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fiscal equalization and regions' (un)willingness-to-tax -evidence from germany

by Timm Bönke, Beate Jochimsen, and Carsten Schröder

Fiscal equalization and regions' (un)willingness-to-tax – evidence from Germany

Timm Bönke, Beate Jochimsen and Carsten Schröder♠

June, 2011

Abstract. Under cooperative federalism, when an identical tax tariff applies to all regions of a federation, usually redistribution rules are implemented to smooth fiscal differences. The administration of tax collection, however, is sometimes delegated to the regional level, leaving the regional administrations some discretion concerning the auditing of tax returns. Building on a stylized model, we show that under such conditions granted discretionary tax deductions at the level of tax units is positively related to state-specific marginal rates of loss (MRL), i.e., the fraction of an additional tax Euro raised in a region that the fiscal-equalization system redistributes to other jurisdictions. We empirically test the model's presumption using administrative income-tax micro data from Germany. Regression estimates comply with the implications of our model.

JEL-Codes: C21, H21, H77

Key words: fiscal federalism, rate of loss, income tax returns

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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. Theoretical research on fiscal federalism, touching the topic from different angles, has a long tradition. Pioneering works on the assignment of functions to different governmental layers and of the 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 has been investigated, for example, in Oates, 1972, Boadway and Flatters, 1982, or Manasse and Schultz, 1999. Other scholars study the issue of asymmetric information over local preferences for public goods (e.g. Cremer et al., 1996, or Bucovetsky et al., 1998), over technologies for the provision of public goods (e.g. Boadway et al., 1995, Raff and Wilson, 1997, and Caplan et al., 2000, Breuillé and Gary-Bobo, 2007, Akai and Silva, 2009), or over local tax bases (Bordignon et al., 2001).

In the present work, we explore the interplay between fiscal equalization, asymmetric information and regional tax policy from an empirical perspective by exploiting some particularities inherent in Germany's fiscal-equalization system. First, Germany has a cooperative federal system where tariffs and bases of fiscally important taxes are set by the central government. Both tariffs and bases are the same in all German Laender. Second, a system of redistributive horizontal and vertical transfers is implemented to offset fiscal imbalances across regions (the German "states").[1] Effectively, the system imposes an implicit tax on states' tax revenues: A state that raises an additional tax Euro expands its public budget only by a small fraction of the same Euro, while the larger fraction is horizontally or vertically redistributed according to various transfer rules. This implicit marginal tax on states' tax revenues, also called the "marginal rate of loss" (MRL), can easily exceed 80 percent, and it differs substantially across German states and time. Third, the administrative process of collecting the fiscally important taxes, including the income tax, is delegated to the German states.

If the states know their tax bases better than the central government or the latter has no perfect control over the tax collection process, such a setting may lead to a moral hazard problem: As states do not bear the full costs and not reap all of the benefits of their economic

[1] In practice, such equalizing grants play a major role in several countries, including also Australia and Canada, for example.

activities, they may respond to these fiscal externalities by adjusting their local policies.[2] This may give rise to inefficient local policies in terms of overall costs and benefits to society (see, for example, Oates, 1999, and Bordignon et al., 2001).

For Germany, Baretti et al. (2002) address this moral hazard problem, pointing out that high MRL may undermine states' willingness to administer tax collection effectively. Yet, due to data limitations, the authors did not perform a direct empirical test of their conjecture (Baretti et al., 2002, 639). The relationship between MRL and locally decided taxes is addressed in Buettner (2006) and Egger et al. (2009). Their framework is distinct from ours as local tax rates are set by the local governments while, in our case, the same tax tariff and definition of tax basis apply in all regions. Buettner (2006) finds that the rate of loss has a significant positive impact on the local tax rate; similar Egger et al. (2009) find a significant effect of a change in a local equalizing transfer formula on local business tax policy.

In practice, the delegation of tax collection to the states opens up several possibilities of strategic behavior (Mikesell, 2003, Esteller-Moré, 2005, Martinez-Vazquez and Timofeev, 2005, and Libman and Feld, 2007). This concerns the training and instruction of taxmen by the states' ministries of finance, and the endowment of revenue authorities. State-specific auditing rates of income millionaires' tax declarations in Germany, for example, vary between five and almost 40 percent (Schick 2011). Moreover, the delegation may lead to inter-state differences in the treatment of income tax deductions. This reasoning particularly holds for so-called discretionary income tax deductions. Such deductions share a common feature: they are subject to vague legal terms ("*unbestimmte Rechtsbegriffe*"). Accordingly, taxmen have some freedom when interpreting the case-specific peculiarities determining the actual level of granted deductions (for a detailed discussion see Vogel, 2000, 73-75). By the level of granted discretionary deductions, states may align effective tax burdens of their local residents with MRL (see also Stöwhase and Traxler, 2005).

In a Samuelson (1954) type of a local public good model with state-specific public budget constraints reflecting the mechanics of Germany's fiscal equalization system, we show that a state planner who seeks to maximize the utility of the regional tax payers responds to a rise of the MRL with a lowering of the effective tax burdens, and this can be achieved, despite centrally defined tax laws, by granting more discretionary deductions. The rational behind this logic is straightforward: the higher a state's MRL, the higher are the opportunity costs – the

[2] See Bordignon et al., 2001, for a theoretical examination of the issue of asymmetric information and optimal redistribution among regions of a federation. For Germany-specific peculiarities, see also Baretti et al., 2002, Buettner, 2006, and Egger et al., 2009.

additional tax burdens that have to be imposed on the state residents – in order to finance an additional unit of a locally provided public good.

Recent releases of millions of administrative micro-data on income tax returns, provided by the German Federal Statistical Office, open up new possibilities for micro-econometric analyses of the relationship between MRL and a state's willingness to collect income taxes. These data include detailed information on the tax units' incomes, tax burdens, granted tax deductions, and other information that is relevant for the calculation of the units' tax burdens. So, it is feasible to assess the impact of MRL on granted income tax deductions *after* controlling for the specific tax-relevant individual characteristics of each tax unit. We econometrically assess the effect of MRL on discretionary deductions employing Heckman-two stage and three-step censored quantile regression techniques. Estimates indicate that the level of discretionary deductions being granted by the state tax authorities is positively related with MRL. As a result, according to our 2004 point estimates, a five percentage point reduction of all states' MRL levels would increase income tax revenue in Germany by some 0.8 billion EUR.

The remainder of the paper is organized as follows. Section 2 briefly introduces Germany's federal system. Section 3 presents our theoretical model, and the empirical analysis follows in Sections 4 to 6: Our database is described in Section 4, Section 5 introduces the econometric techniques, and specifications of regressions together with estimation results follow in Section 6. Finally, Chapter 7 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 (Bund), the states (Bundesländer), and the local level (Gemeinde). Since the German reunification in 1990, sixteen Laender form the state level and about 11,500 municipalities the local level. The system is cooperative in the sense that the important taxes are set by the central government while redistributive horizontal and vertical transfers serve for offsetting fiscal imbalances across the states to ensure that levels of public goods and services are similar (Art. 107, Para. 2, 1, German Federal Constitution). Essentially, these grants channel funds from relatively wealthy states to poorer ones. Grant levels depend on state-specific "fiscal capacities" and "needs". Essentially, a state's fiscal capacity is equivalent to its tax return per inhabitant (before equalization), while fiscal needs are defined as average tax return per inhabitant across all the 16 states.

Only a small fraction of German states' total tax revenue comes from own-source taxes such as inheritance, property acquisition, or lottery taxes. The predominant fraction stems from so-called joint taxes (income, corporation and value added tax), whose revenues are shared among the federal, state and local level. In year 2009, for example, the joint taxes made up about 71 percent of total tax revenue.[3] The initial assignment of joint taxes by means of politically determined division rules constitutes the first of Germany's 4-stage fiscal equalization system.[4]

At stage 2 (*Umsatzsteuervorwegausgleich*), up to 25 percent of each state's VAT revenue is horizontally (re)distributed in order to ensure that each state receives at least 92 percent of average per capita tax revenue of all states (mainly the states' shares of income and corporate taxes and some state taxes).

Stage 3 is the horizontal "equalization system in the strict sense" (*Länderfinanzausgleich im engeren Sinne*): fiscal resources from financially strong states are transferred to financially weak states. Levels of horizontal payments/transfers depend on how much the state's fiscal revenue per (virtual)[5] capita deviates from the interstate average. Apart from the state's share of income and value added tax, fiscal revenue includes the revenue of pure state taxes like inheritance or beer tax and 50 percent of the most important local taxes' revenue, i.e. local business tax and ground tax. After the third stage, each state receives at least 95 percent of the average (per capita) fiscal revenue.

Stage 4 involves vertical transfers from the federal to the state level, so-called *Fehlbetragsbundesergänzungszuweisungen*, granted to states when fiscal revenue after stages 1 to 3 still falls below the inter-state average. These 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 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 come from the federal level and are given lump-sum, regardless of fiscal or economic performance.

Table 1 about here

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[3] From the remaining 29 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 three percent of total tax revenue is state taxes. The remaining eight percent account for the local level in form of real estate, business and some local consumption taxes (Bundesministerium der Finanzen, 2010).

[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.

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

Stages 1-4 drive a substantial wedge between states' tax revenue before and after fiscal equalization. Effectively, the system imposes an implicit marginal tax, the marginal rate of loss (MRL), on states' tax revenues, both for rich (net contributor) and for poor (net recipient) states. For a net contributor, higher tax revenue implies higher contribution payments, so that, after redistribution, its revenues rise only by a fraction of the original rise in tax revenue. For a net recipient, higher state tax revenue implies lower transfers.[6] In both cases, only part of the additional revenue can be internalized.

We have derived year- and state-specific MRL by means of a simulation model of Germany's fiscal equalization system.[7] For the period of interest, the model reflects all the relevant regulations as codified in Germany's fiscal equalization law, and relies on state-level data as provided by Germany's Federal Statistical Office. Table 2 provides the year- and state specific MRL levels for variations of income tax revenue.[8] In the case of financially strong states, MRL reflects the marginal contribution of the state to VAT redistribution and to interstate redistribution (stage 2 and 3). For financially weak states, MRL basically reflects the reduction in overall transfers received due to a rise in state-specific income tax revenue. The reduction of transfers consists of lower transfers from VAT redistribution, lower interstate transfers and lower vertical grants (stage 2 to 4).

Table 2 about here

Results from Table 2 indicate that MRL are high in general and vary both over states and time. With the only exception of Schleswig-Holstein in year 1998, it never falls below 70 percent. The specific design of Germany's fiscal equalization system implies that a state's MRL is the lowest, i.e. 42.5 percent, if its fiscal capacity coincides with the average fiscal capacity in all the states. Then MRL reflects division rules from step 1, the initial assignment of joint taxes. Every deviation from mean fiscal capacity leads to a sharp rise of MRL. This is shown by Figures 1a-c, giving state-specific levels of MRL for different levels of state-specific per-capita income tax revenue (before fiscal redistribution rules are applied). An abscissa value of "0" indicates the status quo (no deviation from actual income tax revenue), while the value "+10" ("-10") indicates an increase (decrease) of per capita income tax

[6] A detailed description of the German financial constitution provides Plachta, 2008.
[7] Information on the simulations can be provided by the authors upon request.
[8] MRL is the same for a marginal change in income and corporate tax revenue, while it can be different for other types of taxes.

revenue by EUR 10. A change in income tax revenue also changes the fiscal capacity of the respective state. The ordinate then provides MRL as a function of revenue variations.

For example, the upper left graph in Figure 1a shows responses of North-Rhine-Westphalia's MRL in 1998 to changes in its income tax revenue. For the actual level of income tax revenue in 1998 (abscissa is zero), North-Rhine-Westphalia's MRL is 71 percent. The number complies with the corresponding entry in Table 2. It can also be seen from the Figure that North-Rhine-Westphalia is a net contributor. The minimum MRL complies with a per capita tax revenue that falls below the actual level.

Unfortunately, it is not feasible to express MRL by means of a simple closed form. Any variation of a state's characteristics (e.g., tax revenue, number of inhabitants) precipitates itself in stages 2 to 4 of the transfer system, and it is not feasible to "derive a simple formula which summarizes these effects" (Baretti et al., 2002, p. 646).[9] However, the graphs indicate that (a) MRL is highly not linear in state tax revenue, and that (b) MRL usually changes very little for reasonable variations of income tax revenue. Only when a state's fiscal capacity, by coincidence, is fairly close to the interstate average, realistic variations of income tax revenue may have a profound impact on MRL. Accordingly, we interpret MRL as exogeneous from the viewpoint of local governments, at least in the short run. That the income tax is only one out of several fiscally important taxes and that, of course, a variation in a single state's tax revenue is relatively small compared to overall fiscal revenues across all states supports this presumption.

