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**Article**

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Immo Frieden\*, Andreas Peichl and Paul Schüle

# Regional Income Inequality in Germany

## KEY MESSAGES

- We characterize regional inequality in gross incomes at the municipality level in Germany using data from administrative tax returns for the period 1998-2016
- More unequal municipalities are more likely to be urban and located in West Germany
- Decomposing the increase in inequality in the last two decades into a between and within municipality component, we find that the increase was entirely driven by growing inequality within municipalities
- Thirty years after reunification, Germany is a country with rather modest interregional inequalities but a growing level of intraregional inequality

Allocating incomes fairly within a society is currently one of the key economic challenges in developed countries. What a “fair” income distribution looks like is, of course, a matter of public discourse. In recent years, the spatial component of inequality has received growing attention in this debate. While income differences between countries are declining since decades in Europe, income differences between the regions of a given country are growing since 1990 (Rosés and Wolf 2018). Many are concerned that these growing gaps signal that regions and people are being left behind, undermining inclusive growth in the countries and leading to political backlash. Furthermore, if people have a preference to stay in their home re-

\* All views expressed in this article are those of the author and do not necessarily reflect those of the European Central Bank.

gions, they may rather be concerned about their position in the regional – rather than national – income distribution.

In this article, we provide new evidence on regional income inequality in Germany, using tabulated income tax statistics for the period 1998-2016. Other than related work on regional income inequality in Germany which analyzes income (e.g., Bartels 2019; Bartels et al. 2020; Immel and Peichl 2020; Immel 2021) or wages (e.g., Dauth et al. 2014 and 2021) at the county level, we can characterize inequality at the municipality level. As there currently exist 401 counties in Germany, but more than 10,000 municipalities, our analysis is conducted at a much more fine-grained level.

Our findings can be summarized as follows. First, there are persistent differences in the level of regional inequality across Germany. Inequality in West Germany is higher than in East Germany, highly populated municipalities are found to be more unequal, and urban locations are more unequal than their rural counterparts, even conditional on population size. Second, by decomposing overall inequality into a within and between municipality component, we show that income disparities within municipalities account for over 95 percent percent of national inequality. These results mirror the findings in Schluter and Trede (2021), who also decomposed regional inequality in Germany, but for the much more aggregated commuting zones and using wage earnings. Third, we document that the national increase in income inequality in the late 1990s and early 2000s was again mainly driven by growth in within – rather than between – municipality inequality. Overall, Germany is currently a country with rather modest interregional inequalities but a growing level of intraregional inequality.



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## DATA

We use income data from tabulated tax records at the municipality level for the years 1998, 2001, 2004, 2015, and 2016, which we obtained by filing individual requests to the Statistical Offices of the German federal states. We thus have a panel with five data points, spanning a range of 18 years. For 10 of the 16 German states, we have data for each of these years, while for 4 states information for the year 1998 is missing. Statistics for Saxony and Schleswig-Holstein are available only in the years 2015 and 2016. Appendix Table A1 provides a detailed description of the available data by state.

These high-quality administrative data provide a reliable source of information of the local income distributions in all German municipalities and are also accurate for high-income individuals. In contrast, low-income individuals are covered less reliably, as not all adult individuals in Germany file a tax return (Drechsel-Grau et al. 2022). The tabulated data contain information on the sum of gross pre-tax income for all taxpayers within two income thresholds. Thus, average incomes per income bracket and per municipality can be determined. Gross pre-tax income includes seven income categories: agriculture and forestry, business, self-employment, employment, capital income, renting and leasing, and other potential income sources. For privacy reasons, gross income and the number of taxpayers are not reported for all income brackets in some municipalities. We impute these missing values using polynomial or exponential approximations. Whenever the amount of missing tax units was higher than five percent, the corresponding municipality was dropped.

