. For Hamburg, the control sample is drawn exclusively from tax units residing in the city states Berlin and Bremen.

Ex ante to the statistical matching we have partitioned the treat and control samples in four sub-groups by marital and parental status (having children or not). Partitioning means that matches between observations in different sub-groups are not allowed. Partitioning by marital and parental status is important for the reliability of the DiD estimates, because tax burdens of the partitioned groups systematically differ due to splitting boon and child-related tax allowances. For each partitioned group, we have implemented a propensity score based nearest-neighbor matching: an observation from the potential control group is chosen as a matching partner for a treated observation that is closest in terms of the propensity score. The matching considers the following characteristics of the tax units: taxable base before discretionary deductions and its square;²² number of children (for the two sub-groups where children are present); age; dummies for the seven income sources (1 if revenues are positive; zero else); and church membership.²³ Up to five neighbors had been allowed.

Figures A1a to A1c in the Appendix provide the resulting propensity score distributions. Results for Schleswig Holstein are provided in Figure A1a, for Bavaria in A1b, and for Hamburg in A1c. In each of the Figures, three symmetry plots are provided. Each symmetry plot depicts the propensity score distribution for the treated group after treatment, T_1 (black shaded distribution above the horizontal axis), against one of the three groups, T_0 , C_0 or C_1 (distribution below the horizontal axis). As can be seen from the graphs, the propensity scores are highly symmetric, indicating that the distributions of observational characteristics are similar across groups. This can also be seen from the descriptive statistics provided in Tables A4a to A4c in the Appendix. Difference-in-differences estimators from equation (11) together with jackknife standard errors are summarized in Table 6. Further, the effect of treatment on collected income taxes in a treated state is provided. To compute this effect, we, first, have applied the tax schedule of period t_1 to the taxable bases of the treated in t_1 . This gives the original tax burdens of the treated. Subsequently, we have corrected for the treatment by adding $\hat{\alpha}$ to the taxable bases, and simulated the counterfactual treatment-corrected individual tax burdens by applying the respective tax tariff. Finally, we have computed differences between treatment-corrected and original tax burdens, and aggregated the differences over all the treated tax units. Consequently, a positive (negative) number translates into forgone (additional) tax revenue.

²² We have included the squared taxable base because the relationship between the taxable base and discretionary deductions is non-linear. With respect to the matching, inclusion of the squared taxable base requires balancing on both the first and second moments of the covariate distributions.

²³ Controlling for church membership is important because paying church taxes reduces the marginal income tax burden, and thus the marginal income-tax revenue.

Table 6 about here

Results for Schleswig-Holstein are provided in the first panel of Table 6. Between 1998 and 2001, Schleswig Holstein's *TBR* has dropped from 57.05 to 12.15 percent. Accordingly, the internalized marginal returns dropped substantially, lowering the incentives to enforce the income tax law (reflected by higher tax deductions). Indeed, the average treatment effect on the treated suggests that, as result, average tax deductions granted to a 'rich' taxpayer in Schleswig-Holstein increased by about 2,564 Euros, resulting in forgone tax revenues of about 1,194 Euros per unit and 31 million in total.

Results for Bavaria are provided in the second panel of Table 6. Between 1998 and 2001, Bavaria's *TBR* has dropped from 26.59 to 22.34 percent. Accordingly, we should again expect a positive average treatment effect. The result is consistent with expectations: the drop of *TBR* increases the level of granted tax deductions. However, compared to Schleswig Holstein the effect is smaller in absolute terms, most likely because Schleswig Holstein's *TBR* decreased much stronger. Forgone tax revenue amounts to about 576 Euro per rich resident of Bavaria, and to about 98 million in total.

Results for Hamburg are provided in the third panel of Table 6. In contrast to Schleswig Holstein and Bavaria, the time period (2001 vs. 2004) and also the direction of the change of the *TBR* is different. Hamburg's *TBR* has increased from 8.5 percent in 2001 to 17.08 percent in 2004. So, now we should expect a negative average treatment effect; and again the expectation is confirmed by the estimator. The increase of Hamburg's *TBR* means that the incentives to enforce the tax law have increased. As a result, granted tax deductions are lower, resulting in higher tax revenue per tax payer and 11 million rise in tax revenue.

6 Conclusion

In many federations, fiscal-equalization schemes have been installed to soften fiscal imbalances across the member states. Various theoretical works have investigated the incentives of such cooperative systems. However, so far only a few studies addressed the research question of the present paper: whether fiscal equalization matters for the enforcement of a uniform tax by state governments.

By means of a stylized model we show that state authorities have incentives to align the effective tax rates of their residents to the internalized marginal returns from taxation. We empirically test the model using two workhorses, regressions and a natural-experiment design,

and our estimates support the model's prediction: the higher the fraction of additional tax revenues a state internalizes, the stricter it enforces the tax law, as reflected in lower levels of tax deductions.

From the viewpoint of a single state it is rational to align tax enforcement activities with the fraction of additional tax revenue that the state internalizes. However, the alignment causes fiscal externalities, and these imply that state-specific tax enforcement activities are inefficient (too low) from the viewpoint of the overall economy. Further, differences in enforcement activity across the states violate the principle of equal treatment of equal, undermining the tax moral of the taxpayers.

In principle, such problems can be rectified by shifting the tax enforcement responsibility to a central tax collection agency. Indeed, several initiatives have been set up in this direction in the last years in Germany. For example, in year 2007 a commission of German experts on federalism ("*Föderalismuskommission II*") discussed the installation of a central tax collecting agency. In the end, such initiatives have always been dismissed, failing against the resistance of German states.

