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|---|---|
| Journal: | *Regional Studies* |
| Manuscript ID: | CRES-2006-0008.R2 |
| Manuscript Type: | Main Section |
| JEL codes: | C81 - Methodology for Collecting and Estimating Micro Data < C8 - Data Collection and Data Estimation Methodology < C - Mathematical and Quantitative Methods, D31 - Personal Income, Wealth, and Their Distributions < D3 - Distribution < D - Microeconomics, D63 - Equity, Justice, Inequality, etc. and Measurement < D6 - Welfare Economics < D - Microeconomics |
| Keywords: | German Unification, Gini, Inequality Decomposition, Regional Disparities, SOEP, Stratification |
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# Regional Income Stratification in Unified Germany using a Gini Decomposition Approach*

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Using representative micro data from the German Socio-Economic Panel Study (SOEP), this paper delivers new insights into the development of income inequality and regional stratification in Germany after unification. We apply a new method for detecting social stratification by a decomposition of the GINI index which yields the obligatory between- and within-group components as well as an "overlapping" index for the different sup-populations.

We find that East Germany is still a stratum on its own when using post government income, but since 2001 no longer is when using pre-government income. These results remain stable when using alternatively defined regional

* The methodological section of this paper benefited substantially from our longlasting cooperation with Shlomo Yitzhaki and Edna Schechtman within a project funded by the German Israeli Foundation (GIF-Grant I-656-10.4/2000). The paper benefited from comments by Gert G. Wagner, Stephen P. Jenkins, Kurt Geppert and two anonymous referees as well as by participants in the meeting of the International Sociological Association Research Committee 28 (RC28) on Social Stratification and Mobility in Oslo, Norway (5-8 May 2005) and the first conference of the Society for the Study of Economic Inequality (ECINEQ) in Palma de Mallorca, Spain (20-22 July 2005).
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classifications. However, there are also indications of some regional variation within West Germany.

Keywords: Inequality Decomposition; Gini; Stratification; German Unification; Regional Disparities; SOEP

JEL classification: C81; D31; D63

# 1. Introduction

Standard neoclassical growth models for closed economies - assuming similar preferences, full factor mobility, and a free flow of technology - promote the idea of regional income convergence, with poor regions growing faster than rich ones (see, e.g. BARRO and SALA-I-MARTIN, 1992).[1] Applying this idea to the case of Germany after its political reunification in 1990, one would expect to see evidence of economic convergence, i.e., of GDP per capita in (poor) East Germany catching up with that of (rich) West Germany. But even 15 years after the fall of the Wall, the economic literature provides little evidence of such success. This introduction presents a brief overview of German regional economic development in the last several years.[2] Describing the situation at the turn of the new century, BURDA and HUNT (2001) noted that the East German labor market was still in disarray, that convergence of GDP had halted, and that growth in total factor productivity had dropped below western levels. Simultaneously, consumption levels in East Germany had increased to approximately the same levels found in West Germany pre-1990. In an attempt to compensate for this striking disproportion, massive financial transfers were made from West to East Germany, bringing in their wake increasing public deficits.[3] One could argue that the slow development in the East is partly the result of the large-scale adoption of West German institutions including the social security system and labor market system. Particularly the latter system, with its rather low degree of wage differentiation, may have been less appropriate to East Germany in the early stages of the transition process, when the centrally planned economy was being dismantled and a market economy introduced. The most striking outcome has been massive and ongoing unemployment, with about every fifth East German registered unemployed in 2003 or about twice as many as in West Germany. Given the poor labor

market prospects in the East, a wave of selective emigration took place, with younger and better-educated workers moving West (e.g. BURDA and HUNT, 2001). Starting from the lower population density at the outset of reunification around 1990, and considering the subsequent dramatic decline in fertility rates (e.g. WITTE and WAGNER, 1995) as well as net emigration, East Germany is currently even less densely populated than before, while West German regions[4], on average, show increasing population (see Figure 1).

[Figure 1 about here.]

Convergence patterns by economic sector also reveal distinct differences (more detailed information is given in the Appendix, Table 5): firstly, there was a substantial shrinkage in agriculture and mining, but even more so, in manufacturing. Secondly, while investments in construction and buildings boomed during the early 1990s (partly reflecting generous tax provision rules), investment in equipment remained below western levels which according to Sinn "is truly alarming for the convergence process, because it is equipment rather than buildings which promotes technological progress and has a direct effect on labour productivity and competitiveness. If per capita investment in equipment does not exceed that in the west, a continued conversion process is hard to imagine" (SINN, 2002, 119).

However, one should keep in mind that even aside from the current inequalities between East and West, regional variation in economic performance has a long history within West Germany alone. Agriculture, for example, was a crucially important economic sector in the state of *Bayern* for several decades after WW II, until this state's successful industrial modernization got underway. In the state of *Nordrhein- Westfalen* the decline of the formerly successful monostructure of the mining and metal industries began to generate huge

adjustment costs. These developments spurred extensive discussion of differences in economic performance between the North and the South of Germany (see FRIEDRICHS *et al.*, 1986, GEPPERT, 1999). This discussion has largely disappeared from the policy agenda since the fall of the Wall, and today, East-West comparisons dominate the debate on regional variation in Germany.[5]

These regional-level macro-economic processes must have found expression at the individual level as well, making themselves felt, for example, in a lack of market income due to unemployment or dependency on the social welfare system. Cross-regional variation in living standards is a crucial policy issue. According to the German constitution, economic and social policy should aim to diminish regional differences in living conditions. This paper addresses the question of whether a regional convergence in income inequality has occurred in Germany, focusing on personal income distribution at the micro-level, rather than regional incomes (macro-level) of spatial entities such as counties, countries, or continents, the usual approach in the regional inequality research.[6]

We apply a Gini decomposition for detecting stratification in a given society with respect to the distribution of income, i.e., we want to test the main hypothesis of whether the observable regional differences in the income distribution in fact also mirror the stratification of German society. Decomposing inequality in economic well-being requires additive inequality indices such as the Theil Index[7], but it has long been argued that one of the most commonly used indices for inequality analysis, the Gini index, cannot be adequately decomposed in an additive manner. However, using the covariance-based formula of the Gini coefficient, LERMAN and YITZHAKI (1984) and YITZHAKI and LERMAN (1991) propose a decomposition approach which yields the obligatory between- and within-group components as well as an "overlapping" index for the different sup-populations. This is a very helpful tool for

interpreting decomposition results with respect to income stratification. We apply this method (YITZHAKI, 1994) together with a jackknife estimation of confidence bands (FRICK *et al.*, 2006).

Welfare economists are interested mainly in the income distribution *after* government intervention, i.e., re-distribution after receipt of public transfers and after paying taxes and contributions to the social security system. However, given the huge monetary transfers from West to East Germany, it is important to determine the capacities for self-sustenance of these two individual populations. It is also important to look at the distribution of income *prior* to government intervention, i.e., market incomes stemming from both factor income (labor and capital) and private transfers (including private pensions).

One of our central findings is that the distribution of East German market incomes has changed drastically over the period under investigation, starting from a predictably low level in the early 1990s and rising in recent years to much higher levels of inequality than in West Germany. The development of post-government income, however, presents a different picture: here we find significantly lower and more equally distributed incomes in the East across the complete period. These contradicting movements in pre- and post-government income mirror the increasing redistributive effect built into the German tax and transfer system in favor of East Germany.[8] Overall, we find no convincing evidence of increasing regional convergence in post-government income levels and inequality. Correspondingly, the level of between-group inequality, which decreased over the first years of transition parallel to the increase in East German incomes, has not changed significantly since the mid-1990s. The question arises whether the policy goal of equalizing regional differences in income levels and income distribution is a realistic one, or whether regional stratification should simply be accepted as a currently unavoidable byproduct of economic evolution.

The paper is structured as follows: after briefly discussing the literature on income distribution and regional income variation in Germany (Section 2), we sketch some important instruments of the rather complex system of public transfers designed to promote financial equalization between federal states (*Bundesländer*) in Section 3. Section 4 describes the decomposition methodology applied and the data used for our empirical analysis. The empirical application is described in Section 5, and the final section presents our methodological and substantive conclusions.

## 2. Income distribution in West and East Germany

Macroeconomic data makes it possible to compare regional differences in absolute or per capita welfare levels. Data derived from national accounts statistics, for example, is thus often used to analyze processes of regional convergence or divergence (e.g., in 1991, per capita GDP in East Germany was 33% of Western per capita GDP, and rose to "only" 63% in 2003). GEPPERT (1999) and LAMMERS (2003) conducted analyses along this line looking at the economic performance of various German regions. But macroeconomic data does not provide an adequate foundation for analyzing trends in the regional variation of income inequality, while micro-data does. German databases that provide the basis for this kind of study include the EVS ("Income and Expenditure Survey") and the German Socio-Economic Panel Study (SOEP), which also forms the empirical basis of a huge body of literature on the evolution and distribution of pre- and post-government income (and its components) in West and East Germany.[9] The following is a summary of central findings from these studies.

KRAUSE (2003) examines trends in income inequality and poverty dynamics in East and West Germany up to the year 2000, and finds an increase in East German inequality in the first half

of the 1990s, a more stable picture in the mid-1990s, and a trend towards increasing inequality in both parts of Germany at the end of the century. FRICK *et al.* (2005) show that disposable income inequality in East Germany is consistently lower, but that market incomes - starting from a predictably low level of inequality at the beginning of the transition process - have been more unequally distributed in the East than in the West since the mid-1990s. According to GOEBEL *et al.* (2005), this picture is consistent, whether the analysis is based on equivalized household pre-government income or individual labor income; in any case, the increase in inequality is driven by both increasing unemployment and widening wage dispersion. BIRD *et al.* (1998) find evidence that the former GDR elites fared well over the first years of transition, maintaining an income advantage of about 10%. BISHOP *et al.* (2001) show that in West Germany, low-income households (below the median income level) bore an above-average share of the costs of unification and the 1992-93 recession.

Focusing on market incomes and analyzing individual labor income, HUNT (2001) identifies rapid wage growth of more than 80% for East Germany over the period 1990-1996, with the biggest gainers being women and the better educated. According to BIEWEN (2001) the increase in income inequality in East Germany during the first half of the 1990s was due to rising unemployment, decreasing female labor market participation, and a widening income structure. BRENKE (2005) stresses the relevance of differential changes in the demographic compositions of East and West German households since the fall of the Wall: East German households are, on average, shrinking faster with respect to household size due in particular to decreasing fertility and the consequentially declining share of families with dependent children. According to BRENKE (2005), aging, together with increasing unemployment, is linked to the growing importance of (social) transfer income in East Germany.

GRABKA *et al.* (1999) try to disentangle the effects which unification and migration exerted on the German pre- and post-government income distribution over the 1990s by means of a decomposition of the Theil(0) inequality measure. They conclude that migration from East to West reduced overall German income inequality. BÜCHEL and FRICK (2001) analyze the participation of various population subgroups in the income redistribution process induced by the tax and transfer system during the mid-1990s. Comparing relative income positions before and after government intervention, they find that East Germans as a whole as well as specific immigrant groups significantly benefit from re-distribution.

While nearly all these analyses focus on differences between East and West Germany, BERTHOUD (2004) uses data from the European Community Household Panel (ECHP) to look at regional variation of income inequality and poverty across and within EU member states and their regions. For the regional differentiation, he refers to the level of NUTS1[10], which for Germany is defined by the 16 federal states or *Bundesländer*. An important finding from a German point of view is the very low degree of inequality - in cross-national terms - between regions: only 2.2% of overall inequality in Germany is attributed to between-region inequality, while this share is approximately 3 to 5 times higher in France, Spain, and Italy. These findings are in line with those presented by STEWART (2002), who uses data from the Luxembourg Income Study (LIS) to show that variability of poverty rates at German NUTS1-level around 1990 (West Germany only) is much lower than in Italy, France, Spain and the UK. However, between-region variability clearly increases when including East German federal states in the mid-1990s[11], a result which is confirmed by the EUROMOD-based analysis using 1998 income data from MERCADER-PRATS and LEVY (2004). The latter also find a negative correlation between market income inequality and regional economic performance and thus conclude that regions showing weak performance will reap above-

average gains from re-distribution.[12] Obviously how regions are defined plays a significant role here, and a county-level perspective on income inequality also "produces" much more between-regional variation than a more highly aggregated regional perspective.

The findings of LOIKKANEN *et al.* (2003) for Finland demonstrate that welfare state redistribution through taxes and public transfers decreases regional variation and inequality. Surprisingly, the measures of regional differences applied failed to reveal the joint effect of the Finnish economic crisis of the early 1990s and the welfare state's redistribution schemes. FÖRSTER *et al.* (2002), who use LIS-data for four Central and Eastern European countries, show the extent to which intra-country inequality is masked by national-level analyses. This may be especially true for those transition economies where socialist central planning had created regional concentrations of certain industries, producing lasting regional disparities in macro-economic performance. The transition to more market-oriented structures may have further accentuated this variation.