We then use generalized Pareto interpolation to estimate the full income distribution in percentiles (Blanchet et al. 2022). Based on these data, we compute different inequality measures: the Theil index, the Gini coefficient, and top income shares. In our baseline analysis, we focus on the Theil index because it can be additively decomposed into a within-municipality and a between-municipality component of inequality. The Theil index ( $GE(1)$ ) belongs to the class of generalized entropy indices ( $GE(\alpha)$ ), where  $\alpha$  is a parameter for the sensitivity towards higher incomes. A high Theil index implies high inequality, while  $GE(1)=0$  implies total equality in incomes.

## REGIONAL INEQUALITY STATISTICS

Figure 1 shows a heat map of the Theil Index for the year 2016 at the municipality level. The median Theil index value is 0.41, which corresponds to a top 10 percent income share of 32.7 percent and a Gini coefficient of 0.47. Income inequality levels across municipalities vary extensively, and we observe extreme values on both ends of the distribution. While those outliers are mostly municipalities characterized

by a small population size, the variation also remains large when abstracting from extreme values: the municipality at the 90th percentile of the distribution of the Theil index is, for example, 87 percent more unequal than the municipality at the 10th percentile. By construction, variation in the top 10 percent income share and the Gini coefficient is somewhat less pronounced, but still substantial.

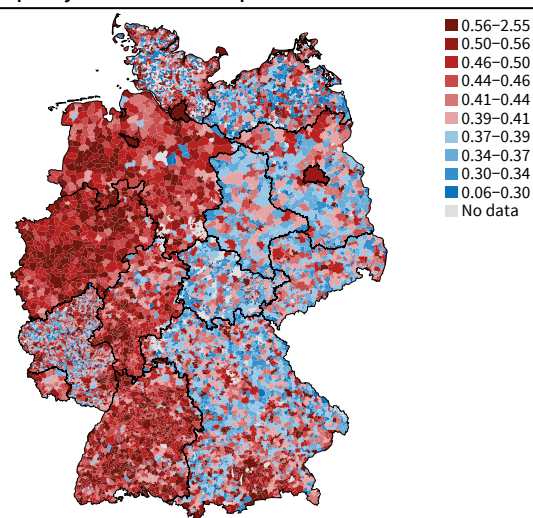
A consistent finding in our data is that income inequality increases in the population size of the municipality. Hamburg, for example, has a high top 10 percent income share (43.2 percent in 2016) and ranges among the top 5 percent of the most unequal municipalities in Germany. On the other hand, the 5 percent most equal municipalities mostly consist of small municipalities. In terms of our preferred inequality measure, the Theil index, Hamburg is at least two times more unequal than these municipalities. This city-size penalty has been previously documented in various contexts (Schluter and Trede 2021; Dauth et al. 2022).

A second stable pattern in our data is that municipalities in Western Germany are on average more unequal than their counterparts in the East. Municipalities in Baden-Württemberg exhibit on average the highest levels of inequality. The most equal municipalities are located in Thuringia. In Erfurt, the capital of Thuringia, the Theil index amounts to 0.45, and the Top 10 income share to 35 percent. In the slightly smaller city of Heilbronn in Baden-Württemberg, the Theil index is as high as 1.54, and the 10 percent highest-income households receive almost 60 percent of total income.

## National Trends

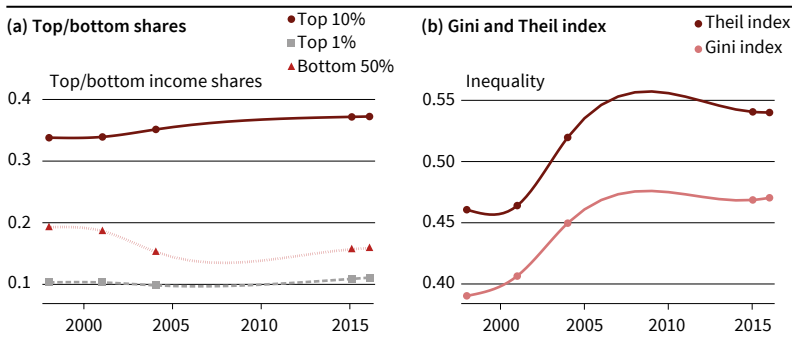
We next investigate changes over time at the national level. Figure 2, Panel (a), shows trends in the income shares of the top 1, top 10, and bottom 50 percent