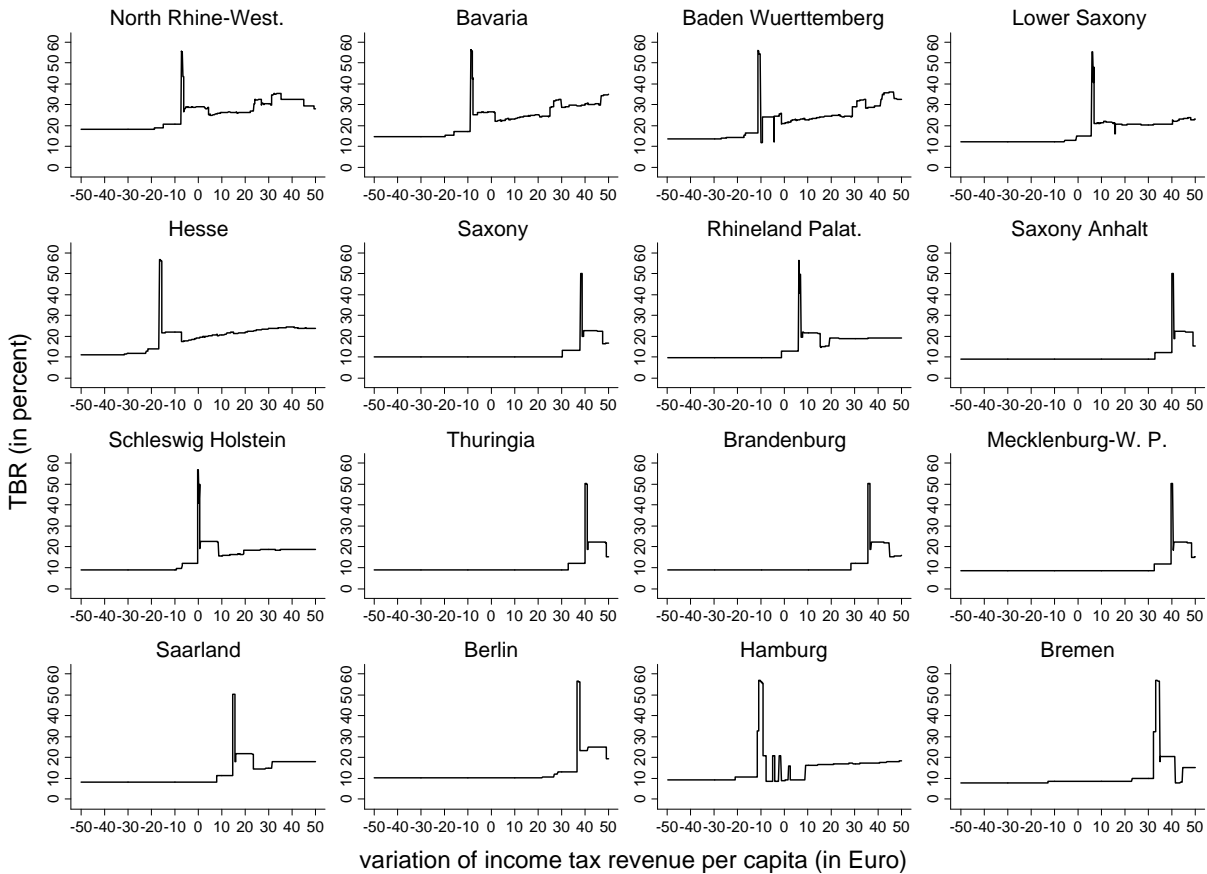
References

- Akai, N., and E. Silva (2009): Interregional Distribution as a Cure to the Soft Budget Syndrome in Federations, *International Tax and Public Finance*, 16, 43-58.
- Audit Office of Berlin (*Rechnungshof von Berlin*) (2001): Jahresbericht 2001 des Rechnungshofs von Berlin gemäß Artikel 95 der Verfassung von Berlin und § 97 der Landeshaushaltsordnung, Berlin.
- Baretti, C., Huber, B., and K. Lichtblau (2002): A Tax on Tax Revenue. The Incentive Effects of Equalizing Transfers: Evidence from Germany, *International Tax and Public Finance*, 9, 631-649.
- Blundell, Richard W. and Costa Dias, Monica (2008): Alternative Approaches to Evaluation in Empirical Microeconomics, IZA Discussion Paper No. 3800.
- Boadway, R., and F.R. Flatters (1982): Efficiency and Equalization Payments in a Federal System of Government: A Synthesis and Extension of Recent Results, *Canadian Journal of Economics*, 15, 613-633.
- Boadway, R., Horiba, I., and R. Jha (1995): The Design of Conditional Grants as a Principal-Agent Problem, Manuscript, Queen's University.
- Bönke, T., B. Jochimsen and C. Schröder (2011): Fiscal equalization and regions' (un)willingness-to-tax - evidence from Germany, Economics Working Paper, Department of Economics, Christian-Albrechts-Universität Kiel, Nr. 2011/6.
- Bordignon, M., Manasse, P., and G. Tabellini (2001): Optimal Regional Redistribution Under Asymmetric Information, *American Economic Review*, 91, 709-723.

- Breuillé, M.-L., and R. Gary-Bobo (2007): Sharing Budgetary Austerity under Free Mobility and Asymmetric Information: An Optimal Regulation Approach to Fiscal Federalism, *Journal of Public Economics*, 91, 1177-1196.
- Bucovetsky, S., Marchand, M., and P. Pestieau (1998): Tax Competition and Revelation of Preferences for Public Expenditure, *Journal of Urban Economics*, 44, 367-390.
- Buettner, T. (2006): The Incentive Effect of Fiscal Equalization Transfers on Tax Policy, *Journal of Public Economics*, 90, 477-497.
- Caplan, A.J., Cornes, R.C. and E.C.D. Silva (2000): Pure Public Goods and Income Redistribution in a Federation with Decentralized Leadership and Imperfect Labor Mobility, *Journal of Public Economics*, 77, 265-284.
- Cremer, H., Marchand, M., and P. Pestieau (1996): Interregional Redistribution through Tax Surcharge, *International Tax and Public Finance*, 3, 157-173.
- Edwards, J., and M. Keen (1996): Tax Competition and Leviathan, *European Economic Review*, 40, 113-134.
- Egger, P., Koethenbueger, M., and M. Smart (2009): Do Fiscal Transfers Alleviate Business Tax Competition? Evidence from Germany, *Journal of Public Economics*, 94, 197-336.
- Esteller-Moré, A. (2005): Is there a Connection Between the Tax Administration and the Political Power?, *International Tax and Public Finance*, 12, 639-663.
- Goodspeed, T.J. (2002): Tax Competition and Tax Structure in Open Federal Economies: Evidence from OECD Countries with Implications for the European Union, *European Economic Review*, 46, 357-374.
- Federal Audit Office (*Bundesrechnungshof*) (2012): Bericht nach §99 BHO über den Vollzug der Steuergesetze, insbesondere im Arbeitnehmerbereich, Bonn.
- Federal Audit Office (*Bundesrechnungshof*) (2009): Bemerkungen 2009 zur Haushalts- und Wirtschaftsführung des Bundes, Bonn.
- Federal Audit Office (*Bundesrechnungshof*) (2006): Probleme beim Vollzug der Steuergesetze, Schriftenreihe des Bundesbeauftragten für Wirtschaftlichkeit in der Verwaltung, Stuttgart: Kohlhammer.
- Federal Ministry of Finance (*Bundesministerium der Finanzen*) (2012): Kassenmäßige Steuereinnahmen nach Steuerarten in den Kalenderjahren 2010-2011, http://www.bundesfinanzministerium.de/Content/DE/Standardartikel/Themen/Steuern/Steuerschaetzungen_und_Steuereinnahmen/2012-05-29-steuereinnahmen-nach-steuerarten-2010-2011.pdf?__blob=publicationFile& (November 21, 2012).
- Inman, R.P., and D.L. Rubinfeld (1992): Fiscal Federalism in Europe - Lessons from the United States Experience, *European Economic Review*, 36, 654-660.
- Jochimsen, B., and R. Nuscheler (2011), The Political Economy of the German Länder Deficits: Weak Governments Meet Strong Finance Ministers, *Applied Economics*, 43, 2399-2416.
- Kleven, H.J., Landais, C., Saez, E., and E.A. Schultz (2013): Migration and Wage Effects of Taxing Top Earners: Evidence from the Foreigners' Tax Scheme in Denmark, NBER Working Papers 18885, National Bureau of Economic Research.
- Libman, A., and L.P. Feld (2007): Strategic Tax Collection and Fiscal Decentralisation: The Case of Russia, *CESifo Working Paper*, 2031.

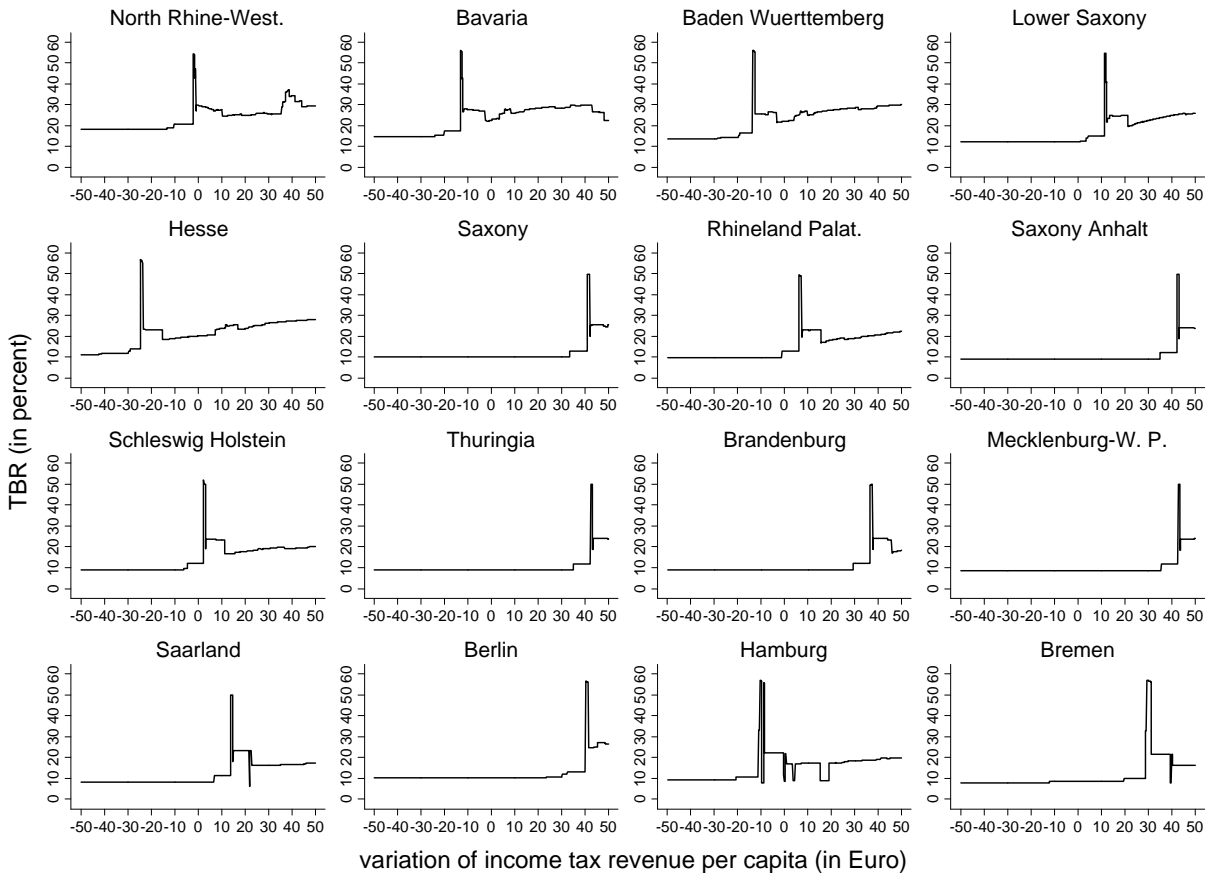
- Liebig, T., Puhani, P., and A. Sousa-Poza (2007): Taxation and Internal Migration - Evidence from the Swiss Census using Community-Level Variation in Income Tax Rates, *Journal of Regional Science*, 47(4), 807–836.
- Manasse, P, and C. Schultz (1999): Regional Redistribution and Migration, *IGIER Working Paper*, 146.
- Martinez-Vazquez, J., and A. Timofeev (2005): Choosing between Centralized and Decentralized Models of Tax Administration, *ISP Working Paper*, 05-02, Georgia State University.
- Mayshar, J. (1991): Taxation with Costly Administration, *The Scandinavian Journal of Economics*, 93(1), 75-88.
- Mikesell, J.L. (2003): *International Experiences with Administration of Local Taxes: A Review of Practices and Issues*, Tax Policy and Administration Thematic Group, The World Bank.
- Musgrave, R.M. (1959): *The Theory of Public Finance*, New York: McGraw-Hill.
- Oates, W.E. (1999): An Essay on Fiscal Federalism, *Journal of Economic Literature*, 37, 1120-1149.
- Oates, W.E. (1972): *Fiscal Federalism*, New York: Harcourt Brace Jovanovich.
- Plachta, R. (2008): *Schuldenfalle Finanzausgleich – Theoretische und empirische Analyse der deutschen Finanzverfassung*, Köln.
- Raff, H., and J.D. Wilson (1997): Income Redistribution with Well-Informed Local Governments, *International Tax and Public Finance*, 4, 407–427.
- Samuelson, P.A. (1954): The Pure Theory of Public Expenditure, *Review of Economics and Statistics*, 36, 387–389.
- Schick, G. (2011): Schwarz-gelbe Landesregierungen betreiben laxen Steuervollzug – und nehmen Ungerechtigkeiten und höhere Schulden in Kauf, <http://www.gerhardschick.net/images/stories/Steuerpolitik/argumentationspapier%20steuervollzug.pdf> (March 11, 2011).
- Slemrod, J., and S. Yitzhaki (1987): The Optimal Size of a Tax Collection Agency, *Scandinavian Journal of Economics*, 89(2), 183-92.
- Traxler, T. and A. Reutter (2008): Apportionment, Fiscal Equalization and Decentralized Tax Enforcement, Working Paper Series of the Max Planck Institute for Research on Collective Goods 2008_21, Max Planck Institute for Research on Collective Goods.
- Vogel, H. (2000): *Ungleichheiten beim Vollzug von Steuergesetzen im Bundesstaat – Juristische und ökonomische Aspekte*, Peter Lang Verlag: Frankfurt et al.
- Young, C., and C. Varner (2011): Millionaire Migration and State Taxation of Top Incomes: Evidence from a Natural Experiment, *National Tax Journal*, 64(2), 255-84.