To target this kind of within-country variation, our paper applies a new stratification method based on the decomposition of the Gini coefficient, which offers the advantage of producing three components: (1) the region-specific contribution to overall inequality in Germany, (2) the inter-regional contribution, and (3) overlapping information defined by the degree to which a given region's income distribution overlaps with the overall distribution (as well as with the distribution of any other region of interest). It is the overlapping index that makes this decomposition approach unique as compared to other well known methods based on additively decomposable inequality measures, e.g., the general entropy family.[13]

In order to give some indication of the sensitivity of inequality results with respect to the choice and number of regions, we first define only two regions, West and East Germany, (focusing on the current political debate) and compare the results with those obtained from a

more diversified grouping of four regions by splitting West Germany into North, Central, and South (looking at the issue of a North-South divide). Certainly the choice of these regions is somewhat arbitrary[14], but it is driven by the interest in expanding public awareness in Germany beyond a purely West-East perspective to a broader view of regional variation in income levels and inequality (see also the recommendations by the SVR, 2004, cipher 617).

# 3. Some stylized facts on the German federal system of financial equalization across regions

Since 1990, there has been an ongoing process of massive re-distribution from West to East through a complex system of government activities and the social security system (i.e., unemployment insurance, old age insurance, health insurance, nursing care insurance). There have been numerous attempts to estimate these transfers[15], some as high as 100 billion euros per year since 1990; RODE (2004) estimated the costs of unification to be about 4% of West German GDP, inducing a slowdown in economic growth (see also the paper by the Dohnany Commission, quoted in *Der Spiegel*, 5 April 2004, p. 26). Statistics Germany (*Arbeitskreis VGR der Länder*) has estimated the volume of these West-East transfers on the basis of national account data disaggregated for East and West Germany: subtracting private and state consumption as well as gross investment in plants and equipment in East Germany from East German GDP yields an implicit West-East "transfer" of approximately 90 billion euros per year for the period 1991 to 2002. This amount has been declining since the mid-1990s, however, from about 110 billion euros in 1995 to "only" 72 billion euros in 2002 (*Arbeitskreis VGR der Länder*). Data on the most important instrument for (horizontal) financial equalization between the federal states, the *Länderfinanzausgleich*, shows a consistent pattern

of transfers from West to East Germany, mostly financed by the federal states in the southern part of West Germany.

[Figure 2 about here.]

Starting immediately after unification, various new instruments began to be developed and existing ones adjusted to meet the extraordinary financial needs of East Germany, all with the aim of ensuring rapid equalization of living conditions in East Germany and preventing a consolidation of regional stratification. The most important instruments include the 82 billion euro fund "*Deutsche Einheit*" 1990 - 1994 and the so-called *Solidarity Pact*, which started in 1995. In 1995 the East German federal states (including the state of Berlin) were fully incorporated into the existing system of financial equalization between the federal and the state governments (*Bund-Länderfinanzausgleich* or vertical equalization) as well as among the federal states themselves (*Länderfinanzausgleich* or horizontal equalization).[16] This rather complex system redistributes funds in two stages: first, sales tax revenues are distributed between federal, state, and local authorities, and second, a further correction is made to guarantee approximately equal per capita tax revenues across federal states. This process makes stronger federal states subsidize weaker ones in order to match factual tax revenues to financial needs. Finally, various types of federal funding (*Bundesergänzungszuweisungen*) focus on meeting specific needs created, for example, by the higher fixed costs of governmental authorities in smaller federal states.

It is clearly very difficult to derive a *true* measure of all West-East transfers. Such a measure would have to take into consideration implicit subsidization within the social security system as well. See, e.g., BLOS (2006) for a description of revenues and expenditures in various parts of the social security systems. For example, in 2003, the Eastern federal states received an

average of 550 euros per inhabitant from unemployment insurance, while the Western states contributed on average of 140 euros per inhabitant (BLOS, 2006, 97).[17] Above and beyond this, figures on the horizontal fiscal equalization provide an important proxy of West-East transfers after incorporating East Germany into the existing system. Figure 2 shows that in the first half of the 1990s, the federal states in the southern part of West Germany (here: *Baden-Württemberg, Bayern, Hessen*) on average were net contributors to the *Länderfinanzausgleich*, while the northern part of West Germany gained an above-average profit, and the states in the center of West Germany benefited marginally. The inclusion of East Germany in 1995 drastically changed the overall turnover and also moved the states of central West Germany on average into the category of donors. In general, however, it is the southwestern states that transferred the bulk of funds to East Germany.[18]

# 4. Empirical analysis: methods and data

## 4.1. The ANOGI (Analysis of Gini) methodology

The ANOGI (ANalysis Of GIni) technique can be seen as the equivalent to ANOVA (ANalysis Of VAriance) performed with the Gini coefficient. To measure inequality, we use the Gini index as represented by the covariance formula according to LERMAN and YITZHAKI (1984):

$$G = \frac{2cov\left(y, F(y)\right)}{\mu} \qquad (1)$$

Here, the Gini is twice the covariance between income $y$ and rank $F(y)$ standardized by mean income $\mu$.[19] The Gini of the entire population, $G_u$, can be decomposed as:

$$G_u = \sum_{i=1}^{n} s_i G_i O_i + G_b \quad (2)$$

where $s_i$ denotes group $i$'s share of overall income, $O_i$ is the overlapping index of the entire population by subpopulation $i$ (to be explained below), $G_i$ represents the Gini of subpopulation $i$, and $G_b$ is the between-group inequality component.

The between-group inequality $G_b$ as defined in YITZHAKI and LERMAN (1991) is:

$$G_b = \frac{2\mathrm{cov}(\bar{y}_i, \bar{F}_{ui})}{\mu_u} \quad (3)$$

Hence $G_b$ is twice the covariance between the mean income of each subpopulation and the subpopulations' mean rank in the overall population[20], divided by overall expected income. The term $G_b$ equals zero if either the mean incomes or the mean ranks are equal for all subpopulations. In extreme cases, $G_b$ can be negative, which occurs when the mean income is negatively correlated with mean rank. This definition of the between-group component is different from the one used by PYATT (1976) and SILBER (1989), $G_{bp}$, which has the advantage of being more easily interpretable, as shown by LAMBERT and ARONSON (1993). However, the drawback is that the definition by Pyatt has no connection to stratification. Whereas Pyatt uses the covariance between the group-specific mean incomes and the rank of the mean incomes of these subpopulations, YITZHAKI and LERMAN (1991) use the mean of the ranks of all group members. Hence, the $G_{bp}$ is the maximum possible value that $G_b$ can reach, because the two approaches yield the same ranking if all individuals have the same (group-specific) income (see MILANOVIC and YITZHAKI, 2002).[21]

The within-group inequality, $s_i G_i O_i$, consists of three components (rather than only two, as when applying ANOVA), of which the overlapping index is the most important for measuring stratification. The formal definition of the overlapping index is given by:

$$O_i = O_{ui} = \frac{\mathrm{cov}_i\left(y, F_u(y)\right)}{\mathrm{cov}_i\left(y, F_i(y)\right)} \tag{4}$$

where, for convenience, the index $\mu$ is omitted and $\mathrm{cov}_i$ gives the covariance according to distribution $i$, i.e.,

$$\mathrm{cov}_i\left(y, F_u(y)\right) = \int \left(y - \mu\right)\left(F_u(y) - \overline{F}_{ui}\right) f_i(y)\, dy \tag{5}$$

where $\overline{F}_{ui}$ is the expected rank of subpopulation $i$ in the overall population (all observations of subpopulation $i$ are assigned their ranks within the union and $\overline{F}_{ui}$ represents the expected value). The numerator in (4) is the covariance between $y$ and its rank, had it been ranked within the entire population, while in the denominator, the ranking is within subpopulation $i$ itself. The overlap as defined in (4) can be further decomposed to identify the overlapping of subpopulation $i$ and all subpopulations that comprise the union. This further decomposition of $O_i$ is:

$$O_i = \sum_j p_j O_{ji} = p_i O_{ii} + \sum_{j \neq i} p_j O_{ji} = p_i + \sum_{j \neq i} p_j O_{ji} \quad , \tag{6}$$

where $O_{ji} = \frac{\mathrm{cov}_i\left(y, F_j(y)\right)}{\mathrm{cov}_i\left(y, F_i(y)\right)}$ is the overlapping of group $j$ by group $i$. From this follows that $O_{ji}$ is equal to zero if no member of distribution $j$ lies within the range of distribution $i$, which means that group $i$ is a perfect stratum. On the other hand, if over the range of distribution $i$, the shape of the distribution of group $j$ is similar to the shape of distribution $i$, then $O_{ji}$ is equal to 1, and by definition, $O_{ii}$ in any case is equal to 1. $O_{ji}$ is bounded from

above by 2. This maximum value will be reached if all observations belonging to distribution $j$ that are located in the range of $i$ are concentrated at the mean of distribution $i$.[22] $O_{ji}$ and $O_{ij}$ are connected, in such a way that, generally speaking[23], the higher the overlapping index $O_{ji}$, the lower $O_{ij}$ will be. That is, the more group $j$ is included in the range of distribution $i$, the less distribution $i$ is expected to be included in the range of $j$. Therefore $O_{ji}$ is an index that measures the extent to which population $j$ is included in the range of group $i$.[24] We interpret the overlapping index as the inverse of stratification, and we follow Lasswell's definition:

> "In its general meaning, a stratum is a horizontal layer, usually thought of as between, above or below other such layers or strata. Stratification is the process of forming observable layers, or the state of being comprised of layers. Social stratification suggests a model in which the mass of society is constructed of layer upon layer of congealed population qualities." (LASSWELL, 1965, p. 10)

According to Lasswell, perfect stratification is achieved when all observations of each population (in our case the population living in different German regions) are found in a specific range of income, and the ranges of the income distribution of the various subpopulations do not overlap. One rarely finds perfect stratification in real life, and an index describing the degree of stratification is required. The index of overlapping actually describes the extent to which the different subpopulations are stratified. In our case, this property plays an important role because it tells us whether East and West Germany (according to different regional groupings) represent different income strata even 14 years after unification.

## 4.2. The data

In our empirical application we make use of representative micro-data for private households from the German Socio-Economic Panel Study (SOEP, see WAGNER *et al.*, 1993, and HAISKEN-DENEW and FRICK, 2005). We analyze annual pre- and post-government income (from the previous calendar year) available for all years between 1992-2003 (actually representing the income distribution in the period 1991-2002 as gathered from the population living in the period 1992-2003).[25] Following the standard approach in welfare economics and as strongly recommended by the CANBERRA-GROUP (2001), our income measures include imputed rental values for owner-occupied housing as being the most prominent component of non-cash income FRICK and GRABKA (2003).[26] All income measures are corrected for missing data due to item-non-response by means of longitudinal and cross-sectional imputation (see FRICK and GRABKA, 2005).

In order to adjust income for differences in household size and age composition, we apply a common international equivalence scale, the modified OECD scale (which gives a weight of 1 to the household head, a weight of 0.5 to other adult household members above age 14, and a weight of 0.3 to all children up to 14 years of age). All income measures are deflated to prices of 2000 including a correction for purchasing power differences between West and East Germany.

# 5. Empirical results

This section provides empirical results on the decomposition of the Gini coefficient for annual pre- and post-government income measures for different German regions (East and West Germany, the latter also being split into North, Central and South).

With reference to the theoretical considerations in Section 4.1 on the ANOGI methodology, we can interpret any significant variation between regions (here: West and East Germany) as an indication of stratification. In other words, no regional stratification is given if all parameters of interest were the same for all regions (i.e., no statistically significant differences apply):

Mean income: $\bar{y}_{West} = \bar{y}_{East}$

Mean rank: $\overline{F}_{West} = \overline{F}_{East} = 0.5$

Gini coefficient: $G_{West} = G_{East}$

Overlapping index: $O_{West} = O_{East} = 1$

Between-group inequality[27]: $G_b = 0$

Based on the heavy transfers from West to East Germany, the baseline hypothesis must be that income distribution differentials which may have existed when the Berlin Wall fell diminish over time and eventually disappear. Our analysis will show that this is not true at all for post-government income and that it is only true for the overlap in pre-government income, because the shape of this income distribution in East Germany developed in a rather specific way.

For the sake of illustration[28], the results of our Gini-decomposition (ANOGI) are presented as time series by groups in graphical form using separate figures for

(a) Gini index ($G_i$) and between inequality shares $\left(\frac{G_b}{G_u}\right)$, and the

(b) Overlapping component ($O_i$).

All other results are presented in tables. Confidence bands are also indicated pointwise for the group-specific Gini, the shares of between and within inequality as well as for the overlapping

index. The confidence bands shown are defined as two times the respective standard errors, based on a jackknife procedure. A more detailed description can be found in FRICK *et al.* (2006).