Figures 1a-1c about here

2.2 The process of income taxation

The legislation of joint taxes and the responsibility concerning the administration of tax collection are assigned to different governmental layers. The tax-setting autonomy is allocated at the central level. Particularly, the central government defines both tax-tariffs and tax bases, while the states have no tax setting autonomy even if pure state taxes are affected.[10] Accordingly, the states' possibilities to steer public revenue *directly* are heavily restricted.[11]

Some *indirect* possibilities, however, exist as the administration of tax-collection is delegated to the states. Indeed, Vogel (2000, 91) argues that the monocracy of state financial executives opens up opportunities for a politically motivated practice of tax laws. He shows

[9] See Appendix 1 in Baretti et al. (2002) for details.
[10] Except the rate of the property acquisition tax that can be determined by the states since 2006.
[11] The reasons and incentives for raising public debt are discussed in Jochimsen and Nuscheler, 2010.

that systematic differences exist in state specific tax auditing frequencies and in additional tax revenue per audit (Vogel, 2000, 128-155), although national basic standards exist concerning the endowment of tax collecting agencies, training of taxmen, and the technical procedures of tax collection. Recently, a risk management system has been installed in all states' tax offices. It evaluates roughly 2,500 positions in income tax returns, and indicates incongruities. However, states adjusted the detection algorithm independently, or acted differently once an incongruity had been detected by the system (Bundesrechnungshof 2009, 176-179). In Hamburg for example, a so-called city state[12] with many income millionaires, the auditing of millionaires' income tax returns is substantially lower than in other states (Schick 2011). Furthermore, Vogel (2000) provides several empirical cases where certain tax payers had been treated preferentially by the states. Examples include generous interpretation of amortization rules or the postponement of tax payments.

3 A stylized model

Our model relies on Samuelson's (1954) static public good model, where the state-specific public budget constraints, in addition we have incorporated the central elements of Germany's fiscal equalization system.

Consider a country with $j = 1,..., J$ federal state and let a state j have three sources of revenues: income-tax revenue,[13] equalizing grants, and lump sum transfers feasible for the provision of a region-wide public good provided at the level g_j. Transfer rules determining the equalizing grants, Z_j, and the lump sum transfers 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 $\left[\tau,\left(Z_1,...,Z_J\right),\left(B_1,...,B_J\right)\right]$, are decided before taxes have actually been collected, and before public goods have been provided. Consistent with the situation in Germany we assume that the administrative process of tax collection is delegated to the federal states who interpret $\left[\tau,\left(Z_1,...,Z_J\right),\left(B_1,...,B_J\right)\right]$ as exogenous (henceforth indicated by vertical bars). We further assume that tax units (and the tax bases) are immobile and that taxable income is equal across all tax payers in the same federal state.

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

[12] Three German cities (Berlin, Bremen, Hamburg) are also independent federal states.
[13] We abstain from modeling other tax types to keep the analysis simple.

(1) $g_j \leq T_j + Z_j + \overline{B_j}$,

with

(2) $T_j = \overline{r} \cdot \overline{n}_j \cdot t_j\left(\overline{\tau}, \overline{y}_j, \Delta_j\right)$,

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 $\overline{r} \approx 0.575$ gives the share from income tax revenue which is assigned to the state level (including the state's municipalities), $\overline{n}_j$ is the number of residents, and $t_j\left(\overline{\tau}, \overline{y}_j, \Delta_j\right)$ is the effective tax burden imposed on a representative tax unit with gross income $\overline{y}_j$. The tax burden imposed on a tax unit depends both on the income tax tariff, which is progressive in Germany, and discretionary deductions being granted, Δ_j. The second term in the state's budget constraint is the level of equalizing transfers a state receives or contributes,

(3) $Z_j = Z_j\left[t_j\left(\overline{\tau}, \overline{y}_j, \Delta_j\right), \overline{n}_j, t_{-j}\left(\overline{\tau}, \overline{y}_{-j}, \overline{\Delta}_{-j}\right), \overline{n}_{-j}, \overline{F}\right]$,

with $-1 < \frac{\partial Z_j}{\partial T_j} < 0$ both for transfer recipients and contributors and $\sum_{j=1}^{J} Z_j \doteq 0$. $\overline{F}$ denotes other particular regulations inherent in Germany's fiscal equalization system. The third term in the state's budget constraint, $\overline{B}_j$ are lump sum vertical transfers, i.e. special need grants.

For the tax unit, we assume that preferences are characterized by an additive utility function of the form,

(4) $U_j = u_j\left(c_j\right) + h_j\left(g_j\right)$,

with c_j denoting the level of private consumption, and with g_j denoting the level of a locally-provided public good. Accordingly, we abstain from modeling public good spillover effects. The budget constraint of a tax unit is,

(5) $c_j \leq \frac{\overline{y}_j - t_j\left(\overline{\tau}, \overline{y}_j, \Delta_j\right)}{\overline{p}}$,

with $\overline{p}$ being the price of the private good, assumed to be identical across regions.

Combining equations (1) to (5), we obtain,

(6) $U_j = u_j\left(\frac{\overline{y}_j - t_j\left(\overline{\tau}, \overline{y}_j, \Delta_j\right)}{\overline{p}}\right) + h_j\left(\overline{r} \cdot \overline{n}_j \cdot t_j\left(\overline{\tau}, \overline{y}_j, \Delta_j\right) + Z_j\left(t_j\left(\overline{\tau}, \overline{y}_j, \Delta_j\right), .\right) + \overline{B}_j\right)$.

Given $\left[\tau,\left(Z_1,...,Z_J\right),\left(B_1,...,B_J\right)\right]$ and an interior solution exists, a benevolent state planner who seeks to maximize utility of the same state's residents sets Δ_j so that,

$$(7) \qquad \frac{\partial u_j}{\partial \Delta_j} = \frac{\partial u_j}{\partial c_j} \cdot \left(-\frac{\partial t_j}{\partial \Delta_j} \cdot \frac{1}{\overline{p}} \right) + \frac{\partial h_j}{\partial g_j} \cdot \left(\overline{r} \cdot \overline{n}_j \frac{\partial t_j}{\partial \Delta_j} + \frac{\partial Z_j}{\partial t_j} \cdot \frac{\partial t_j}{\partial \Delta_j} \right) \doteq 0$$

$$\Leftrightarrow \quad (8) \qquad \overline{n}_j \frac{\partial h_j / \partial g_j}{\partial u_j / \partial c_j} \doteq \frac{1}{\overline{p}} \cdot \left(\overline{r} + \frac{1}{\overline{n}_j} \frac{\partial Z_j}{\partial t_j} \right)^{-1} = \frac{1}{\overline{p}} \cdot \frac{1}{1 - MRL_j}.$$

The modified Samuelson condition (8) requires that the sum of marginal rates of substitution between the public and the private good is equal to the price ratio times the reciprocal of one minus the marginal rate of loss, $MRL_j = 1 - \left(\overline{r} + \frac{1}{\overline{n}_j} \cdot \frac{\partial Z_j}{\partial t_j} \right)$. This has immediate implications for the optimal level of discretionary deductions, Δ_j^*, from the viewpoint of the benevolent state planner. For example, consider a situation when a state planner faces a situation where the state-specific marginal rate of loss, ceteris paribus, *rises*, so that the right hand side of equation (8) goes up. Then, in the optimum, also the sum of marginal rates of substitution is higher. This is guaranteed if the state residents' consumption level of the private good, c_j, relative to g_j rises. This again requires a low individual tax burden which is secured when discretionary deductions being granted are *increased*. With the same reasoning, Δ_j^* is *lower* when the marginal rate of loss is *lower*.[14] Equation (8) also indicates that the state planner does not consider the effect of its policy on other states' budgets: Every variation of Δ_j alters the state's tax revenue ex ante to fiscal equalization, and thus the grant levels of all other states. This fiscal externality implies an inefficient local policy in terms of overall costs and benefits to society. The following empirical sections scrutinize whether the positive relationship between a state's MRL and Δ_j is actually supported by the data.

4 Database and key figures

4.1 Germany's "Factually Anonymous Income Tax Statistic"

[14] The argumentation requires that variations of discretionary deductions and corresponding changes in income tax revenue have only moderate effects on MRL. As Figures 1a-c indicated, this is not a too strong assumption. Only in the exceptional case when a state's fiscal capacity approaches the average fiscal capacity in all states, changes in fiscal capacity lead to substantial MRL variations. Moreover, discretionary deductions compared to actual income tax base are relatively small (see Tables 3a and 3b). It must also be ensured that the substitution effect always dominates the income effect.

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).

So far, FAST cross sections have been provided in form of scientific-use-files containing data for the assessment years 1998, 2001, and 2004. These three cross sections form our database. Long delays in releasing the data are for two reasons. First, tax units have an extensive period to file their income tax statement, and afterwards the statement has to be audited and processed by the tax collecting authority. For extensive and/or complex income tax statements the whole process can easily take 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 all kinds of granted deductions. We have classified these deductions in non-discretionary and discretionary deductions. Non-discretionary deductions are lump sum deductions and deductions based on automatisms following *well-defined* legal terms ("*bestimmter Rechtsbegriff*"): Once a specific requirement ("*Tatbestandsmerkmal der Besteuerung*") is met (e.g., having a tax-relevant child or paying church taxes), the deduction is granted. As a result, non-discretionary deductions leave hardly any room for taxmen to manipulate income tax burdens. However, the case is different for discretionary deductions. In contrast to non-discretionary deductions, discretionary deductions mutually share the feature that they are subject to *vague* legal terms ("*unbestimmte Rechtsbegriffe*"). Accordingly, taxmen have some discretion concerning the interpretation of the case-relevant facts that determine the actual level of granted deductions (for a detailed discussion see Vogel, 2000, 73-75). 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. Therefore, discretionary deductions can serve as a measure how strict tax returns are audited by the local taxman. Over our observation period (1998 to 2004) several paragraphs of Germany's income tax law have changed. Sometimes, these modifications also concern paragraphs relating to discretionary deductions. To ensure inter-temporal consistency of discretionary deductions, which will serve as our willingness-to-tax indicator, we have restricted our attention to kinds of discretionary deductions that are inter-temporally comparable, i.e. where the tax law remained unchanged or changed only marginally. A summary of the set of discretionary deductions considered in the empirical analysis can be found in Table A1 in the Appendix.

4.2 Descriptive figures of our micro database

Descriptive statistics of FAST variables used in adjacent regression analyses are summarized in Tables 3a and 3b. Table 3a refers to unmarried while Table 3b refers to married tax units. By year and state, the tables provide means and standard deviations of taxable bases before discretionary deductions, TB, and of discretionary deductions. All monetary amounts are expressed in year 2004 prices. The tables also give the number of observations and the share of tax units with strictly positive discretionary deductions.

Tables 3a and 3b about here

Taxable base before discretionary deductions is the central micro-level conditioning variable in regression analysis. It has a profound impact on the level of discretionary deductions, and it is exogeneous from the viewpoint of states' taxmen. Across the states, average TB is the highest for Hamburg and Hesse, and the lowest in Thuringia. Over time, the data indicate a slight decrease in price-adjusted taxable bases. This is due to the fact that the blanket allowance for employment-related expenses has been reduced between year 2001 and 2004, so that now more tax units with low incomes than before have an incentive to declare their incomes.

Conditional averages of discretionary deductions for unmarried tax units in year 1998, for example, range between €1,400 (Saarland) and €2,235 (North Rhine-Westphalia). It is, however, not necessarily true that average discretionary deductions are high in "rich" and "low" in poor states. For example, take Bavaria and Mecklenburg-Western Pomerania in year 2004. While Bavaria's average taxable base is about €13,500, average discretionary deductions in Mecklenburg-Western Pomerania exceed the level in Bavaria by about €250.

Concerning unmarried and married tax units, married tax units benefit from substantially higher discretionary deductions. This is due to the fact that married couples have higher incomes compared to singles. The fraction of married tax units with strictly positive discretionary deductions is also higher than for unmarried units: about 80 percent vs. 70 percent. For the remaining non-trivial part of the sub-samples, discretionary deductions have not been declared by the taxpayer (be it that the tax burden was already zero or no legal basis existed for the declaration of discretionary deductions), or have been declared but not even a single EUR has been granted (which should be an exception).

Figure 2 gives a graphical representation of the conditional distribution of the dependent variable in regression analysis, the natural logarithm of discretionary deductions (excluding cases with discretionary deductions being zero). In Figure 2, three lines are provided, one per cross section. The density function reaches its maximum around for a level of discretionary deductions around €1,100 ($\ln(1{,}100) \approx 7$). For several tax units, granted discretionary deductions reach values of more then €20,000 ($\ln(20{,}000) \approx 9.9$). Over the observation period, the distributions of discretionary deductions have changed only little, indicating that the aggregate conveys inter-temporally consistent information: modifications of the income tax law had no systematic effect on the aggregate. For married tax units, discretionary deductions have always been divided by two. This division is congruent with the fiscal effects of Germany's splitting boon: When a taxman audits a tax return of an unmarried tax unit and grants a marginal amount of discretionary deductions, the taxable base falls by the same amount, and the effect on tax revenue is the change in the taxable base times the marginal tax rate. For married tax units, effects are different. Due to the splitting boon, the change in tax base is divided by two, then the tax tariff is applied, and the change in the unit's tax burden is derived by doubling the respective amount. As Germany's income tax tariff is progressive, the fiscal loss of an additionally granted tax Euro, ceteris paribus, is typically higher for unmarried compared to married couples.

Figure 2 about here

Figure 3 gives the same frequency distribution, now disaggregated at the state level. Black solid curves refer to state specific distribution in the respective year and, as a benchmark, distributions for Germany as a whole are provided (dashed lines). For all states, distributions of log discretionary deductions over time change very little. However, there are some apparent differences in the shapes of the distributions across states. Most prominent are the particularly shaped two-peak distributions for the Saarland. In adjacent regression analyses we scrutinize whether MRL is a suited candidate for explaining inter-state differences in discretionary deductions after conditioning for control variables.