Figure 1  
Inequality in German Municipalities in 2016



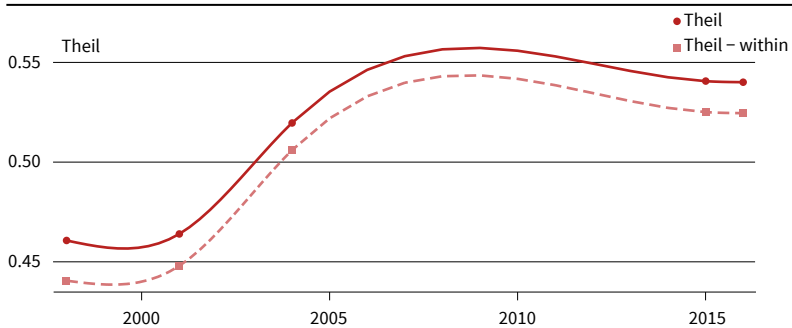
Note: This map shows municipality-level Theil indices in 2016. For Lower Saxony, small municipalities are aggregated to larger units (Samtgemeinden) due to data availability. The class breaks are defined by assigning municipalities into deciles. Source: Authors' calculations. © ifo Institute

Figure 2  
National Inequality Trends



Note: The figures show national income inequality trends. Figure (a) shows the evolution of different income shares over time. Figure (b) shows the evolution of the Theil index and of the Gini index over time. The lines show a smoothed median spline.  
Source: Authors' calculations. © ifo Institute

Figure 3  
Decomposition of the Theil Index in Within- and Between-Municipality Inequality



Note: The figure shows national income inequality in Germany for the period 1998–2016 as measured by the Theil index, and the within-municipality component of the Theil index for each point in time. The lines are fitted using a median spline.  
Source: Authors' calculations. © ifo Institute

of the income distribution for the period from 1998 to 2016. The top 10 percent income share, that is the share in total income that is earned by the richest 10 percent of taxpayers, increased steadily during the last two decades and ultimately rose by roughly ten percent from 33.8 percent in 1998 to 37.2 percent in 2016. Additionally, the top 1 percent income share rose from 10.3 percent to 11.1 percent in the same time span. The temporary drop in 2004 is potentially explained by the gradual exclusion of capital income from personal income taxation, as explained below. As capital income accounts for a larger share in total earnings at the top of the distribution, true income growth among the top 10 percent and top 1 percent income earners might have been even higher, and our estimates can be interpreted as lower bounds. In contrast, the income share earned by the bottom 50 percent decreased by more than fifteen percent since 1998, decreasing from 19.3 percent to 15.9 percent.

As top earners have gained during this period while taxpayers in the bottom half of the distribution have lost in relative terms, it is no surprise that aggregate inequality as measured by the Theil index and the Gini coefficient increased. Panel (b) of Figure 2 shows that the Gini coefficient increased by more than 20 percent from a value of 0.39 in 1998 to

0.47 in 2016. The Theil index rose in accordance. These results confirm the finding of an increase in national income inequality during this period, especially in the years 2000–2005, as documented, for example, in Bartels (2019), Biewen et al. (2018), Drechsel-Grau et al. (2022), and Fuchs-Schündeln et al. (2010).

### DECOMPOSING INEQUALITY TRENDS IN GERMANY

To better understand the regional component of this increase in income inequality, we investigate if inequality arises mainly due to income differences between or within regions. A distinct feature of all generalized entropy indices is their additive decomposability.

$$(1) GE(\alpha) = GE(\alpha)_{within} + GE(\alpha)_{between}$$

We can thus compute the share of national level inequality in the Theil index arising from income differences within municipalities and the share of inequality which arises because average incomes differ between municipalities.

