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Inequality Trends in the German Income Distribution*

By Martin Biewen**

Summary

This paper presents estimates of a variety of inequality measures for several subsamples of the German population using cross-sectional data on equivalent personal income from the German Socio-Economic Panel (GSOEP). The empirical results of the paper confirm the relative stability of the West German income distribution. While income inequality in West Germany has not altered in any economically relevant way over the period 1985 to 1996, inequality in Eastern Germany has been moderately increasing since reunification. However, inequality in unified Germany has been drastically decreasing since 1990 as mean income in East Germany converges toward its western counterpart.

1. Introduction

Distributional issues have experienced a renaissance in recent years, especially as a consequence of the discussion on the increase of earnings inequality in the United States.¹ While earnings inequality or wage inequality may be interesting for its own sake, e.g., when studying changing conditions on the labor market, it does not tell the whole story, if one is interested in the distribution of individual welfare in a population. This is particularly true of European countries, where the income distribution is affected by state interventions to a much greater extent than in the United States. It is generally accepted that an effective method to study the distribution of welfare across individuals is to consider the distribution of equivalent income. This approach can account for two important facts in the distribution of income, namely that income is shared among members of a given household and that this sharing of resources generates economies of scale.

The aim of this paper is to study in detail the evolution of income inequality in four subpopulations of Germany, namely residents of West Germany including foreigners, residents of eastern Germany, the population of recent immigrants and a comprehensive German population, using cross-sectional data from the German Socio-Economic Panel (GSOEP).

Related studies have been carried out by Burkhauser, Crews, and Daly (1997), Schwarze (1995), Hauser and Becker (1993), and Becker and Hauser (1996). Burkhauser, Crews, and Daly (1997) examine how the income distribution of working-age households evolves over the business cycle of the 1980s using 90/10-percentile ratios and kernel density estimates. Unfortunately, their comparisons only include one trough year (1984) and one peak year (1991), so that long-term conclusions on the trend of inequality might be affected by the state of the business cycle. Schwarze

(1995) decomposes inequality levels and trends for the years 1990 to 1992 into eastern and western components to determine the effect of the massive public transfers from West to East in the post-reunification period. The studies most similar to the present one are that of Hauser and Becker (1993) and Becker and Hauser (1996). Both papers examine, among other things, income inequality for various years from 1962 to 1995 using data from the Statistisches Bundesamt and the GSOEP.²

2. Data and Methods

This paper uses four samples from the GSOEP. The first sample, with 13 cross-sections ranging from 1984 to 1996, comprises foreigners living in West Germany, mainly guest-workers and their families. In the GSOEP, foreigners on average have a sampling probability four times as high as that of non-foreigners to allow separate analyses of this socio-economic subpopulation. This fact has to be taken into account by using the appropriate sample weights delivered with the GSOEP.³ Cross-sections of the eastern German population are not available until 1990, the year of the reunification. For eastern Germany, seven cross-sections ranging from 1990 to 1996 are examined. The third sample consists of households with persons who have immigrated to West Germany after 1984. Two cross-sections of this sample are available for the years 1995 and 1996. The fourth sample is a comprehensive German population, including everyone in the first three samples. This sample consists of seven cross-sections, ranging from 1990 to 1996. The only group of individuals that is not covered by these samples is that of institutionalized residents. The sample sizes are of the order of 10,000 to 15,000 for the West German sample, 5,000 to 6,000 for eastern Germany and 1,500 for the immigrant sample.

The ultimate goal of any measurement of income inequality lies in the analysis of individual welfare. Unfortunately, neither individual welfare nor individual disposable income is directly observable. Instead, following a generally accepted methodology, individual welfare is approximated in this analysis by the concept of equivalent income, derived from observed household income. In this paper the current monthly net household income variable

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¹ For a survey, see Levy and Murnane (1992).

² In contrast to the first two studies, this paper and Hauser and Becker (1993) as well as Becker and Hauser (1996) use the monthly income "screener" of the GSOEP instead of relying on generated income measures.

³ For details, see DIW (1997), chapter 5.

in the GSOEP serves as the basis for all income calculations. The GSOEP net household income variable comprises the income of all household members inclusive of transfers and exclusive of taxes and social security contributions.

As the benchmark case, the equivalence scale of the Federal Statistical Office of Germany (Statistisches Bundesamt) was used.⁴ According to this scale, the household head is assigned a weight of 1, any members of the same household aged 15 or older a weight of 0.7, and everyone else a weight of 0.5.⁵

The next section presents the estimates of a variety of inequality indices. The Gini coefficient, the Theil index, the coefficient of variation, the Atkinson index with inequality aversion parameters 0.5 and 2, the logarithmic variance, and the mean logarithmic deviation. The reason for using such a variety of indices is to ensure that measured inequality trends are independent of the chosen index.⁶ All estimates take account of the sample weights and are presented in the form of diagrams along with 95-percent confidence intervals. These confidence intervals and the related statistical tests were calculated by the method of bootstrapping.⁷

3. Empirical Results

To evaluate the significance of changes in income inequality from one year to another and over the relevant period of the samples, it is important to take account of the impact of the state of the business cycle. With respect to West Germany, this suggests comparing the years 1985

⁴ Compare for example Statistisches Bundesamt (1997).