Figures 3a - c about here

5 Econometric models

5.1 Heckman selection model

Due to the large number of observations with discretionary deductions being zero, OLS or other comparable techniques are not appropriate for our purposes. Moreover, excluding all those cases from the analysis may lead to biased estimates because it is conceivable that – also after controlling for regressors – those tax units with $\Delta = 0$ are not randomly selected. For example, low-income households may not declare (all) deductions because their taxable income is already zero. For low income households, also the tax administrator may not be willing to invest time to control the claimed deductions as the tax burden of the tax unit, so or so, is already zero. Dealing properly with the censoring issue in empirical analysis, therefore, is of considerable importance. Particularly, it is not appropriate to assume that the same probability mechanism generates both zero and positive values of Δ (see Cameron and Trivedi, 2009, p. 538).

The Heckman selection model (see Gronau, 1974; Lewis, 1974; and Heckman, 1976) allows for the possibility that probability mechanisms differ. To keep the explanations and formulae simple, we suppress individual and period subscripts. The Heckman selection model (HSM) is a two-step model. It assumes the existence of an underlying regression equation, the so-called outcome equation, which takes the standard form,

$$(9) \quad \ln\left(\Delta_i / n_i\right) = X_i^{'}\beta + u_{1i} \, ,$$

where $\ln\left(\Delta/n\right)$ is the national logarithm of Δ/n when $\Delta/n > 0$.[15] The vector X_i contains covariates characterizing tax unit i, and u_{1i} denotes the error term with $u_{1i} \sim N(0,\sigma)$. The dependent variable, however, is only observed if

$$(10) \quad X_i^{'}\gamma + u_{2i} > 0$$

where $u_{2i} \sim N(0,1)$ and $corr(u_{1i}, u_{2i}) = \rho$. Equation (10) is referred to as the selection equation. Apparently, if $\rho \neq 0$, standard regression techniques applied to the outcome equation will lead to biased regression coefficients.

5.2 Three-step censored quantile regressions

Another suitable candidate for our purposes is censored quantile regressions techniques. A particular strength of the quantile regresion technique is its flexibility compared to parametric

[15] We have taken the logarithm of discretionary deductions as well of the taxable base before discretionary deductions as distributions of both variables have a long right tail and are not normally distributed.

regression techniques.[16] Particularly, quantile regressions can provide information about the relationship between the outcome and the regressors at different points in the conditional distribution of the outcome, thereby allowing deeper insights in the data. In our case, for example, it is not ruled out that the relationship between discretionary deductions and MRL is not the same at different levels of discretionary deductions. Standard regression techniques fail in providing such information, but reveal the general relationship between the outcome and the covariate. Also, the method is more robust to outliers than standard (mean) regression techniques.

To control for the issue of censoring, we apply a three-step censored quantile regression estimator suggested by Chernozhukov and Hong (2002). The idea of the three-step estimator is to first select a subsample from the whole sample for which the conditional quantile falls in the observed part of the distribution. These observations are selected by estimating the probabilities of not being censored, $h\left(X_i\right)=P\left(\ln\left(\frac{\Delta}{n}\right)^{*}>0\middle|X_i\right)$, with $\ln\left(\frac{\Delta}{n}\right)^{*}$ denoting the non-censored level of discretionary deductions. For a quantile q of the distribution of discretionary deductions, we then take the observations for which $h\left(X_i\right)>1-q$.[17] We carry out step 1 by estimating the logit model,

$$(11)\quad \eta_i = p\left(X_i^{'}\gamma+u_i\right),$$

with η_i denoting the probability of discretionary deductions to be positive. As (11) is possibly mis-specified, it is recommended not to select all observations with $p\left(X_i^{'}\hat{\gamma}\right)>1-q$ but only the fraction $p\left(X_i^{'}\hat{\gamma}\right)>1-q+t$, with $0<t<q$ denoting the trimming parameter.[18] The second step consists of running a quantile regression on the selected and trimmed subsample $J\left(t\right)$,

$$(12)\quad \min_{\beta}\sum_{i\in J(c)}\varsigma_q\left(\ln\left(\frac{\Delta_i}{n_i}\right)-X_i^{'}\beta_0\left(q\right)\right),$$

where ς_q is the check function,

[16] Of course, also quantile regressions suffer from drawbacks. First, there exist no closed form formulas with explicit solutions for the estimators making it harder to derive e.g. the asymptotic properties. Second, the estimates are derived with time-consuming numerical methods, which also may converge to a local optimum instead of a global optimum.

[17] Accordingly, it is ensured that in the selected subsample the fraction of observations with positive discretionary deductions is larger than *(1-q)*, and that the conditional *q*-th quantile exists and exceeds the censoring point.

[18] According to Chernozhukov and Hong, 2002, a selection of 90 percent of the sub-sample worked well in simulations and we followed their advice.

$$(13) \quad \varsigma_q\left(\ln\left(\frac{\Delta_i}{n_i}\right)^* - X_i^{'}\beta(q)\right) = \begin{cases} q\left(\ln\left(\frac{\Delta_i}{n_i}\right)^* - X_i^{'}\beta(q)\right) & if \quad \ln\left(\frac{\Delta_i}{n_i}\right)^* > X_i^{'}\beta \\ (q-1)\left(\ln\left(\frac{\Delta_i}{n_i}\right)^* - X_i^{'}\beta(q)\right) & if \quad \ln\left(\frac{\Delta_i}{n_i}\right)^* \leq X_i^{'}\beta. \end{cases}$$

The check function weights positive errors by q, and negative errors by $q-1$. The estimate $\beta_0(q)$ of $\beta(q)$ is consistent, yet not efficient because the trimmed subsample is not the largest subsample. In order to obtain the largest subsample with $X_i^{'}\beta(q) > 0$, we use the fact that $\hat{\beta}_0(q)$ is consistent and select all observations with $X_i^{'}\hat{\beta}_0(q) > 0$. Then the third step is carried out by running standard quantile regression on the subsample selected at the end of step two. The result is a consistent estimation $\hat{\beta}_1(q)$ of $\beta(q)$.[19]

6 Specification and estimation results

6.1 Specification of regressions

Suppressing individual, state and period subscripts, the basic structure of all the estimation equations is,

$$(14) \qquad \beta_0 + \beta_1 State + \beta_2 Period + \beta_3 Micro + \beta_4 Interaction + error\ .$$

$State$ is a set of state-level variables, e.g. the marginal rate of loss and levels of per-capita lump-sum grants. $Period$ includes two period dummies for years 2001 and 2004. $Micro$ comprises several characteristics of the tax units, e.g. taxable income before discretionary deductions, or number of tax-relevant children.[20] Finally, $Interaction$ contains interactions between micro-level variables and the period dummies.

To check for robustness, we fitted four specifications (S1-S4) of the HSM using different sets of variables. For the three-step censored quantile regressions, we provide results

[19] The entire paragraph relies on Chernozhukov and Hong, 2002. See Chernozhukov and Hong, 2002, for further details on three-step censored quantile regressions.

[20] For robust identification of HSM, an exclusion restriction should be imposed: the selection equation should include at least one exogeneous variable not being included in the outcome equation. Ideally, the excluded variable should have a substantial impact on the probability of selection but a negligible impact on the outcome (see Cameron and Trivedi, 2009, p. 546). A suitable candidate for our purposes is marital status. In year 1998 (2001, 2004), we observe strictly positive amounts of discretionary deductions for 66.66 (71.18, 71.39) percent of the unmarried and 83.56 (87.52, 88.00) percent for the married tax units. The conditional means of *ln(Δ/n)* for unmarried and married tax units are fairly close: for year 1998 (2001, 2004) we have 6.65 vs. 6.37 (6.77 vs. 6.52; 6.58 vs. 6.35). Due to the exclusion restriction, the set of individual-level variables in the selection equation is the same as Micro except that it also includes a dummy for married (jointly assessed) tax units.

for specification S4, the Heckman specification recommended according to the Bayesian Information Criterion (BIC, see Table 4).[21]

For the Heckman model, the baseline specification (S1) includes a set of state-level variables, $State_{S1}$, and the micro-variable set $Micro_{S1}$ but not the set of interactions between individual characteristics and period dummies. Particularly, $State_{S1}$ includes:

1. $MRL_{s,t}$, the marginal rate of loss in state s in period t. If the respective regression coefficient is positive, it supports the relationship implied by equation (8) from our theoretical model.
2. $Contributor_{s,t}$, taking the value 1 for the states' net contributing to equalization (Bavaria, Baden-Württemberg, Hamburg, and Hesse).[22] The corresponding regression coefficient controls for potential differences in discretionary deductions between net contributing and net recipient states.
3. $Citystate_{s}$, taking the value 1 for the city states Berlin, Bremen and Hamburg. The respective coefficient controls, for example, for the particular fiscal needs of city states compared to non-city states, e.g. due to a rather small population. Together with the variable $Contributor_{s,t}$, this gives us a set of four groups of countries.
4. $MRL_{s,t} \times Contributor_{s,t}$, an interaction which is 0 for all net recipient states, and equal to the state-specific marginal rates of loss in case of the net contributing states. The corresponding regression coefficient quantifies potential differences in the relationship between MRL and the level of discretionary deductions between net contributor and recipient states.
5. $MRL_{s,t} \times Citystate_{s}$, an interaction which is 0 for the 13 non-city states, and equal to the state-specific marginal rates of loss in case of city states. The corresponding regression coefficient quantifies potential differences in the relationship between MRL and the level of discretionary deductions for city-states compared with non-city states.
6. $Lumpsum_{s,t}$, the annual per capita vertical lump sum transfer (in €1,000) granted to state s in period t. According to our theoretical model, the respective regression coefficients should be zero.

$Micro_{S1}$ comprises the taxable base before discretionary deductions (in logs), $\ln(TB)$.

[21] This is solely for technical reasons: The large sample size led to extensive computing times of more than 12 hours *per percentile*.
[22] In year 1998, Schleswig-Holstein was another net contributor. For the three periods of interest, Schleswig-Holstein is the only country with a switch of status from net contributor to net recipient (or vice versa).

Specification S2 is the same as S1 with the only exception that $Micro_{S2}$ (compared with $Micro_{S1}$) further includes the number of tax-relevant children and age dummies of the taxpayer. In Specification S3, the set of micro-variables also comprises the income shares of different income sources. In specification S4 all micro-variables from S3 are also interacted with the two period dummies.

6.2 Results from regressions

Results from the four Heckman regressions are summarized in Table 4. To adjust standard errors for intra-group correlation, regressions are always clustered at the state level.[23] The upper panel of Table 4 provides the coefficient estimates and respective standard errors for the outcome equation, while estimates for the selection equation are summarized in the lower panel. Underneath the bottom panel, three summary statistics are reported. The statistic $\rho = corr(u_1, u_2)$ gives the correlation of errors in the outcome and the selection equation. That the statistic is significantly different from zero in all specifications indicates a positive correlation between error terms in the selection and outcome equation. Accordingly, standard regression techniques applied to the outcome equation would yield biased estimates. The λ term, the product of ρ with the standard error of the residual in the outcome equation, conveys complementary information. The χ^2 statistic is the comparison of the joint likelihood of an independent probit model for the selection equation and a regression model on the observed discretionary deductions against the Heckman model likelihood. Together, estimates of ρ, λ, χ^2 clearly justify the Heckman equation with the data. For model selection, we have also provided the Bayesian information criterion (BIC) which introduces a penalty term for the number of parameters in the model. According to BIC, specification S4 is recommended.

Table 4 about here

An immediate observation from the outcome regressions in Table 4 is that *MRL* and granted discretionary deductions are positively related. The finding is significant at the 1 percent level in all four specifications, supporting the implications from the Samuelson condition (8) in the theoretical model. The estimates from the selection equation further support this assessment. We also find that the probability for discretionary deductions being

[23] For correction of standard errors in pooled micro-macro datasets see Moulton, 1990.

granted is increasing in MRL. It should, however, be noted that the positive relationship between MRL and the level of deductions is a phenomenon most prominent in the non-contributing states. The regression coefficients pertaining to $MRL \times Contributor$ is negative and it is quantitatively close to the regression coefficients for MRL, thus mitigating the quantitative effect of MRL on discretionary deductions. For the city states, the interaction $MRL \times Citystate$ reveals no differences compared with the non-city states regarding the impact of MRL.

Another remarkable result refers to the lump-sum transfers, $Lumpsum$. According to our theoretical model in Section 2, lump-sum transfers should not affect the level of discretionary deductions granted by the taxmen. Indeed, our regression analysis renders supportive evidence. In the outcome equation the regression coefficient for $Lumpsum$ is quantitatively small and only marginally significant. In the selection equation, $Lumpsum$ plays no role.