### Within- and Between-municipality Inequality

In Figure 3, we decompose national income inequality in Germany in a within- and between-municipality component and plot the composition over time. The within-municipality component accounts for the lion's share of inequality in Germany: between 95.6 and 97.4 percent of inequality in gross income can be described by the income differences within the municipalities, depending on the year under consideration. Furthermore, the increase in within-municipality inequality (19 percent between 1998 and 2016) was more pronounced than the respective increase in overall inequality (17 percent). This implies that regional differences in income levels have actually declined in the past decades and cannot explain the increase in national inequality. The high share of within-municipality inequality is also visible for other general entropy indices like the mean log deviation ( $GE(0)$ ). By construction, the share of interregional inequality is even lower at higher levels of spatial aggregation, such as counties and states (compare Appendix Figure A2).

### Urban versus Rural: Comparing Municipality Characteristics

The share of within-municipality inequality is even higher among the subset of urban municipalities. To capture the degree of urbanization, we first follow a five-category classification provided by the Bundesinstitut für Bau-, Stadt- und Raumforschung (BBSR) on the basis of population size, importance for the surrounding areas, and the urban infrastructure. In Figure 4, we compare the difference in overall and within inequality between rural municipalities and metropolitan cities. In line with the results for popu-

lation size, inequality in metropolitan municipalities is on average around 25 percent higher than in very rural municipalities. Interestingly, the within-municipality inequality share is also increasing in urbanization. Differences in income inequality between rural municipalities are therefore more marked than differences between metropolitan cities.

Another proxy for urbanization is population density. In line with the aforementioned results, income inequality increases in population density as well, even when conditioning on population size. Hence, urbanization in itself constitutes an important predictor of intra-regional inequality.

### Sensitivity Analysis

Our results are robust to several alternative definitions of our sample and the income concepts used. For example, we investigate the sensitivity of our results with respect to a change in the German capital income taxation. As pointed out in Bartels and Jenderny (2015), capital income taxation was gradually excluded from the personal income tax in two subsequent steps which both fall in our observation period. Hence, our latest three income tax records only partly include capital income. To address this and ensure that we can compare incomes over time, we approximate capital income by assuming a constant capital income share for the top 1 percent income earners after 2001.<sup>1</sup> Adding to the income of high-income earners naturally results in higher inequality in all years after 2001. However, the trends in overall as well as in within-municipality inequality are basically unaffected by this procedure (compare Appendix Figure A3b).

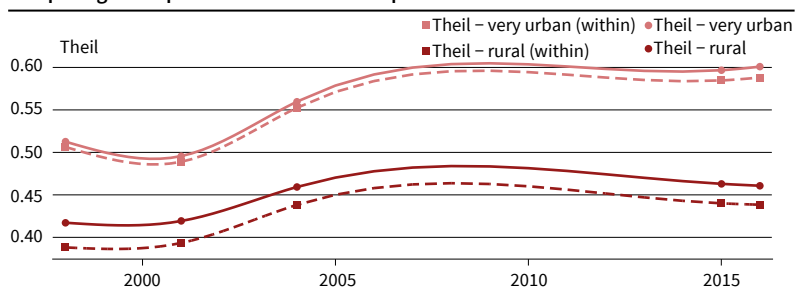
As described above, for reasons of data protection some municipalities did not report gross income and the number of tax units for all tax brackets. So far, we have imputed these missing values. To validate the outcome of this procedure, we compare our baseline results with a “balanced” sample and a sample without any interpolated values. While the “balanced” sample excludes all municipalities for which we had to drop any of the given observations over time, the second case is even more restrictive by excluding all municipalities for which gross income and the number of tax units had to be interpolated in any income bracket at any time. Even though summary statistics of the different subsets indicate sample selection towards larger and more urban municipalities after removing municipalities with imputed values, the levels and trends of income inequality hardly change after constraining the data (compare Appendix Figure A3).

### POLICY CONCLUSIONS

<sup>1</sup> Capital income accounts for a substantial share of gross income only at the very top of the income distribution (Bartels and Jenderny 2015; Drechsel-Grau et al. 2022).