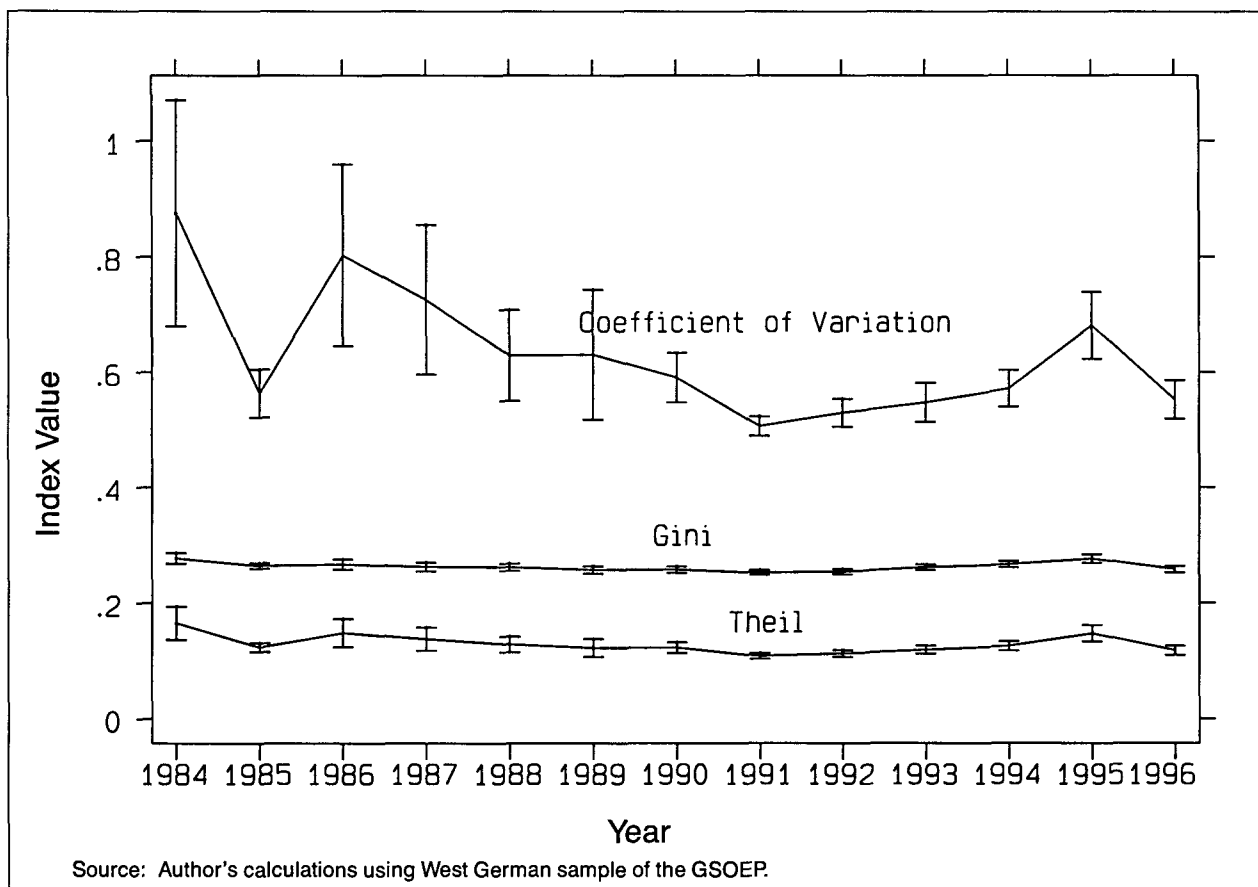
⁵ For comparison purposes, all measures were also calculated using the so-called OECD scale, which divides household income by household size squared.

⁶ Another reason is that this allows exploitation of the differences of the indices with respect to redistributions in different parts of the distribution. For example, the Atkinson index with a high inequality aversion parameter of 2.0, the logarithmic variance, and the mean logarithmic deviation are particularly sensitive to changes in the lower tail of the distribution, while the Gini coefficient, the Theil index, and the Atkinson measure with its low inequality aversion of 0.5 are more sensitive to inequality movements in the middle or the top of the distribution.

⁷ Exact numbers are available from the author on request. Compare also Biewen (1998) and Mills and Zandvakili (1997). It has to be noted that the employed test procedures understate statistical significance because of the positive correlation of incomes from two subsequent cross-sections.

Figure 1

Estimates of Income Inequality in West Germany, 1984-1996:
Coefficient of Variation, Gini Coefficient, and Theil Index



and 1996, as both follow a recession with a lag of three years. Since it is rather difficult to identify any business cycle in the East German case, inequality in 1996 will be compared to that in 1990.