Results from the quantile regressions give further supportive evidence on the positive relationship between MRL and discretionary deductions. Figure 4 gives a graphical summary of the results for the set of state-level variables, $State_{S1}$, and also for the micro-variable taxable base. Due to censoring, it was not possible to derive quantile coefficients for the low quantiles (1 to 25). Solid lines denote the 3-step estimates, while the shaded area depicts 95 percent confidence intervals.[24] Consistent with the results from the Heckman model, regression coefficients pertaining MRL are again positive and significant. Furthermore, the quantile regression indicates an inverse-u-relationship between MRL and discretionary deductions across quantiles. For the quantiles in the middle of the distribution, the effect of MRL on discretionary deductions appears to be particularly strong, while it is weaker for the extreme quintiles of non-censored data.

Figure 4 about here

Two further robustness checks on the MRL-Δ relationship can be found in the Appendix. First, we have rerun Heckman specification S4 but instead of the macro-variable set we have included 15 state dummies (Baden-Württemberg serves as the reference). The corresponding regression coefficients reveal between-state differences in discretionary deductions after controlling for tax units' individual characteristics. We have implemented

[24] Percentile-specific confidence intervals reveal whether regression coefficients are different from zero. They are not suited for making visual tests of parameter constancy.

this approach separately for each of our three cross sections (and, therefore discarded the period dummies), and then computed the correlation between the regression coefficients for the state dummies and MRL. Correlations are always positive, thus supporting our previous conclusions: 0.173 for year 1998 (without city states: 0.424), 0.226 for year 2001 (without city states: 0.525), and 0.338 for year 2004 (without city states: 0.486). Second, we have rerun specifications S1 to S4 excluding Schleswig-Holstein. As can be seen from Table 2, Schleswig-Holstein's marginal rate of loss was exceptionally low in year 1998, so that Heckman regression estimates may be biased. However, Table A3 in the Appendix reveals that the exclusion of Schleswig-Holstein has a quite moderate effect on regression estimates, and does not change our previous conclusions.[25]

6.3 Reactions of income tax revenue to hypothetical MRL variations

We conclude our empirical examination with predictions of changes in state-specific tax revenue (per tax unit and over all tax units) due to MRL variations. All estimates rely on the Heckman model and take the states' actual MRL levels in a particular year as the reference point. More precisely, changes in tax revenue per tax unit are derived by first predicting for each observation the expected value of the dependent variable (Δ/n) conditional on the dependent variable for a tax unit i in period t and resident in state s being selected. Then the change in taxable base compared to the status quo is derived and multiplied with the tax unit's marginal income tax rate.[26] Using the frequency weights, we then derive the average change in income tax burden across all state residents. Multiplying the average change in income tax burden with the number of tax units gives the overall change in income tax revenue ex ante to redistribution in a particular state. The numbers we provide are derived from the point estimates of regression coefficients, and thus should be interpreted with sufficient care.

Figures 5a-5c about here

By year and state, Figures 5a to 5c provide estimates of additional tax revenues for particular MRL reductions (dMRL) compared with the status quo. Within each of the 16 graphs for a particular year, two functions are provided: solid lines give the additional income

[25] We have also run separate OLS and probit regressions with bootstrap samples to get an idea of the sensitivity of confidence intervals to sample size (1,000 replications; five percent sub-samples). Bootstrapped standard errors of regression coefficients were always small. Particularly, confidence intervals for the MRL coefficient never included the zero.

[26] In case of married couples, amounts are multiplied by two.

tax revenue per tax unit; dashed lines give the state-wide increase in overall income tax revenue in million EUR. All numbers are expressed in year 2004 prices.

Take for example the graph for Lower Saxony in year 2004. The abscissa value "5" indicates a five percentage-point reduction in Lower Saxony's year 2004 MRL, i.e. a reduction from 87.17 to 82.17 percent. The left ordinate indicates that the same reduction is associated with an estimated rise of income tax revenue per tax unit by EUR 39.33. The right-hand side ordinate indicates that the reduction rises Lower Saxony's income tax revenue (before redistribution) by 73 million EUR. Summing up, for dMRL=5 percent, the state-specific changes in total income tax revenue amount to 992 million EUR in year 1998, 963 million EUR in year 2001, and 799 million EUR in year 2004.

7 Conclusion

In many federal countries, fiscal-equalization schemes have been installed to soften fiscal imbalances across states. Various theoretical works have investigated the incentive effects associated with fiscal equalization in such a cooperative framework, but few papers have confronted the theory with evidence from micro data. The present study has provided new evidence in this direction. Particularly, using cross-sectional representative administrative micro data on income tax returns for Germany (for years 1998, 2001, 2004), we have estimated the relationship between state-specific marginal rates of loss and levels of granted discretionary deductions.

Results from two-stage Heckman and three-step censored quantile techniques indicate a positive relationship between a state's marginal rate of loss and the level of discretionary deductions granted by the state's taxmen. According to our Heckman estimates, a reduction of year 2004 state-specific levels of MRL of 5 percentage points would lead to an increase of income tax revenue per tax unit of about EUR 30 in Hamburg and about EUR 60 in Saarland. This is equivalent to an estimated rise in Germany-wide income tax income revenue of about 0.8 billion EUR.

To resolve the issue of unwanted state-specific policies concerning the treatment of discretionary income tax deductions, a possibility would be the delegation of tax collection to the federal level. In the last years, several initiatives have been set up in this direction. 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.

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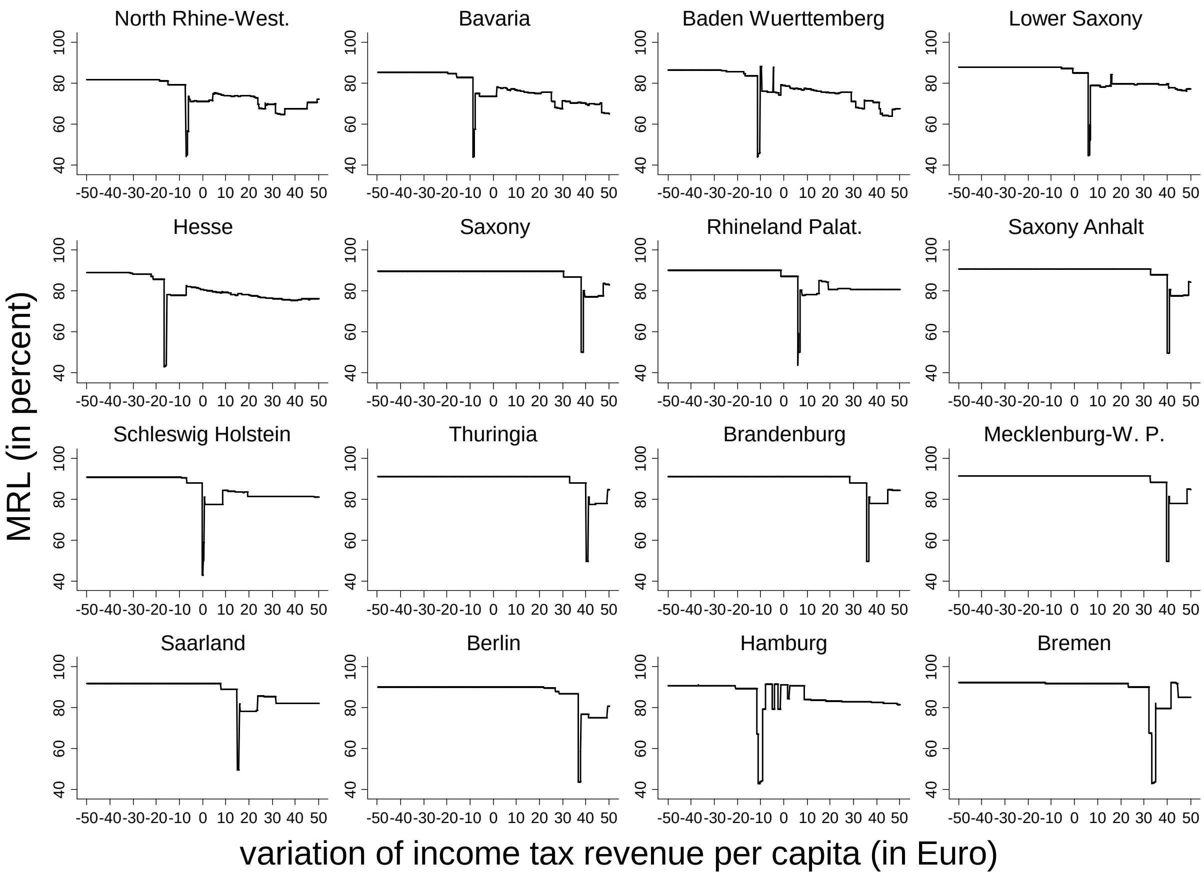
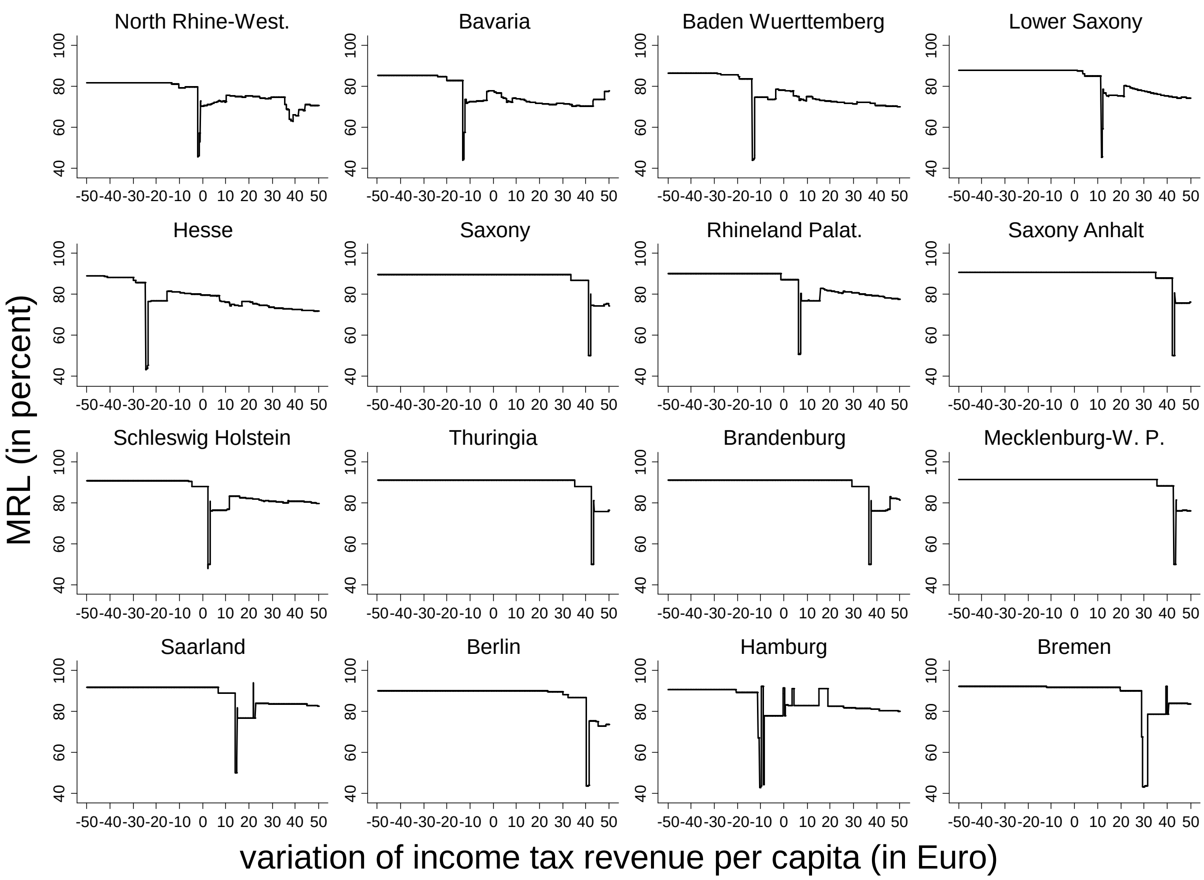
Figure 1a. Marginal rate of loss and income tax revenue, 1998



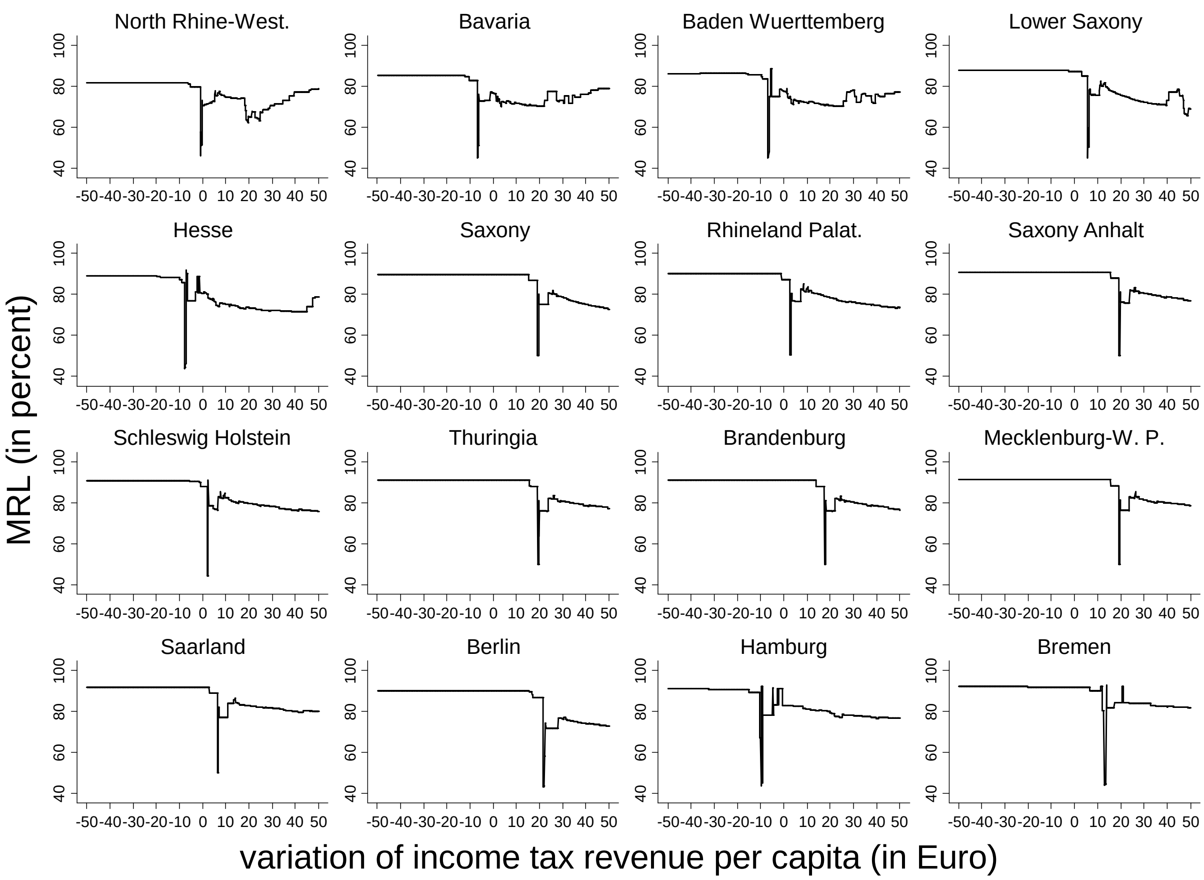
Note. Own computations.