Figure 1a. Tax back rate and income tax revenue, 1998



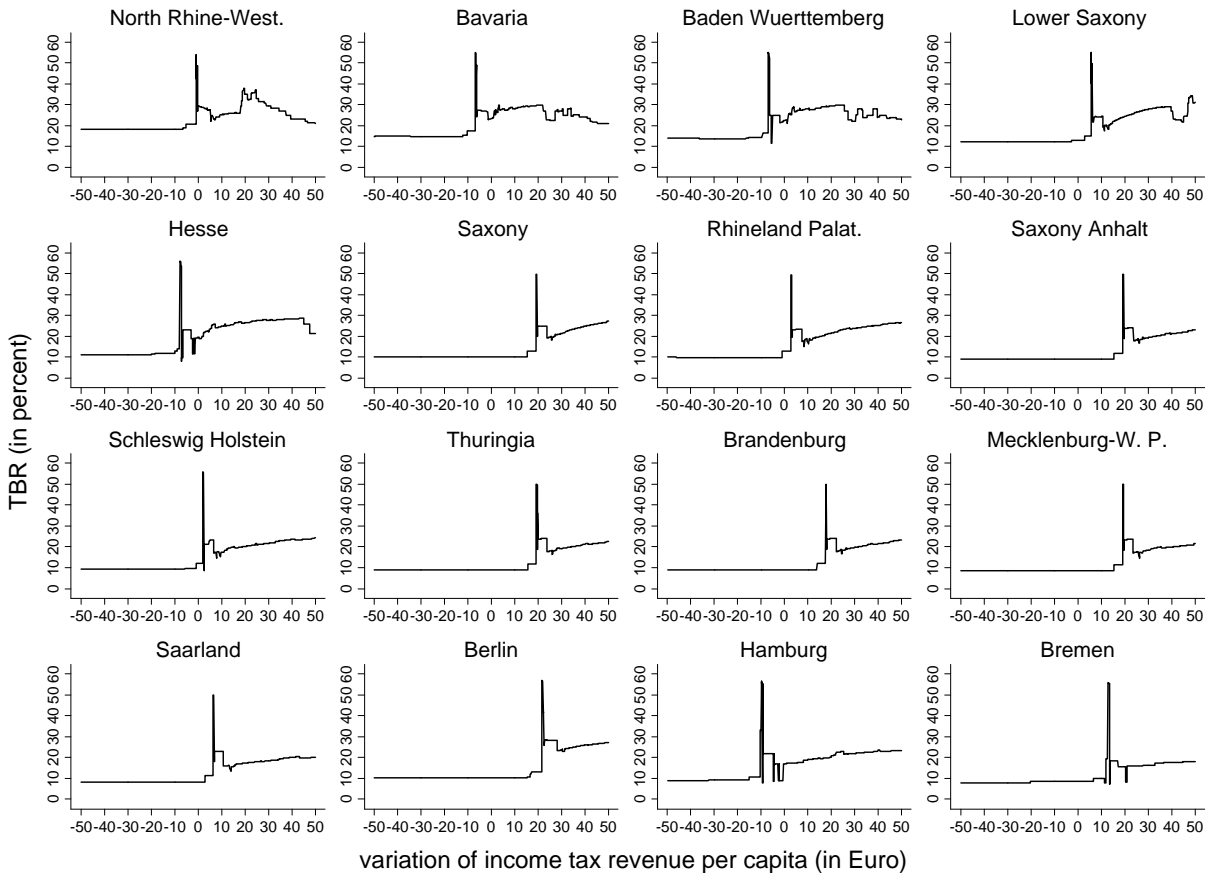
Note. Own computations.

Figure 1b. Tax back rate and income tax revenue, 2001



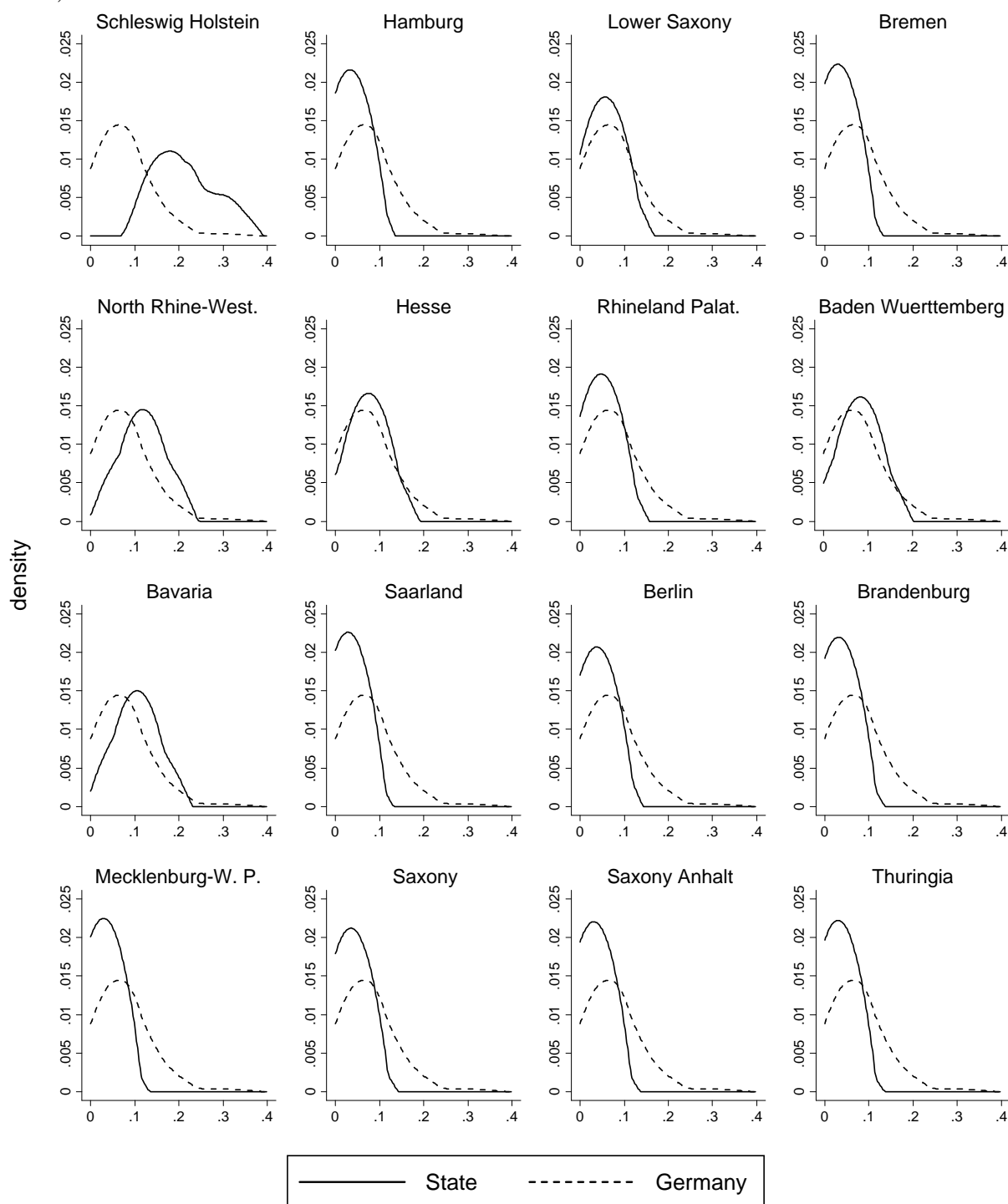
Note. Own computations.