West German Sample

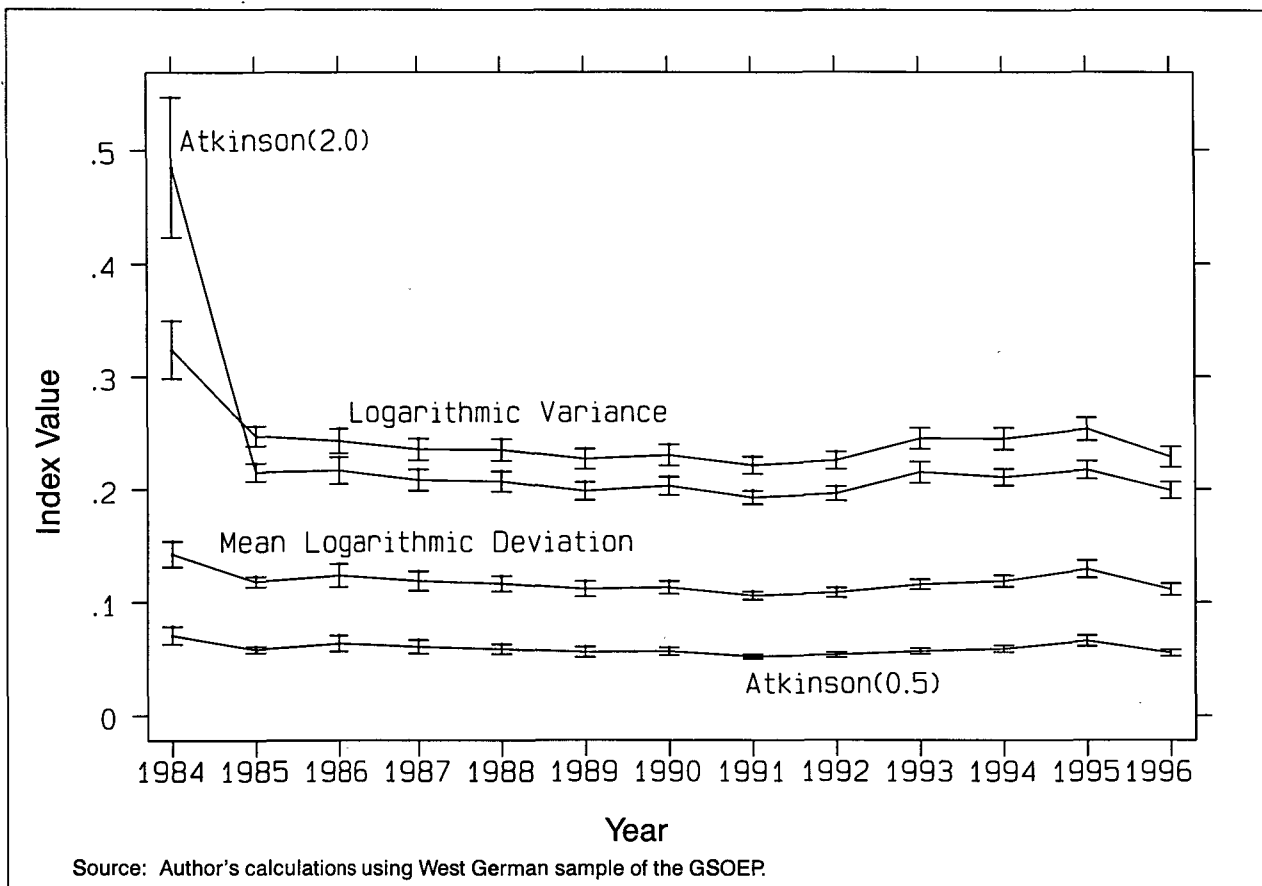
Figures 1 and 2 show the estimates of the diverse inequality measures. In most cases, the direction of change and statistical significance is independent from the chosen index. All measures note a significant decrease in inequality from 1984 to 1985. From 1984 to 1985, the Atkinson index with high inequality aversion parameter, which puts more weight on individuals with low income, shows a particularly sharp drop in inequality. However, this marked drop might be due to measurement error. Pannenberg and Rendtel (1996) study the determinants of attrition in the GSOEP and their results suggest that 1984 was the only year in which attrition was significantly biased toward very low incomes. From 1990 to 1991 inequality once again dropped signi-

ficantly for all measures except the Gini coefficient and the logarithmic variance. Between 1992 and 1993, however, the Gini coefficient, the Atkinson index with high inequality aversion, the logarithmic variance, and the mean logarithmic deviation increased significantly. The same is true between 1994 and 1995 for the Gini coefficient, the Theil measure, the coefficient of variation, and the Atkinson index with low inequality aversion parameter. This development is reversed by a significant decrease of all measures from 1995 to 1996.

Summing up the year-to-year changes, the development of inequality in the period under consideration was characterized by a slight decrease in the second half of the 1980s and a kind of hump in the period 1991 to 1996, but generally inequality remained very stable over the whole period. While this evidence does not directly correspond to any development of the business cycle, the latter hump might be related to the so-called reunification boom, in which the German economy faced considerable extra demand from the eastern part of Germany.

Figure 2

**Estimates of Income Inequality in West Germany, 1984-1996:
Atkinson Indices with Aversion Parameters of .5 and 2, Logarithmic Variance, and Mean Logarithmic Deviation**



The year-to-year development is confirmed by the direct comparison between 1985 and 1996. All measures show a decrease that is statistically significant only for the logarithmic variance, the mean logarithmic deviation, and the Atkinson index with high inequality aversion parameter. It is very difficult to assess whether this long-term drop has any political or economic relevance. A convincing method to assess the economic significance of a change in inequality is only available for the Gini coefficient. This method was proposed by Blackburn (1989). With respect to the comparison between 1996 and 1985, Blackburn's criterion implies that 1.3 percent of the mean income in 1996, i.e., 27 DM, would have to be redistributed from any person with an income below the median (of 1996) to any individual with income above the median in order to reach the same level of inequality in 1985. This, of course, does not amount to a major redistribution.

