

# Fiscal Federalism in Germany: Stabilization and Redistribution Before and After Reunification

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## Abstract

We provide empirical estimates of the risk-sharing and redistributive properties of fiscal equalization among the states of the German federation. Fiscal equalization serves the dual role of insuring regional income against asymmetric revenue shocks (i.e., short-run income differences), and decreasing long-run differences by redistributing tax revenues among states. In our empirical study, we evaluate the performance of the German fiscal system between 1970 and 2006. We find that tax revenue sharing and the fiscal equalization mechanism (*Länderfinanzausgleich*) together lead to a redistribution of 36.9 percent of state income, with a contribution of 5.5 percent by the *Länderfinanzausgleich*, for the period 1970 to 1994. After the full integration of East German states into the mechanism in 1995, redistributive effects slightly drop to about 35 percent. The contribution of the *Länderfinanzausgleich* increases significantly – to 14 percent – for this period. With respect to the insurance effect of the German fiscal system, our results indicate that this effect has dramatically increased after the inclusion of the East German states (from 41.6 percent for 1970 to 1994 to 73.6 percent for 1995 to 2006), however, with the contribution of the *Länderfinanzausgleich* decreasing from 11.8 percent to 2.5 percent.

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# 1 Introduction

Fiscal arrangements for sharing income risk and redistributing income across different regions of a nation state or across the states forming a federation have received considerable interest, especially in the run-up to the formation of the European Monetary Union during the mid-to-late 1990s. The literature has looked at such arrangements from two different angles. Following the tradition of Mundell (1961)'s analysis of optimum currency areas, one branch of the literature considers the importance of fiscal arrangements among regions or states sharing the same currency as mechanisms for regional economic stabilization, i.e., as a substitute for exchange rate flexibility. The basic idea of this approach is nicely summarized in a quote by Jacques Delors, the former president of the European Commission, in the *Delors Report* (see Delors (1989), p.89), the blueprint for the European Economic and Monetary Union:

“... in all federations, the different combinations of federal budgetary mechanisms have powerful “shock-absorber” effects dampening the amplitude either of economic difficulties or of surges in prosperity of individual states. This is both the product of, and the source of the sense of national solidarity which all relevant economic and monetary unions share.”

Following this approach, the *MacDougall Report* (European Commission (1977a,b)) and Sachs and Sala-i-Martin (1992) estimate the extent of regional insurance provided by the US fiscal system. Their results are fairly similar with estimates of 28 and 33-40 percent absorption of the impact effect of asymmetric shocks, respectively. Subsequent studies [von Hagen (1992), Goodhart and Smith (1993), Bayoumi and Masson (1995), Mélitz and Zumer (1998, 2002)] begin to distinguish between the (short-term) stabilization and (long-term) redistribution properties of federal fiscal systems. The empirical results of these studies vary fairly widely. The point estimates for the redistribution effects range from 7 to 47 percent, the point estimates for stabilization range from 7 to 30 percent.

The other branch of the literature considers the role of national or federal fiscal arrangements for consumption risk-sharing among consumers living in different regions of a country or federation (Persson and Tabellini (1996a,b); Bucovetsky (1998)). Here, the motivation is that fiscal arrangements may improve consumption smoothing in the presence of incomplete capital markets. Empirical contributions following this approach include Atkeson and Bayoumi (1993), van Wincoop (1995), Asdrubali et al. (1996), Sorensen and Yosha (1997), Athanasoulis and van Wincoop (2001), Asdrubali and Kim (2005), and Becker and Hoffmann (2006), among others. For example, Persson and Tabellini (1996a,b) analyze the political economy of regional risk-sharing arrangements. They argue that there is a trade-off between redistribution and risk-sharing among the regions of a federation and find that underinsurance is a likely outcome of inter-governmental transfer schemes.

The empirical work in both strands of this literature has concentrated mostly on the United States and Canada and provided only some evidence for other federations or nations. This paper provides new empirical evidence of the risk-sharing and redistributive properties of the

fiscal equalization mechanism in Germany. Germany is a particularly interesting case in this context, because, like Canada and in contrast to the United States, it has an explicit, formula-based mechanism for fiscal equalization, the *Länderfinanzausgleich (LFA)*. Its legal framework is based on the principle stated in the federal constitution guaranteeing similar living standards throughout the federation. Unlike most previous studies, we focus specifically on the LFA, while leaving out other (federal) mechanisms like unemployment insurance or social security payments. Furthermore, our study is – to the best of our knowledge – the first one to explicitly compare the mechanism’s effectiveness for two dramatically different time periods and environments. From 1970-1994, only states in the former West Germany were part of the LFA. Since 1995, all German states are included in the LFA. One of the key differences between the two time periods is the dramatically increased divergence in per capita incomes that came with the inclusion of the significantly poorer East Germany states in 1995. This difference turns out to be crucial for the effectiveness of the LFA. The German case has not received much attention in the empirical literature, most likely because of the intricacies of the formal arrangement and the difficulties to find the appropriate data. To the best of our knowledge, this is the first study providing point estimates for the redistributive properties of the German fiscal system for post-reunification Germany.

In our empirical study, we find that tax revenue sharing and the fiscal equalization mechanism together lead to a redistribution of 36.9 percent of state income, with a contribution of 5.5 percent by the LFA, for the period 1970 to 1994. After the full integration of East German states into the fiscal equalization mechanism, redistributive effects increase to about 42 percent for 1995 to 2006. The contribution of the LFA increases significantly – to 17 percent – for this period. With respect to the insurance effect of the German fiscal system, our results indicate that this effect has dramatically increased after the inclusion of the East German states (from 41.6 percent for 1970 to 1994 to 74.2 percent for 1995 to 2006), however, with the contribution of the LFA decreasing from 11.8 percent to 3.9 percent.

In section 2, we briefly survey the literature. Section 3 provides a detailed description of the fiscal equalization mechanism in Germany. In section 4, we present the empirical methodology and our main empirical results. Section 5 concludes.

## 2 Literature on the German fiscal system

In a world of perfect capital markets, the government has no role in providing private consumers with insurance against income shocks, as every individual could buy the amount of insurance she desires in the market. Insurance against regional shocks can be achieved by cross-ownership of productive assets or through lending and borrowing on credit markets. There might still be fiscal arrangements for redistributing income between individuals living in different regions of a country, but these would target permanent income differentials across regions rather than deal with region-specific income risk. In a world with incomplete capital markets, however, fiscal transfers between regions can improve consumption smoothing.