Figure 1c. Tax back rate and income tax revenue, 2004



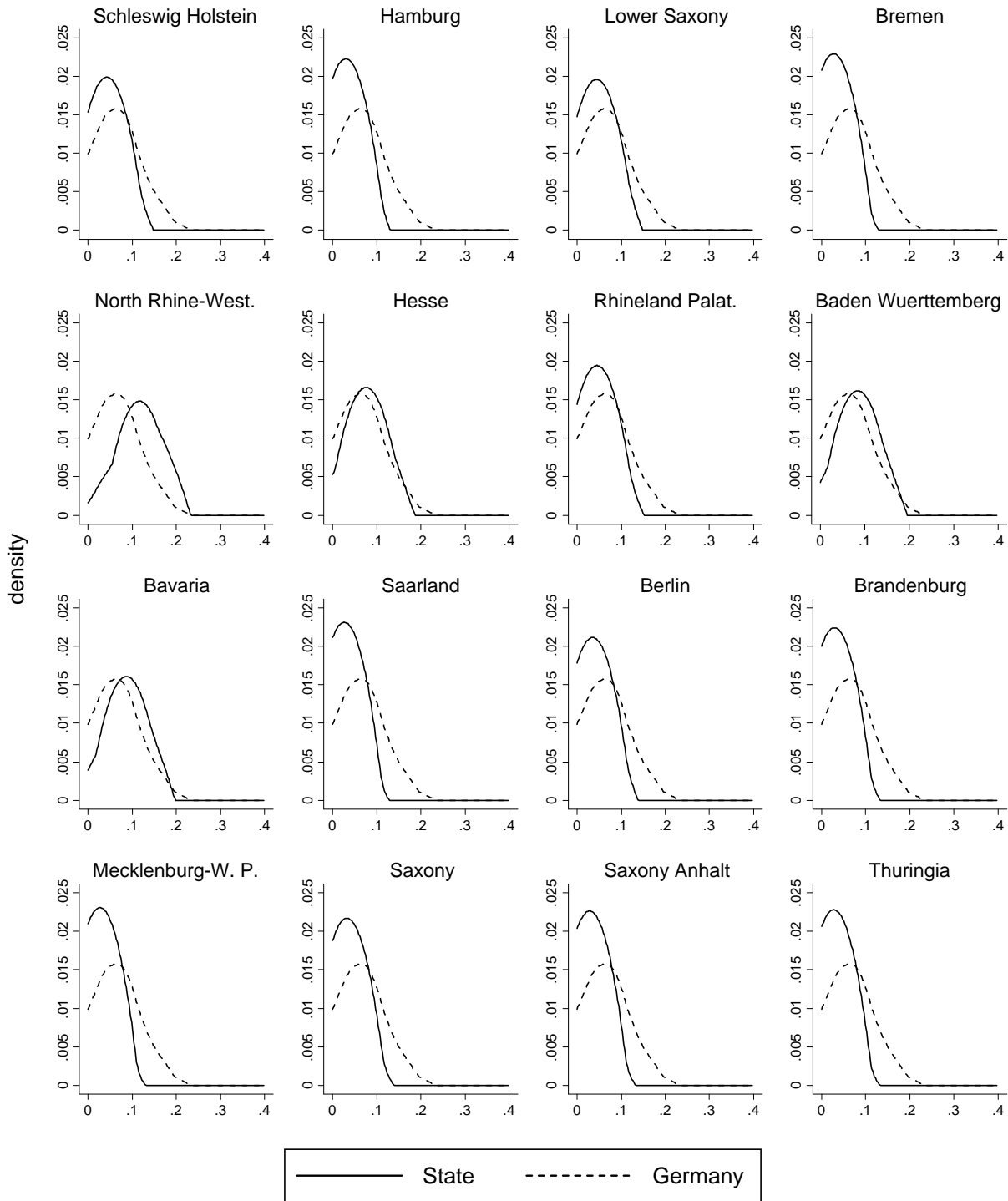
Note. Own computations.

Figure 2a. Distributions of internalized marginal tax revenues (IMR) of an additional taxed Euro, 1998



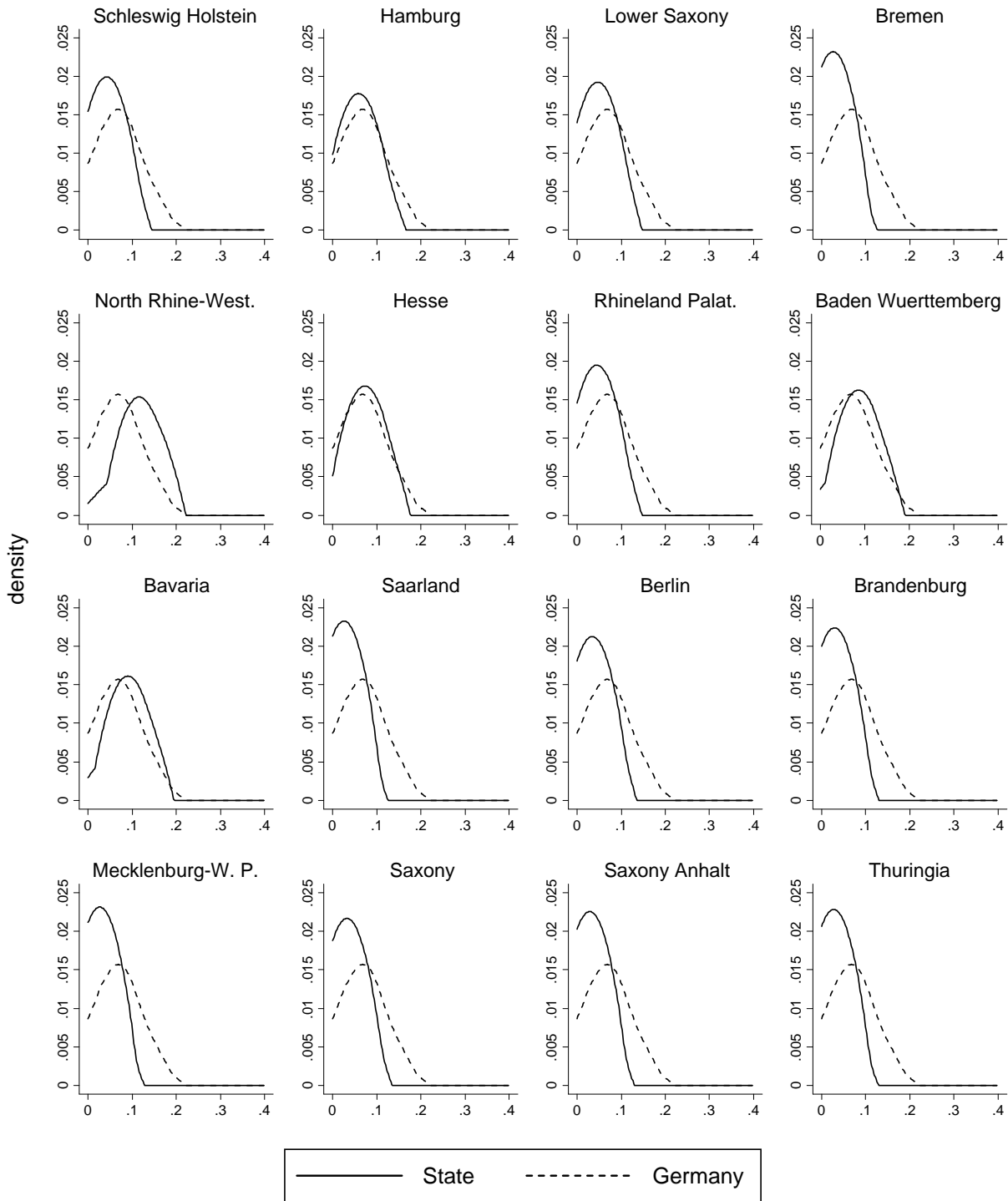
Note. Own computations. *Data.* FAST 1998.

Figure 2b. Distributions of internalized marginal tax revenues (IMR) of an additional taxed Euro, 2001



Note. Own computations. *Data.* FAST 2001.

Figure 2c. Distributions of internalized marginal tax revenues (IMR) of an additional taxed Euro, 2004



Note. Own computations. *Data.* FAST 2004.

Table 1. Germany's fiscal equalization system

	Stage 1	Stage 2	Stage 3	Stage 4
Type	Revenue sharing	VAT distribution	Horizontal equalization payments	Supplementary federal grants
Instrument	Revenue sharing of joint taxes (income, corporation, VAT) according to fixed division rules	Distribution of VAT revenue amongst the states	Transfers from financially strong states (above average joint-tax-revenues) to financially weak ones (below average)	Transfers from the federal government to states whose fiscal revenue is still below average
Fiscal effect	Fixed rate of loss for provinces, e.g. 42.5% for income tax revenue, i.e. they keep 57.5% of income tax revenue.	All states receive at least 92% of average (per capita) tax revenue	All states receive at least 95% of average (per capita) fiscal revenue	All states receive at least 99.5% of average (per capita) fiscal revenue

Note. In addition to stage 1 to 4 some provinces receive special need grants that are paid lump-sum.