Figure 1b. Marginal rate of loss and income tax revenue, 2001



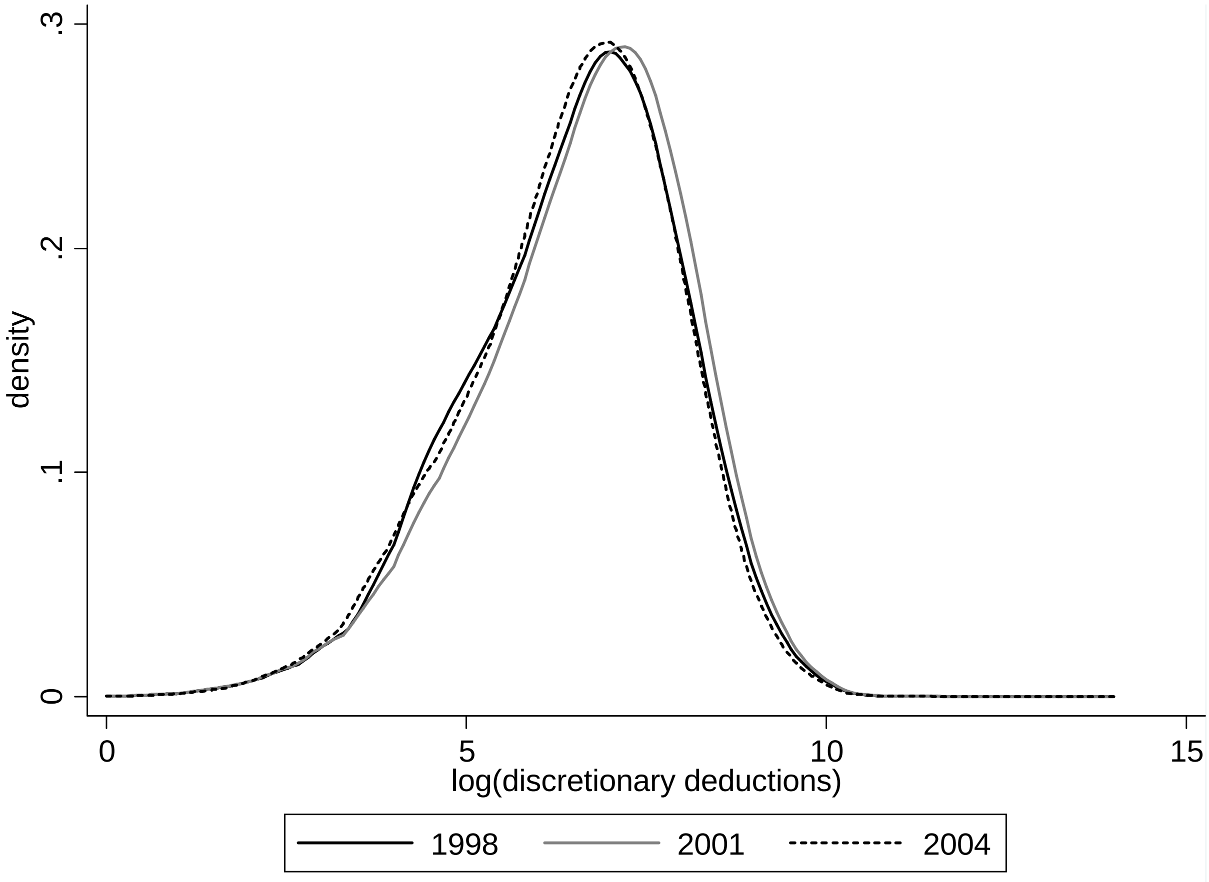
Note. Own computations.

Figure 1c. Marginal rate of loss and income tax revenue, 2004



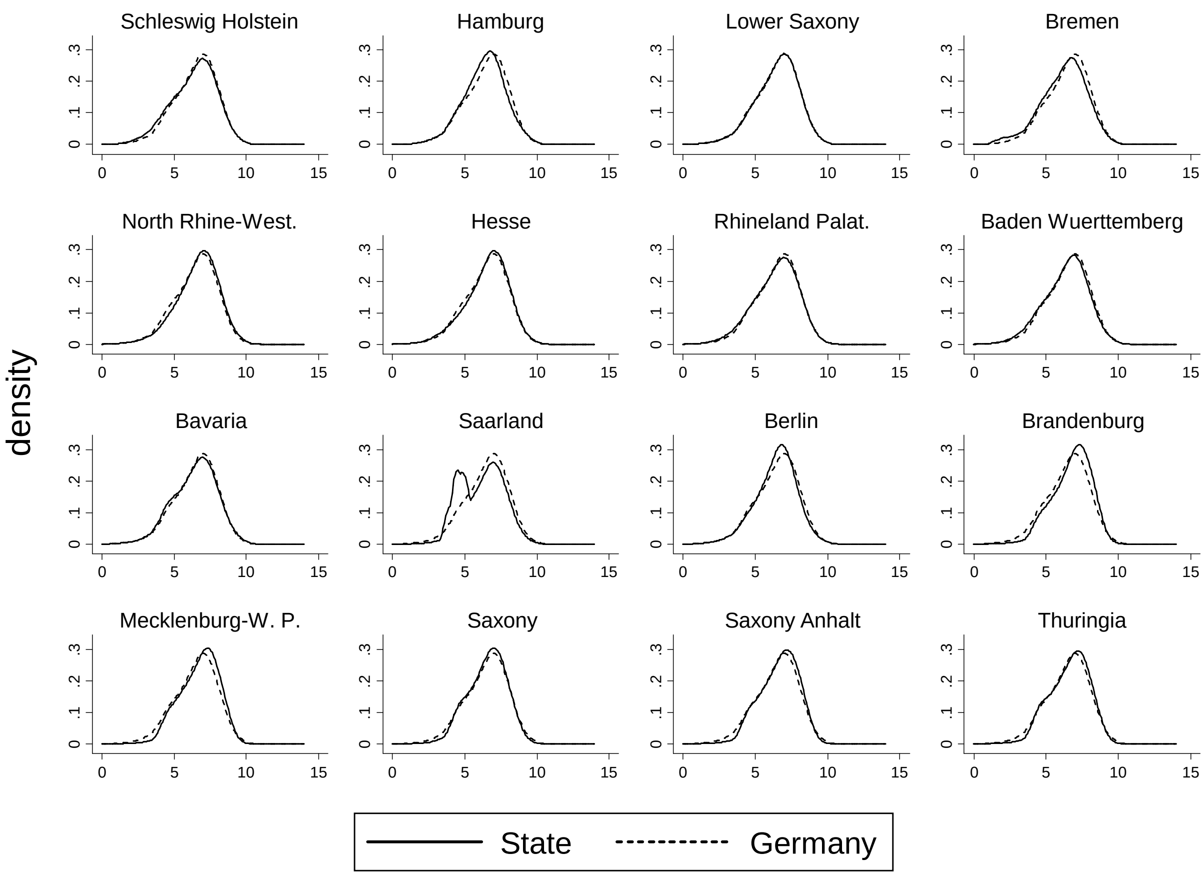
Note. Own computations.

Figure 2. Distribution of log-dicretionary deductions



Note. Own computations. Database is FAST 1998-2004.

Figure 3a. State specific distributions of log-dicretionary deductions in 1998



Note. Own computations. Database is FAST 1998-2004.

