Income Inequality

Can Employment Changes
Explain Rising Income Inequality in Germany?

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Abstract

From 2000 to 2005, Germany experienced an unprecedented rise in net equivalized income inequality and poverty. At the same time, unemployment rose to record levels and overall employment stagnated, suggesting that changes in households' conditional employment outcomes were partly responsible for the inequality increase observed. Using DiNardo/Fortin/Lemieux's semiparametric kernel density reweighting method, we examine what part of the inequality and poverty increase can be accounted for by changes in households' conditional employment outcomes. Our results suggest that employment outcomes explain only around 14 percent of the inequality increase observed, and around 23 percent of the poverty increase observed, leaving plenty of room for the contribution of other factors.

1. Introduction

There has been a clear trend of increasing income inequality in industrialized countries over the past three decades, although with differences in the timing and intensities across countries (see OECD, 2008). A commonly cited theory that aims to explain differing inequality trends across countries is Krugman's (1994) hypothesis that changes in wage inequality in the United States and other Anglo-Saxon countries on the one hand, and growing unemployment in the less flexible European labor markets on the other hand, are "two sides of the same coin", i.e. consequences of skill-biased technological progress. Skill-biased technological progress increases wage differentials if labor markets are

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flexible, and leads to higher unemployment for the low-skilled if labor markets are less flexible. Both increasing wage differentials in Anglo-Saxon countries and rising unemployment in non-Anglo-Saxon countries lead to more inequality in the overall distribution of disposable incomes.

In this paper, we address the question to what extent changes in conditional employment structures (which comprise changes in unemployment risk) were responsible for the unprecedented increase in income inequality and poverty in Germany from 2000 to 2005. To this end, we employ the semiparametric reweighting methodology originally suggested by DiNardo/Fortin/Lemieux (1996), which allows us to construct a counterfactual distribution of equivalized personal incomes that would have prevailed if only conditional employment outcomes had changed to their 2005 level but all other factors had remained fixed as they were in 2000. This allows us to isolate the effect of the changes in employment (and unemployment) on the income distribution and to quantify their importance.[1]

2. Descriptive Evidence

In this section, we provide some descriptive evidence on the unprecedented increase in inequality and poverty in Germany over the period 2000 to 2005. This increase is shown in Figure 1, which also displays the development of inequality and poverty before 2000 and after 2005 when inequality remained more or less constant.[2] For more evidence on the development of the German income distribution see, for instance, Biewen (2000), Hauser/Becker (2003), and Grabka/Frick (2010).

As measured by commonly used indices, inequality and poverty increased considerably between 2000 and 2005. For example, the Gini increased from .248 to .274. Similarly, the percentage of individuals below the widely used poverty line of 60 percent of median equivalized income rose from 10.9 percent in 2000 to 13.5 percent in 2005. For sample size reasons, we will pool the years 1999/2000 and 2005/2006 in our analysis, which is well justified given the roughly constant level of inequality and poverty in the years we pool. As Figure 2 shows, the period 2000 to 2005 was also one of steep unemployment growth, suggesting that this factor had a potentially large impact on the devel-

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[1] In this paper we focus exclusively on the effect of changes in employment outcomes on income distribution. A more detailed analysis including other factors can be found in Biewen/Juhasz (2010).

[2] Our income concept is yearly equivalized post-government personal income, which is calculated as the sum of income from all sources in a given household (including government transfers), net of taxes and social security contributions. The resulting value is then divided by an equivalence scale and distributed equally among household members. More details on the definition of our variables are given in Section 4.
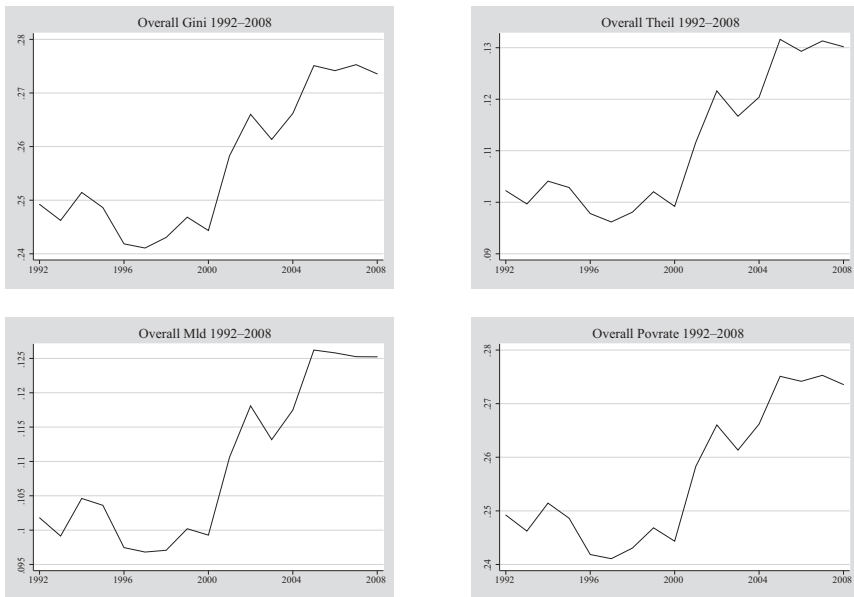
Source: SOEP. See text for the definition of inequality measures and income variables.