Table 2. Tax back rates

State	Acronym	<i>TBR (in %)</i>		
		1998	2001	2004
Schleswig-Holstein	SH	57.05	12.15	12.16
Hamburg	HH	8.80	8.50	17.08
Lower Saxony	NI	14.97	12.19	12.83
Bremen	HB	8.39	8.38	8.38
North Rhine-Westphalia	NW	29.07	29.63	29.46
Hesse	HE	19.20	20.08	19.41
Rhineland-Palatine	RP	12.84	12.83	12.84
Baden-Württemberg	BW	21.12	21.98	22.45
Bavaria	BV	26.59	22.34	23.37
Saarland	SL	8.14	8.13	8.12
Berlin	BE	10.19	10.16	10.16
Brandenburg	BB	9.02	9.03	9.01
Mecklenburg-Western Pomerania	MV	8.56	8.54	8.51
Saxony	SN	10.17	10.1	10.04
Saxony-Anhalt	ST	9.09	9.03	8.97
Thuringia	TH	8.96	8.92	8.89

Note. Own calculations.

Table 3. Average state level internalized marginal tax revenues

State	Acronym	<i>av(IMR)</i> (in %):		
		1998	2001	2004
Baden-Württemberg	BW	6.66	6.18	6.09
Bavaria	BV	8.21	6.16	6.19
Berlin	BE	3.13	2.74	2.54
Brandenburg	BB	2.44	2.12	2.06
Bremen	HB	2.57	2.25	2.13
Hamburg	HH	2.81	2.40	4.57
Hesse	HE	6.03	5.63	5.20
Mecklenburg-Western Pomerania	MV	2.24	1.92	1.85
Lower Saxony	NI	4.49	3.26	3.33
North Rhine-Westphalia	NW	9.03	8.17	7.81
Rhineland-Palatine	RP	3.93	3.49	3.37
Saarland	SL	2.46	2.20	2.12
Saxony	SN	2.66	2.26	2.17
Saxony-Anhalt	ST	2.35	2.01	1.95
Schleswig-Holstein	SH	17.65	3.32	3.18
Thuringia	TH	2.32	2.00	1.95

Note. The average marginal tax revenue is calculated as the state specific average marginal tax rate multiplied with one minus the state's tax back rate. Average marginal tax rates are provided in Table A1. Own calculations.

Table 4. State level regression

Specification	S1.1		S1.2	
Dependent variable: $\Delta staffing$				
ΔTBR	-71.323	(42.290)		
$\Delta av(IMR)$			-244.987*	(136.323)
ΔGDP	0.012**	(0.004)	0.012**	(0.004)
ΔPop	0.071	(0.324)	0.047	(0.320)
<i>City</i>	33.265**	(11.857)	33.975**	(11.766)
<i>Constant</i>	46.673***	(7.142)	44.614***	(7.571)
R ²	0.382		0.399	
F statistic	3.318		3.487	
Observations	16		16	

Note. Ordinary least squares regression, standard errors in parentheses. Levels of significance: * 10%, ** 5%, *** 1%. All variables denoted with Δ are calculated as difference between 1998 and 2004. Underlying values for the variables are provided in Table 2 (ΔTBR), Table 3 ($\Delta av(IMR)$) and Table A2 ($\Delta staffing$: difference in relative staffing; ΔGDP : difference in per capita GDP; ΔPop : difference in population density) in the Appendix. *Data.* Federal Statistical Office, Income Tax Statistics, Own Calculation.

Table 5. Regression results

Specification	S2.1		S2.2		S2.3		S2.4	
Dependent variable: $\ln(\Delta_i)$								
Incentives								
<i>IMR</i>	-1.227***	(0.015)	-0.167***	(0.017)				
<i>TBR</i>					-0.036***	(0.007)	-0.033***	(0.007)
$\partial t_i / \partial \Delta_i$			-0.798***	(0.006)			-0.827***	(0.006)
Year								
<i>year₂₀₀₁</i>	-0.100***	(0.003)	-0.113***	(0.003)	-0.089***	(0.003)	-0.113***	(0.003)
<i>year₂₀₀₄</i>	-0.293***	(0.003)	-0.312***	(0.003)	-0.283***	(0.003)	-0.312***	(0.003)
Char								
<i>ln(y_i)</i>	0.624***	(0.001)	0.709***	(0.001)	0.593***	(0.000)	0.709***	(0.001)
<i>children</i>	0.255***	(0.000)	0.256***	(0.000)	0.256***	(0.000)	0.256***	(0.000)
<i>age</i>	0.103***	(0.000)	0.103***	(0.000)	0.103***	(0.000)	0.103***	(0.000)
<i>married</i>	0.131***	(0.001)	0.074***	(0.001)	0.073***	(0.001)	0.073***	(0.001)
<i>church</i>	0.138***	(0.001)	0.140***	(0.001)	0.139***	(0.001)	0.139***	(0.001)
Source								
<i>agriculture/ forestry</i>	0.549***	(0.003)	0.544***	(0.003)	0.547***	(0.003)	0.544***	(0.003)
<i>business</i>	0.181***	(0.002)	0.184***	(0.002)	0.178***	(0.002)	0.183***	(0.002)
<i>self employment</i>	0.250***	(0.002)	0.256***	(0.002)	0.245***	(0.002)	0.256***	(0.002)
<i>employment</i>	0.134***	(0.002)	0.139***	(0.002)	0.131***	(0.002)	0.139***	(0.002)
<i>investment</i>	0.161***	(0.002)	0.165***	(0.002)	0.155***	(0.002)	0.165***	(0.002)
<i>rent/ lease</i>	0.089***	(0.002)	0.091***	(0.002)	0.085***	(0.002)	0.090***	(0.002)
<i>other</i>	0.208***	(0.002)	0.198***	(0.002)	0.214***	(0.002)	0.198***	(0.002)
Source · year₂₀₀₁								
<i>agriculture/ forestry</i>	-0.061***	(0.004)	-0.055***	(0.004)	-0.051***	(0.004)	-0.054***	(0.004)
<i>business</i>	0.016***	(0.002)	0.013***	(0.002)	0.020***	(0.002)	0.013***	(0.002)
<i>self employment</i>	-0.020***	(0.003)	-0.022***	(0.003)	-0.014***	(0.003)	-0.022***	(0.003)
<i>employment</i>	-0.072***	(0.002)	-0.076***	(0.002)	-0.067***	(0.002)	-0.075***	(0.002)
<i>investment</i>	-0.089***	(0.002)	-0.089***	(0.002)	-0.084***	(0.002)	-0.089***	(0.002)
<i>rent/ lease</i>	-0.021***	(0.002)	-0.018***	(0.002)	-0.017***	(0.002)	-0.018***	(0.002)
<i>other</i>	0.077***	(0.002)	0.074***	(0.002)	0.075***	(0.002)	0.074***	(0.002)
Source · year₂₀₀₄								
<i>agriculture/ forestry</i>	0.005	(0.004)	0.010**	(0.004)	0.015***	(0.004)	0.011**	(0.004)
<i>business</i>	-0.041***	(0.002)	-0.047***	(0.002)	-0.036***	(0.003)	-0.046***	(0.002)
<i>self employment</i>	0.006**	(0.003)	-0.002	(0.003)	0.013***	(0.003)	-0.001	(0.003)
<i>employment</i>	0.043***	(0.003)	0.036***	(0.003)	0.048***	(0.003)	0.037***	(0.003)
<i>investment</i>	-0.049***	(0.003)	-0.053***	(0.003)	-0.042***	(0.003)	-0.052***	(0.003)
<i>rent/ lease</i>	0.037***	(0.002)	0.038***	(0.002)	0.041***	(0.002)	0.039***	(0.002)
<i>other</i>	0.170***	(0.002)	0.167***	(0.002)	0.169***	(0.002)	0.167***	(0.002)
State								
<i>SH</i>	-0.024***	(0.002)	-0.047***	(0.002)	-0.047***	(0.002)	-0.049***	(0.002)
<i>HH</i>	-0.127***	(0.002)	-0.095***	(0.002)	-0.092***	(0.002)	-0.093***	(0.002)
<i>NI</i>	-0.123***	(0.002)	-0.100***	(0.002)	-0.095***	(0.002)	-0.098***	(0.002)
<i>HB</i>	-0.138***	(0.003)	-0.103***	(0.003)	-0.100***	(0.003)	-0.102***	(0.003)
<i>NW</i>	-0.069***	(0.001)	-0.094***	(0.001)	-0.095***	(0.001)	-0.096***	(0.001)
<i>HE</i>	-0.064***	(0.002)	-0.057***	(0.002)	-0.056***	(0.002)	-0.057***	(0.002)
<i>RP</i>	-0.075***	(0.002)	-0.050***	(0.002)	-0.047***	(0.002)	-0.048***	(0.002)
<i>BY</i>	0.023***	(0.001)	0.014***	(0.001)	0.015***	(0.001)	0.014***	(0.001)
<i>SL</i>	-0.100***	(0.002)	-0.066***	(0.003)	-0.061***	(0.003)	-0.064***	(0.003)
<i>BE</i>	-0.150***	(0.002)	-0.120***	(0.002)	-0.116***	(0.002)	-0.118***	(0.002)
<i>BB</i>	-0.061***	(0.002)	-0.033***	(0.002)	-0.027***	(0.002)	-0.032***	(0.002)
<i>MV</i>	-0.034***	(0.002)	-0.005**	(0.002)	0.001	(0.002)	-0.005**	(0.002)
<i>SN</i>	0.012***	(0.002)	0.038***	(0.002)	0.044***	(0.002)	0.038***	(0.002)
<i>ST</i>	-0.056***	(0.002)	-0.029***	(0.002)	-0.023***	(0.002)	-0.029***	(0.002)
<i>TH</i>	0.023***	(0.002)	0.050***	(0.002)	0.057***	(0.002)	0.051***	(0.002)
<i>Constant</i>	1.324***	(0.005)	0.670***	(0.007)	1.555***	(0.005)	0.643***	(0.009)
R ²	0.559		0.561		0.559		0.561	