East German Sample

Figures 3 and 4 depict the evolution of inequality indices over the period 1990 to 1996.⁸ All measures note signifi-

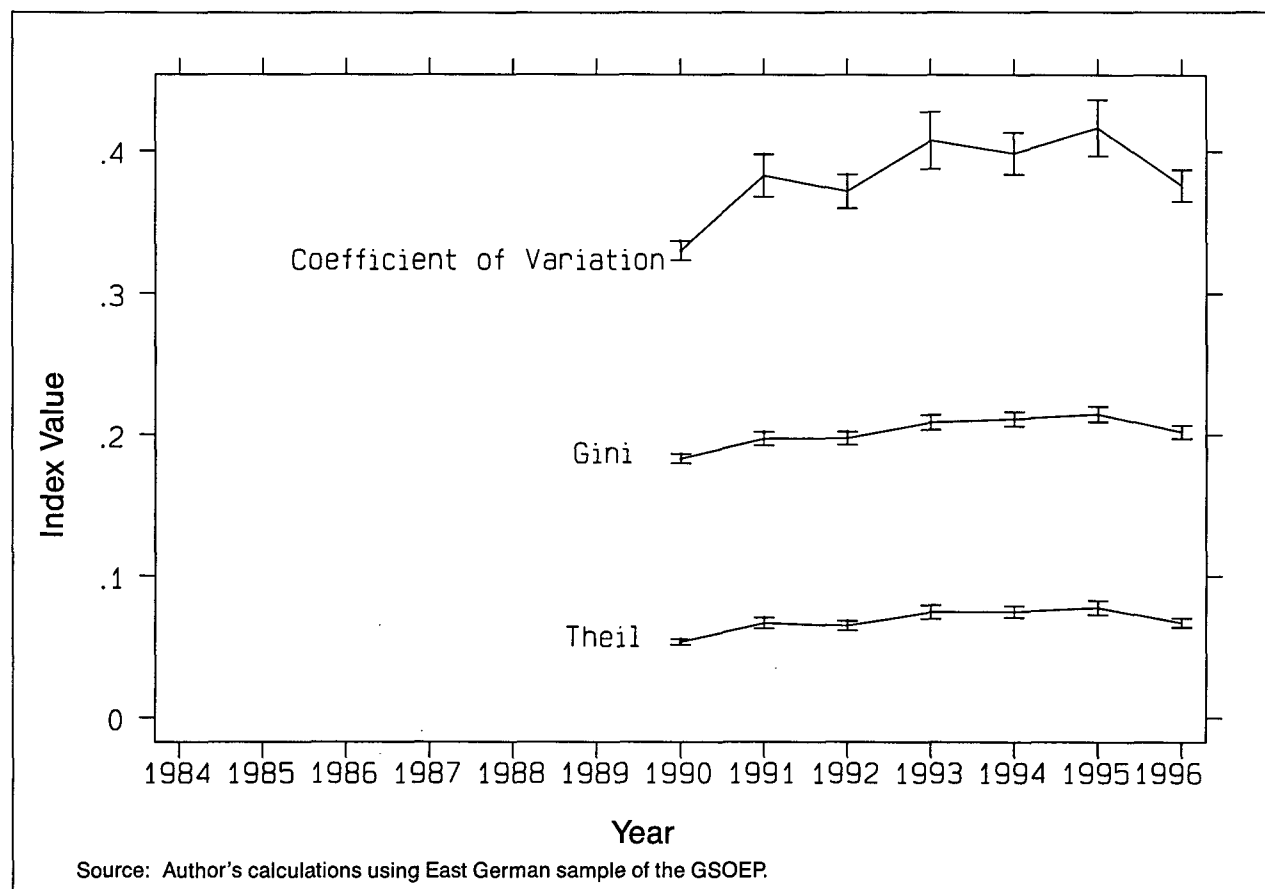
cant increases from 1990 to 1991 and from 1992 to 1993. However, the peak of this development seems to be passed in 1995, where inequality falls significantly for all measures.

While the overall development with a kind of hump in the first half of the 1990s is very similar to that in the West German data, the hump in the eastern states seems to be considerably more pronounced. This could once again be explained by the aforementioned reunification boom. This boom brought extra profits for West German entrepreneurs entering the eastern German market as well as quick income increases for the few eastern Germans who could cope with the conditions of a market economy. The results in Burda and Schmidt (1997) show that the observed patterns of inequality are unlikely to be explained by the development of wages alone, as the period of rapid wage growth already ended in 1992. Other explanations should identify developments affecting both parts of Germany, but with stronger effects on the economy in transition.

⁸ Income in 1990 is in East German marks. In view of the subsequent 1:1 currency union, this does not constitute any problem.

Figure 3

**Estimates of Income Inequality in East Germany, 1990-1996:
Coefficient of Variation, Gini Coefficient, and Theil Index**



The long-term comparison from 1990 to 1996 shows a significant increase in inequality for all measures. Judged by the Gini coefficient, the increase from 1990 to 1996 would correspond to a redistribution of 3.8 percent of the mean income in 1996, i.e., 63 DM from each individual of the poorer 50 percent to each individual of the richer 50 percent of the eastern German population. This change can already be considered as economically quite significant.

Figure 5 presents weighted kernel density estimates for normalized equivalent income in the former East Germany for the years 1990 and 1996.⁹ The tails of the distribution have become fatter and its mode smaller. This apparent widening of the distribution is consistent with the noted increase in inequality.

Immigrant Sample

This section examines inequality measures for the immigrant sample of the GSOEP, which represents individuals residing in households in which at least one household member moved from abroad to West Germany after 1984. The size of this immigrant sample is con-

siderably smaller compared to those used above, and only the cross-sections for 1995 and 1996 are available for analysis.¹⁰ Apart from the income shares, all measures except the coefficient of variation show an increase in inequality for the immigrant sample from 1995 to 1996, but — maybe due to the small sample size — none of these increases seems to be statistically significant.