Figure 1: Trends in inequality and poverty 1999–2006

opment of the income distribution during this period. Figure 2 also shows that overall employment was stagnating between 2000 and 2005. In the next section, we outline our methodological approach to isolating the influence of changes in employment outcomes on the distribution of equivalized incomes.
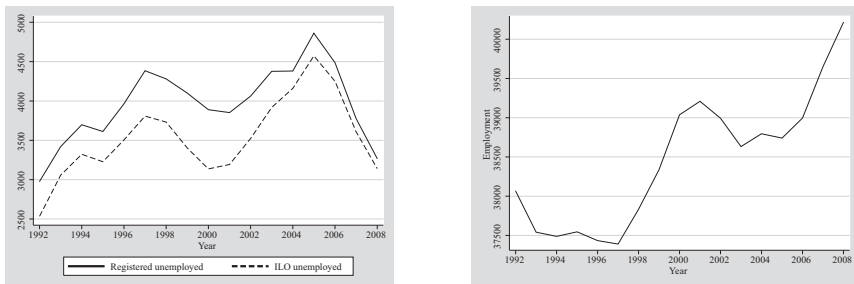
Source: German Federal Employment Office

Figure 2: Trends in employment and unemployment 1999–2006

3. Estimation of Counterfactual Income Densities

Following DiNardo et al. (1996) and Hyslop/Mare (2005), we use a semi-parametric approach to construct a counterfactual income distribution that would have resulted if only employment outcomes had changed but all other factors had remained constant. We consider two periods 1999/2000 (period 0) and 2005/2006 (period 1). As conditional employment outcomes differ to a large extent across household types, we differentiate between six household types in our analysis. These are: i) single pensioner households (65 years or older), ii) multiple pensioner households (at least one household member is 65 or older and no household member is under 55), iii) single adults without children, iv) multiple adults without children, v) single adults with children, and vi) multiple adults with children.

The overall income density in period 0 is given by

$$(1) \qquad f_0(y) = \sum_{j=1}^{6} w_{0j} f_{0j}(y),$$

where y denotes net equivalized personal income, w_{0j} is the population share of household type j in period 0, and $f_{0j}(y)$ the income distribution of individuals from household type j in period 0.

We define the following categories characterizing household employment outcomes e: i) no part-time or full-time workers in the household, ii) no full-time workers but at least one part-time worker, iii) one full-time worker but no part-time workers iv) one full-time worker and at least one part-time worker, v) at least two full-time workers. We consider changes in conditional employment outcomes, i.e., changes in employment outcomes e conditional on household socio-economic attributes (e.g., the age and educational composition of the household, see below for more details). This also characterizes changes in unemployment risk given household characteristics x, i.e. for a given subgroup described by x, certain employment outcomes become more (or less) likely.

The counterfactual income density for individuals living in household type j in which everything else remains the same as in period 0 but conditional employment outcomes are as in period 1 is given by

$$(2) \qquad f_{0j}(y|t_e = 1) = \int_e \int_x f_{0j}y|x,e)dF_{1j}(e|x)dF_{0j}(x)$$

$$(3) \qquad = \int_e \int_x f_{0j}(y|x,e)\left[\frac{dF_{1j}(e|x)}{dF_{0j}(e|x)}\right]dF_{0j}(e|x)dF_{0j}(x)$$

$$(4) \qquad = \int_e \int_x \Psi_e|x,j \cdot f_{0j}(y|x,e)dF_{0j}(e|x)dF_{0j}(x).$$

The counterfactual distribution $f_{0j}(y|t_e = 1)$ is just a reweighted version of the factual distribution $f_{j0}(y)$ with reweighting factor $\Psi_{e|x,j}$. Reweighting factor $\Psi_{e|x,j}$ can be written as

$$(5) \qquad \Psi_e|x,j = \frac{dF_{1j}(e|x)}{dF_{0j}(e|x)} = \frac{P_{1j}(e|x)}{P_{0j}(e|x)}$$

and estimated using predictions from multinomial logit models $\hat{P}_{1j}(e|x)$ and $\hat{P}_{0j}(e|x)$.[3] Following DiNardo et al. (1996), the counterfactual density $f_0(y|t_e = 1)$ can then be estimated as

$$(6) \qquad \hat{f}_0(y|t_e = 1) = \sum_{j=1}^{6} w_{0j} \sum_{i=1}^{n_j} \theta_i \Psi_{e|x,j} K\left(\frac{y - y_i}{h}\right)\frac{1}{h},$$

where θ_i denotes the sample weight of individual i, n_j is the number of individuals in household type j, y_i the equivalized income of individual i, $K(.)$ a kernel function, h a bandwidth. Given an estimated income density, we use numerical integration methods to calculate the inequality and poverty indices shown in the figures and in Table 1.[4]