F statistic	186,735.8	185,765.7	185,068.3	185,713.8
Observations	5,990,667	5,990,667	5,990,667	5,990,667

Note. Robust standard errors in parentheses. Levels of significance: * 10%, ** 5%, *** 1%. *Data.* FAST 1998-2004.

Table 6. Treatment effects pertaining to tax units in the top income bracket

State	$\Delta TBR_j =$ $TBR_{j,t_1} - TBR_{j,t_0}$	Average treatment effect on the treated (change in granted deductions)	Average change of tax revenue	Number of tax units	Change in total tax revenue (in millions)
Schleswig-Holstein	-44.9	2,563.598 (256.148)	-1,193.885 (1.003)	25,899	-30.914
Bavaria	-4.25	1,237.469 (89.555)	-575.574 (0.1888)	170,637	-98.204
Hamburg	8,58	-929.669 (204.897)	305.669 (0.957)	36,250	11.080

Note. All results significant at the 1% level. Jackknife standard errors in parentheses. Number of tax units denotes “rich” tax units with gross taxable income in the top income bracket only.

Data. FAST 1998-2004.

Appendix

Table A1. Sample statistics

State j	Mean gross taxable income: $\frac{1}{I_j} \sum_{i_j}^{I_j} y_{i_j}$			Mean overall deductions: $\frac{1}{I_j} \sum_{i_j}^{I_j} \Delta_{i_j}$			Mean marginal tax rate: $\frac{1}{I_j} \sum_{i_j}^{I_j} \frac{\partial t_{i_j}}{\partial \Delta_{i_j}}$			Number of observations: I_j		
	1998	2001	2004	1998	2001	2004	1998	2001	2004	1998	2001	2004
SH	34,344 (25,390)	34,606 (26,147)	34,367 (25,316)	6,163 (9,739)	5,440 (8,094)	5,472 (7,622)	0.310 (0.125)	0.273 (0.118)	0.261 (0.119)	878,828 (110,474)	903,132 (107,632)	854,272 (77,594)
HH	34,651 (28,227)	35,167 (28,838)	34,510 (27,568)	5,836 (11,916)	5,443 (9,398)	5,397 (9,350)	0.317 (0.142)	0.280 (0.132)	0.266 (0.132)	548,603 (91,902)	570,559 (90,759)	528,053 (65,226)
NI	32,976 (25,182)	33,800 (25,263)	33,705 (24,375)	5,927 (10,746)	5,361 (7,689)	5,283 (7,097)	0.301 (0.129)	0.267 (0.120)	0.258 (0.118)	2,474,700 (191,631)	2,479,352 (192,710)	2,337,241 (135,470)
HB	32,383 (24,402)	32,944 (25,489)	30,847 (24,341)	5,615 (8,137)	5,087 (7,278)	4,809 (7,108)	0.305 (0.135)	0.268 (0.127)	0.245 (0.131)	178,317 (46,499)	191,403 (44,400)	181,383 (32,636)
NW	34,687 (25,658)	35,382 (26,321)	35,148 (25,358)	6,074 (10,053)	5,484 (7,816)	5,479 (7,173)	0.310 (0.129)	0.275 (0.121)	0.265 (0.120)	5,679,807 (299,115)	5,689,523 (335,094)	5,380,788 (255,416)
HE	35,623 (27,509)	36,817 (28,236)	36,124 (27,095)	6,619 (11,646)	5,877 (8,694)	5,775 (8,216)	0.313 (0.137)	0.280 (0.126)	0.267 (0.126)	1,992,821 (180,180)	2,033,802 (194,493)	1,950,343 (143,737)
RP	33,920 (24,488)	34,340 (25,336)	34,188 (24,449)	6,254 (9,090)	5,521 (7,528)	5,383 (6,884)	0.307 (0.125)	0.270 (0.118)	0.261 (0.118)	1,271,695 (132,092)	1,315,679 (130,962)	1,266,083 (95,025)
BW	36,100 (26,851)	36,986 (27,235)	36,614 (26,225)	7,186 (11,493)	6,241 (8,475)	6,036 (7,281)	0.315 (0.133)	0.281 (0.123)	0.271 (0.123)	3,400,128 (230,061)	3,551,120 (250,835)	3,435,706 (194,084)
BY	34,184 (26,330)	35,141 (27,151)	34,691 (25,837)	6,976 (11,280)	6,147 (9,052)	5,913 (7,982)	0.309 (0.131)	0.275 (0.123)	0.264 (0.122)	4,274,891 (262,694)	4,407,231 (290,241)	4,243,803 (219,380)
SL	32,785 (22,432)	33,343 (23,983)	32,848 (23,357)	5,859 (7,077)	5,175 (6,770)	4,964 (6,301)	0.303 (0.123)	0.269 (0.118)	0.256 (0.120)	299,006 (59,284)	318,922 (57,246)	311,526 (39,514)
BE	33,252 (26,740)	32,860 (26,767)	31,400 (26,054)	5,657 (11,508)	5,065 (8,354)	4,947 (9,094)	0.308 (0.140)	0.268 (0.133)	0.249 (0.135)	958,551 (124,825)	953,737 (123,849)	908,772 (86,642)
BB	27,985 (22,590)	28,466 (23,490)	29,156 (23,365)	5,466 (7,973)	4,650 (6,422)	4,246 (5,860)	0.269 (0.136)	0.234 (0.129)	0.229 (0.127)	742,139 (99,581)	734,397 (97,004)	702,976 (65,408)
MV	26,566 (22,014)	26,903 (22,499)	26,785 (22,095)	5,571 (8,433)	4,730 (6,349)	4,124 (5,561)	0.260 (0.137)	0.225 (0.129)	0.215 (0.128)	484,863 (79,687)	477,469 (76,526)	452,290 (50,242)
SN	26,485 (21,949)	26,347 (22,201)	26,752 (22,183)	5,912 (9,177)	5,030 (6,749)	4,445 (6,099)	0.262 (0.135)	0.222 (0.130)	0.217 (0.128)	1,238,743 (129,644)	1,227,052 (126,153)	1,164,448 (84,642)
ST	26,036 (21,240)	26,275 (21,721)	26,823 (22,043)	5,467 (7,683)	4,558 (6,069)	3,965 (5,050)	0.256 (0.137)	0.221 (0.129)	0.216 (0.128)	719,091 (96,218)	689,597 (90,504)	651,628 (61,496)
TH	25,617 (20,885)	25,988 (21,248)	26,370 (21,151)	5,771 (8,295)	4,769 (5,975)	4,221 (5,311)	0.258 (0.134)	0.224 (0.126)	0.218 (0.124)	706,092 (92,765)	704,049 (89,928)	665,284 (59,595)

Note. Standard deviation in parentheses. Weighted numbers of observations. Non-weighted numbers in parentheses. *Data.* FAST 1998-2004.

Table A2. State specific characteristics

State	Staffing of financial administration			Per capita GDP			Population density (per km ²)		
	1998	2001	2004	1998	2001	2004	1998	2001	2004
BW	208.76	232.11	284.07	32,023	33,406	32,805	291.62	296.51	299.77
BY	222.51	243.83	285.19	32,767	34,290	34,631	171.32	174.76	176.38
BE	110.51	120.63	152.22	27,171	26,569	25,178	3828.80	3817.09	3816.41
BB	172.05	188.95	246.748	19,288	20,273	20,667	87.86	87.95	87.09
HB	109.86	174.47	240.40	37,908	39,421	40,197	1593.28	1573.44	1581.94
HH	105.92	143.14	187.02	48,985	50,646	50,171	2251.30	2286.09	2297.30
HE	210.79	245.35	287.79	34,006	35,672	35,873	285.82	287.84	288.79
MV	164.04	179.73	230.15	19,189	19,931	20,344	77.56	75.89	74.15
NI	226.13	230.89	280.30	26,009	26,151	25,707	165.20	167.11	168.04
NW	213.12	227.86	275.25	29,212	29,274	29,364	527.26	529.51	530.19
RP	210.64	226.17	258.88	25,653	25,729	26,174	202.73	203.94	204.55
SR	188.18	170.46	237.93	26,275	26,983	27,743	418.19	415.17	411.26
SN	156.55	184.92	230.43	19,561	20,381	21,896	243.73	238.02	233.25
ST	182.47	191.38	222.32	18,726	19,511	20,775	130.78	126.19	121.98
SH	221.51	227.03	292.33	26,832	27,121	26,229	175.07	177.49	179.04
TH	157.60	177.55	222.87	18,610	19,771	20,830	152.28	149.10	145.63

Note. Staffing of the financial administration is the total number of income tax returns divided by full time equivalent employees working in the state's financial administration. Per capita GDP is denoted in 2004 prices. *Source:* Federal Statistical Office.