Figure 3b. State specific distributions of log-dicretionary deductions in 2001

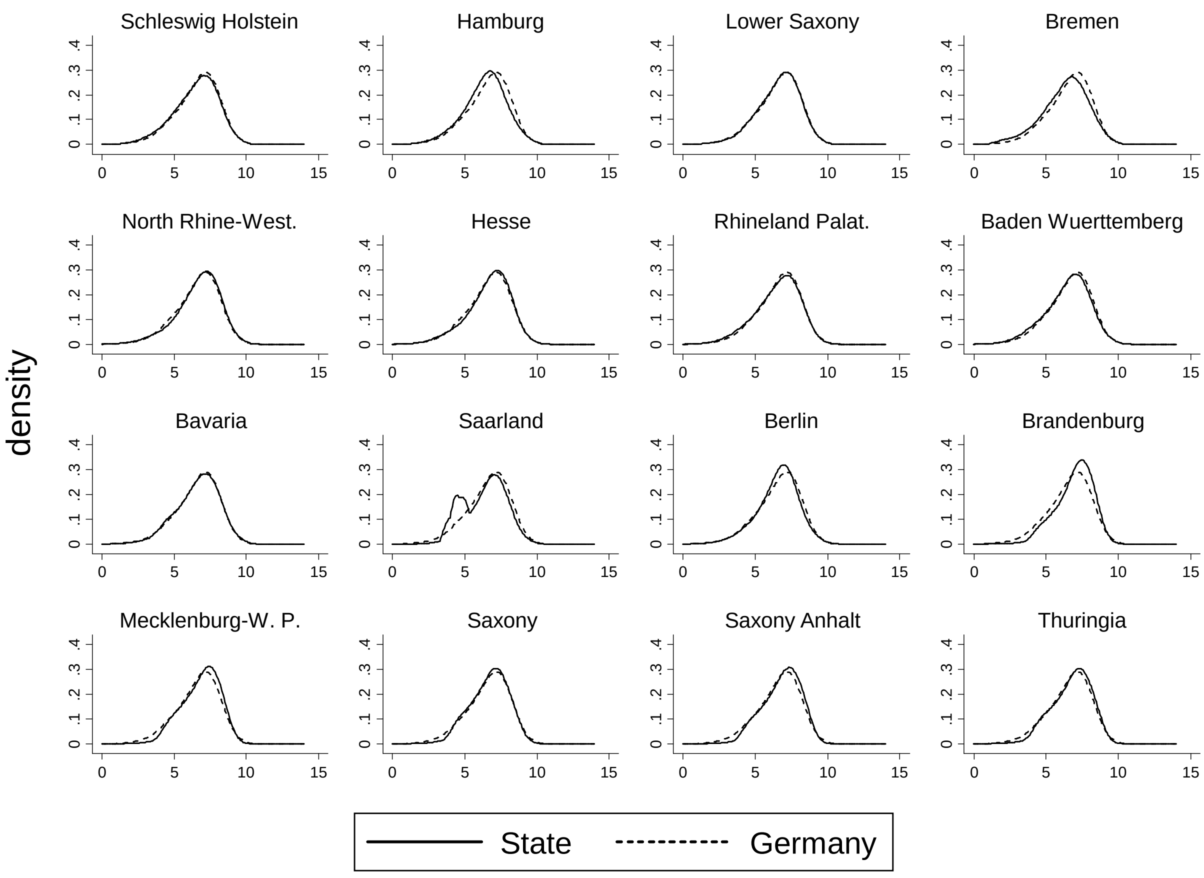


Figure 3c. State specific distributions of log-dicretionary deductions in 2004

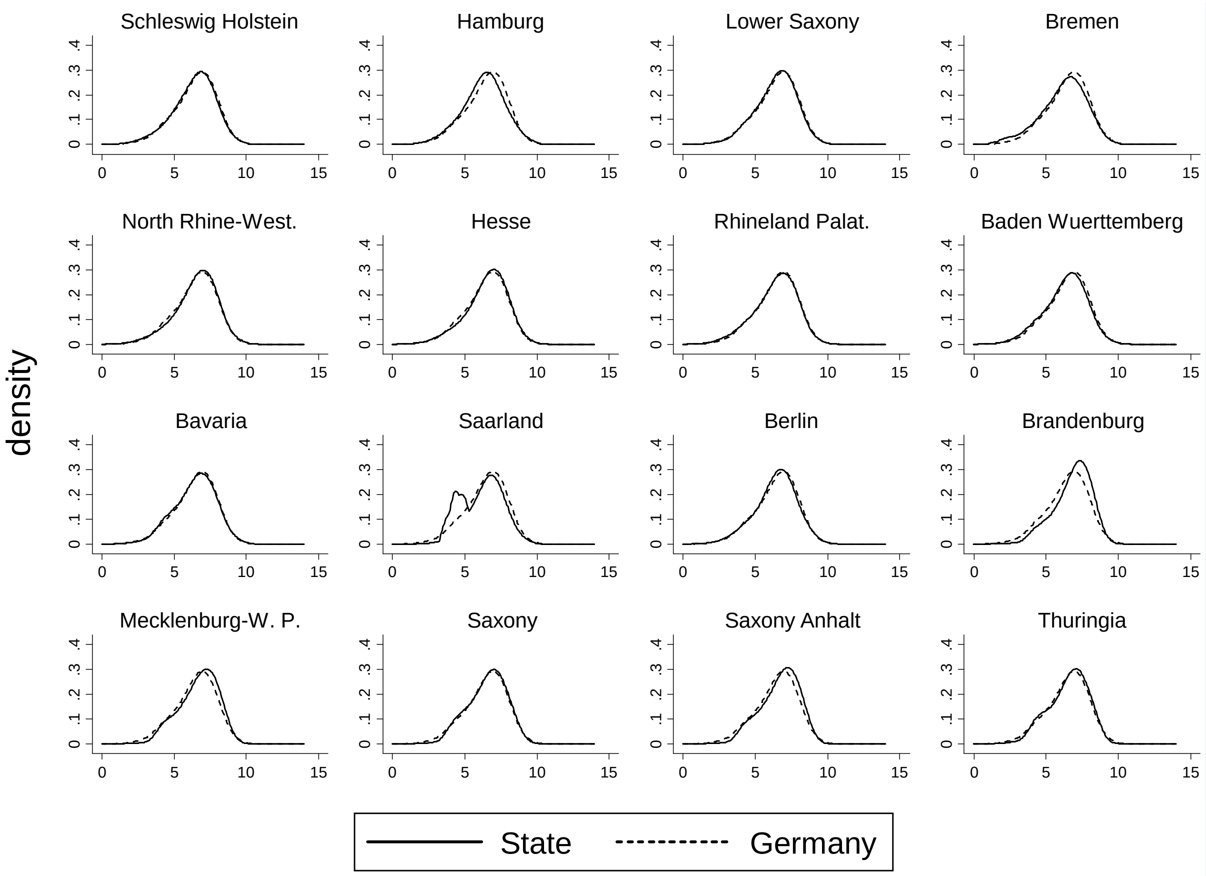
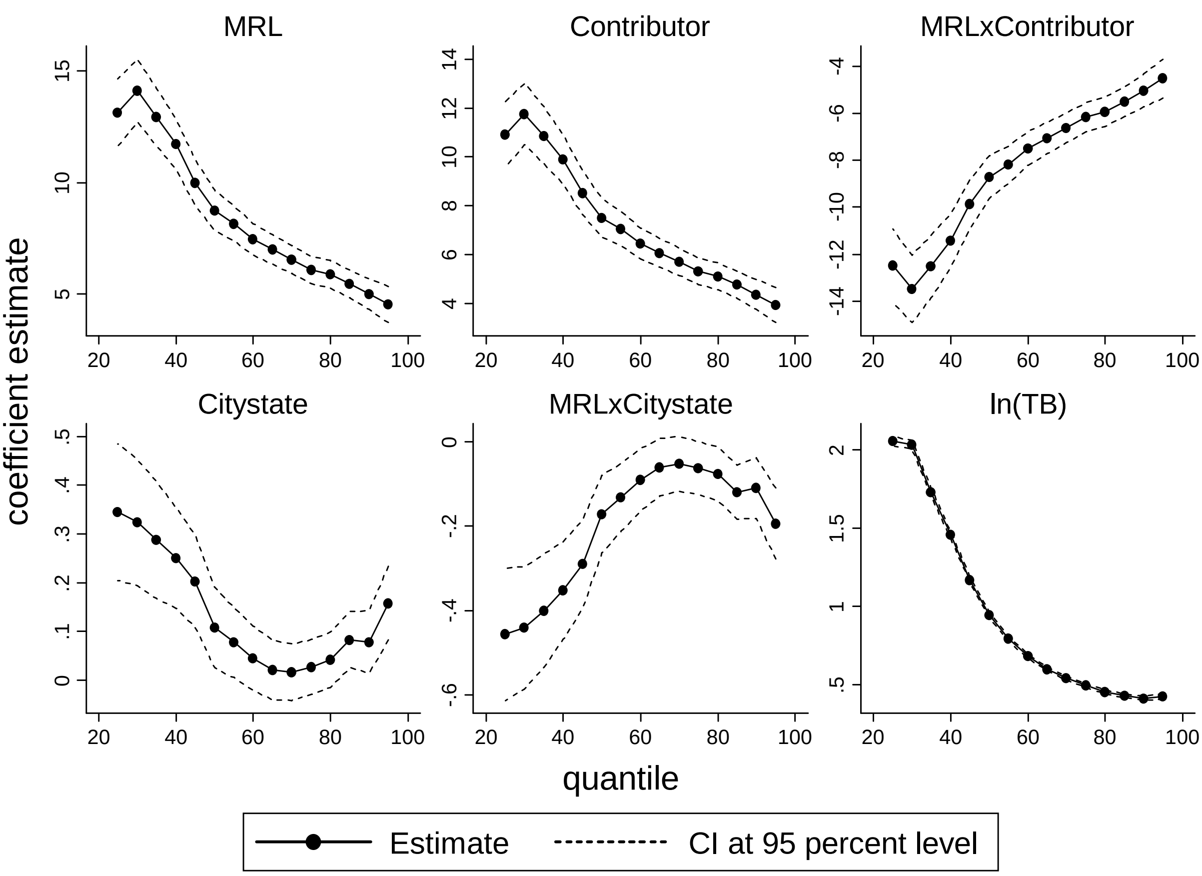
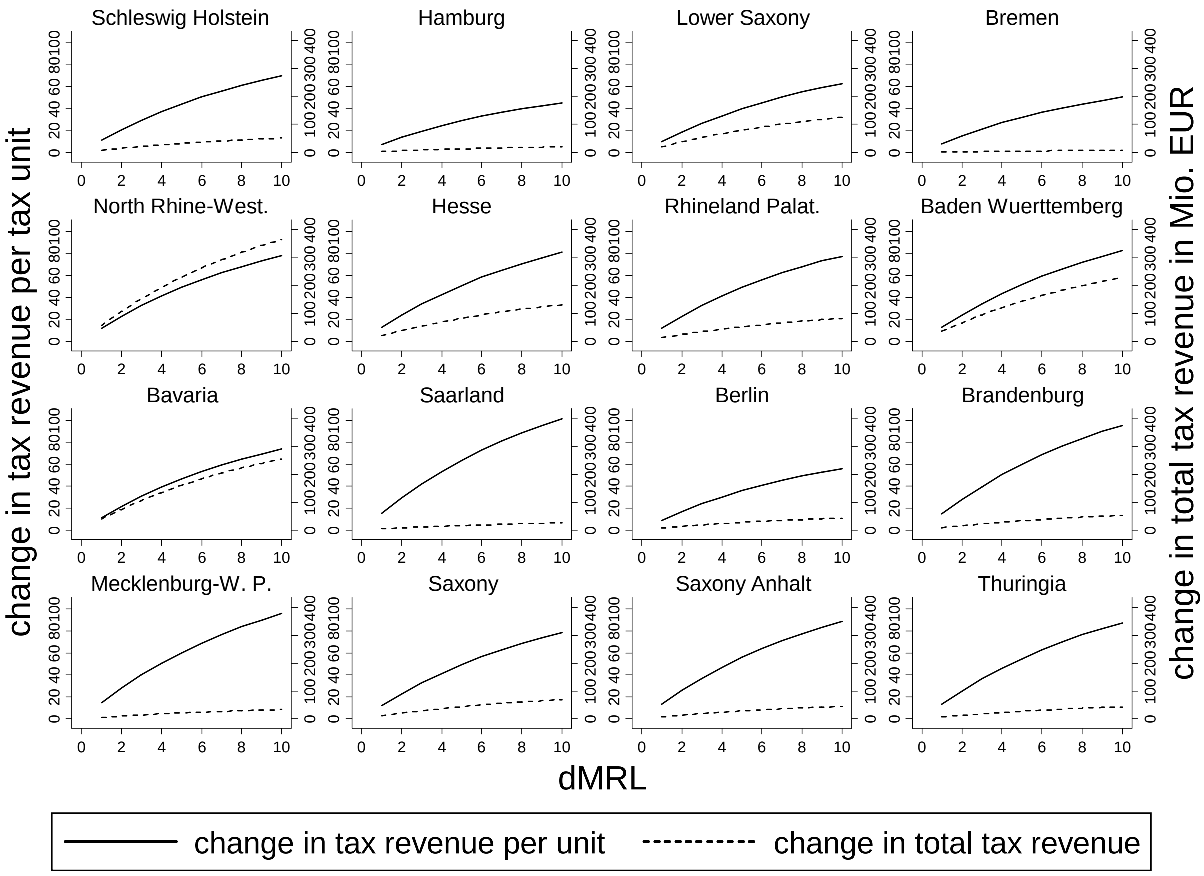


Figure 4. Coefficient estimates from Censored Quantile Regression



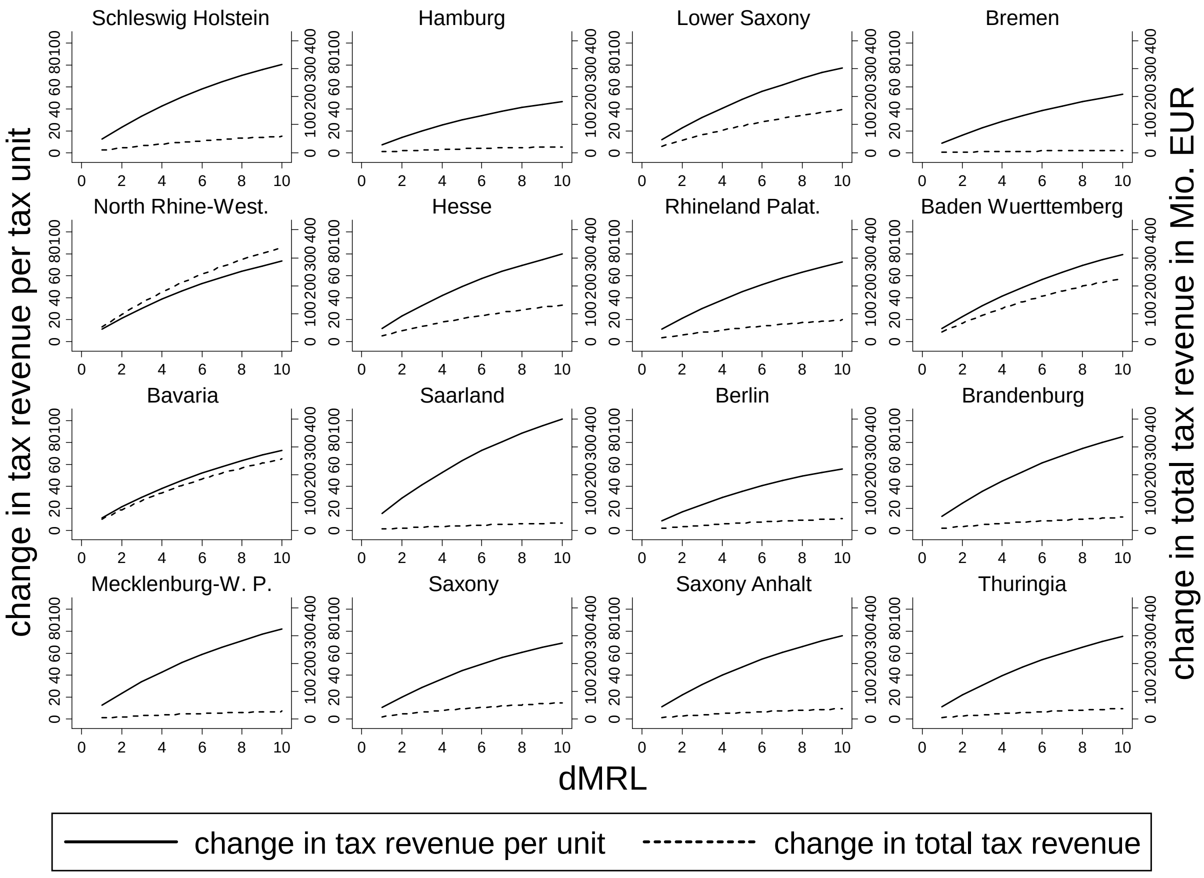
Note. Own computations. Database is FAST 1998-2004.