The literature typically considers regional transfer mechanisms providing direct consumption smoothing by pooling regional income risk across regions. It is achieved by a transfer mechanism that collects payments from citizens in individual regions proportional to their incomes and pays transfers proportional to average per capita income. An alternative transfer mechanism collects and pays transfers between the state governments on the basis of their tax collections. This intergovernmental transfer scheme makes governments collecting higher than average tax revenues pay a part of their receipts to governments collecting less than average tax revenues. The design of a federal system, therefore, entails some compromise among the states. Persson and Tabellini (1996a,b) discuss the political economy of such a compromise. While details are beyond the scope of this paper, two points are particularly noteworthy. First, in the presence of differences in expected per-capita incomes across states, the political equilibrium implies a trade-off between redistribution and consumption smoothing which may lead to under-provision of the latter. Second, a political equilibrium may emerge, in which high-risk regions pay a permanent transfer to low-risk regions in return for obtaining a higher degree of insurance than the low-risk regions would choose for themselves. Thus, a federal arrangement for consumption smoothing may lead to permanent, unconditional transfers even when the expected per capita incomes are the same in all states.

While the fiscal system in the United States has been studied extensively, there are only a few studies that consider interregional risk-sharing and redistribution for Germany. The first such study was conducted by Pisani-Ferry et al. (1993). They calibrate a two-sector simulation model for the United States, Germany, and France. For Germany, they find that the stabilization achieved by the German fiscal system is between 34 and 42 percent – depending on whether a rich or poor state is hit by an asymmetric shock. Büttner (1999, 2002) focuses also on the stabilization properties of the German fiscal system for West German states from 1970 to 1997. In addition to fiscal transfers mandated by the fiscal equalization system, the study considers income smoothing through federal taxes, as well as through contributions and transfers from the mandatory pension system, and the unemployment insurance. Using the methodology suggested by Asdrubali et al. (1996), Büttner finds that in the German fiscal system only around 15 percent of a shock to state income is smoothed by public transfers. The *Länderfinanzausgleich* contributes roughly 6.8 percent of this income smoothing.<sup>1</sup> Kellermann (2001) looks at German data from the same time period, 1970 to 1997. However, she distinguishes between pre- and post-unification data. The sample from 1970 to 1990 (“pre-unification”) includes only the 10 states of the former West Germany; the sample from 1992 to 1997 (“post-unification”) includes all 16 states of the unified Germany. When using the same methodology as Büttner; Büttner (Asdrubali et al. (1996)) as well as Bayoumi and Masson (1995)’s methodology for the pre-unification data, her results differ significantly from Büttner:

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<sup>1</sup>Of the remainder, about 5 percent of income smoothing comes from the federal unemployment insurance, and around 4.3 percent from the federal mandatory pension system. In a paper that focuses on the risk sharing properties of Germany’s federal unemployment insurance with respect to regional labor income, Kurz (2000)’s empirical investigation leads to a very similar result. In her study, about 8 percent of a shock to regional labor income is smoothed by the federal unemployment insurance. Additionally, she finds that unemployment insurance has only a small effect on long-term redistribution of regional labor incomes.

In both cases, public transfers smooth over 40 percent of shocks to state income. Additionally, private capital markets smooth out about 30 percent of state GDP volatility. In the post-reunification data, the role of private capital markets in income smoothing is drastically reduced (to 7 and 1 percent, respectively). The results for the income smoothing effect of public transfers depend heavily on the estimation method used: They are 38 and 16 percent, respectively. It is not entirely clear to us where these dramatic differences in results between the two papers are coming from, since the data and definitions used seem to be almost identical. In a more recent study, Jüßen (2006) investigates both risk sharing and redistribution in post-reunification Germany. To study risk-sharing, the author uses a modified version of Asdrubali et al. (1996)’s methodology. His data set is very disaggregated and comprised of 271 labor market regions. Looking at data for the years 1995 to 2002, the study has two main empirical findings. First, estimation of risk-sharing properties by using ordinary least squares (OLS) as well as a non-parametric density estimation suggest that private capital markets provide almost full insurance against region-specific income shocks, with the German fiscal system providing no additional insurance. The study’s OLS results even seem to suggest that the fiscal system has a destabilizing effect on regional incomes. Second, estimating the redistributive properties of the German fiscal system using a distribution dynamics approach, the fiscal system turns out to be very effective in decreasing long-term differences in regional incomes leading to convergence of regional incomes towards the national average.

### 3 The Fiscal Equalization Mechanism in Germany

Deriving from principles laid out in the German constitution, the main goal of the fiscal system according to the German constitution is to “*create and secure uniform living standards throughout Germany*”.<sup>2</sup> An important element of the German fiscal system – and the focus of our study – is the *Länderfinanzausgleich*, which is an arrangement for redistributing tax revenues among the federal, state, and local governments of Germany. The original constitution of West Germany in 1949 assigned all taxes of unambiguous local incidence to the states, among them personal and corporate income taxes and business taxes, and all other taxes to the federal government. Apart from some minor taxes, this left the federal government with sales tax revenues, which were later replaced by a value-added tax (VAT). In order to secure the federal government with a sufficient revenue base, it initially received a third of personal and corporate income tax revenue (with its share eventually climbing to 35 percent by 1969). The fiscal constitution act (*Finanzverfassungsgesetz*) of 23 December 1955 instituted a “horizontal” tax revenue sharing arrangement among the states covering revenues from all state taxes plus half of the local taxes collected by municipalities. From 1956 onwards, it guaranteed every state a minimum of 88.75 percent of the federal average per capita revenue from this tax base. By 1959, this minimum had been increased to 91 percent. In 1967, the federal government started paying supplementary transfers (*Bundesergänzungszuweisungen*) to states

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<sup>2</sup>See Artikel 72, Paragraph 2, Absatz 3, and Artikel 106, Paragraph 3, Absatz 2, of the German *Grundgesetz* (constitution).

with low tax capacities.