Table A3a. Sample statistics of treatment and control samples, Schleswig-Holstein

	Mean of variable			
	Treatment group		Control group	
	2001	1998	2001	1998
Char				
<i>y_i</i>	110,732 (30,482)	103,702 (29,046)	111,142 (30,237)	104,176 (28,330)
<i>married</i>	0.658 (0.474)	0.658 (0.474)	0.658 (0.474)	0.658 (0.474)
<i>church</i>	0.762 (0.426)	0.756 (0.430)	0.763 (0.425)	0.763 (0.425)
<i>children</i>	1.017 (1.114)	1.013 (1.109)	1.015 (1.109)	1.015 (1.115)
<i>age</i>	4.567 (1.125)	4.552 (1.116)	4.563 (1.115)	4.554 (1.122)
Source				
<i>agriculture/ forestry</i>	0.042 (0.200)	0.042 (0.201)	0.042 (0.200)	0.043 (0.203)
<i>business</i>	0.289 (0.453)	0.283 (0.450)	0.292 (0.45)5	0.293 (0.455)
<i>self employment</i>	0.295 (0.456)	0.299 (0.458)	0.294 (0.456)	0.298 (0.457)
<i>employment</i>	0.727 (0.446)	0.728 (0.445)	0.724 (0.447)	0.725 (0.447)
<i>investment</i>	0.357 (0.479)	0.357 (0.479)	0.359 (0.480)	0.356 (0.479)
<i>rent/ lease</i>	0.235 (0.424)	0.233 (0.423)	0.237 (0.425)	0.233 (0.423)
<i>other</i>	0.118 (0.323)	0.118 (0.323)	0.119 (0.323)	0.119 (0.324)

Note. Treatment group in 2001 is the base sample, treatment group 1998 and control groups in 2001 and 1998 are matched to the base sample to resemble base sample characteristics. Standard deviation in parentheses.

Data. FAST 1998 and 2001.

Table A3b. Sample statistics of treatment and control samples, Bavaria

	Mean of variable			
	Treatment group		Control group	
	2001	1998	2001	1998
Char				
<i>y_i</i>	115,982 (27,271)	108,823 (26,102)	116,918 (27,214)	109,151 (25,603)
<i>married</i>	0.704 (0.456)	0.704 (0.456)	0.704 (0.456)	0.704 (0.456)
<i>church</i>	0.864 (0.342)	0.864 (0.342)	0.864 (0.342)	0.864 (0.343)
<i>children</i>	0.993 (1.084)	1.002 (1.101)	0.992 (1.083)	0.998 (1.093)
<i>age</i>	4.412 (1.109)	4.417 (1.105)	4.414 (1.094)	4.412 (1.105)
Source				
<i>agriculture/ forestry</i>	0.021 (0.143)	0.021 (0.142)	0.021 (0.143)	0.021 (0.144)
<i>business</i>	0.262 (0.439)	0.265 (0.441)	0.262 (0.440)	0.261 (0.439)
<i>self employment</i>	0.274 (0.446)	0.274 (0.446)	0.274 (0.446)	0.273 (0.446)
<i>employment</i>	0.798 (0.401)	0.796 (0.403)	0.797 (0.402)	0.796 (0.403)
<i>investment</i>	0.394 (0.489)	0.396 (0.489)	0.394 (0.489)	0.397 (0.489)
<i>rent/ lease</i>	0.232 (0.422)	0.230 (0.421)	0.232 (0.422)	0.233 (0.423)
<i>other</i>	0.104 (0.305)	0.105 (0.307)	0.103 (0.304)	0.106 (0.308)

Note. Treatment group in 2001 is the base sample, treatment group 1998 and control groups in 2001 and 1998 are matched to the base sample to resemble base sample characteristics. Standard deviation in parentheses.

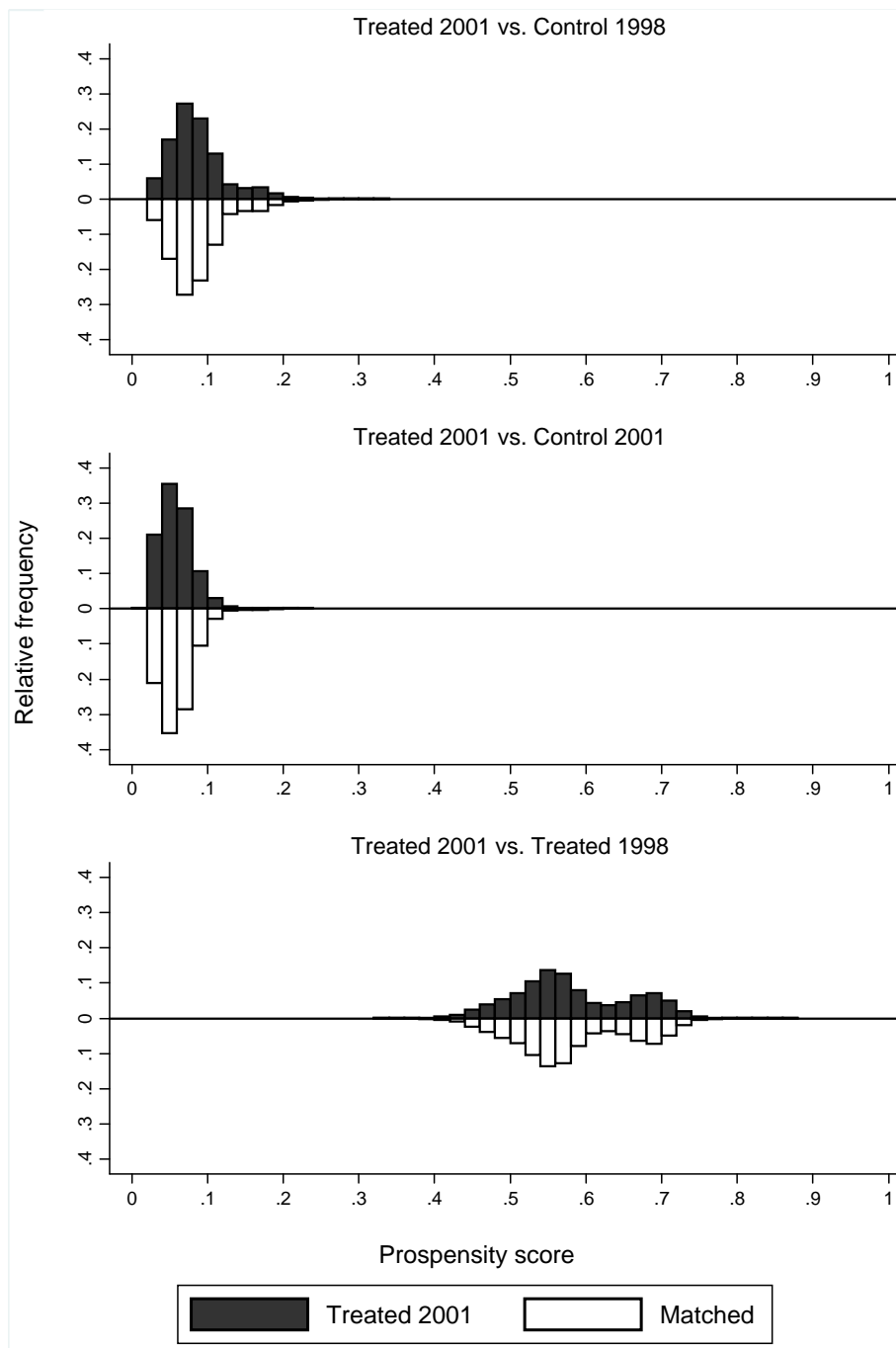
Data. FAST 1998 and 2001.