## 5.1. Income inequality decomposition by region: West and East Germany

### 5.1.1. Pre-government income

Pre-government income levels in West Germany generally mirror the development of the business cycle[29] (see Table 1). Over the whole period, inequality, $G_i$, increases at a moderate pace (see Figure 3), but again in line with the business cycle; i.e., there are years that even show a minor decrease in inequality. As is to be expected, pregovernment income inequality in East Germany in the early years of transition was significantly lower than in the West, but inequality increased steadily and overtook West German levels as early as the mid-1990s (see also BIEWEN, 2001, HUNT, 2001). Market income inequality in the East is still rising and indeed accelerating in recent years (see Figure 3)[30]. This process is mainly driven by massive and increasingly longterm unemployment (see FRICK *et al.*, 2005). East German pre-government income levels (as measured by mean and ranks) cannot close the gap to West Germany; again the process of catching up had already stopped in 1995 and mean ranks, $F_i$, (see Table 1) have remained very stable at about 0.41 for almost 10 years.

[Table 1 about here.]

[Figure 3 about here.]

[Figure 4 about here.]

The contribution of between-region inequality, $G_b$, was significantly reduced in those early years (1992: 4.7%) and reached its minimum in the mid-90s (1995: 2.0%) when pre-government income inequality in the East matched that in the Western part of the country. However, the between-group contribution has increased slightly in more recent years in line with East Germany's skyrocketing inequality (2000: 2.7%).[31] According to the overlapping indicator, $O_i$, East Germany was clearly a pre-government income stratum on its own over the first 10 years of the unification process.[32] In 1992, the $O_i$ for East Germany was as low as 0.7741 but developed rapidly to 0.9282 in 1995. Since then, although at a lower pace, this measure further approached the value of one, and in 2003, the income ranges covered by the pre-government income distribution in both parts of Germany overlapped almost perfectly ($O_{West}$ ~ .9873 versus $O_{East}$ ~ .9930, see Figure 4.[33] This result, however, must be interpreted together with the consistently lower income levels and increasing income inequality in East Germany: i.e., those East Germans who do have a paid job (which is by far the most important source of pre-government income) "reach into" the range of the West German distribution. However, a large group of East German individuals have very low or even zero market incomes as well due to unemployment or early retirement schemes. GOEBEL *et al.* (2005) showed that the fraction of persons living in private households with zero market income increased from 1% in 1992 to almost 5% in 2002 for East Germany, whereas the corresponding figures for the West are only 3.6% and 4%.

### 5.1.2. Post-government income

Post-government income levels in East Germany increased significantly over the first half of the 1990s, steadily closing the gap to the Western levels (see Table 2). However, as could be observed for pre-government income, this process came to a halt around 1995. Inequality, as measured by the Gini coefficient, $G_i$, remained consistently and significantly lower in the East than in the West. This process mirrored the development of the business cycle, although to a less pronounced degree than was the case for pre-government income. This merely reflects the fact that public transfers are effectively performing their stabilizing function, especially the unemployment assistance schemes which appear to be more important in East Germany given the extraordinarily high unemployment rates there (almost 20% and as such about twice as high as in the West). For West Germany, we find a mildly u-shaped trajectory in the inequality development since 1995 ($G_i$ = .2841), with another local maximum reached in 2002 ($G_i$ = .2904). The decrease found here in recent years does not appear in the East, resulting in a somewhat narrowed regional inequality gap in 2003, but the difference remains statistically significant ($G_{West}$ = .2847 versus $G_{East}$ = .2416).

[Table 2 about here.]

[Figure 5 about here.]

[Figure 6 about here.]

In line with these results, mean ranks do not show any relevant changes since 1995 in West and East Germany ($F_{East} \approx .42$). The overlapping index suggests that East Germany remained significantly different throughout the period under investigation, i.e., that this region still forms an income stratum on its own (2003: $O_{East} \approx .9184$).

From the findings in Section 5.1, one can conclude that the German welfare state is highly effective in continuously and significantly reducing market-induced inequality. Although for pre-government income, the overlapping index indicates a perfect overlap of East and West German income distributions, caused by the high inequality in East Germany, the same cannot be said for disposable or post-government income.

## 5.2. Income inequality decomposition using an extended regional grouping

In a second step we extend our differentiation to allow for more regional variation within West Germany. One may argue that the differences between East and West Germany do not come as a surprise, since such differences also arise within West Germany alone if it is divided in an appropriate way.[34] Certainly any such regional grouping is based on some normative decisions. Given the federal organization of Germany on the one hand and the availability of external data at the federal state level as well as the identification of these regional entities in our micro data on the other hand, the grouping chosen in this paper is based on federal states (NUTS1-level). In the context of the discussion about a "North-South divide" within West Germany, we group the federal states into northern, central, and southern states (see Figure 1 as well as Table 5 in the Appendix).

Using this extended grouping, the substantive group-specific results described in Section 5.1 above for East Germany (Gini $G_i$ mean income and rank $F_i$, and overlapping $O_i$) will remain unchanged, while the results for West Germany will now be derived from three measures: the northern, central, and southern parts of West Germany. However, the contribution of

between-group inequality, $G_b$, as well as the group-by-group overlapping index, $O_{ji}$, may very well be subject to change also for East Germany. It is not only important to find out the degree to which these three West German regions deviate from each other, but also to see whether the East Ger-man results come closer to at least one of the western regions. If they do, this would falsify the hypothesis of East Germany forming an income stratum on its own.[35]

### 5.2.1. Pre-government income

With only one exception in the year 2000, we find a consistent picture of pre-government incomes being higher on average in the southern part of West Germany than in the central and the northern parts, which is perfectly in line with the discussion about the North-South divide (see Section 1). According to mean rank, all three western regions (see Table 1, columns (3) to (5)) show above-average values throughout the entire observation period, although in most recent years the mean rank for the South ($F_{South}$, column (10) in Table 1) improved, while it clearly worsened for the northern and central groups. Despite this development, the average East German income still falls far short of the lowest of these three reference values (see Table 1 above, columns (1) for mean and column (6) for rank respectively). It should be noted that this overall development at the micro-level perfectly matches the regionally disaggregated macro-information on GDP as given in Table 5.

[Figure 7 about here.]

[Figure 8 about here.]

There is no clear trend with respect to market income inequality across the West German groups - all of them remain rather close and it was only during the early 1990s and in very recent years that the South began to show significantly lower inequality than the central and northern regions (see Figure 7). But as was true when comparing East to West Germany overall, we find East German inequality in pre-government income to be lower in the early years of transition and significantly higher since the late 1990s. In 2003, $G_{East}$ reached .5227 and the "closest" western value was given by the northern region with $G_{North}$ = .4795. This finding is confirmed by the fact that between-group inequality does not significantly change when using four rather than only two regions for the decomposition analysis.

With respect to the overlapping index, $O_i$, we conclude that, starting in 2002, the distribution in East Germany began extending into the range of the corresponding West German $O_i$ (see Figure 8). Nevertheless, the mean rank in the East has remained significantly lower and the increase in inequality has accelerated in recent years.

[Table 3 about here.]

Table 3 presents the decomposition results with respect to the overlapping indices for each group in terms of the respective other groups, namely $O_{ji}$. In contrast to the above-mentioned results for $O_i$, where we compare each group with the entire population, such a group-by-group comparison is not affected by the relative size of the various groups.[36] Following this consideration, Table 3 includes for each of the regions considered in our analysis (North, Central, South, East) the corresponding overlapping indices with the respective three other regions.

Throughout the entire period under investigation, East Germany (Table 3, in the rightmost main column) formed a distinct income stratum with respect to all three western regions, except for last year, when a significant deviation printed in bold was found only in comparison to the North. None of the other regions formed an income group with respect to the East in the first years following unification. For the South, this changed starting in 1996, for the central part in 1998, and finally in 2002 for the northern part as well (Table 3). Since then, each of the other regions has shown a distinctively different distribution from the East German distribution. There is a more heterogeneous picture within West Germany: while over the early 1990s, only southern Germany formed a group with respect to northern and central Germany, we observe a convergence during the mid-1990s, a period with less inequality and more similar mean ranks among the three western regions. Starting in 1998, however, the overlapping results indicate that the southern and central regions also form distinct income groups in relation to the northern part of the country. This may be taken as an indication of a revitalization of the North-South divide.

### 5.2.2. Post-government income

Given the results on pre-government income, it comes as no surprise that a more diversified regional grouping in West Germany also does not yield significant changes (for the West-East comparison) when the dependent variable is post-government income (see Figure 9 and 10). Income levels in the southern part of West Germany are in principle higher than in the central and northern parts, and all of them are clearly above the average eastern income. This is also confirmed by the mean rank, $F_i$. The ranking of West German regions with respect to income inequality ($G_i$) changed in the late 1990s, when the North became the region with highest

inequality after having been below-average for the first half of the period under investigation. The more important finding is once again that all group-specific decomposition components - inequality, average income, mean ranks, overlapping - for East German disposable income remain far below all of the three West German regions.

[Figure 9 about here.]

[Figure 10 about here.]

Even with the increased differentiation of West Germany into regions, the overlapping index with the overall distribution, $O_i$ (Figure 10), as well as the group-specific overlapping, $O_{ji}$ (see Table 3), East Germany remains significantly different from all three reference regions. And again, we can conclude that with respect to regional stratification, the East still forms an income stratum on its own.

[Table 4 about here.]

The overlapping indices for each group in relation to the respective other groups (Table 3) from a western point of view indicate that only in the first years after unification did the western regions form distinct income strata with respect to the East. However, this changed rather quickly, and since 2000, only the South has again come to constitute a group with respect to the East. Within West Germany, there is a much more homogeneous picture when using the group-specific overlapping indices. The central part does not form a group at all over the whole period, and the northern part was only a group with respect to central Germany in the first half of the period under investigation. Solely the South seems to have become more stratified with respect to the North in the more recent years after a process of assimilation during the mid-90s, in line with the pre-government income results presented in Section 5.2.1.

# 6. Conclusion

Using analysis of Gini (ANOGI) for an inequality decomposition, we empirically demonstrate the evolution of the income distribution after German unification. The unique advantage of this methodology is that it provides an additional term which reflects the overlap between the distributions of two or more interesting groups or strata formed by various German regions.

Concluding from our empirical results with respect to post-government income, we must reject the hypothesis that East and West Germany are moving towards a common income distribution.[37] After a "promising" start in the first half of the 1990s, with increasing income levels among East Germans but also with rising inequality, this process appears to have stopped in the mid-1990s without major changes since. The picture is quite different for pre-government incomes, which are heavily dominated by labor income for East Germany, while for the West German population, capital gains are a more relevant issue. Mostly driven by massive unemployment and the lack of counteracting capital income, market-income inequality in East Germany already surpassed the western level in the early 1990s and this difference has increased continuously. The huge inequality of market incomes in East Germany results in East Germany no longer being a stratum on its own with respect to the overlapping of pre-government incomes: very low (zero) as well as (very few) extremely high market incomes yield an income distribution overlap with West Germany. However, average East German market incomes (as well as the respective mean rank) are still far lower than in West Germany.

Enlarging the number and structure of the regions under consideration by splitting the western part into its northern, central, and southern components also reveals a certain degree of

regional variation *within* West Germany, with the South holding a somewhat more favorable position with respect to market and disposable income. If the regions of West Germany (in particular the South) constitute income strata on their own at all, then only at a much smaller scale and not persistently over time. There is, however, a clear picture of East Germany still being quite different from the rest of the country, irrespective of any western regional grouping.[38]

Overall, we find clear indications of post-government income stratification and no sign of convergence.[39] On the one hand, this may be taken as support for the argument that transfers from West to East should be continued in the context of the new *Solidarity Pact II*, which started in 2005. However, instead of arguing about the need to counter any remaining differences with further and even higher transfers, politicians and the public may have to start discussing whether regional differences should in fact be accepted as the basis for endogenous growth in the less-advantaged regions. These issues are not limited solely to the East-West discussion: there has been a tendency in recent years towards pre-government income stratification in South (West) Germany as compared to both other western regions, as well as in central (West) Germany as compared to the northern part.

# Notes

[1] For a review of the various approaches to studying regional income convergence see, e.g., BARRO and SALA-I-MARTIN (1995) and REY and JANIKAS (2005).

[2] Table 5 in the appendix presents a selection of economic indicators for 1991 and 2003 across German regions.

[3] This additional demand from East Germany actually boosted the West German economy - if only temporarily - postponing the economic slowdown that affected other industrialized countries during the period 1990-1991.

[4] Figure 1 maps the 16 federal states of Germany into four regions which form the unit of analysis throughout this paper. It should be noted that Berlin is treated here as part of East Germany due to problems of differentiating its eastern and western parts in aggregated statistics.