Figure 5a. Simulated responses of tax revenue to MRL variations, 1998



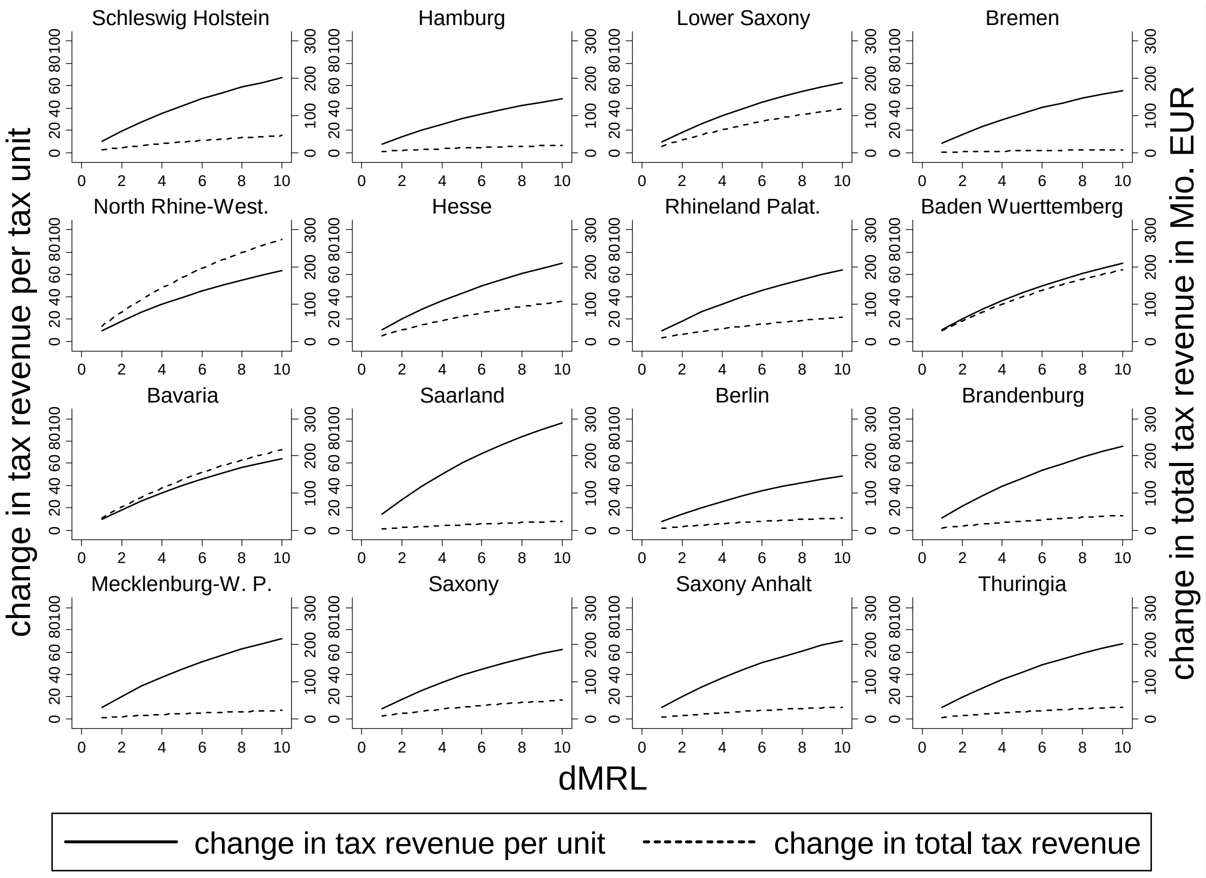
Note. Own computations. Database is FAST 1998-2004.

Figure 5b. Simulated responses of tax revenue to MRL variations, 2001



Note. Own computations. Database is FAST 1998-2004.

Figure 5c. Simulated responses of tax revenue to MRL variations, 2004



Note. Own computations. Database is FAST 1998-2004.

Table 1. Germany's fiscal equalization system

	Stage 1	*Stage 2*	*Stage 3*	*Stage 4*
Name	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 provinces	Transfers from financially strong provinces (above average joint-tax-revenues) to financially weak ones (below average)	Transfers from the federal government to provinces whose fiscal revenue is still below average.
Result	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 provinces receive at least 92% of average (per capita) tax revenue	All provinces receive at least 95% of average (per capita) fiscal revenue	All provinces 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. Marginal rates of loss

		Marginal rate of loss (in %)		
State	**Acronym**	**1998**	**2001**	**2004**
Schleswig-Holstein	SH	42.95	87.85	87.84
Hamburg	HH	91.20	91.50	82.92
Lower Saxony	NI	85.03	87.81	87.17
Bremen	HB	91.61	91.62	91.62
North Rhine-Westphalia	NW	70.93	70.37	70.54
Hesse	HE	80.80	79.92	80.59
Rhineland-Palatine	RP	87.16	87.17	87.16
Baden-Württemberg	BW	78.88	78.02	77.55
Bavaria	BV	73.41	77.66	76.63
Saarland	SL	91.86	91.87	91.88
Berlin	BE	89.81	89.84	89.84
Brandenburg	BB	90.98	90.97	90.99
Mecklenburg-Western Pomerania	MV	91.44	91.46	91.49
Saxony	SN	89.83	89.90	89.96
Saxony-Anhalt	ST	90.91	90.97	91.03
Thuringia	TH	91.04	91.08	91.11

Note. Own calculations.

Table 3a. Sample statistics - unmarried

State	1998			2001			2004		
	Taxable base (sd)	Discretionary ded. (sd)	Observations (Fraction in %)	Taxable base (sd)	Discretionary ded. (sd)	Observations (Fraction in %)	Taxable base (sd)	Discretionary ded. (sd)	Observations (Fraction in %)
SH	27,484	1,824	32,850	32,883	2,070	31,094	28,623	1,644	34,006
	(26,386)	(2,975)	(69.23)	(32,188)	(3,130)	(70.98)	(29,158)	(2,482)	(68.21)
HH	31,083	1,775	31,159	38,913	1,873	29,658	34,211	1,610	29,589
	(30,321)	(3,254)	(59.31)	(37,268)	(3,250)	(64.77)	(34,436)	(2,888)	(65.64)
NI	28,450	1,920	51,525	35,833	2,122	48,044	29,222	1,645	66,430
	(28,930)	(2,974)	(65.37)	(36,342)	(3,523)	(68.59)	(30,709)	(2,474)	(69.61)
HB	25,093	1,648	15,752	29,073	1,876	14,190	26,003	1,551	12,291
	(22,447)	(2,576)	(59.12)	(26,485)	(2,952)	(63.86)	(24,786)	(2,426)	(64.08)
NW	35,270	2,235	76,152	47,609	2,453	76,364	35,467	1,882	123,322
	(35,872)	(3,596)	(63.16)	(44,492)	(3,810)	(69.82)	(36,718)	(2,994)	(68.86)
HE	32,554	2,008	48,493	44,948	2,276	49,599	36,552	1,847	63,861
	(32,585)	(3,158)	(68.69)	(42,417)	(3,459)	(73.90)	(37,018)	(2,861)	(73.68)
RP	27,305	1,873	36,780	34,047	2,030	34,036	28,385	1,632	42,999
	(26,519)	(2,880)	(67.88)	(33,571)	(3,037)	(71.01)	(29,032)	(2,614)	(71.94)
BW	31,858	1,852	60,760	43,413	2,043	59,993	34,001	1,650	90,292
	(32,543)	(3,155)	(66.65)	(41,682)	(3,399)	(71.97)	(35,135)	(2,902)	(71.32)
BY	33,572	1,922	69,023	47,433	2,341	70,747	35,568	1,744	109,521
	(34,455)	(3,202)	(69.40)	(44,373)	(3,768)	(73.27)	(36,807)	(2,887)	(73.91)
SL	23,606	1,400	17,812	27,966	1,577	16,625	25,552	1,283	15,814
	(20,924)	(2,367)	(85.55)	(25,943)	(2,558)	(86.72)	(24,207)	(2,070)	(86.99)
BE	28,357	1,685	40,933	35,559	1,877	38,623	30,322	1,664	43,887
	(27,896)	(2,812)	(59.08)	(35,573)	(3,106)	(65.58)	(32,242)	(2,856)	(66.15)
BB	22,087	2,173	28,779	26,828	2,401	26,585	23,617	2,112	31,246
	(20,486)	(2,441)	(68.15)	(26,724)	(2,626)	(73.68)	(24,298)	(2,262)	(76.08)
MV	20,128	2,196	22,677	24,043	2,323	21,172	22,089	2,001	21,987
	(17,948)	(2,466)	(68.43)	(22,913)	(2,517)	(71.62)	(22,229)	(2,272)	(73.14)
SN	21,143	1,799	34,366	26,450	2,032	32,446	22,286	1,719	44,281
	(20,195)	(2,294)	(68.64)	(27,075)	(2,487)	(71.67)	(23,690)	(2,102)	(72.71)
ST	20,960	2,028	26,138	24,855	2,291	24,406	22,053	2,025	28,450
	(19,226)	(2,347)	(66.78)	(24,320)	(2,504)	(71.27)	(22,277)	(2,219)	(73.41)
TH	19,843	1,973	25,446	23,887	2,243	24,761	21,062	1,733	28,803
	(17,753)	(2,326)	(70.10)	(23,494)	(2,573)	(74.09)	(21,000)	(2,042)	(73.33)

Note. Mean taxable base and conditional mean discretionary deductions. Standard deviations for taxable base and deduction in parentheses. Values in price-adjusted EUR per year. Fraction gives the share of tax units in the respective group with strictly positive discretionary deductions.
Data. FAST 1998-2004.

Table 3b. Sample statistics - married

State	1998			2001			2004		
	Taxable base (sd)	Discretionary ded. (sd)	Observations (Fraction in %)	Taxable base (sd)	Discretionary ded. (sd)	Observations (Fraction in %)	Taxable base (sd)	Discretionary ded. (sd)	Observations (Fraction in %)
SH	65,302	2,388	36,266	77,407	2,686	37,864	73,079	2,316	37,469
	(37,282)	(3,330)	(84.43)	(40,901)	(3,582)	(85.94)	(37,962)	(3,227)	(86.00)
HH	66,050	2,177	27,630	77,258	2,376	29,980	76,709	2,170	24,014
	(37,652)	(3,132)	(77.51)	(40,673)	(3,667)	(83.18)	(38,504)	(3,426)	(83.95)
NI	71,494	2,496	61,680	84,538	2,844	74,720	76,257	2,323	78,934
	(38,858)	(3,269)	(82.60)	(39,753)	(3,565)	(85.74)	(37,604)	(3,081)	(86.47)
HB	53,174	2,012	13,665	60,795	2,227	13,393	61,010	2,028	8,696
	(31,881)	(2,816)	(75.72)	(36,106)	(3,105)	(81.01)	(36,580)	(2,949)	(81.04)
NW	84,785	2,953	118,014	96,543	3,232	158,886	84,863	2,670	177,571
	(38,578)	(3,803)	(84.07)	(36,546)	(4,075)	(88.64)	(36,038)	(3,440)	(88.04)
HE	76,668	2,761	62,515	90,674	3,147	81,088	83,312	2,699	81,155
	(39,510)	(3,652)	(86.88)	(39,369)	(3,813)	(90.19)	(37,122)	(3,439)	(90.14)
RP	65,678	2,427	42,676	78,173	2,855	48,757	73,170	2,380	48,334
	(37,660)	(3,221)	(84.76)	(40,591)	(7,351)	(88.22)	(37,922)	(3,228)	(88.06)
BW	79,002	2,432	81,450	92,609	2,792	111,335	83,775	2,328	123,704
	(38,818)	(3,568)	(85.86)	(37,542)	(3,769)	(89.46)	(35,639)	(3,257)	(89.37)
BY	80,906	2,636	92,867	94,539	3,037	129,718	83,799	2,487	140,461
	(39,133)	(3,804)	(86.80)	(37,299)	(3,934)	(89.68)	(36,308)	(3,398)	(90.22)
SL	53,180	2,059	17,840	62,179	2,361	18,256	62,343	1,960	14,163
	(32,056)	(2,799)	(88.69)	(36,747)	(3,028)	(89.08)	(36,664)	(2,798)	(94.08)
BE	65,665	2,298	33,573	77,338	2,645	36,635	74,422	2,368	31,067
	(37,266)	(3,217)	(79.47)	(40,098)	(3,504)	(84.50)	(38,264)	(3,449)	(85.51)
BB	55,305	2,567	25,473	66,900	3,151	27,174	66,104	2,675	25,245
	(33,906)	(2,836)	(79.70)	(38,467)	(3,291)	(85.14)	(38,052)	(2,953)	(87.11)
MV	50,163	2,378	19,679	58,811	2,707	19,624	58,153	2,306	16,046
	(30,924)	(2,722)	(79.40)	(35,519)	(2,985)	(82.39)	(36,132)	(2,742)	(83.73)
SN	55,116	2,128	30,447	66,985	2,545	32,145	64,573	2,196	32,802
	(34,335)	(2,625)	(80.99)	(38,824)	(3,037)	(84.96)	(37,903)	(2,893)	(85.52)
ST	51,205	2,169	23,002	60,424	2,682	22,758	62,646	2,271	22,047
	(32,004)	(2,432)	(77.40)	(36,524)	(2,969)	(82.57)	(37,627)	(2,592)	(84.35)
TH	49,681	2,205	21,923	59,961	2,607	22,416	58,985	2,080	20,345
	(31,338)	(2,588)	(80.92)	(36,481)	(2,931)	(84.34)	(36,801)	(2,546)	(85.01)

Note. Mean taxable base and conditional mean discretionary deductions. Standard deviations for taxable base and deduction in parentheses. Values in price-adjusted EUR per year. Fraction gives the share of tax units in the respective group with strictly positive discretionary deductions.
Data. FAST 1998-2004.