The *Länderfinanzausgleich* was reformed in 1969, assigning half of the revenue from corporate income tax, 42.5 percent of the revenue from personal income tax, and 70 percent of the revenue from VAT to the federal government. The horizontal tax revenue sharing arrangement guaranteed each state now a minimum of 95 percent of federal average per capita revenues from all taxes included in the arrangement, i.e., all state taxes and half of the revenue from local taxes. Over the next two decades, the federal share of personal and corporate income tax remained virtually unchanged, but the federal share of VAT was adjusted numerous times, fluctuating between 70 and 65 percent between 1970 and 1990. After the reunification in 1990, the VAT share was reduced to 63 percent by 1994. From 1991 to 2004, the federal government, the West German state governments including West Berlin, and the West German local governments also contributed to the unification fund (“Fonds Deutsche Einheit”) to finance infrastructure projects in East Germany. In 1995, the German fiscal system was reformed again to integrate the states of former East Germany fully into the LFA. This entailed a significant change in the distribution formula of VAT. The federal share of VAT revenue dropped from 63 percent (1994) to 56 percent (1995), and then 50.5 percent (1996,1997), with the respective remainder going to the state governments. From 1998 onwards, local governments also received a share of around two percent of VAT revenue, by cutting the state government share. In more recent years, the federal share stabilized at around 53 percent and the state government share at around 45 percent.

In this paragraph, we are describing how the German *Länderfinanzausgleich* worked in the 1970s and 1980s.<sup>3</sup> In essence, the German *Länderfinanzausgleich* is a three stage process. At the first stage, the states’ share of total national VAT revenue is redistributed among all states in the following manner: 75% of it is distributed among the states on an equal per-capita basis, which already implies redistribution since per-capita incidence of VAT revenue differs significantly from state to state. The remaining 25 percent are used to make payments to states with per capita revenues from all state taxes of less than 92% of the federal average. If the amount available for redistribution is not high enough, transfers are cut accordingly. If the amount available is more than what is needed, the remainder is distributed among the financially strong states on a per-capita basis. At the second stage, tax capacities and resource needs are calculated for all states. Tax capacity is determined by the sum of state tax revenues<sup>4</sup> and 50 percent of the local taxes collected on a state’s territory. Resource needs are calculated as the average per capita tax revenues in Germany multiplied by the population of the respective state.<sup>5</sup> The difference between tax capacity and resource needs determines whether a state pays or receives additional transfers under the *Länderfinanzausgleich* (“horizontal” transfer payments between states). Financially weak states receive payments which

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<sup>3</sup>Despite some reforms over the years, the principle mechanism of the German fiscal system remains unchanged.

<sup>4</sup>This sum now includes the VAT revenue assigned to a state in the first stage.

<sup>5</sup>At this stage, the special financial needs of the city states Hamburg and Bremen (and later Berlin) are recognized by attributing them with larger than actual populations.

lift them to at least 92 percent of federal average per capita tax revenues. If a state’s revenues are between 92 and 100 percent of the federal per capita average, it receives transfers that amount to 37.5 percent of that difference. If a state’s tax revenues are above 102 percent of the national average, it pays a contribution to LFA. For per capita revenues between 102 and 110 percent of the federal average, the contribution is equal to 70 percent of the difference, for per capita revenues above 110 percent of the federal average, the contribution is 100 percent of the difference between the state’s revenues and the federal average. As a result, the differences in per capita tax revenues among the states after redistribution are reduced and range between 95 percent and 104.4 percent of the federal average. At the third stage, payments from the federal government to the states are made to further reduce the differences in per capita tax revenues. These supplementary transfers are general-purpose grants which are computed on the basis of special financial needs and the per capita VAT revenue of the financially weak states.<sup>6</sup>

## 4 Empirical Methodology and Results

### 4.1 Methodology

We use the framework of Méltitz and Zumer (2002) to estimate the stabilization and redistribution properties of the German *Länderfinanzausgleich*. Their proposed framework takes the following form:

$$Y_{it} = \alpha_d + \beta_d \bar{X}_i + \beta_s (X_{it} - \bar{X}_i) + \epsilon_{it} \quad (i = 1, 2, \dots, M; t = 1, 2, \dots, T) \quad (1)$$

where  $X_{it}$  stands for the ratio of per capita state income in state  $i$  at time  $t$  to the national average of per capita state income at time  $t$ .  $\bar{X}_i$  is the sample period average for state  $i$  of  $X_{it}$ .  $Y_{it}$  is defined as the ratio of per capita *disposable* state income in state  $i$  at time  $t$  to its national average.

The model in equation (1) postulates two influences on (relative) disposable state income  $Y_{it}$ . First, the coefficient  $\beta_d$  describes the effect of a change in the (relative) long-run average state income on the (relative) long-run average disposable state income. Hence, a coefficient of  $\beta_d$  equal to one implies “no redistribution” and  $\beta_d$  equal to zero implies “full redistribution”. Second, the coefficient  $\beta_s$  describes the insurance aspect of the federal fiscal system, since it relates deviations of (relative) state income at time  $t$  from the (relative) long-run average state income to deviations of (relative) disposable state income from its (relative) long-run average. Méltitz and Zumer (2002)’s decomposition of equation (1) into two parts illustrates this point

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<sup>6</sup>When the LFA was reformed again in 1995 to integrate the new East German states, the fiscal equalization mechanism was modified as follows: For per capita revenues between 100 and 101 percent of the federal average the contribution is now 15 percent of the difference, for per capita revenues between 101 and 110 percent of the federal average, it is 66 percent of the difference, for per capita revenues above 110 per cent of the federal average, it is 80 percent of the difference. Contributing states must be left with at least 95 percent of the average per capita revenues after redistribution. Together with the supplementary payments, all states have at least 99.5 percent of the average per capita revenues.

nicely:

$$\bar{Y}_i = \alpha_d + \beta_d \bar{X}_i + \eta_i \quad (2)$$

$$Y_{it} - \bar{Y}_i = \beta_s (X_{it} - \bar{X}_i) + \mu_{it} \quad (3)$$

where  $\eta_i$  and  $\mu_{it}$  are new disturbance terms, and  $\bar{Y}_i$  is the sample period average for state  $i$  of  $Y_{it}$ . We use panel data analysis and estimate equations (7) and (8) using four different definitions of disposable state income variable  $Y$ , which are described in more detail below. In the German fiscal system, the revenues from personal income tax, corporate income tax, and value-added tax (VAT) are shared among the federal government and the states. These taxes are called *Gemeinschaftsteuern*. In its broadest definition, we measure disposable state income as state income after subtracting federal taxes and the federal share of the *Gemeinschaftsteuern* and the local business tax. We then further narrow the definition of what constitutes disposable state income by successively subtracting contributions to or from the three stages of the *Länderfinanzausgleich* (as described in section 3).