Comprehensive Sample

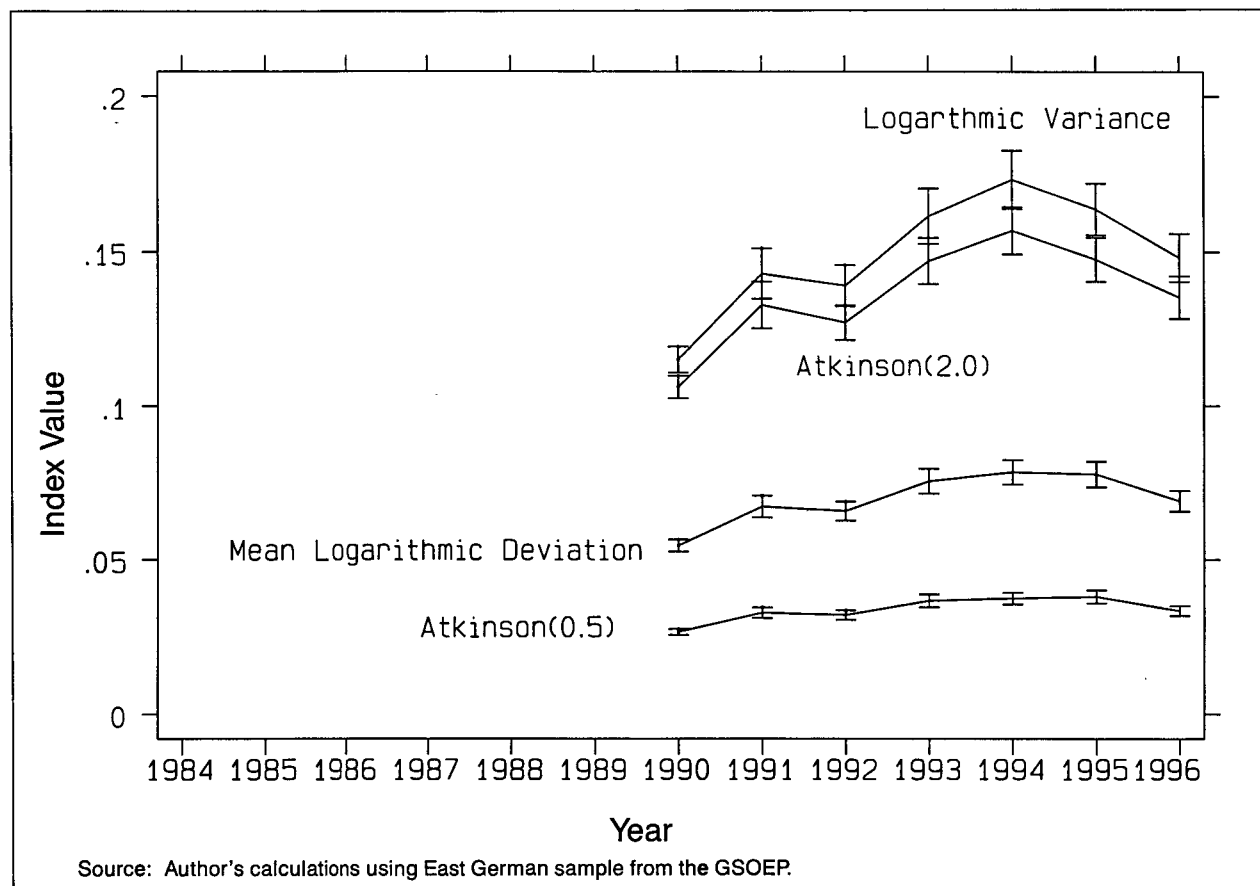
The comprehensive sample for Germany consists of seven yearly cross-sections for the period 1990 to 1996. It comprises individuals from western and eastern Germany and — from 1995 on — recent immigrants. The inclusion of the latter group leads to a slight structural break in 1995, which is acceptable in view of the higher representativeness of the sample. The estimates presented in this section do not correct for the fact that the purchasing power of one deutsche mark differed in the eastern and western

⁹ Normalized income means income divided by mean income.

¹⁰ As a consequence, no figures will be presented but they are available from the author on request.

Figure 4

**Estimates of Income Inequality in East Germany, 1990-1996:
Atkinson Indices with Aversion Parameters of .5 and 2, Logarithmic Variance, and Mean Logarithmic Deviation**