[5] See LAMMERS (2003) for a discussion of an emerging North-South variation within East Germany.

[6] See, e.g., SERGIO J. REY (1999) for an analysis of regional income convergence of US states using spatial econometrics, explicitly controlling for spatial dependencies such as spill-over effects. Using aggregated income data from various household datasets, MILANOVIC and YITZHAKI (2002) address global income inequality.

[7] A description of this measure can be found in THEIL (1967).

[8] Dividing the difference between the Ginis for market and disposable income by the Gini coefficient for market income yields a straightforward measure of this process $\left((G_{pre} - G_{post})/G_{pre}\right)$. For East Germany, this indicator rose from .46 in 1992 to .54 in 2003, while the degree of redistribution in West Germany changed only slightly from .37 to .38, in the same period.

[9] See BECKER *et al.* (2002) for a more detailed discussion of the impact of survey characteristics when comparing distribution results based on SOEP with those based on EVS due to the latter's quota sampling design, misrepresentation of foreigners, and non-coverage of top-income households.

[10]NUTS is the acronym for Nomenclature des unités territoriales statistiques.

[11]Based on log GDP per capita information for 110 regions in the EU-12 (applying a mix of NUTS-0, NUTS-1, and NUTS-2), PITTAU (2005) identifies a convergence between poorer and richer European regions during the late 1970s and 1980s. In the mid-1990s however, a small group of very rich regions seems to have emerged, mostly large metropolitan areas including the German city-state of *Hamburg*.

[12]This is exemplified by the East German federal state of *Sachsen-Anhalt*, which comes in 88th (out of 100 regions) in market income inequality, but only 3rd in funds received through redistribution by the tax and transfer system (MERCADER-PRATS and LEVY, 2004, 19).

[13]See SHORROCKS (1984) for a general discussion of inequality decomposition by population subgroups.

[14]Spatial dependence in terms of "nuisance dependence" (SERGIO J. REY, 1999) may be less of concern in our study, given that there is no boundary mismatch between regional organization of our data and that of the relevant processes constituting the financial equalization between federal states, as described in Section 3 below.

[15]See SVR (2004, cipher 628 et seqq.)

[16]The basis for this regulation is laid down in Articles 106 and 107 of the German Constitution. See http://www.bundesregierung.de/artikel-,413.45447/Der-Laenderfinanzausgleich-und.htm for more details on the Länderfinanzausgleich. For more information on the Solidarity Pact see http://www.bundesregierung.de/Politikthemen/Aufbau-Ost-,6253/Solidarpakt.htm. In 2005, regulations of Solidarity Pact II came into force, see http://www.bundesregierung.de/Politikthemen/Aufbau-Ost-,1872/Solidarpakt-II.htm. All documents can be found at http://www.bundesregierung.de.

[17]This redistribution process also includes a 6.2 billion euro subsidy by the federal government.

[18]Accounting for differences in population size and inflation (as well as West-East purchasing power differences) does not change but in fact accentuates this finding.

[19]Note that the relative version of Gini is used here, which is most commonly used in the income distribution literature.

[20]All observations of population $i$ are assigned their rank in the overall population and $\overline{F}_{ui}$ represents the expected value.

[21]For a more detailed discussion of between-group inequality and the relation to the overlapping index as well as a more precise description of the alternative specifications of $G_b$, see FRICK *et al.* (2006). See DICKEY (2001) for an empirical application to earnings inequality in the UK using the alternative decomposition of the Gini coefficient following PYATT (1976).

[22]Note, however, that for a given distribution i, the upper limit can be lower than 2 (for details see SCHECHTMAN, 2005).

[23]Note that the indices $O_{ji}$ and $O_{ij}$ are not interrelated by a simple relationship. However, it is clear that the indices of overlapping are not independent.

[24]A discussion of the estimation with grouped and weighted data is given in LERMAN and YITZHAKI (1989), and for a description of the jackknife estimation, see YITZHAKI (1991) FRICK *et al.* (2006).

[25]Income measures for 1989 and 1990 are not included in this analysis due to the introduction of the common currency on 1 July 1990 and comparability problems of East and West German incomes immediately after unification (see HAUSER *et al.* 1994).

[26]In line with the high share of owner-occupiers in West Germany (2003: 43% of private households), this income component is most relevant in the "old" federal states (approx. 4.5% of post-government income) as opposed to the Eastern part of the country (approx. 3%), where only about one-third of private households live in their own home. However, income inequality results for East and West Germany, as measured by the Gini coefficient, do not vary significantly once imputed rent is excluded from the employed income measure.

[27]Referring to Section 4, this implies that $G_{bp}$ is zero as well.

[28]All results are available in tabular form on request.

[29]BURKHAUSER *et al.* (1999) argue that when comparing time trends on inequality measures, one needs to properly consider the state of the business cycle, i.e., one should compare "peak to peak" and "trough to trough" years.

[30]In 1992, the East German Gini was .3711 as compared to .4129 in West Germany. In 2003, the corresponding values were .5227 and .4584, respectively.

[31]The results for the within- and between-group components are perfectly in line with those obtained from conventional inequality decomposition based on general entropy measures. Results are available on request.

[32]The impact of the overlapping component on between-group inequality can be seen in table 6 in the appendix, where the maximum between-group inequality ($G_{bp}$) is also listed. The figures show that the relation $\frac{G_b}{G_{bp}}$ decreases rapidly between 1992 and 1994 and is almost stable thenceforward.

[33]In this decomposition for only two groups, we refrain from presenting results for the group-by-group overlapping index, $O_{ji}$, given that $O_i$ qualitatively resembles $O_{ji}$. Note that $O_i$ is the weighted sum of the group-specific $O_{ji}$ with $O_{ii}$ being equal to one.

[34]According to STEWART (2002) between-region variation of the poverty rate in West Germany as measured at NUTS1-level (federal states) is rather low, especially when compared to other large EU-countries.

[35]For clarity of presentation, none of the figures in this section show results for Germany as a whole, which are given in Section 5.1 above. By definition, these do not change with the number of groups distinguished.

[36]Note that the overlapping index for two groups $i$ and $j$ may not be symmetrical (see Section 4).

[37]As such, our results provide reason for disappointment among those who wish to see Willy Brandt's message come true: "*now what belongs together will grow together*" (Original quote: "*Jetzt wächst zusammen, was zusammen gehört.*") Commentary about the fall of the Berlin Wall by Willy Brandt, German chancellor 1969-1974 and mayor of Berlin, on 10 November 1989.

[38]These finfings are perfectly in line with COLAVECCHIO *et al.* (2005), who analyze GDP per capita at the county level ("Kreis", n=439) derived from aggregated statistics by the Arbeitskreis VGR. They are also able to identify variation within East Germany, however: in 2001 about 80% of Eastern counties still belonged to the poorest of three income categories, while only 8% could be found in the richest category. Our results are based on micro-data with a finite number of observations, which cannot deal with such a high level of regional disaggregation.

[39]It is not clear at this point to what extent these processes are influenced by regional mobility of East Germans moving to the western part of the country and vice versa - however, given tendency towards selective mobility, this issue may be taken up in a future extension of this paper.

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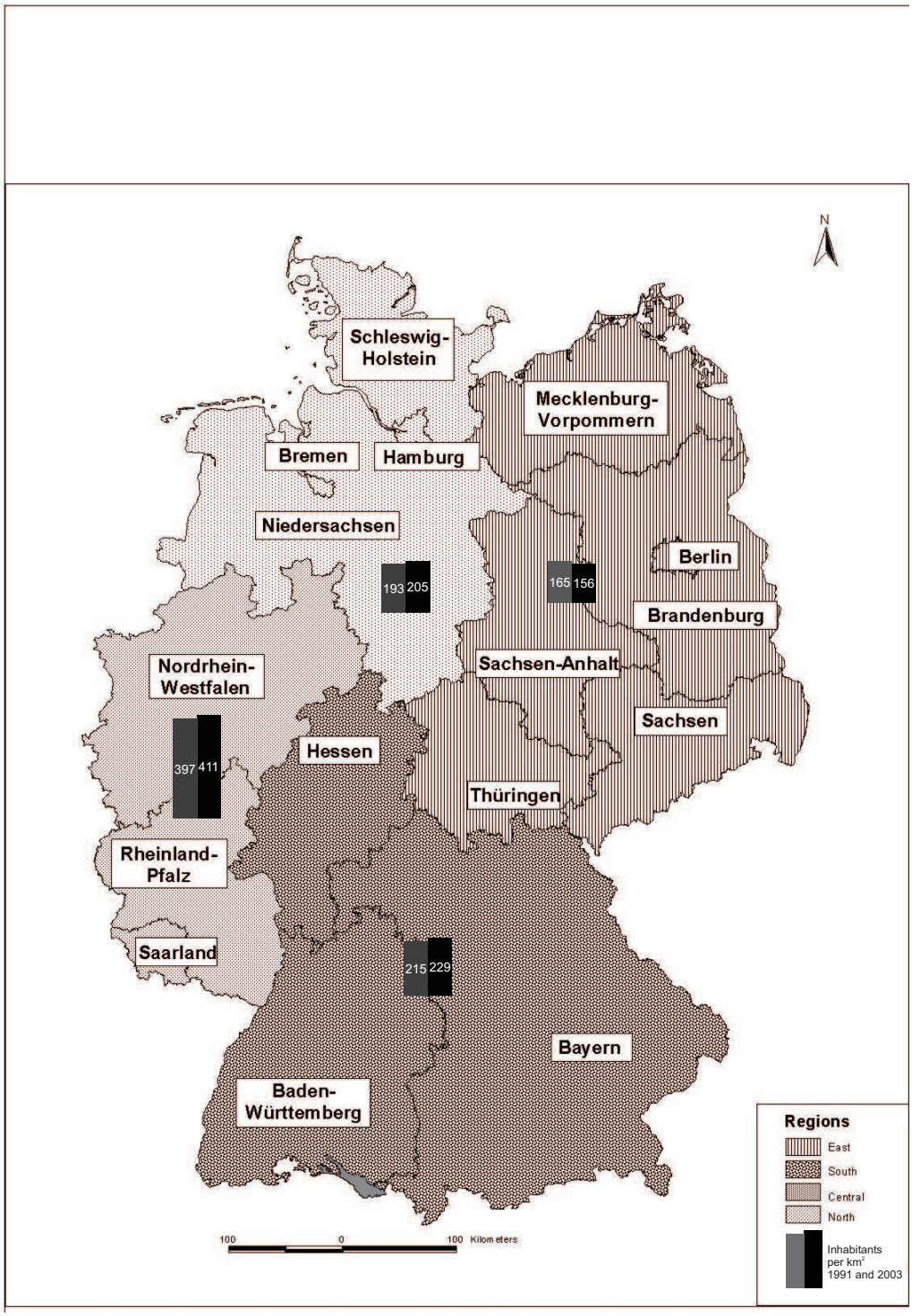
# A. Appendix

[Table 5 about here.]

[Table 6 about here.]