Table 4. Heckman regression results

	S1		S2		S3		S4	
Outcome equation								
MRL	7.898***	(2.634)	7.167***	(2.488)	6.349***	(2.436)	6.616***	(2.449)
Contributor	6.783***	(2.295)	6.202***	(2.177)	5.524***	(2.127)	5.735***	(2.137)
MRL x Contributor	-7.826***	(2.622)	-7.175***	(2.492)	-6.416***	(2.433)	-6.671***	(2.444)
City state	0.086	(0.088)	0.082	(0.077)	0.079	(0.069)	0.055	(0.067)
MRL x City state	-0.118	(0.102)	-0.108	(0.090)	-0.106	(0.080)	-0.080	(0.078)
Lump sum	-0.091**	(0.044)	-0.093**	(0.039)	-0.099***	(0.033)	-0.104***	(0.034)
Year_2001	0.046**	(0.020)	0.052***	(0.020)	0.038**	(0.019)	4.959***	(0.632)
Year_2004	-0.062***	(0.018)	-0.066***	(0.016)	-0.103***	(0.015)	6.981***	(0.619)
ln(TB)	0.350***	(0.030)	0.435***	(0.024)	0.404***	(0.022)	0.362***	(0.016)
Controls for number of children and age	no		yes		yes		yes	
Controls for income sources	no		no		yes		yes	
Time interaction of micro variables	no		no		no		yes	
Constant	-4.262*	(2.297)	-4.568**	(2.189)	-3.615*	(2.142)	-3.375	(2.126)
Selection equation								
MRL	3.006**	(1.422)	3.612**	(1.407)	3.475**	(1.402)	3.611***	(1.389)
Contributor	2.473**	(1.262)	2.984**	(1.250)	2.904**	(1.239)	3.021**	(1.229)
MRL x Contributor	-2.780*	(1.438)	-3.368**	(1.427)	-3.287**	(1.411)	-3.419**	(1.399)
City state	0.038	(0.044)	0.057	(0.048)	0.059	(0.048)	0.054	(0.049)
MRL x City state	-0.069	(0.051)	-0.090	(0.056)	-0.092*	(0.056)	-0.088	(0.057)
Lump sum	0.005	(0.026)	0.001	(0.029)	-0.008	(0.026)	-0.011	(0.026)
Year_2001	0.063***	(0.014)	0.057***	(0.015)	0.050***	(0.015)	-1.085***	(0.258)
Year_2004	0.122***	(0.014)	0.121***	(0.016)	0.092***	(0.015)	-0.520	(0.351)
ln(TB)	0.371***	(0.010)	0.409***	(0.009)	0.384***	(0.008)	0.372***	(0.008)
Married	0.252***	(0.021)	0.188***	(0.016)	0.154***	(0.017)	0.181***	(0.024)
Controls for number of children and age	no		yes		yes		yes	
Controls for income sources	no		no		yes		yes	
Time interaction of micro variables	no		no		no		yes	
Constant	-5.893***	(1.272)	-6.975***	(1.258)	-6.751***	(1.245)	-6.760***	(1.225)
Mills λ	0.433		0.368		0.316		0.217	
ρ	0.298		0.258		0.227		0.159	
$\Pr ob > \chi^2$	0.000		0.000		0.000		0.000	
BIC	16690173		16546309		16322992		16220926	

Note. Standard errors in parentheses. Number of observation is 4,459,269; number of censored observations is 933,954; number of uncensored observations is 3,525,315.
Data. FAST 1998-2004.

Appendix

Table A1. Discretionary deductions

Paragraph	Technical term	Content
§9 EStG	Werbungskosten (c65172, c65173); berücksichtigt sind nur solche, die Pauschbetrag übersteigen	Amount of employment-related expenses exceeding the blanket allowance (§9a EStG)
§10 Para. 1 No. 1 EStG	Sonderausgaben: Unterhaltsleistungen (c65401)	Special expenses: alimony payment
§10 Para. 1 No. 8 EStG	Sonderausgaben: Aufwendungen für hauswirtschaftliche Beschäftigungsverhältnisse (c65431)	Special expenses: Expenses for hired labor in the household
§10 EStG	Sonderausgaben: Steuerberatungskosten (c65409)	Special expenses: Expenses for tax advice
§10 EStG No. 7	Sonderausgaben: Ausbildungs- und Weiterbildungskosten (c65410)	Special expenses: Expenses for further education
§10 Para. 1 No. 9 EStG	Sonderausgaben: Schulgeld (c65432)	Special expenses: Tuition fees
§10b EStG	Beiträge und Spenden (c65411)	Contributions and donations
§33a Para. 2 EStG	Außergewöhnliche Belastungen: Ausbildungskosten (c65472)	Extraordinary burden: expenses for training costs
§33a Para 3 EStG	Außergewöhnliche Belastungen: Haushaltshilfe, Haushaltsgehilfin, Heimunterbringung (c65471)	Extraordinary burden: domestic aid, residential care

Note. EStG denotes German Income Tax Code (Einkommensteuergesetz). Own tabulation.

Table A2. Heckman with country dummies

	1998		2001		2004	
Outcome equation						
SH	0.070***	(0.006)	0.146***	(0.008)	0.119***	(0.004)
HH	-0.047***	(0.004)	-0.067***	(0.007)	-0.039***	(0.003)
NI	0.123***	(0.007)	0.180***	(0.004)	0.141***	(0.003)
HB	-0.132***	(0.009)	-0.084***	(0.014)	-0.062***	(0.009)
NW	0.197***	(0.003)	0.161***	(0.003)	0.154***	(0.001)
HE	0.171***	(0.003)	0.183***	(0.003)	0.190***	(0.002)
RP	0.110***	(0.006)	0.127***	(0.007)	0.113***	(0.005)
BY	0.074***	(0.001)	0.139***	(0.001)	0.115***	(0.001)
SL	-0.046***	(0.018)	0.030	(0.019)	-0.008	(0.015)
BE	0.025***	(0.008)	0.087***	(0.010)	0.101***	(0.007)
BB	0.466***	(0.019)	0.578***	(0.019)	0.589***	(0.017)
MV	0.452***	(0.021)	0.489***	(0.022)	0.473***	(0.018)
SN	0.257***	(0.019)	0.312***	(0.019)	0.308***	(0.017)
ST	0.346***	(0.020)	0.458***	(0.022)	0.453***	(0.018)
TH	0.342***	(0.021)	0.433***	(0.023)	0.328***	(0.019)
ln(TB)	0.322***	(0.025)	0.337***	(0.028)	0.322***	(0.024)
Controls for income components	yes		yes		yes	
Controls for age and children	no		no		no	
Constant	2.715***	(0.273)	2.565***	(0.313)	2.527***	(0.267)
Selection equation						
SH	0.077***	(0.004)	-0.006	(0.004)	-0.061***	(0.002)
HH	-0.244***	(0.003)	-0.213***	(0.004)	-0.187***	(0.003)
NI	-0.048***	(0.006)	-0.089***	(0.003)	-0.045***	(0.002)
HB	-0.225***	(0.005)	-0.197***	(0.006)	-0.194***	(0.004)
NW	-0.115***	(0.002)	-0.069***	(0.002)	-0.068***	(0.001)
HE	0.055***	(0.001)	0.047***	(0.001)	0.052***	(0.001)
RP	0.057***	(0.004)	0.034***	(0.004)	0.042***	(0.003)
BY	0.062***	(0.001)	0.012***	(0.001)	0.072***	(0.001)
SL	0.529***	(0.007)	0.418***	(0.007)	0.580***	(0.005)
BE	-0.198***	(0.005)	-0.159***	(0.005)	-0.112***	(0.004)
BB	0.019**	(0.009)	0.058***	(0.009)	0.151***	(0.007)
MV	0.034***	(0.011)	-0.005	(0.011)	0.060***	(0.008)
SN	0.062***	(0.010)	0.026***	(0.010)	0.074***	(0.008)
ST	-0.024**	(0.010)	-0.007	(0.011)	0.058***	(0.008)
TH	0.102***	(0.011)	0.084***	(0.011)	0.089***	(0.009)
ln(TB)	0.374***	(0.013)	0.341***	(0.009)	0.365***	(0.009)
Married	0.189***	(0.018)	0.244***	(0.025)	0.237***	(0.019)
Controls for income components	yes		yes		yes	
Controls for age and children	no		no		no	
Constant	-3.446***	(0.135)	-3.048***	(0.101)	-3.304***	(0.094)
Mills λ	0.410		0.376		0.381	
ρ	0.290		0.266		0.272	
$\Pr ob > \chi^2$	0.000		0.000		0.000	

Note. Standard errors in parentheses. Number of observation is 4,459,269; number of censored observations is 933,954; number of uncensored observations is 3,525,315. State acronyms are introduced in Table 2.
Data. FAST 1998-2004.

Table A3. Heckman regression results without Schleswig-Holstein

	S1		**S2**		**S3**		**S4**	
Outcome equation								
MRL	7.806^{***}	(2.563)	7.712^{***}	(2.530)	7.127^{***}	(2.443)	7.046^{***}	(2.452)
Contributor	6.825^{***}	(2.244)	6.747^{***}	(2.221)	6.309^{***}	(2.161)	6.222^{***}	(2.163)
MRL x Contributor	-7.915^{***}	(2.578)	-7.822^{***}	(2.554)	-7.336^{***}	(2.491)	-7.234^{***}	(2.493)
Citystate	0.077	(0.086)	0.086	(0.084)	0.075	(0.077)	0.053	(0.082)
MRL x Citystate	-0.108	(0.101)	-0.116	(0.098)	-0.098	(0.090)	-0.075	(0.095)
Lumpsum	-0.105^{**}	(0.042)	-0.105^{**}	(0.042)	-0.105^{***}	(0.040)	-0.098^{**}	(0.040)
Year_2001	0.049^{**}	(0.023)	0.049^{**}	(0.022)	0.053^{**}	(0.023)	0.066^{***}	(0.024)
Year_2004	-0.061^{***}	(0.020)	-0.056^{***}	(0.020)	-0.067^{***}	(0.019)	0.178^{***}	(0.014)
ln(TB)	0.347^{***}	(0.032)	0.332^{***}	(0.033)	0.432^{***}	(0.025)	0.436^{***}	(0.025)
Controls for number of children	no		yes		yes		yes	
Controls for age of tax unit members	no		no		yes		yes	
Time interaction of micro variables	no		no		no		yes	
Constant	-4.134^{*}	(2.237)	-3.940^{*}	(2.213)	-4.490^{**}	(2.152)	-4.566^{**}	(2.158)
Selection equation								
MRL	2.766^{**}	(1.401)	2.677^{*}	(1.433)	3.361^{**}	(1.379)	3.352^{**}	(1.381)
Contributor	1.746	(1.204)	1.666	(1.227)	2.224^{*}	(1.182)	2.211^{*}	(1.186)
MRL x Contributor	-1.877	(1.370)	-1.782	(1.396)	-2.424^{*}	(1.347)	-2.408^{*}	(1.351)
Citystate	0.047	(0.038)	0.051	(0.037)	0.066	(0.040)	0.061	(0.041)
MRL x Citystate	-0.083^{*}	(0.045)	-0.087^{*}	(0.045)	-0.104^{**}	(0.048)	-0.098^{**}	(0.049)
Lumpsum	0.017	(0.028)	0.019	(0.028)	0.013	(0.031)	0.015	(0.032)
Year_2001	0.070^{***}	(0.017)	0.069^{***}	(0.017)	0.065^{***}	(0.019)	0.056^{***}	(0.019)
Year_2004	0.139^{***}	(0.013)	0.144^{***}	(0.013)	0.138^{***}	(0.014)	0.233^{***}	(0.021)
ln(TB)	0.372^{***}	(0.011)	0.370^{***}	(0.011)	0.410^{***}	(0.011)	0.411^{***}	(0.011)
Married	0.253^{***}	(0.022)	0.227^{***}	(0.024)	0.188^{***}	(0.017)	0.190^{***}	(0.017)
Controls for number of children	no		yes		yes		yes	
Controls for age of tax unit members	no		no		yes		yes	
Time interaction of micro variables	no		no		no		yes	
Constant	-5.697^{***}	(1.258)	-5.626^{***}	(1.286)	-6.770^{***}	(1.237)	-6.803^{***}	(1.236)
Mills λ	0.431		0.420		0.365		0.366	
ρ	0.297		0.290		0.257		0.258	
$\Pr ob > \chi^2$	0.000		0.000		0.000		0.000	

Note. Standard errors in parentheses. Number of observation is 4,249,720; number of censored observations is 887,965; number of uncensored observations is 3,361,755.
Data. FAST 1998-2004.