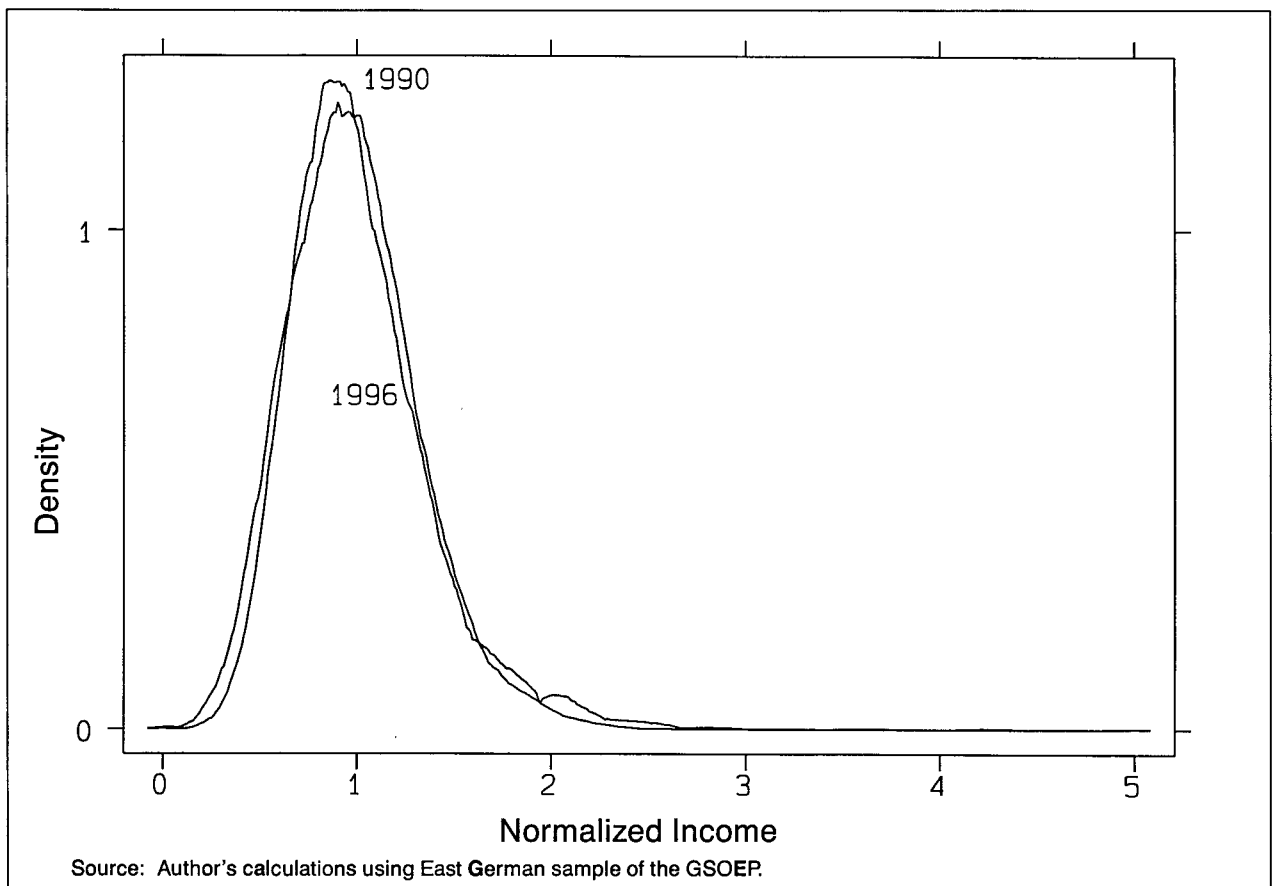
states, especially in the earlier years. For example, housing costs were much lower in the former GDR. For a discussion of these problems, see Frick, Hauser, Müller, and Wagner (1995).

Figures 6 and 7 show the evolution of inequality measures. All measures (except the coefficient of variation from 1991 to 1992) fall significantly in the first two years after reunification. Moreover, these decreases seem to be very substantial, especially for the logarithmic variance, the Atkinson measure with high inequality aversion, and the mean logarithmic variation, which are particularly sensitive to changes affecting the lower part of the distribution. From 1992 to 1994, neither of the indices changes significantly. From 1994 to 1995 and from 1995 to 1996, however, all measures first increase and then decrease significantly. The rise in inequality from 1994 to 1995 can be partly explained by the addition of recent immigrants to the sample in 1995. However, all measures still significantly increase from 1994 to 1995, even if these recent immigrants are ex-

cluded from the sample. With respect to the long-term period from 1990 to 1996, all indices fall significantly. On the one hand, this decline is understated, since the 1990 sample does not comprise recent immigrants, who generally enhance inequality. On the other hand, it is overstated by the fact that the generally lower prices in eastern Germany gradually converged to western levels.

Once again, the Gini criterion can be used to assess this decrease in economic terms. According to this criterion, the fall in inequality from 1990 to 1996 can be compared to a hypothetical redistribution of 7.4 percent of mean income (for unified Germany) from any individual with income above the corresponding median to any individual with income below the median. This amounts to 145 DM. Of course, in view of the massive transfers from western to eastern Germany, this kind of redistribution was far from being hypothetical. Figure 8 shows that these transfers have led to a more compressed income distribution for unified Germany in 1996 when compared to 1990.

Figure 5
Weighted Kernel Density Estimates for Normalized Equivalent Income in East Germany, 1990 and 1996



4. Conclusion

The evolution of inequality in the West German distribution of equivalent income was characterized by a slight decrease in the second half of the 1980s and a kind of hump in the period 1991 to 1996, but inequality generally remained stable over the whole period.¹¹ Inequality in 1996 was slightly lower than in 1985, but this difference is neither economically nor statistically significant. In the former East Germany, inequality significantly increased over the period 1990 to 1996. This rise in inequality can be compared with a redistribution of about 4 percent of mean income from every individual below the median to every individual above the median. Despite this increase, inequality still remains substantially lower in the eastern states. It has to be noted that the higher level of inequality in western Germany is accompanied by a still considerably higher average income.

Despite the relative stability of inequality in its western and eastern population, inequality in unified Germany has been declining since reunification. This is a consequence of the growth of mean income in eastern Germany, which converged very rapidly towards its western counterpart during the first years after reunification. Recent immigration increases inequality very slightly, but this effect does not seem to be statistically significant.¹²

¹¹ All findings are generally independent of the employed equivalence scale. However, the slight fall in inequality in West Germany becomes more marked if the OECD-scale is used instead of the scale employed by the Statistisches Bundesamt, whereas the rise in inequality in the eastern part loses statistical significance if the first of the two scales is used.