## 4.2 Data

In this section, we provide a more detailed description of the variables used in the panel data analysis to estimate the amount of risk sharing and redistribution of tax revenues provided by the German *Länderfinanzausgleich*. We construct two different data sets: The first consists of annual data of the 10 West German states (excluding West-Berlin) from 1970 to 1994. We choose the year 1994 – rather than the year of the German reunification, 1990 – as the cut-off year, because the five East German states were only included in the *Länderfinanzausgleich* starting in 1995; the second data set contains annual data of all 16 German states covering the period from 1995 to 2006. Both panel data sets are balanced.

We follow the previous literature and construct the variable *state income* by adding net national income at factor prices and all tax revenues with incidence in the state. These tax revenues include all federal (*Bundessteuern*), state (*Landessteuern*), and local taxes (*Gemeindesteuern*), plus taxes shared between all three levels of government (*Gemeinschaftsteuern*). Since the fiscal equalization mechanism proceeds in several steps, we construct different versions of the variable called *disposable state income (DSI)*.  $DSI_0$  includes state income as defined above minus all federal taxes, minus the federal share of the shared taxes, minus the federal share of the local business tax (*Gewerbsteuerumlage*). Hence, this variable is the sum of net national income at factor prices plus all state and local taxes that remain with either the state or the state’s local governments. The law on the German *Länderfinanzausgleich* governs the next two steps in the redistribution of tax revenue. First, VAT is redistributed:  $DSI_1$  adds the VAT transfer (+) or payment (–) of a state to  $DSI_0$ . The VAT transfer/payment is the difference between the combined state and local share of VAT by tax incidence and the VAT revenue assigned to a state by the *Länderfinanzausgleich* described in section 3. Second, states make transfer payments amongst each other:  $DSI_2$  includes  $DSI_1$  plus any state-to-



state (“horizontal”) transfers/payments based on resource needs and tax capacity.<sup>7</sup> Finally,  $DSI_3$  includes any additional federal grants paid to a state (*Bundesergänzungszuweisungen*).

For the period 1970-1994, we used national accounting data provided to us by the (Statistisches Landesamt Baden-Württemberg (1998)). Data on tax revenues before and after redistribution come from publications of the German federal statistical office (Statistisches Bundesamt (1977, 1989, 2000)). Very detailed tax data on the local, state, and federal level for the years 1991 to 1994 was provided by the Statistical Office of Baden-Württemberg. Data on VAT redistribution and state-to-state transfers is provided in the annual publications of the Bundesrat (Bundesrat). All nominal variables for this sample period are deflated with the West German GDP deflator with base year 1991.

For the period 1995-2006, we used national accounting data provided online by the German federal and state statistical offices (Statistisches Landesamt Baden-Württemberg (2008)) which was computed using a standardized European Union methodology (ESVG1995). Very detailed tax data on the local, state, and federal level for the years 1995 to 2002 was provided by the Statistical Office of Baden-Württemberg, data for the years 2003 to 2006 was available online from the German Federal Statistical Office (Statistisches Bundesamt). Data on VAT redistribution and state-to-state transfers is published annually by the German Bundesrat (Bundesrat). Given the detailed data, we were able to construct GDP deflators for the individual states (with base year 1995) for the data from the year 1995 to 2006. Hence, the nominal variables for this time period were deflated by these state-specific GDP deflators. With population data from the national accounts, we then converted all variables into real per capita terms.

### 4.3 Descriptive Statistics

Table 1 reports some basic statistics for the sample period 1970 to 1994. All data are expressed in constant 1991 Deutsche Mark.<sup>8</sup> This table contains only data for the West German states. In 1970, real GDP per capita among the 10 West German states ranged from 82 to 171 percent of the average real GDP per capita, with the standard deviation amounting to around 16 percent of average real GDP per capita. Over the next two and a half decades, this range somewhat narrowed with per capita real incomes between 83 and 167 percent of the average. The standard deviation from the average remained virtually unchanged with 15 percent of average per capita real GDP. It is noteworthy that per capita VAT transfer and state-to-state transfer receipts do not seem to have changed significantly as a percentage of

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<sup>7</sup>Again, see section 3 for a more detailed description of this mechanism.

<sup>8</sup>Since the euro was only introduced in 1999 as an accounting unit, we left the values for the early sample period in Deutsche Mark. To make comparison across the two sample periods possible, all values would need to be converted into euros by using the official exchange rate of €1 per *DM* 1.95583. Data from the national accounts for the two time periods is not comparable, however, because different accounting methods were used.

average GDP over time. State-to-state transfer payments have even fallen in both absolute value and as a percentage of GDP. However, federal transfers have noticeably gone up (in both absolute value and as a percentage of GDP), particularly in 1994.<sup>9</sup>

*[Table 1 here]*

In table 2, we report these same basic statistics for the data set from 1995 to 2006, when all 16 states of the re-unified Germany were included in the *Länderfinanzausgleich*. Looking at per capita real GDP, the gap between the poorest and richest states appears to be narrowing over time. Not unexpectedly, transfer payments – especially from VAT revenue – have increased significantly compared to the earlier time period. Hence, the inclusion of the much poorer states of East Germany led to the expected response of the fiscal equalization mechanism.

*[Table 2 here]*

In the analysis below, we focus on two questions: How much insurance against asymmetric shocks and how much redistribution does the German fiscal system provide? While there are no payments directly to individuals in response to income shocks, transfers under the *Länderfinanzausgleich* might still respond to asymmetric shocks (by insuring state income) and, thus, provide insurance against such shocks to the entire state.

#### 4.4 Redistribution

We estimate the redistributive properties of the German fiscal system with cross-section equation (7), where  $(1 - \beta_d)$  corresponds to the degree of redistribution that the system provides. The results are presented in table 5. We find that for the time period 1970 to 1994 the degree of redistribution of the fiscal system ranges from about 31.2% to 36.9%, depending on which elements of the system are included. This result is lower than von Hagen (1992)'s result for the US fiscal system of 47 %, but in the same range as Mélitz and Zumer (2002)'s and Bayoumi and Masson (1995)'s results for France and Canada, respectively. The contribution of the *Länderfinanzausgleich* itself is around 5.7%, with the most important component of it being the redistribution of VAT revenue with a contribution of 4.3% followed by the horizontal transfer payments between states with about 1.1%. Federal grants (*Bundesergänzungszuweisungen*) play no significant role here.<sup>10</sup>

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<sup>9</sup>Also, during this time period, Hessen and Bavaria were the only states that changed their positions from large net recipients to large net contributors to the system. The position of the remaining states did not change importantly.