Figure 4

#### Decomposition of the Theil Index in Within- and Between-Municipality Inequality, comparing Metropolitan and Rural Municipalities



Note: The figure compares income inequality trends in Germany for the period 1998–2016 between rural and metropolitan municipalities. Municipalities are classified as rural and metropolitan according to definitions of the Bundesinstitut für Bau-, Stadt-, und Raumforschung (BBSR). Dashed lines show within-municipality inequality in those municipality groups. The lines are fitted using a median spline.  
Source: Authors' calculations.

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Our results show that inequality in Germany is mainly a phenomenon within regions rather than between regions. Thirty years after the reunification, Germany is a country with rather modest interregional inequalities but a growing level of intra-regional inequality.

As most inequality arises within municipalities, it will not be very effective to focus on regional income differences, like the still substantial earnings and employment gaps between East and West Germany. Given the descriptive evidence presented here, place-based policies and interregional transfers are unlikely to substantially impact income inequality. To ensure that the distribution of gross income in Germany does not grow further apart, policymakers will have to consider different instruments. For example, if extreme skill complementarity is responsible for higher income inequality in metropolitan areas (Schluter and Trede 2021; Eeckhout et al. 2014), education policies might be a promising approach to reduce inequality.

Besides these aspects, our data also show a positive relationship between average income in a municipality and measures of income inequality. Municipalities where incomes are distributed very equally tend to be relatively poor. When only focusing on (relative) inequality, one runs the risk of forgetting that absolute incomes matter for welfare as well. In that sense, policies which strengthen inclusive and broad-based economic growth should be the way forward.

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APPENDIX

Table A1

Data Availability and Imputation Method by State

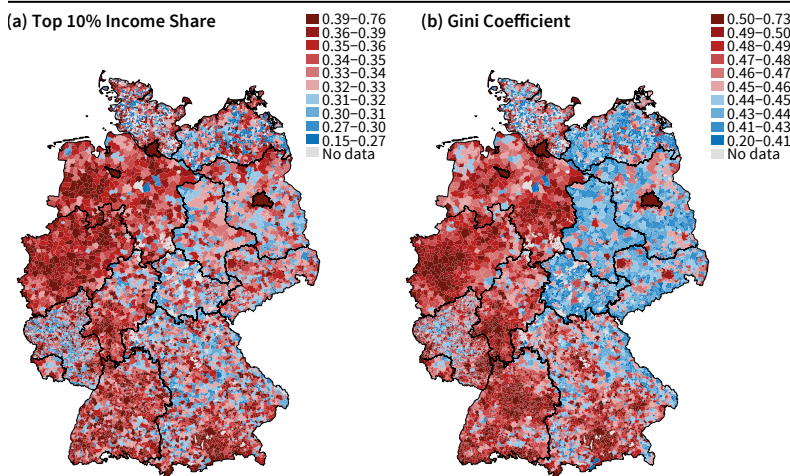
State	Years available	Interpolation method
Baden-Württemberg	2001, 2004, 2015 & 2016	polynomial
Bavaria	1998, 2001, 2004, 2015 & 2016	linear
Berlin	1998, 2001, 2004, 2015 & 2016	no missing values
Brandenburg	2001, 2004, 2015 & 2016	polynomial
Bremen	2001, 2004, 2015 & 2016	no missing values
Hamburg	1998, 2001, 2004, 2015 & 2016	no missing values
Hesse	1998, 2001, 2004, 2015 & 2016	polynomial
Mecklenburg-Western Pomerania	1998, 2001, 2004, 2015 & 2016	polynomial
Lower Saxony	1998, 2001, 2004, 2015 & 2016	linear
North Rhine-Westphalia	2001, 2004, 2015 & 2016	no missing values
Rhineland-Palatinate	1998, 2001, 2004, 2015 & 2016	polynomial
Saarland	1998, 2001, 2004, 2015 & 2016	no missing values
Saxony	2015 & 2016	polynomial
Saxony-Anhalt	1998, 2001, 2004, 2015 & 2016	polynomial
Schleswig-Holstein	2015 & 2016	polynomial
Thuringia	1998, 2001, 2004, 2015 & 2016	polynomial

Note: The table shows data availability by federal state and the imputation method applied in case of missing values. In states not disclosing information on brackets with less than three tax units, we linearly interpolated the values from the bordering brackets. In states where missing values occurred also in brackets with three or more taxpayers, we instead used polynomial or exponential approximations to impute the missing values.