Table A3c. Sample statistics of treatment and control samples, Hamburg

	Mean of variable			
	Treatment group		Control group	
	2004	2001	2004	2001
Char				
<i>y_i</i>	105,480 (27,740)	107,189 (30,199)	103,873 (26,327)	107,035 (29,755)
<i>married</i>	0.588 (0.492)	0.588 (0.492)	0.588 (0.492)	0.588 (0.492)
<i>church</i>	0.593 (0.491)	0.594 (0.491)	0.589 (0.492)	0.589 (0.492)
<i>children</i>	0.585 (0.933)	0.578 (0.925)	0.582 (0.929)	0.578 (0.928)
<i>age</i>	4.475 (1.149)	4.479 (1.161)	4.486 (1.204)	4.495 (1.309)
Source				
<i>agriculture/ forestry</i>	0.004 (0.063)	0.003 (0.057)	0.004 (0.065)	0.004 (0.062)
<i>business</i>	0.217 (0.412)	0.216 (0.411)	0.216 (0.412)	0.210 (0.408)
<i>self employment</i>	0.278 (0.448)	0.280 (0.449)	0.280 (0.449)	0.280 (0.449)
<i>employment</i>	0.768 (0.422)	0.766 (0.424)	0.771 (0.420)	0.773 (0.419)
<i>investment</i>	0.311 (0.463)	0.311 (0.463)	0.312 (0.463)	0.316 (0.465)
<i>rent/ lease</i>	0.189 (0.391)	0.194 (0.396)	0.194 (0.395)	0.192 (0.394)
<i>other</i>	0.137 (0.344)	0.136 (0.343)	0.134 (0.341)	0.136 (0.343)

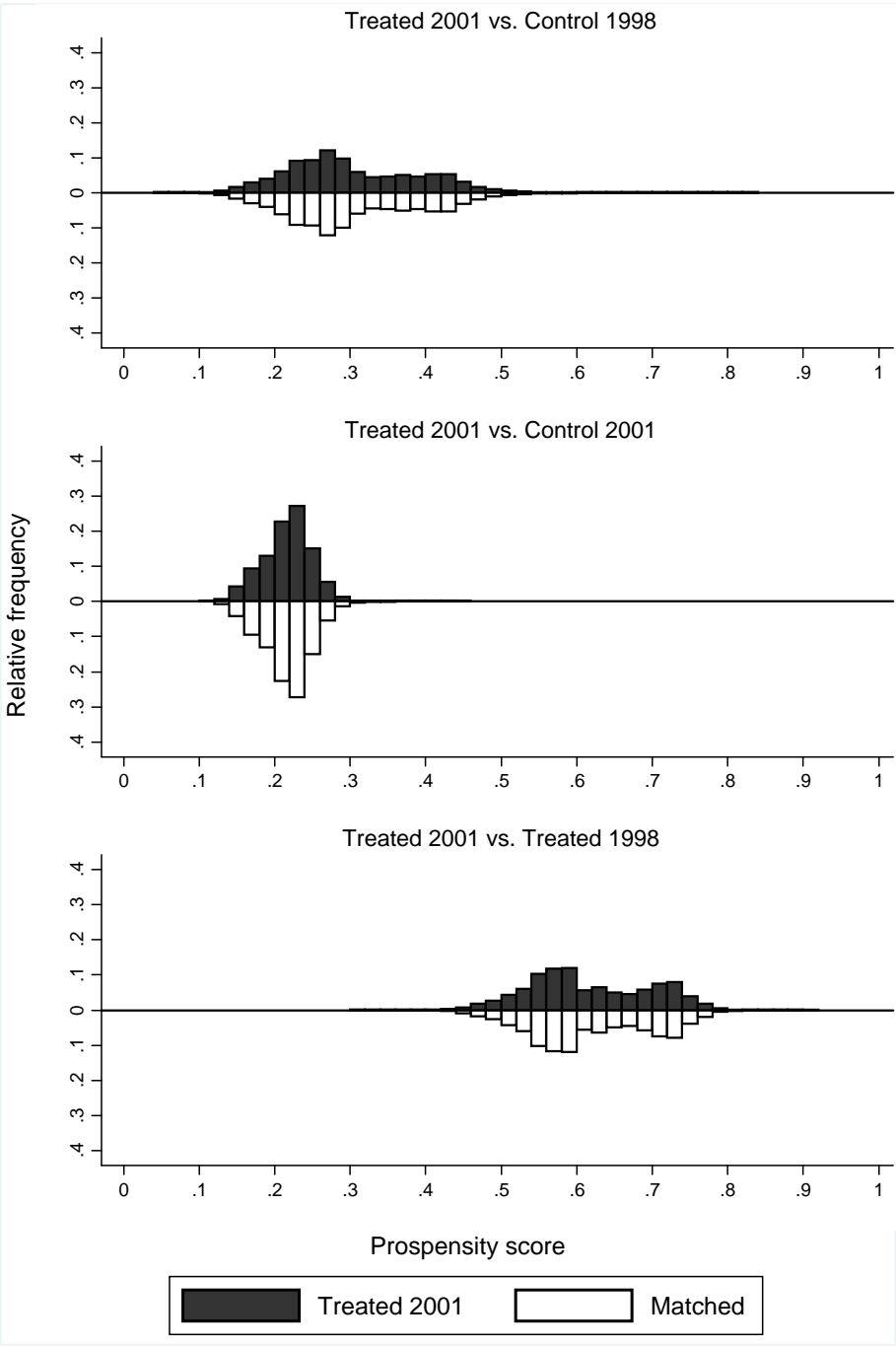
Note. Treatment group in 2004 is the base sample, treatment group 2001 and control groups in 2004 and 2001 are matched to the base sample to resemble base sample characteristics. Standard deviation in parentheses.
Data. FAST 2001 and 2004.

Figure A1a. Distribution of Propensity score for Schleswig-Holstein



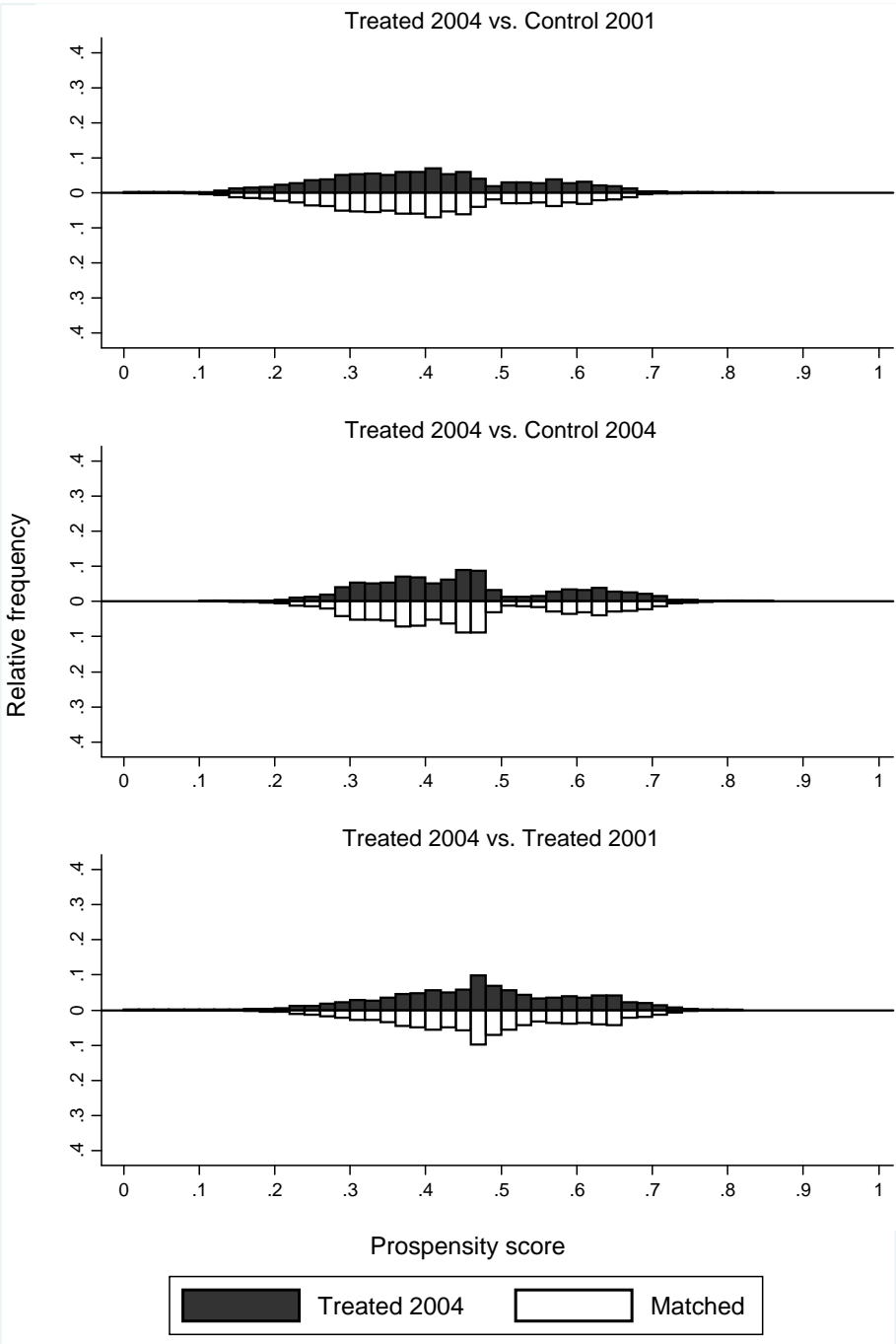
Note. Database is FAST 1998 and 2001.

Figure A1b. Distribution of Propensity score for Bavaria



Note. Database is FAST 1998 and 2001.

Figure A1c. Distribution of Propensity score for Hamburg



Note. Database is FAST 2001 and 2004.