<sup>10</sup>These results are robust to using shorter sample periods. Results are available upon request.

*[Table 5 here]*

Since the *Länderfinanzausgleich* was extended to include the new East German states in 1995 (five years after the German reunification), we estimate the time period 1995 to 2006 in a separate regression. To the best of our knowledge, the only study looking at this time period is Jüßen (2006), but his focus are regional labor markets instead of states; and he does not provide any point estimates for the redistributive properties of the German fiscal system. In our study, we find that the degree of redistribution ranges from 21% to 35%, implying increased redistributive effectiveness overall, and a significantly increased contribution of the *Länderfinanzausgleich* itself with about 14%. Given the greater income disparities amongst German states when the new states of the former East Germany are included, this result confirms the redistributive efficacy of the fiscal system and of the *Länderfinanzausgleich* in particular. As before, of the components of the *Länderfinanzausgleich*, the contribution of VAT redistribution is largest (about 9.7%), this time followed by federal grants (about 2.7%). Horizontal transfer payments contribute only about 1.6%. However, one issue to be kept in mind here is that between 1991 and 2004, the West German states were also making indirect transfer payments to East Germany by contributing to the *Fonds Deutsche Einheit* (German Reunification Fund). The *Fonds Deutsche Einheit* by definition served a redistributive function, but we are not aware of the existence of state-specific data for the recipient states to be able to estimate the effects of these transfer payments.

To summarize, the German fiscal system is quite effective in achieving its main goal of creating comparable living standards throughout Germany. And, as we would expect, the system seems to be more effective the less equal the income distribution among states is, exemplified by the difference in results for pre- and post-reunification data.

## 4.5 Stabilization

Now we turn to estimating equation (8) where  $(1 - \beta_s)$  corresponds to the degree of stabilization that the German fiscal system provides. Our results are presented in table 6. We show that in the period 1970 to 1994, the degree of stabilization ranges between 29.8% and 41.6%. This result is in line with Kellermann (2001) who also found a degree of stabilization of around 40%. The contribution of the *Länderfinanzausgleich* itself is of around 11.8%, which is about twice as high as the estimate of Büttner (2002). The difference is likely a result of the fact that we use actual transfer amounts of VAT, rather than approximations as Büttner does. In our study, the redistribution of VAT revenue contributes about 3.3% of stabilization; the horizontal transfer payments between states, however, contribute about 6.8%, the largest part. Federal grants to states play the smallest role with about 2.9%.

*[Table 6 here]*

For the post-reunification period 1995 to 2006, the insurance properties of the fiscal system dramatically increase to a range of 71.1% to 73.6%. This result is in stark contrast to Jüßen (2006), who finds an insignificant or even destabilizing role of the German fiscal system. The strong insurance effect of the fiscal system in our study is mainly due to the “automatic stabilizer” effect of taxation of the tax revenue sharing between the different levels of government. The contribution of the *Länderfinanzausgleich* is fairly small, declining to about 2.5%: Of that, VAT distribution contributes about 0.4%, horizontal transfer payments about 0.5%, and federal grants about 1.6%. But this is expected since the primary and explicitly stated purpose of the *Länderfinanzausgleich* is long-term redistribution rather than short-term stabilization.

## 5 Conclusion

The theoretical literature shows that, apart from pure income redistribution, fiscal equalization can be motivated by considerations of regional risk sharing among consumers living in different states. Regional risk sharing may aim at insuring consumer incomes against asymmetric, region-specific shocks. Alternatively, regional risk-sharing may aim at insuring state budgets against asymmetric tax revenue shocks, enabling states to smooth the provision of local public goods over time. Our empirical analysis explores the insurance and redistributive properties of the fiscal equalization mechanism in Germany, using data from 1970 to 2006, and hence covering pre- and post-reunification Germany. Fiscal equalization in Germany is a formula-based mechanism redistributing tax revenues between the states, augmented by vertical payments from the federal government to individual states. It is an outflow of the constitutional mandate to secure equal living conditions for all citizens in the country. To the best of our knowledge, our study is the first one analyzing both stabilization and redistributive properties of the fiscal system of pre-unification Germany. It is also the first study directly comparing the effectiveness of the German fiscal system pre- and post-reunification. Comparing the period 1970-1994 to 1995-2006, we find that the fiscal system is effective in redistributing regional state income, and that this effectiveness has slightly increased in the post-reunification period. The fiscal equalization mechanism specifically designed for this purpose – the *Länderfinanzausgleich* – contributed about 5 and 17 percent, respectively, to the long-term smoothing of income differences between states. It therefore played and continues to play an important role in securing comparable living standards across Germany. The fiscal system’s secondary purpose as an insurance mechanism for disposable state income is also quite pronounced. The main component of the insurance mechanism is played by the tax-revenue sharing scheme between the different levels of government which acts as an “automatic stabilizer” for disposable state income. The overall fiscal system smoothes about 42 percent of short-term income differences before unification. After unification, this effect climbs to around 72%. Compared to studies of other developed countries, this estimate of the insurance effect is very high. However, given the volatility in the economic development of East Germany during this period, this result may not be too surprising.