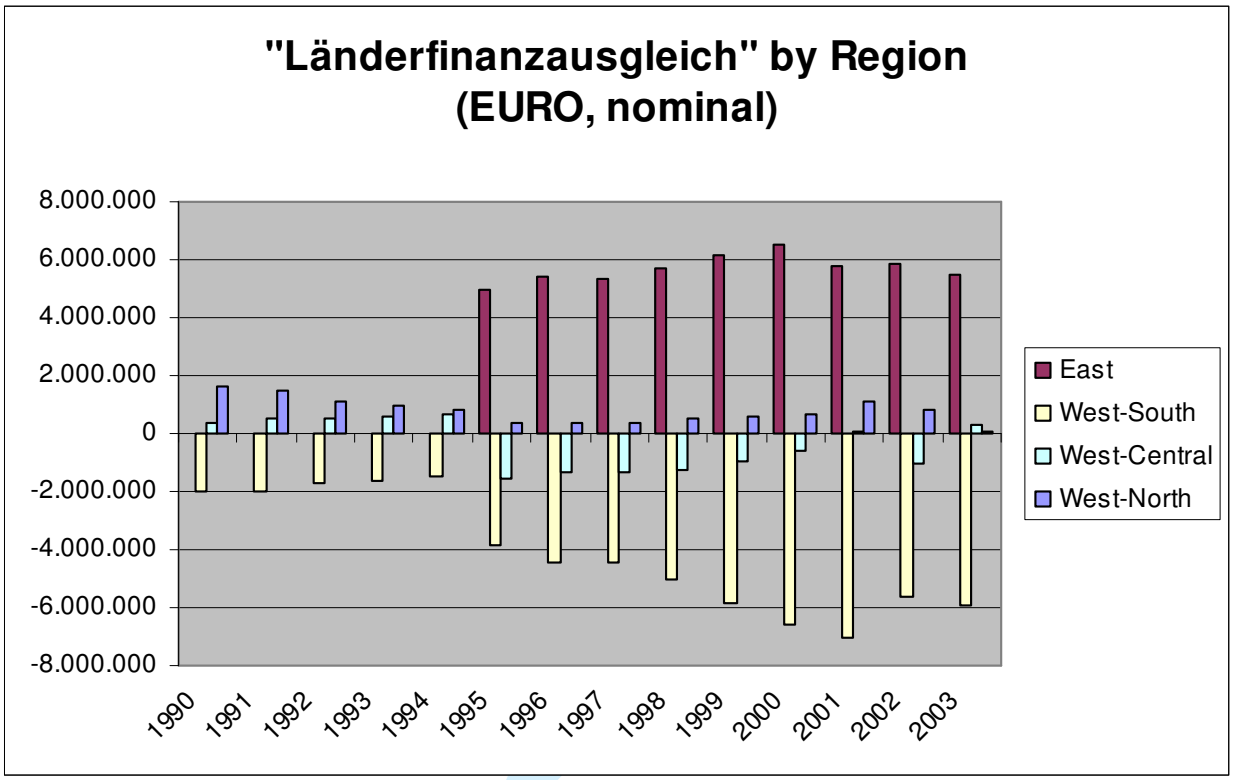
Figures 42

Figure 1: German Regions (Federal States) and Population Density



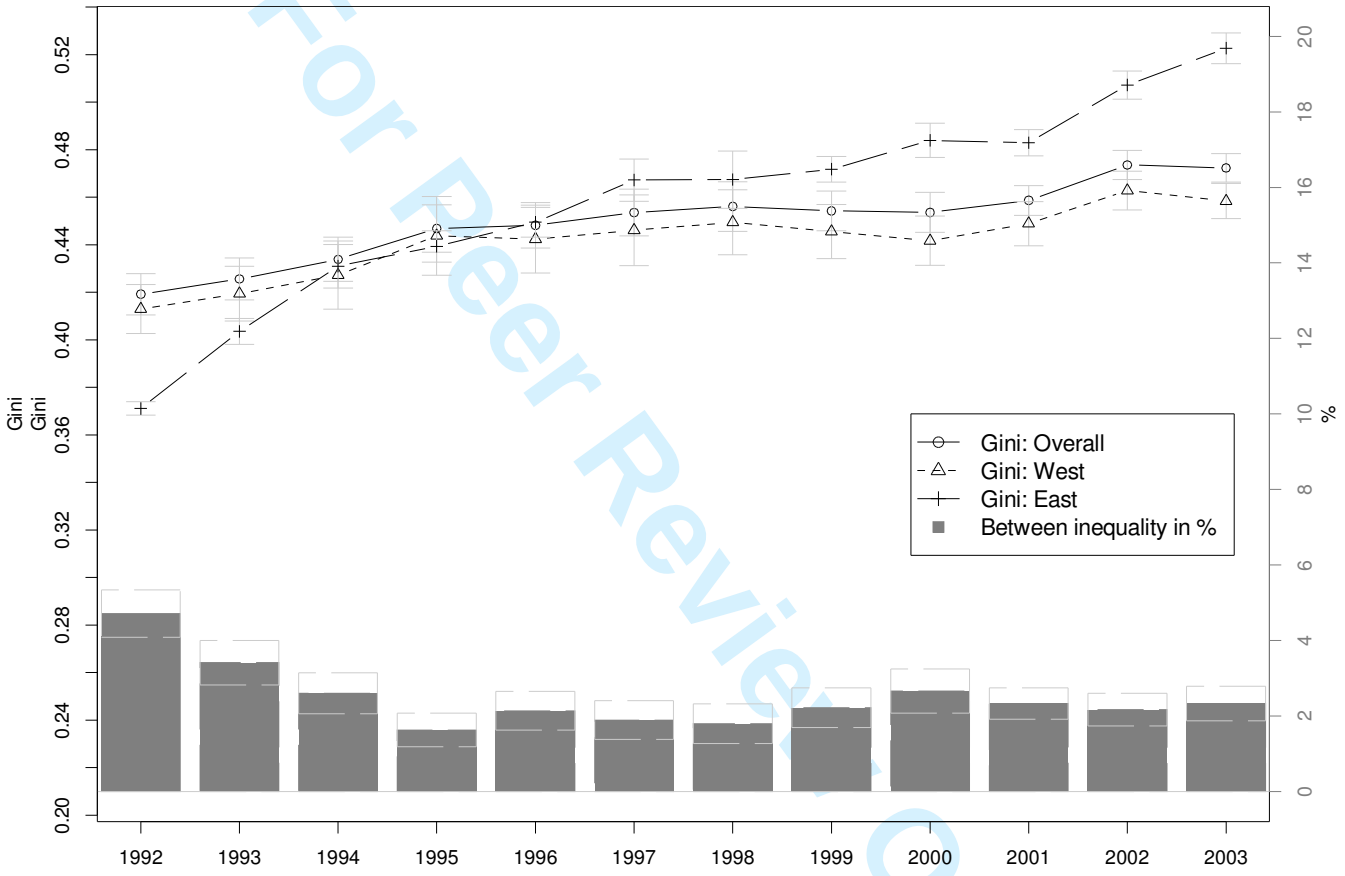

Source: Statistisches Bundesamt; Authors' calculations.

Figure 2: Financial Equalization across Regions




Source: Bundesfinanzministerium; Statistisches Bundesamt; Authors' calculations.

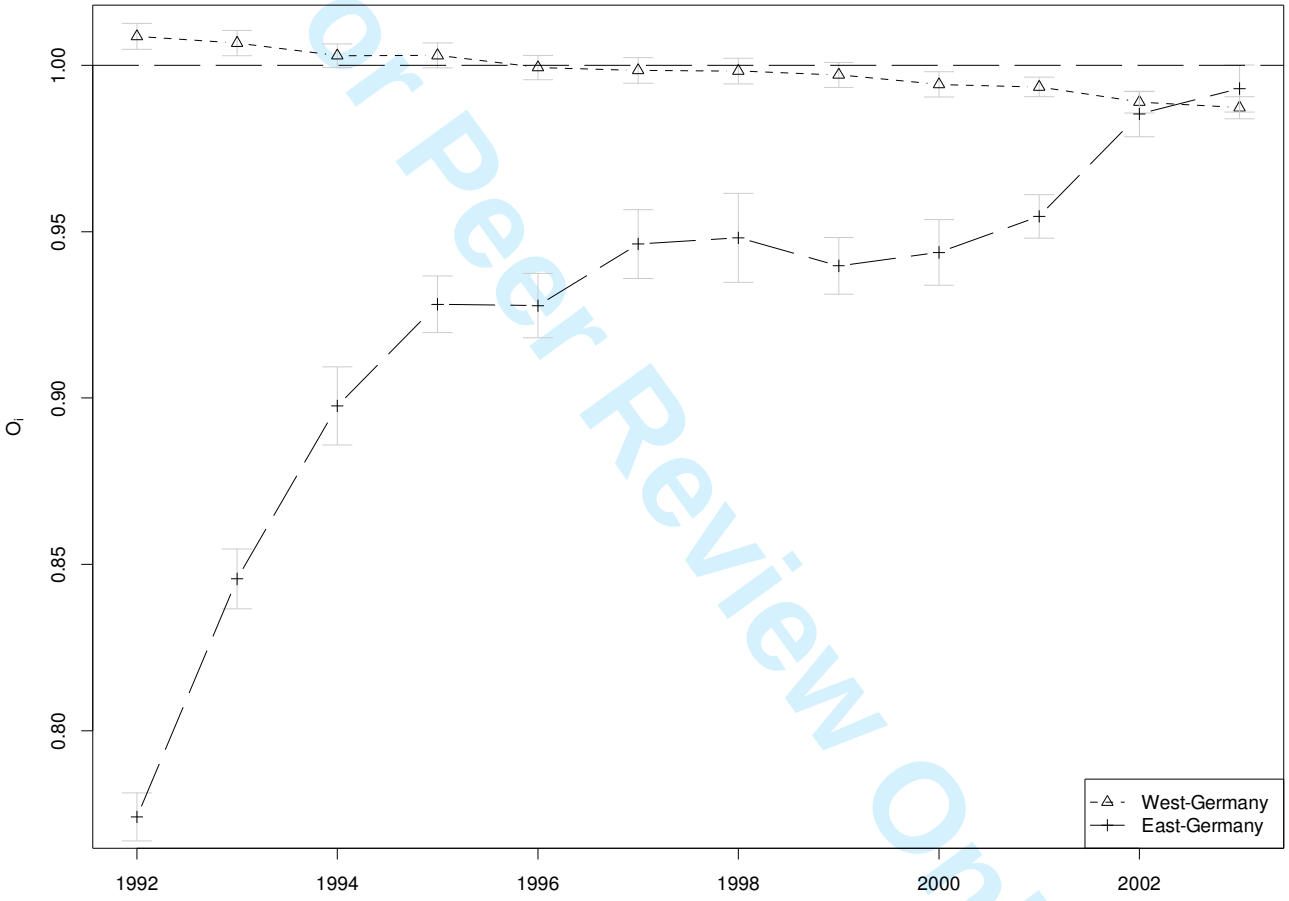
Figure 3: Inequality Decomposition on Pre-Government Income: East vs. West Germany, 1992-2003




Note: Confidence bands for the Gini are indicated by vertical lines and for between-group inequality by horizontal dashed lines, respectively.

Source: SOEP; Authors' calculations.

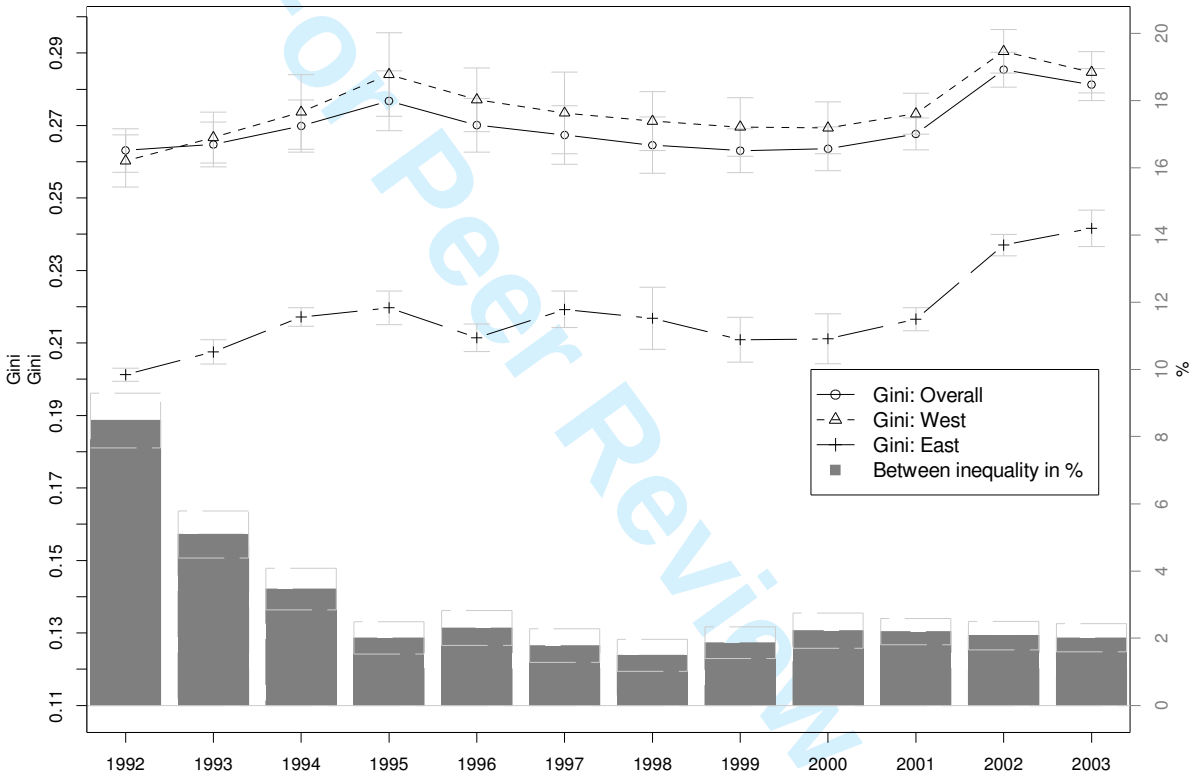
Figure 4: Overlapping on Pre-Government Income: East vs. West Germany, 1992-2003




Note: Confidence bands are indicated by vertical lines.

Source: SOEP; Authors' calculations.