¹² See also Bedau, Frick, Krause, and Wagner (1996).

Figure 6

Estimated Income Inequality in Unified Germany, 1990-1996:
Coefficient of Variation, Gini Coefficient, and Theil Index

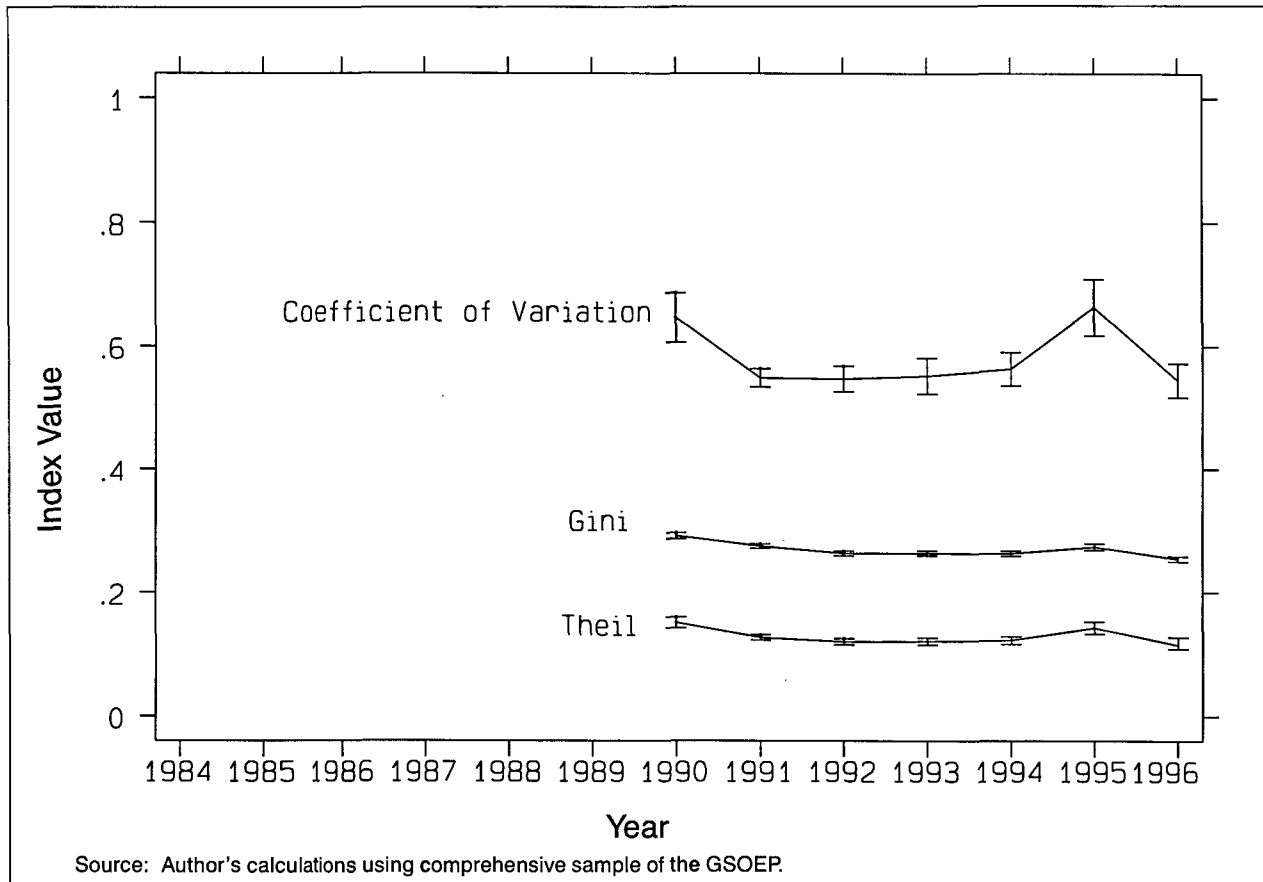


Figure 7

Estimated Income Inequality in Unified Germany, 1990-1996:
Atkinson Indices with Aversion Parameters of .5 and 2, Logarithmic Variance and Mean Logarithmic Deviation