## References

- Asdrubali, Pierfederico and Soyoung Kim**, “Dynamic Risk Sharing in the United States and Europe,” *Journal of Monetary Economics* 51, 2005, pp. 809–836.
- , **Bent E. Sorensen, and Oved Yosha**, “Channels of Interstate Risk Sharing: United States 1963-1990,” *Quarterly Journal of Economics*, 1996, 111 (4), 1081–1110.
- Athanasoulis, Stefano G. and Eric van Wincoop**, “Risk Sharing Within The United States: What Do Financial Markets and Fiscal Federalism Accomplish?,” *The Review of Economics and Statistics*, November 2001, 83 (4), 688–698.
- Atkeson, Andrew and Tamim Bayoumi**, “Do Private Capital Markets Insure Regional Risk? Evidence from the United States and Europe,” *Open Economies Review* 4, 1993, pp. 303–324.
- Bayoumi, Tamim and Paul R. Masson**, “Fiscal Flows in the United States and Canada: Lessons for Monetary Union in Europe,” *European Economic Review* 39, 1995, pp. 253–274.
- Becker, Sascha and Mathias Hoffmann**, “Intra- and International Risk-Sharing in the Short and Long Run,” *European Economic Review* 50, 2006, pp. 777–806.
- Bucovetsky, Sam**, “Federalism, Equalization, and Risk Aversion,” *Journal of Public Economics*, March 1998, 67 (3), 301–328.
- Bundesrat**, *Zweite Verordnung zur Durchführung des Finanzausgleichsgesetzes im Ausgleichsjahr .....*, Drucksache, various years.
- Büttner, Thiess**, “Regional Stabilization by Fiscal Equalization? Theoretical Considerations and Empirical Evidence from Germany,” 1999. ZEW Mannheim, mimeo.
- , “Fiscal Federalism and Interstate Risk Sharing: Empirical Evidence from Germany,” *Economics Letters* 74, 2002, pp. 195–202.
- Delors, Jacques**, “Regional Implications of Economic and Monetary Integration,” in Committee for the Study of Economic and Monetary Union, eds., *Report on Economic and Monetary Union in the European Community*, Luxembourg: Office for Official Publications of the EU, 1989.
- European Commission**, “Report of the Study Group on the Role of Public Finance in European Integration, Vol.1,” Studies: Economic and Financial Series A13, Brussels 1977.
- , “Report of the Study Group on the Role of Public Finance in European Integration, Vol.2,” Studies: Economic and Financial Series B13, Brussels 1977.
- Goodhart, Charles E.A. and Stephen Smith**, “Stabilisation,” in “The Economics of Community Public Finance” European Economy Reports and Studies 5, European Commission, 1993, pp. 417–455.

- Jüßen, Falko**, “Interregional Risk Sharing And Fiscal Redistribution in Unified Germany,” *Papers in Regional Science*, June 2006, 85 (2), 235–255.
- Kellermann, Kerstin**, “Stabilization Properties of Interregional Fiscal Flows: Evidence for Germany, 1970-1997,” 2001. University of Fribourg, Center of Public Finance, mimeo.
- Kurz, Claudia**, “Regional Risk Sharing and Redistribution by the Unemployment Insurance System: The Case of Germany,” 2000. Europa-Universität Viadrina, mimeo.
- Méltiz, Jacques and Frédéric Zumer**, “Regional Redistribution and Stabilization by the Centre in Canada, France, the United Kingdom and the United States: New Estimates based on Panel Data Econometrics,” *CEPR Discussion Paper 1829*, 1998.
- **and** –, “Regional Redistribution and Stabilization by the Center in Canada, France, the UK and the US: A Reassessment and New Tests,” *Journal of Public Economics*, November 2002, 86 (2), 263–286.
- Mundell, Robert**, “A Theory of Optimum Currency Areas,” *American Economic Review*, September 1961, 51 (4), 657–665.
- Persson, Torsten and Guido Tabellini**, “Risk Sharing and Moral Hazard,” *Econometrica*, May 1996, 64 (3), 623–646.
- **and** –, “Risk Sharing and Redistribution,” *Journal of Political Economy*, October 1996, 104 (5), 979–1009.
- Pisani-Ferry, Jean, Alexander Italianer, and Roland Lescure**, “Stabilization Properties of Budgetary Systems: A Simulation Analysis,” in “The Economics of Community Public Finance” European Economy Reports and Studies 5, European Commission, 1993, pp. 511–538.
- Sachs, Jeffrey and Xavier Sala-i-Martin**, “Fiscal Federalism and Optimum Currency Areas: Evidence for Europe from the United States,” in Vittorio Grilli Matthew Canzoneri and Paul Masson, eds., *Establishing a Central Bank: Issues in Europe and Lessons from the US*, London, UK: Cambridge University Press, 1992, pp. 195–219.
- Sorensen, Bent E. and Oved Yosha**, “Federal Insurance of US States: An Empirical Investigation,” in Assaf Razin and Efraim Sadka, eds., *Globalization: Public Economics Policy Perspectives*, Cambridge: Cambridge University Press, 1997.
- Statistisches Bundesamt**, *Fachserie 14, Finanzen und Steuern, Reihe 4.S.1, Kassenmässige Steuereinnahmen, 1967 bis 1976*, W. Kohlhammer Verlag Stuttgart und Mainz, 1977.
- , *Fachserie 14, Finanzen und Steuern, Reihe 4.S.1, Kassenmässige Steuereinnahmen, 1977 bis 1987*, Metzler-Poeschel Verlag Stuttgart, 1989.
- , *Fachserie 14, Finanzen und Steuern, Reihe 4.S.1, Kassenmässige Steuereinnahmen, 1988 bis 1999*, Metzler-Poeschel Verlag Stuttgart, 2000.

– , *Fachserie 14, Finanzen und Steuern, Reihe 4, Steuerhaushalt*, Metzler-Poeschel Verlag Stuttgart, various years.

**Statistisches Landesamt Baden-Württemberg**, *Arbeitskreis Volkswirtschaftliche Gesamtrechnungen der Länder*, Berechnungsstand 1998, electronic copy, 1998.

– , *Arbeitskreis Volkswirtschaftliche Gesamtrechnungen der Länder*, Berechnungsstand 1998, available online at [http://www.vgrdl.de/Arbeitskreis\\_VGR/home.asp](http://www.vgrdl.de/Arbeitskreis_VGR/home.asp), 2008.

**van Wincoop, Eric**, “Regional Risksharing,” *European Economic Review* 39, 1995, pp. 1545–1568.

**von Hagen, Jürgen**, “Fiscal Arrangements in a Monetary Union - Some Evidence From the US,” in Don Fair and Christian de Boissieux, eds., *Fiscal Policy, Taxes, and the Financial System in an Increasingly Integrated Europe*, Deventer: Kluwer Academic Publishers, 1992, pp. 337–359.