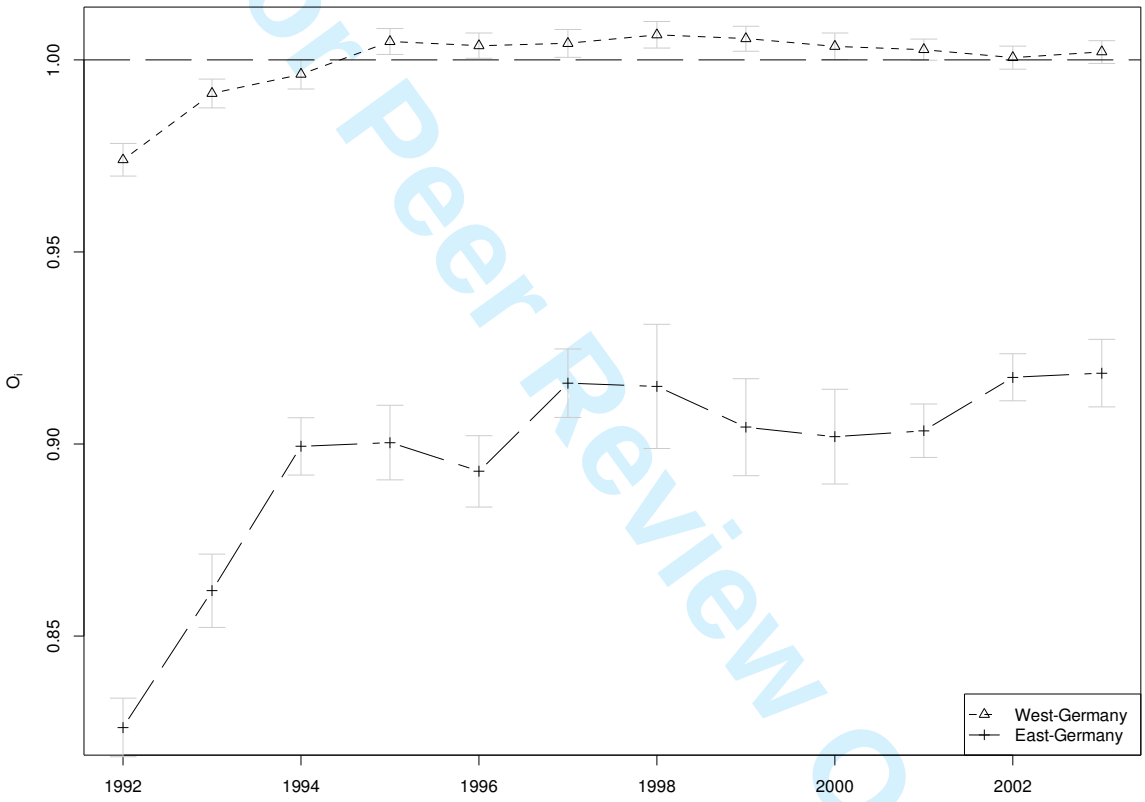
Figure 5: Inequality Decomposition on Post-Government Income: East vs. West Germany, 1992-2003




Note: Confidence bands for the Gini are indicated by vertical lines and for between-group inequality by horizontal dashed lines, respectively.

Source: SOEP; Authors' calculations.

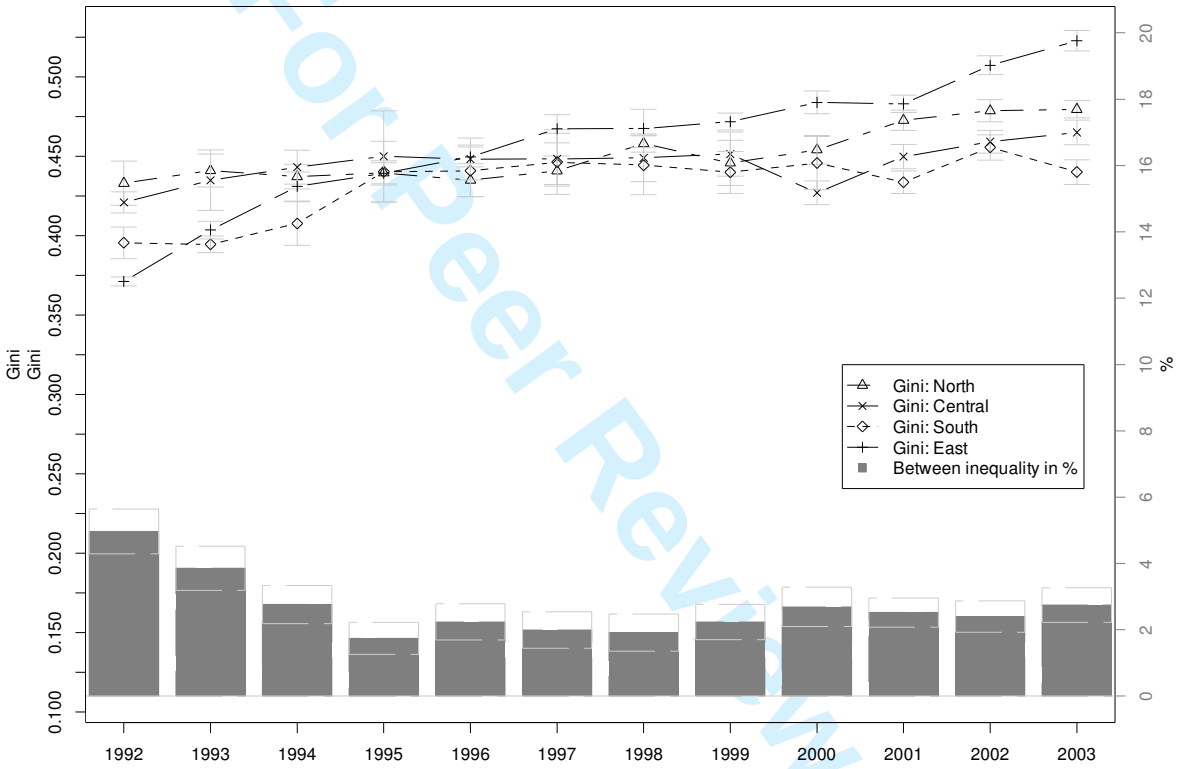
Figure 6: Overlapping on Post-Government Income: East vs. West Germany, 1992-2003




Note: Confidence bands are indicated by vertical lines.

Source: SOEP; Authors' calculations.

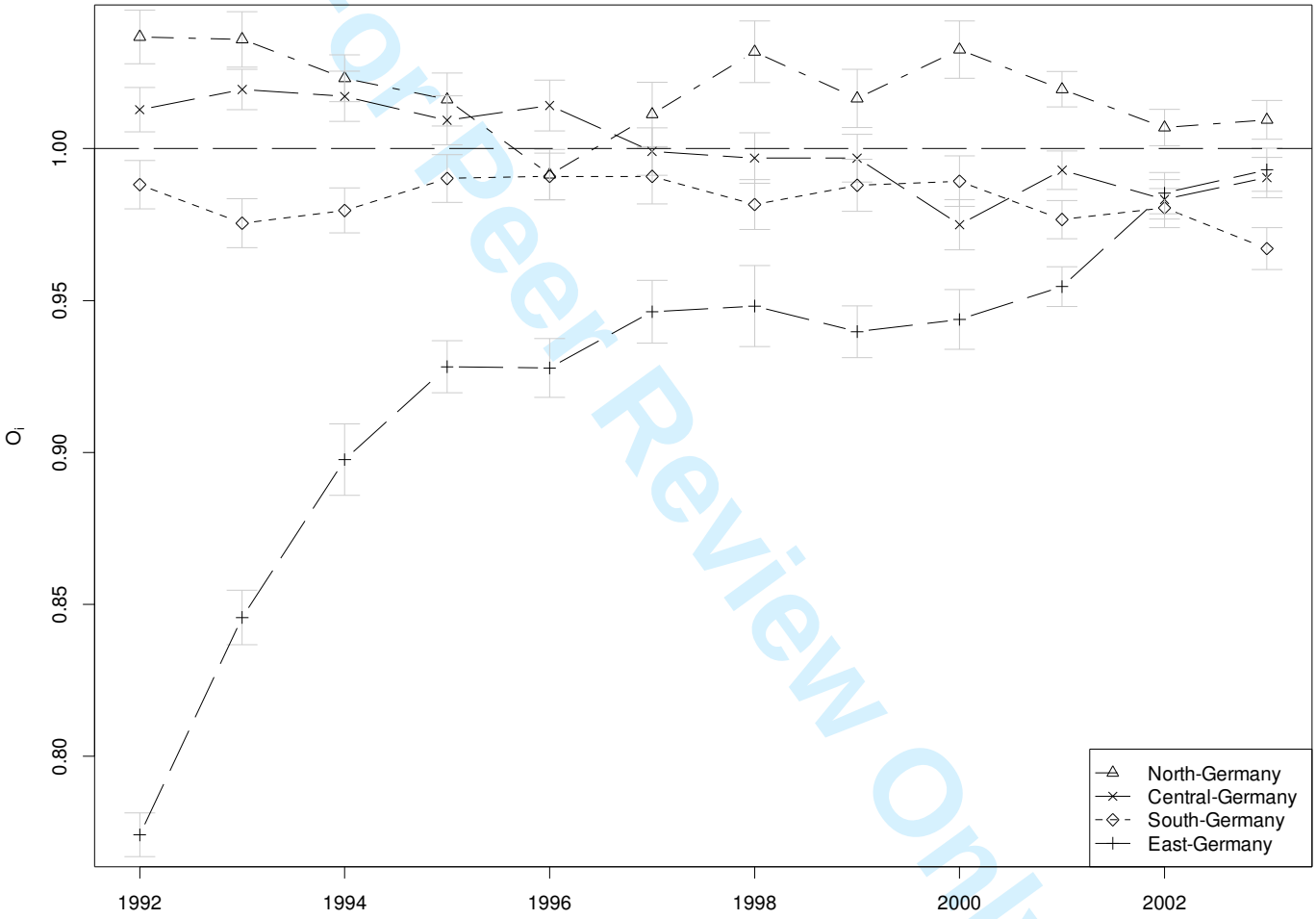
Figure 7: Inequality decomposition on Pre-Government Income: Extended regional grouping, 1992-2003




Note: Confidence bands for the Gini are indicated by vertical lines and for between-group inequality by horizontal dashed lines, respectively.

Source: SOEP; Authors' calculations.

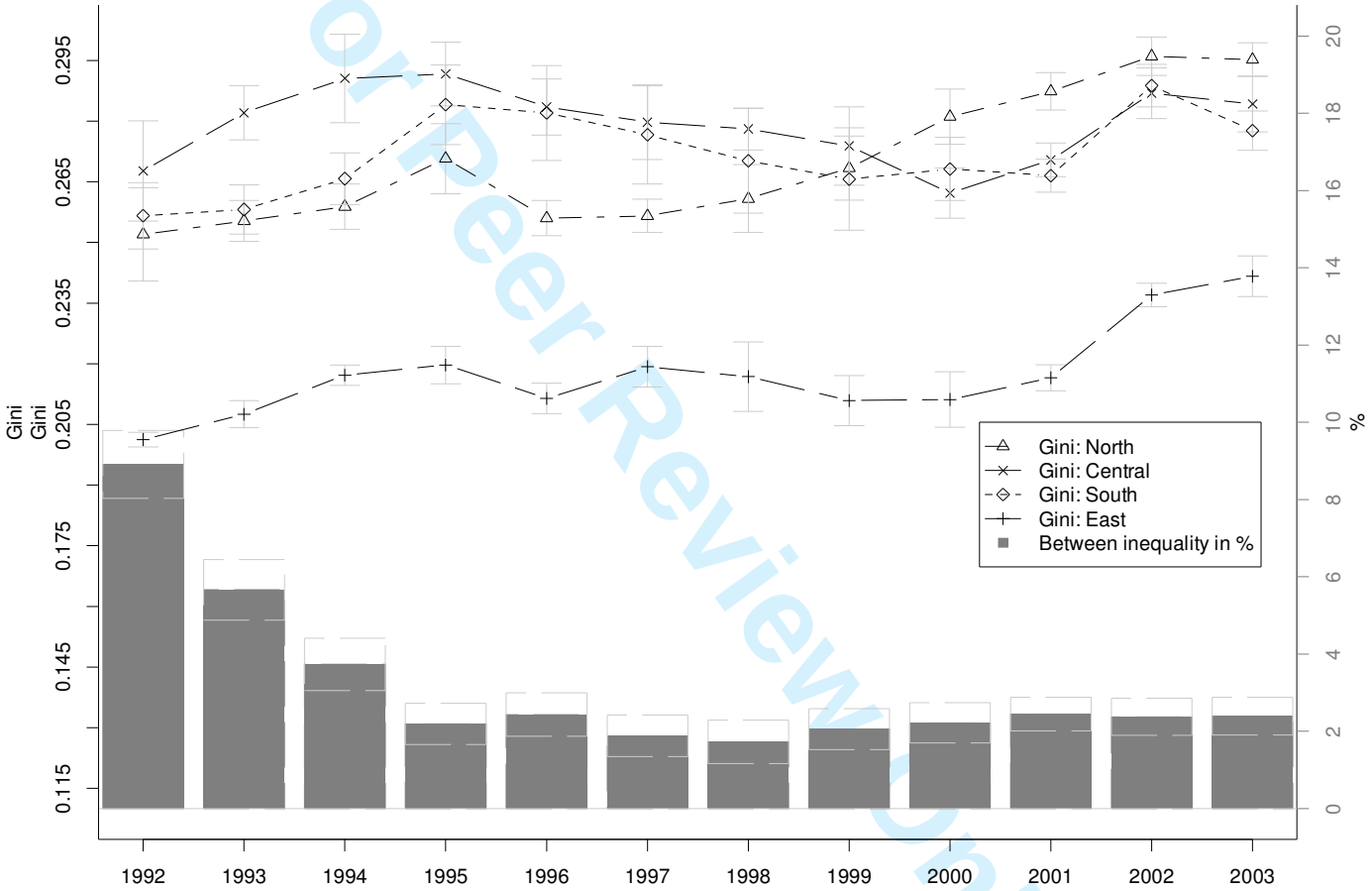
Figure 8: Overlapping on Pre-Government Income: Extended regional grouping, 1992-2003




Note: Confidence bands are indicated by vertical lines.