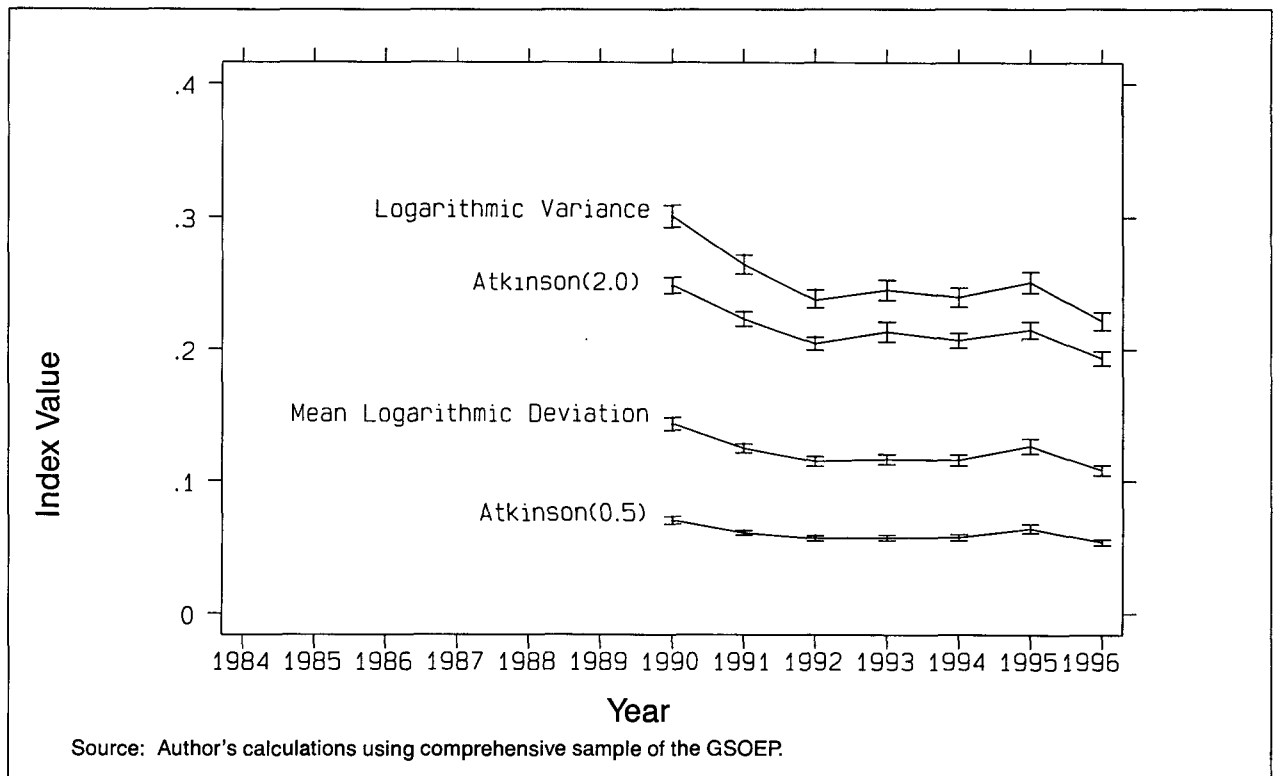
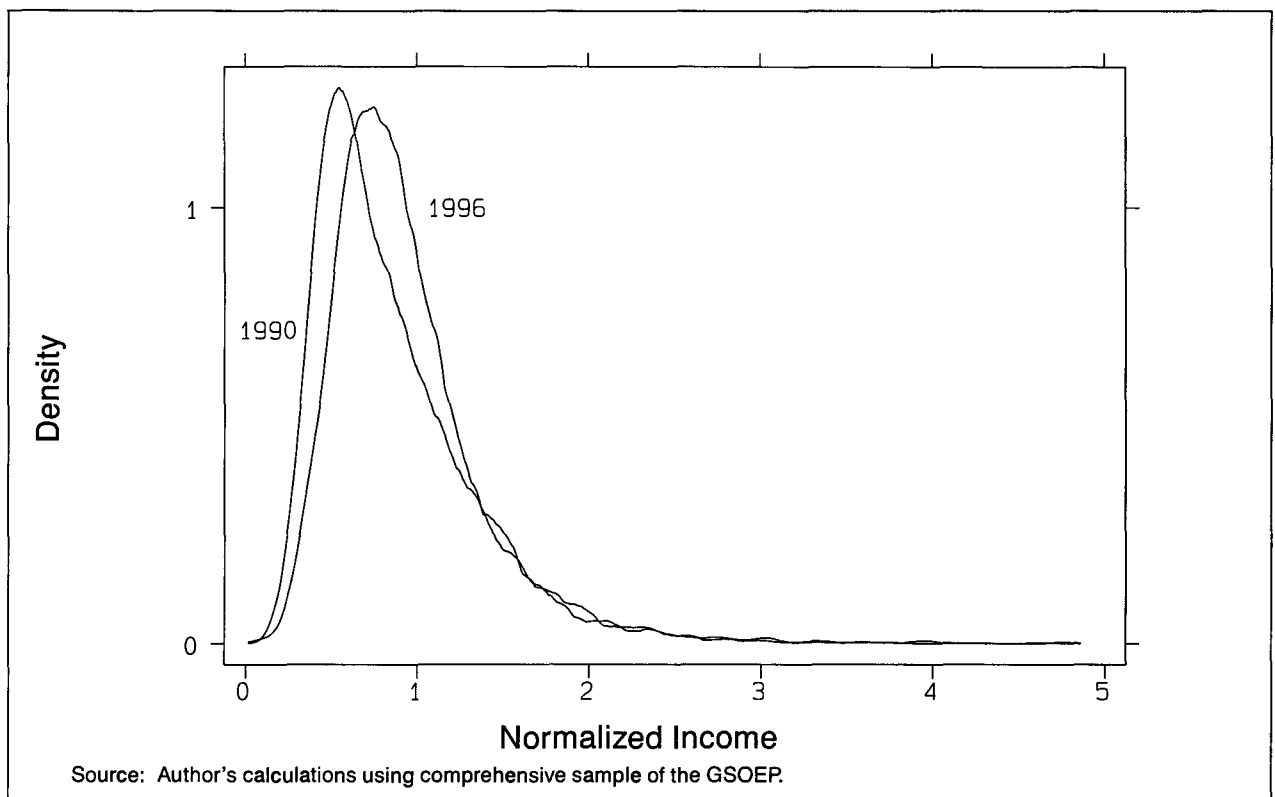


Figure 8

Weighted Kernel Density Estimates for Normalized Equivalent Income in Unified Germany, 1990 and 1996



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