# A Tables

Table 1: Basic Statistics 1970-1994

Year	Variable	Average	Std. Dev.	Maximum	Minimum
1970	<b>Gross Domestic Product</b>	12,942.27	2,043.55	10,673.85	22,174.13
	<b>Net national income</b>	10,177.25	1,550.24	8,228.12	16,983.01
	<b>Total tax revenue</b>	2,930.01	1,496.27	1,996.68	10,734.71
	<b>VAT transfer</b>	-3.71	117.44	-502.43	184.34
	<b>State-to-state transfers</b>	0.00	63.28	-204.22	152.91
	<b>Federal grants</b>	1.98	2.75	0.00	7.57
1980	<b>Gross Domestic Product</b>	16,711.16	2,417.64	14,222.43	28,444.22
	<b>Net national income</b>	12,891.84	1,799.05	10,892.14	20,902.04
	<b>Total tax revenue</b>	4,166.18	1,824.97	2,745.61	14,200.00
	<b>VAT transfer</b>	-6.46	152.47	-784.65	143.11
	<b>State-to-state transfers</b>	0.00	69.95	-136.42	186.09
	<b>Federal grants</b>	16.01	21.32	0.00	55.93
1990	<b>Gross Domestic Product</b>	20,300.27	3,082.82	16,875.95	33,441.32
	<b>Net national income</b>	15,694.01	2,460.70	13,054.69	25,468.07
	<b>Total tax revenue</b>	4,530.46	1,770.59	2,802.12	13,532.56
	<b>VAT transfer</b>	-8.72	203.01	-599.34	278.52
	<b>State-to-state transfers</b>	0.00	105.78	-135.13	497.33
	<b>Federal grants</b>	26.01	47.41	0.00	199.36
1994	<b>Gross Domestic Product</b>	20,836.16	3,207.54	17,230.39	34,866.71
	<b>Net national income</b>	15,630.91	2,579.84	12,567.42	25,823.43
	<b>Total tax revenue</b>	5,114.96	2,056.89	3,411.83	16,688.09
	<b>VAT transfer</b>	-114.94	217.31	-1,023.35	119.33
	<b>State-to-state transfers</b>	0.00	71.51	-142.63	389.47
	<b>Federal grants</b>	53.12	183.66	0.00	1,435.81

*Notes:* All values in the table are per capita values in *constant 1991 Euros*. Average values are calculated as averages weighted by respective state population. *Total tax revenue* refers to the sum of federal, state, and local taxes with tax incidence within a state's border.



Table 2: Basic Statistics 1995-2006, all states.

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Year	Variable	Average	Std. Dev.	Maximum	Minimum
1995	Gross Domestic Product	19,875.77	4,660.57	10,641.35	34,143.84
	Net national income	15,017.86	3,056.21	8,309.51	19,470.82
	Total tax revenue	4,472.52	2,364.84	1,143.32	17,100.91
	VAT transfer	-19.30	382.58	-1,282.29	713.62
	State-to-state transfers	-5.19	157.65	-163.71	539.72
	Federal grants	127.76	222.21	0.00	1,425.11
2000	Gross Domestic Product	21,817.94	5,184.91	12,169.30	37,107.45
	Net national income	16,123.25	3,344.14	8,742.88	20,723.28
	Total tax revenue	5,317.35	2,663.47	1,420.24	18,812.02
	VAT transfer	-55.63	536.61	-1,768.98	880.90
	State-to-state transfers	-7.61	228.42	-402.51	710.22
	Federal grants	130.48	209.40	0.00	1,325.25
2006	Gross Domestic Product	23,049.85	5,349.63	13,492.00	38,580.95
	Net national income	17,399.75	3,726.13	9,344.21	23,409.90
	Total tax revenue	5,207.29	2,353.90	1,539.61	16,965.18
	VAT transfer	-48.29	531.84	-2,156.43	845.41
	State-to-state transfers	-6.87	200.62	-326.69	629.58
	Federal grants	130.07	240.65	0.00	670.25

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*Notes:* All values in the table are per capita values in *constant 1991 Euros*. Average values are calculated as averages weighted by respective state population. *Total tax revenue* refers to the sum of federal, state, and local taxes with tax incidence within a state's border.

Table 3: Basic Statistics 1995-2006, East German states.

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Year	Variable	Average	Std. Dev.	Maximum	Minimum
1995	Gross Domestic Product	12,981.48	3,488.74	10,641.35	19,981.02
	Net national income	9,817.01	2,274.15	8,309.51	14,364.39
	Total tax revenue	1,932.97	1,172.06	1,143.32	4,276.98
	VAT transfer	537.42	250.62	42.51	713.62
	State-to-state transfers	228.91	153.93	132.48	539.72
	Federal grants	416.20	31.66	386.92	476.09
2000	Gross Domestic Product	14,077.73	2,832.77	12,169.30	19,794.40
	Net national income	10,242.88	1,745.62	8,742.88	13,714.20
	Total tax revenue	2,158.82	1,029.44	1,420.24	4,210.58
	VAT transfer	671.08	308.51	54.47	880.90
	State-to-state transfers	300.30	202.43	183.40	710.22
	Federal grants	427.31	35.23	391.08	493.00
2006	Gross Domestic Product	15,086.77	1,918.69	13,492.00	18,725.85
	Net national income	10,707.28	1,184.77	9,344.21	12,929.70
	Total tax revenue	2,318.59	1,103.85	1,539.61	4,483.08
	VAT transfer	600.81	239.02	150.14	845.41
	State-to-state transfers	271.06	181.68	164.24	629.58
	Federal grants	603.08	42.13	532.87	670.25

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*Notes:* All values in the table are per capita values in *constant 1991 Euros*. Average values are calculated as averages weighted by respective state population. *Total tax revenue* refers to the sum of federal, state, and local taxes with tax incidence within a state's border. The sample consists of the 5 East German states and Berlin.

Table 4: Basic Statistics 1995-2006, West German states.

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Year	Variable	Average	Std. Dev.	Maximum	Minimum
1995	Gross Domestic Product	21,780.13	2,757.33	18,551.15	34,143.84
	Net national income	16,454.46	978.03	13,550.45	19,470.82
	Total tax revenue	5,174.01	2,117.60	3,428.44	17,100.91
	VAT transfer	-173.08	245.34	-1,282.29	100.00
	State-to-state transfers	-69.85	76.50	-163.71	377.35
	Federal grants	48.09	182.80	0.00	1,425.11
2000	Gross Domestic Product	23,879.13	3,420.92	19,765.83	37,107.45
	Net national income	17,689.17	1,299.82	15,535.37	20,723.28
	Total tax revenue	6,158.45	2,310.17	3,687.79	18,812.02
	VAT transfer	-249.15	401.50	-1,768.98	253.08
	State-to-state transfers	-89.61	152.26	-402.51	594.66
	Federal grants	51.43	159.63	0.00	1,325.25
2006	Gross Domestic Product	25,073.98	3,839.53	20,410.03	38,580.95
	Net national income	19,100.90	1,666.63	16,608.11	23,409.90
	Total tax revenue	5,941.56	1,994.81	3,904.01	16,965.18
	VAT transfer	-213.28	453.78	-2,156.43	311.97
	State-to-state transfers	-77.52	132.14	-326.69	513.78
	Federal grants	9.83	29.17	0.00	242.81

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*Notes:* All values in the table are per capita values in *constant 1991 Euros*. Average values are calculated as averages weighted by respective state population. *Total tax revenue* refers to the sum of federal, state, and local taxes with tax incidence within a state's border. The sample consists of the 10 West German states (excluding Berlin).