Source: Authors’ compilation.

Figure A1

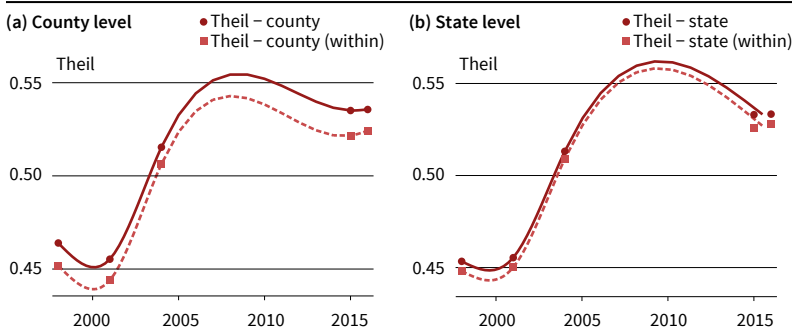
Top Income Shares and Gini Coefficient in German Municipalities



Note: This heat map shows municipality-level top 10% income shares (Figure a) and of the Gini coefficient (Figure b) for the year 2016. For Lower Saxony, small municipalities are aggregated to larger units (Samtgemeinden) due to data availability. The class breaks are defined by assigning municipalities into deciles of the respective inequality statistic. Source: Authors’ calculations. © ifo Institute

Figure A2

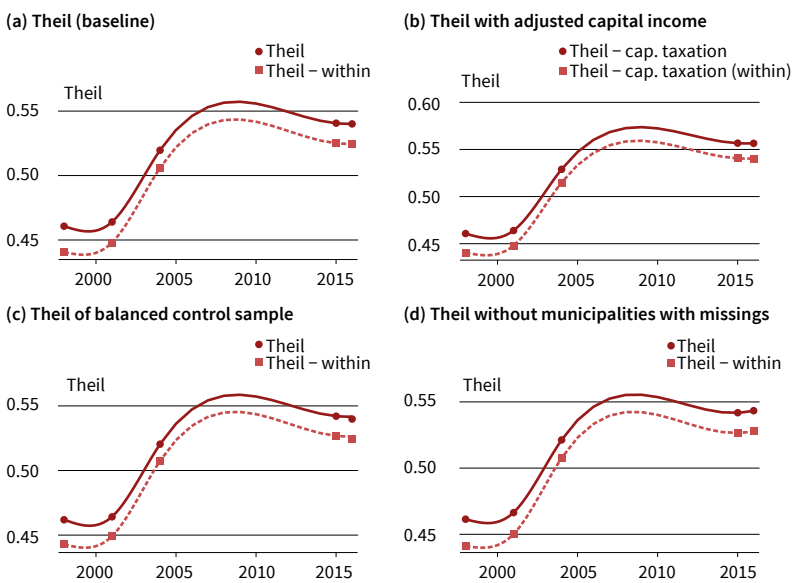
**Decomposition of Theil Index for Other Regional Levels**



Note: The figures compare within-region decomposition on other regional levels. Figure (a) shows the overall as well as the within-county inequality trend calculated from county-level data. Figure (b) shows the overall as well as the within-state inequality trend calculated from state-level data. The lines are fitted using a median spline.  
Source: Authors' calculations. © ifo Institute

Figure A3

**Inequality Trends According to Theil Index with Sensitivity Check Specifications**



Note: The figures analyse the sensitivity of the baseline results to different data specifications. Figure (a) is the baseline within-municipality decomposition. Figure (b) accounts for changes in capital taxation within the observational window. Figures (c) and (d) prove the liability of the used interpolation techniques and, thus, of the data. The lines are fitted using a median spline.  
Source: Authors' calculations. © ifo Institute