Source: SOEP; Authors' calculations.

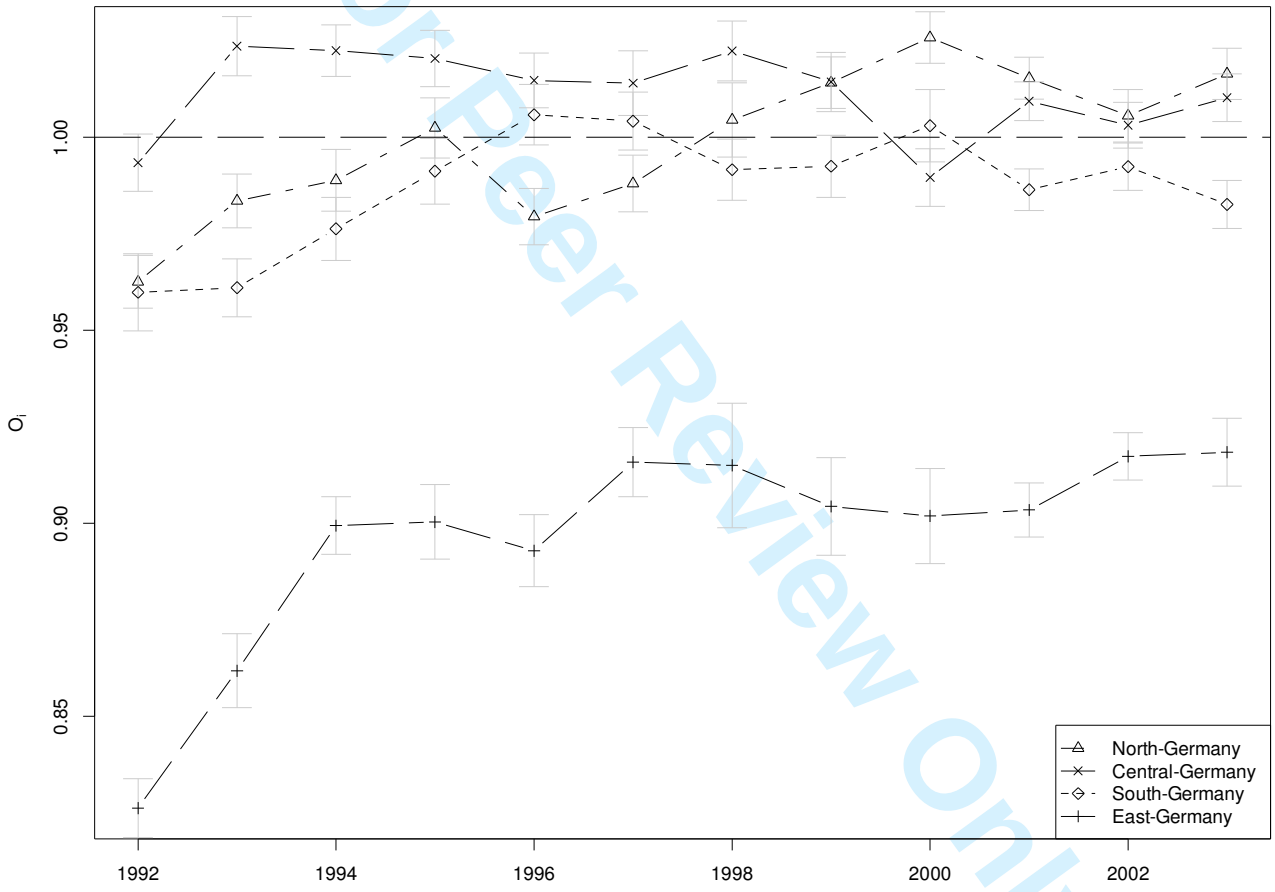
Figure 9: Inequality decomposition on Post-Government Income: Extended regional grouping, 1992-2003




Note: Confidence bands for the Gini are indicated by vertical lines and for between-group inequality by horizontal dashed lines, respectively.

Source: SOEP; Authors' calculations.

Figure 10: Overlapping on Post-Government Income: Extended regional grouping, 1992-2003




Note: Confidence bands are indicated by vertical lines.

Source: SOEP; Authors' calculations.

Table 1: Mean and Mean Rank for Pre-Government Income by German Regions

| | Mean Income (in €) | | | | | Mean Rank (Fi) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | East Total (1) | West Total (2) | Western Regions North (3) | Central (4) | South (5) | East Total (6) | West Total (7) | Western Regions North (8) | Central (9) | South (10) |
| 1992 | 12285 | 19683 | 18929 | 19203 | 20463 | 0.3 76 | 0.530 | 0.512 | 0.517 | 0.551 |
| 1993 | 13470 | 20225 | 19188 | 19550 | 21336 | 0.395 | 0.525 | 0.503 | 0.507 | 0.552 |
| 1994 | 13913 | 19965 | 18725 | 20162 | 20468 | 0.409 | 0.522 | 0.503 | 0.515 | 0.537 |
| 1995 | 14499 | 19569 | 18562 | 19471 | 20195 | 0.430 | 0.516 | 0.505 | 0.511 | 0.527 |
| 1996 | 14485 | 20501 | 19477 | 20416 | 21124 | 0.419 | 0.519 | 0.508 | 0.514 | 0.529 |
| 1997 | 14578 | 20070 | 18934 | 20005 | 20731 | 0.421 | 0.518 | 0.507 | 0.515 | 0.527 |
| 1998 | 14545 | 20026 | 18773 | 20318 | 20471 | 0.425 | 0.518 | 0.501 | 0.519 | 0.525 |
| 1999 | 14280 | 20423 | 20157 | 20368 | 20621 | 0.415 | 0.519 | 0.518 | 0.513 | 0.525 |
| 2000 | 14744 | 21605 | 21953 | 21846 | 21210 | 0.404 | 0.522 | 0.525 | 0.528 | 0.516 |
| 2001 | 14560 | 21076 | 21027 | 20142 | 21903 | 0.411 | 0.520 | 0.511 | 0.506 | 0.537 |
| 2002 | 14574 | 21005 | 20462 | 20062 | 22103 | 0.413 | 0.519 | 0.507 | 0.508 | 0.536 |
| 2003 | 14731 | 21351 | 20427 | 20319 | 22726 | 0.407 | 0.520 | 0.501 | 0.504 | 0.545 |

Source: SOEP, Authors calculations.

Table 2: Mean and Mean Rank for Post-Government Income by German Regions

| | Mean Income (in €) | | | | | Mean Rank ($F_i$) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | East | West | Western Regions | | | East | West | Western Regions | | |
| Year | Total | Total | North | Central | South | Total | Total | North | Central | South |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| 1992 | 11954 | 17240 | 16813 | 16764 | 17846 | 0.326 | 0.543 | 0.531 | 0.519 | 0.568 |
| 1993 | 13203 | 17602 | 16939 | 17146 | 18334 | 0.368 | 0.532 | 0.515 | 0.506 | 0.562 |
| 1994 | 13830 | 17610 | 16768 | 17630 | 18044 | 0.391 | 0.526 | 0.507 | 0.510 | 0.548 |
| 1995 | 14118 | 17182 | 16593 | 16968 | 17675 | 0.421 | 0.519 | 0.511 | 0.505 | 0.534 |
| 1996 | 14286 | 17549 | 16888 | 17484 | 17961 | 0.415 | 0.520 | 0.510 | 0.513 | 0.531 |
| 1997 | 14733 | 17560 | 17123 | 17399 | 17923 | 0.424 | 0.518 | 0.512 | 0.507 | 0.529 |
| 1998 | 14877 | 17488 | 16735 | 17338 | 18022 | 0.432 | 0.516 | 0.501 | 0.508 | 0.531 |
| 1999 | 14970 | 17914 | 17458 | 17709 | 18344 | 0.422 | 0.518 | 0.507 | 0.503 | 0.536 |
| 2000 | 15438 | 18771 | 18825 | 18764 | 18747 | 0.414 | 0.520 | 0.517 | 0.519 | 0.521 |
| 2001 | 15429 | 18819 | 19000 | 18179 | 19263 | 0.414 | 0.519 | 0.514 | 0.501 | 0.538 |
| 2002 | 15433 | 19067 | 18915 | 18431 | 19685 | 0.417 | 0.518 | 0.509 | 0.500 | 0.539 |
| 2003 | 15806 | 19323 | 19193 | 18609 | 19985 | 0.417 | 0.518 | 0.507 | 0.497 | 0.542 |

Source: SOEP, Authors' calculations.

Table 3: Overlapping for Each Group with Each Other Group ($O_{ji}$); Pre-Government Income

| Year | North with . . . | | | Central with . . . | | | South with . . . | | | East with . . . | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Central | South | East | North | South | East | North | Central | East | North | Central | South |
| 1992 | **1.020** | **1.035** | **1.097** | 0.981 | **1.018** | **1.051** | **0.959** | **0.978** | 1.008 | **0.704** | **0.737** | **0.713** |
| 1993 | 1.014 | **1.046** | **1.085** | 0.987 | **1.034** | **1.052** | **0.944** | **0.958** | 0.986 | **0.797** | **0.818** | **0.807** |
| 1994 | 1.000 | **1.032** | **1.064** | 1.001 | **1.039** | 1.018 | **0.964** | **0.960** | 0.987 | **0.860** | **0.871** | **0.882** |
| 1995 | 1.004 | 1.017 | **1.049** | 0.998 | 1.018 | 1.019 | 0.980 | 0.982 | 0.995 | **0.899** | **0.912** | **0.917** |
| 1996 | **0.975** | 0.992 | 1.006 | **1.025** | **1.021** | 1.012 | 1.003 | **0.979** | 0.9 79 | **0.925** | **0.899** | **0.913** |
| 1997 | 1.008 | 1.011 | **1.027** | 0.993 | 1.005 | 0.992 | 0.986 | 0.994 | **0.974** | **0.924** | **0.937** | **0.937** |
| 1998 | **1.028** | **1.045** | **1.045** | **0.973** | 1.015 | 0.983 | **0.954** | 0.986 | **0.969** | **0.907** | **0.941** | **0.948** |
| 1999 | 1.017 | **1.027** | 1.015 | 0.987 | 1.009 | 0.980 | **0.975** | 0.993 | **0.972** | **0.900** | **0.937** | **0.932** |
| 2000 | **1.056** | **1.043** | 1.012 | **0.945** | 0.986 | **0.948** | **0.958** | 1.015 | **0.963** | **0.883** | **0.946** | **0.946** |
| 2001 | **1.027** | **1.041** | 0.989 | **0.972** | 1.009 | **0.9 74** | **0.958** | **0.985** | **0.940** | **0.925** | **0.957** | **0.944** |
| 2002 | **1.024** | **1.020** | **0.963** | **0.976** | 0.995 | **0.942** | **0.976** | 0.998 | **0.921** | **0.971** | 0.998 | **0.975** |
| 2003 | **1.020** | **1.033** | **0.958** | **0.980** | 1.014 | **0.942** | **0.958** | **0.978** | **0.897** | **0.983** | 1.000 | 0.990 |

Note: Values significantly different from one are printed in bold. Source: SOEP, Authors calculations.