Table 5: Redistribution of state income in Germany

Dependent variable	1970-1994		1995-2006	
<i>Disposable state income after ...</i>	$1 - \beta_d$	adjusted $R^2$	$1 - \beta_d$	adjusted $R^2$
... transfer of federal tax share	0.314 (0.038)***	0.98	0.21 (0.089)***	95
+ VAT redistrib. among states	0.357 (0.039)***	0.97	0.307 (0.096)***	0.92
+ state-to-state transfers	0.366 (0.041)***	0.97	0.323 (0.096)***	0.92
+ federal grants	0.369 (0.042)***	0.97	0.35 (0.094)***	0.92

Notes: \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. The robust standard errors in parentheses pertain to  $\beta_d$ . Constants are omitted. 1970-1994: 10 observations; 1995-2006: 16 observations.

The regression equation is equation (7):  $\bar{Y}_i = \alpha_d + \beta_d \bar{X}_i + \eta_i$ , where  $\bar{X}_i$  is the ratio of average per capita state income (over the sample period) of state  $i$  and the national average of per capita state income.  $\bar{Y}_i$  is the ratio of average per capita *disposable* state income (over the sample period) of state  $i$  and the national average of per capita *disposable* state income.

Table 6: Stabilization of state income in Germany

Dependent variable	1970-1994		1995-2006	
<i>Disposable state income after ...</i>	$1 - \beta_s$	adjusted $R^2$	$1 - \beta_s$	adjusted $R^2$
... transfer of federal tax share	0.298 (0.050)***	0.44	0.711 (0.091)***	0.24
+ VAT redistrib. among states	0.331 (0.053)***	0.39	0.715 (0.090)***	0.26
+ state-to-state transfers	0.399 (0.054)***	0.33	0.72 (0.089)***	0.26
+ federal grants	0.416 (0.057)***	0.3	0.736 (0.084)***	0.22

Notes: \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. The robust standard errors in parentheses pertain to  $\beta_s$ . 1970-1994: 250 observations, 10 states; 1995-2006: 192 observations, 16 states.

The regression equation is equation (8):  $Y_{it} - \bar{Y}_i = \beta_s (X_{it} - \bar{X}_i) + \mu_{it}$ , where  $\bar{X}_{it}$  is the ratio of per capita state income of state  $i$  at time  $t$  and the national average of per capita state income at time  $t$ .  $\bar{Y}_{it}$  is the ratio of per capita *disposable* state income of state  $i$  at time  $t$  and the national average of per capita *disposable* state income at time  $t$ .  $\bar{X}_i$  is the ratio of average per capita state income (over the whole sample period) of state  $i$  and the national average of per capita state income.  $\bar{Y}_i$  is the ratio of average per capita *disposable* state income (over the whole sample period) of state  $i$  and the national average of per capita *disposable* state income.

Table 7: Redistribution of state tax revenue in Germany

Dependent variable	1970-1994		1995-2006	
<i>Net state tax revenue after ...</i>	$1 - \beta_d$	adjusted $R^2$	$1 - \beta_d$	adjusted $R^2$
... transfer of federal tax share	0.596 (0.027)***	0.91	0.325 (0.080)***	0.91
+ VAT redistrib. among states	0.746 (0.020)***	0.84	0.69 (0.042)***	0.84
+ state-to-state transfers	0.78 (0.025)***	0.83	0.741 (0.041)***	0.78
+ federal grants	0.717 (0.026)***	0.88	0.743 (0.078)***	0.63

Notes: \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. The robust standard errors in parentheses pertain to  $\beta_d$ . Constants are omitted. 1970-1994: 10 observations; 1995-2006: 16 observations.

The regression equation is equation (7):  $\bar{Y}_i = \alpha_d + \beta_d \bar{X}_i + \eta_i$ , where  $\bar{X}_i$  is the ratio of average per capita state tax revenue *before* redistribution (over the sample period) of state  $i$  and the national average of per capita state tax revenue *before* redistribution.  $\bar{Y}_i$  is the ratio of average per capita state tax revenue *after* redistribution (over the sample period) of state  $i$  and the national average of per capita state tax revenue *after* redistribution.

Table 8: Stabilization of state tax revenue in Germany

Dependent variable	1970-1994		1995-2006	
<i>Net state tax revenue after ...</i>	$1 - \beta_s$	adjusted $R^2$	$1 - \beta_s$	adjusted $R^2$
... transfer of federal tax share	0.564 (0.062)***	0.12	1.008 (0.03)	0
+ VAT redistrib. among states	0.725 (0.052)***	0.05	0.994 (0.01)	0
+ state-to-state transfers	0.896 (0.047)**	0	0.997 (0.01)	0
+ federal grants	1.016 -0.02	0	0.989 (0.01)	0

Notes: \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. The robust standard errors in parentheses pertain to  $\beta_s$ . 1970-1994: 250 observations, 10 states; 1995-2006: 192 observations, 16 states.

The regression equation is equation (8):  $Y_{it} - \bar{Y}_i = \beta_s (X_{it} - \bar{X}_i) + \mu_{it}$ , where  $\bar{X}_{it}$  is the ratio of per capita state income of state  $i$  at time  $t$  and the national average of per capita state income at time  $t$ .  $\bar{Y}_{it}$  is the ratio of per capita *disposable* state income of state  $i$  at time  $t$  and the national average of per capita *disposable* state income at time  $t$ .  $\bar{X}_i$  is the ratio of average per capita state income (over the whole sample period) of state  $i$  and the national average of per capita state income.  $\bar{Y}_i$  is the ratio of average per capita *disposable* state income (over the whole sample period) of state  $i$  and the national average of per capita *disposable* state income.