Table 4: Overlapping for Each Group with Each Other Group ($O_{ji}$); Post-Government Income

| Year | North with . . . | | | Central with . . . | | | South with . . . | | | East with . . . | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Central | South | East | North | South | East | North | Central | East | North | Central | South |
| 1992 | **0.969** | 0.989 | **0.873** | **1.032** | **1.024** | **0.895** | 1.003 | **0.967** | **0.839** | **0.808** | **0.812** | **0.748** |
| 1993 | **0.958** | 1.004 | **0.969** | **1.041** | **1.048** | 1.000 | **0.982** | **0.941** | **0.902** | **0.859** | **0.827** | **0.813** |
| 1994 | **0.962** | 0.996 | 1.005 | **1.036** | **1.048** | 0.996 | 0.993 | **0.952** | **0.954** | **0.896** | **0.872** | **0.867** |
| 1995 | **0.979** | 0.999 | **1.046** | **1.022** | **1.024** | **1.042** | 0.995 | **0.973** | 0.999 | **0.881** | **0.874** | **0.877** |
| 1996 | **0.961** | **0.962** | 1.018 | **1.036** | 1.006 | **1.030** | **1.030** | 0.993 | 1.012 | **0.899** | **0.863** | **0.855** |
| 1997 | **0.973** | **0.976** | 1.021 | **1.027** | 1.008 | **1.033** | **1.020** | 0.991 | 1.016 | **0.917** | **0.895** | **0.887** |
| 1998 | 0.9 79 | 1.000 | **1.055** | 1.020 | 1.026 | **1.051** | 0.991 | **0.971** | 1.008 | **0.903** | **0.887** | **0.898** |
| 1999 | 1.000 | 1.013 | **1.052** | 1.004 | **1.021** | **1.036** | 0.982 | **0.978** | 1.011 | **0.879** | **0.891** | **0.877** |
| 2000 | **1.035** | **1.021** | **1.047** | **0.965** | 0.990 | 0.999 | **0.980** | 1.011 | 1.021 | **0.849** | **0.903** | **0.878** |
| 2001 | 1.007 | **1.027** | **1.022** | 0.990 | **1.014** | **1.036** | **0.972** | **0.979** | 0.989 | **0.869** | **0.890** | **0.882** |
| 2002 | 1.003 | 1.009 | 1.010 | 0.996 | 1.003 | 1.016 | 0.989 | 0.990 | 0.986 | **0.900** | **0.913** | **0.887** |
| 2003 | 1.007 | **1.028** | **1.028** | 0.992 | **1.017** | **1.033** | **0.969** | **0.973** | **0.980** | **0.891** | **0.908** | **0.900** |

Note: Values significantly different from one are printed in bold. Source: SOEP, Authors calculations.

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Table 5: Grouping of Federal States and Economic Indicators

| | ***East*** | ***West*** | | | ***Total*** |
|---|---|---|---|---|---|
| ***Grouping 1*** | Berlin, Brandenburg, Mecklenburg-Vorpommern, Sachsen, Sachsen-Anhalt, Thüringen | Baden-Württemberg, Bayern, Hessen, Nordrhein-Westfalen, Rheinland-Pfalz, Saarland, Bremen, Hamburg, Niedersachsen, Schleswig-Holstein | | | |
| | | South | Central | North | |
| ***Extended Grouping 2*** | Berlin, Brandenburg, Mecklenburg-Vorpommern, Sachsen, Sachsen-Anhalt, Thüringen | Baden-Württemberg, Bayern, Hessen | Nordrhein-Westfalen, Rheinland-Pfalz, Saarland | Bremen, Hamburg, Niedersachsen, Schleswig-Holstein | |
| ***Population size (%)*** | | | | | |
| ***1991*** | *22,4* | *34,2* | *27,9* | *15,5* | *100,0* |
| ***2003*** | *20,5* | *35,4* | *28,1* | *16,0* | *100,0* |
| ***Gross Domestic Product (%)*** | | | | | |
| ***1991*** | *11,0* | *41,4* | *30,2* | *17,3* | *100,0* |
| ***2003*** | *14,8* | *41,3* | *27,5* | *16,4* | *100,0* |
| ***GDP per capita (1995 prices)*** | | | | | |
| ***1991*** | *11,997* | *25,452* | *22,563* | *23,366* | *21,312* |
| ***2003*** | *17,224* | *28,216* | *23,605* | *24,574* | *24,084* |
| ***Unemployment Rate (% of labor force)*** | | | | | |
| ***09/1991*** | *11.5* | *4.1* | *7.1* | *7.6* | *7.4* |
| ***09/2003*** | *19.4* | *7.4* | *10.2* | *10.4* | *11.2* |
| ***Public sector[a] (%)*** | | | | | |
| ***1991*** | *33.8* | *23.7* | *24.7* | *28.1* | *27.1* |
| ***2003*** | *29.8* | *23.0* | *27.1* | *29.1* | *26.5* |
| ***Industrial composition (%)*** | | | | | |
| ***1991*** | | | | | |
| ***Agriculture, Mining*** | 5.9 | 1.0 | 0.9 | 1.7 | 2.2 |
| ***Manufacturing*** | 38.1 | 41.2 | 39.5 | 31.8 | 38.6 |
| ***Service Sector*** | 56.0 | 57.8 | 59.6 | 66.5 | 59.3 |
| ***2003*** | | | | | |
| ***Agriculture, Mining*** | 2.6 | 0.8 | 1.0 | 1.5 | 1.3 |
| ***Manufacturing*** | 23.5 | 32.1 | 27.9 | 24.7 | 28.1 |
| ***Service Sector*** | 73.8 | 67.1 | 71.1 | 73.8 | 70.6 |
| Average wage and salary by industrial sector (in 1,000 € p.a.) | | | | | |
| ***1991, total*** | 12,659 | 21,826 | 21,964 | 21,040 | 19,691 |
| ***Agriculture, Mining*** | 9,270 | 15,067 | 14,401 | 13,791 | 11,442 |
| ***Manufacturing*** | 12,632 | 24,220 | 24, 586 | 24,432 | 21,659 |
| ***Service Sector*** | 12,983 | 20,178 | 20,333 | 19,590 | 18,710 |
| ***2003, total*** | 22,084 | 27,973 | 26,643 | 25,832 | 26,214 |
| ***Agriculture, Mining*** | 14,313 | 18,189 | 16,937 | 16,5 74 | 16,333 |
| ***Manufacturing*** | 24,928 | 34,172 | 33,033 | 33,124 | 3 2,174 |
| ***Service Sector*** | 21,556 | 25,066 | 24,263 | 23,616 | 24,023 |

[a]: Share of full-time or part-time employed persons in the public sector, including civil servants.

Source: Statistisches Bundesamt; authors' calculations.

Tables

Table 6: Inequality Decomposition components

| | *Group specific Gini ($G_i$)* | | | | | *Overlapping Index ($O_i$)* | | | | | *East vs. West* | | | *Extended Grouping* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Year* | *East* | *West* | *North* | *Central* | *South* | *East* | *West* | *North* | *Central* | *South* | $G_b$ | $s_iG_iO_i$ | $G_{bp}$ | $G_b$ | $s_iG_iO_i$ | $G_{bp}$ |
| | *Pre Government Income* | | | | | | | | | | | | | | | |
| 1992 | 0.371 | 0.413 | 0.433 | 0.421 | 0.395 | 0.774 | 1.009 | 1.037 | 1.013 | 0.988 | 0.020 | 0.399 | 0.064 | 0.021 | 0.398 | 0.077 |
| 1993 | 0.404 | 0.419 | 0.441 | 0.435 | 0.395 | 0.846 | 1.007 | 1.036 | 1.019 | 0.975 | 0.015 | 0.411 | 0.056 | 0.016 | 0.409 | 0.073 |
| 1994 | 0.431 | 0.427 | 0.437 | 0.443 | 0.408 | 0.898 | 1.003 | 1.023 | 1.017 | 0.980 | 0.011 | 0.423 | 0.050 | 0.012 | 0.422 | 0.061 |
| 1995 | 0.439 | 0.444 | 0.440 | 0.450 | 0.440 | 0.928 | 1.003 | 1.016 | 1.009 | 0.990 | 0.007 | 0.440 | 0.042 | 0.008 | 0.439 | 0.054 |
| 1996 | 0.449 | 0.442 | 0.435 | 0.448 | 0.441 | 0.928 | 0.999 | 0.991 | 1.014 | 0.991 | 0.010 | 0.439 | 0.048 | 0.010 | 0.438 | 0.059 |
| 1997 | 0.467 | 0.446 | 0.441 | 0.448 | 0.446 | 0.946 | 0.998 | 1.011 | 0.999 | 0.991 | 0.009 | 0.445 | 0.044 | 0.009 | 0.445 | 0.057 |
| 1998 | 0.467 | 0.449 | 0.458 | 0.449 | 0.444 | 0.948 | 0.998 | 1.032 | 0.997 | 0.982 | 0.008 | 0.448 | 0.044 | 0.009 | 0.447 | 0.055 |
| 1999 | 0.472 | 0.446 | 0.446 | 0.451 | 0.440 | 0.940 | 0.997 | 1.017 | 0.997 | 0.988 | 0.010 | 0.444 | 0.048 | 0.010 | 0.444 | 0.052 |
| 2000 | 0.484 | 0.442 | 0.454 | 0.427 | 0.446 | 0.944 | 0.994 | 1.033 | 0.975 | 0.989 | 0.012 | 0.442 | 0.051 | 0.012 | 0.441 | 0.057 |
| 2001 | 0.483 | 0.449 | 0.473 | 0.450 | 0.434 | 0.955 | 0.994 | 1.020 | 0.993 | 0.977 | 0.011 | 0.448 | 0.049 | 0.012 | 0.447 | 0.063 |
| 2002 | 0.507 | 0.463 | 0.479 | 0.459 | 0.456 | 0.985 | 0.989 | 1.007 | 0.983 | 0.980 | 0.010 | 0.463 | 0.048 | 0.011 | 0.462 | 0.065 |
| 2003 | 0.523 | 0.458 | 0.480 | 0.465 | 0.440 | 0.993 | 0.987 | 1.009 | 0.990 | 0.967 | 0.011 | 0.461 | 0.048 | 0.013 | 0.459 | 0.068 |
| | *Post Government Income* | | | | | | | | | | | | | | | |
| 1992 | 0.201 | 0.260 | 0.252 | 0.268 | 0.257 | 0.826 | 0.974 | 0.963 | 0.993 | 0.960 | 0.022 | 0.241 | 0.051 | 0.023 | 0.240 | 0.062 |
| 1993 | 0.208 | 0.267 | 0.255 | 0.282 | 0.258 | 0.862 | 0.991 | 0.984 | 1.024 | 0.961 | 0.013 | 0.251 | 0.041 | 0.015 | 0.250 | 0.054 |
| 1994 | 0.217 | 0.274 | 0.259 | 0.291 | 0.266 | 0.899 | 0.996 | 0.989 | 1.022 | 0.976 | 0.009 | 0.261 | 0.035 | 0.010 | 0.260 | 0.045 |
| 1995 | 0.220 | 0.284 | 0.271 | 0.292 | 0.284 | 0.900 | 1.005 | 1.002 | 1.020 | 0.991 | 0.006 | 0.271 | 0.028 | 0.006 | 0.271 | 0.038 |
| 1996 | 0.211 | 0.277 | 0.256 | 0.284 | 0.282 | 0.893 | 1.004 | 0.979 | 1.015 | 1.006 | 0.006 | 0.264 | 0.030 | 0.007 | 0.264 | 0.038 |
| 1997 | 0.219 | 0.273 | 0.257 | 0.280 | 0.277 | 0.916 | 1.004 | 0.988 | 1.014 | 1.004 | 0.005 | 0.263 | 0.025 | 0.005 | 0.262 | 0.032 |
| 1998 | 0.217 | 0.271 | 0.261 | 0.278 | 0.270 | 0.915 | 1.007 | 1.005 | 1.022 | 0.992 | 0.004 | 0.261 | 0.024 | 0.005 | 0.260 | 0.034 |
| 1999 | 0.211 | 0.270 | 0.268 | 0.274 | 0.266 | 0.904 | 1.006 | 1.014 | 1.014 | 0.993 | 0.005 | 0.258 | 0.026 | 0.005 | 0.258 | 0.033 |
| 2000 | 0.211 | 0.269 | 0.281 | 0.262 | 0.268 | 0.902 | 1.004 | 1.026 | 0.990 | 1.003 | 0.006 | 0.258 | 0.028 | 0.006 | 0.258 | 0.028 |
| 2001 | 0.217 | 0.273 | 0.287 | 0.270 | 0.267 | 0.903 | 1.003 | 1.015 | 1.009 | 0.986 | 0.006 | 0.262 | 0.028 | 0.007 | 0.261 | 0.037 |
| 2002 | 0.237 | 0.290 | 0.296 | 0.287 | 0.289 | 0.917 | 1.001 | 1.006 | 1.003 | 0.992 | 0.006 | 0.279 | 0.029 | 0.007 | 0.279 | 0.040 |
| 2003 | 0.242 | 0.285 | 0.295 | 0.284 | 0.278 | 0.918 | 1.002 | 1.016 | 1.010 | 0.983 | 0.006 | 0.276 | 0.028 | 0.007 | 0.275 | 0.039 |

Source: SOEP; Authors calculations.