4. Data

We base our analysis on data from the German Socio-Economic Panel (SOEP) for the years 1992 to 2008 and concentrate in particular on the comparison of the years 1999/2000 (period 0) with the years 2005/2006 (period 1). As indicated above, we pool two adjacent years in order to increase sample sizes and to make our analysis less dependent on particular years.[5] Our data refers to individuals (including children). We use all SOEP subsamples and all our calculations are weighted with the appropriate sample weights.

Our main income variable is real annual equivalized personal net income which is calculated from annual net household income. We use the annual income variables in the SOEP which are based on retrospective information from the previous year. (We match this information correctly to the year it refers to.)[6] These variables may also include imputed values for missing informa-

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[3] We estimate our multinomial models separately for eastern and western Germany and also include interaction effects between individual components of x, see below. We thank our referee for suggesting this.

[4] For the definition and properties of these indices, see Cowell (2000).

[5] As a robustness check, we also varied the choice 1999/2000 to 1998/1999, and 2005/2006 to 2006/2007. The results were similar, but obviously the impact of employment changes may vary with the choice of periods 0 and 1, as is clear from Figure 2.

tion on individual income sources. In order to compute the individual income of the members of a given household, household net income is divided by the sum of equivalence weights defined by the OECD equivalence scale. (The household head receives a weight of 1, additional household members over 14 years receive a weight of 0.5, household members aged 14 years or younger receive a weight of 0.3). Following the recommendations and practices of the Statistical Office of the European Commission, we set the poverty line to 60 percent of the median of equivalized personal incomes in a given year. Note that our definitions are roughly the same as those used in the official 'Report on Poverty and Richness' published by the German government.[7]

As socio-economic household attributes x, we consider the number of adults in the household, the fraction of female adults in the household, the fraction of adult household members with different educational qualifications (university degree, high school and/or vocational training, no such degree or qualification), the fraction of adult household members with non-German nationality, the fraction of adult household members with disabilities, the fraction of married adults in the household, the fraction of household members in different age groups (0–3 years, 4–11 years, 12–17 years, 18–30 years, 31–50 years, 51–64 years, 65 or older). As mentioned above, we estimate employment probabilities separately for eastern and for western Germany.

Note that our analysis refers to inequality in net income *between individuals* (not households). All data are individual data but the characteristics and the (equivalized) incomes of the households the individuals live in are attributed to them. Incomes are expressed in year 2005 Euros. For expositional reasons we consider log equivalized incomes, which we convert back in order to calculate inequality and poverty indices.
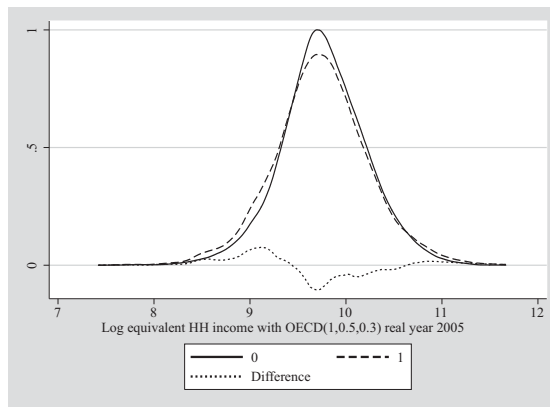
5. Empirical Results

This section presents our empirical results. Figure 3 shows how the overall shape of the (log) income distribution changed from 1999/2000 (period 0) to 2005/2006 (period 1). The picture that emerges is that the middle of the distribution lost in favor of the upper and, especially, the lower part of the distribution.

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[6] Note that the use of annual income variables along with information on household characteristics at survey time requires the assumption that household characteristics do not change (or change only slightly) over the year. Given that we are interested in the annual income variables of the SOEP, we believe that this is a reasonable approximation. We thank our referee for pointing this out.
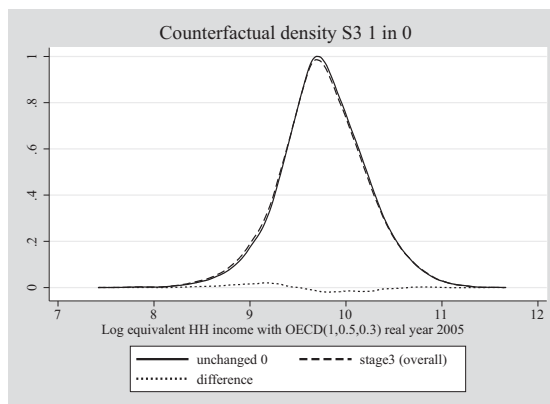
[7] See Federal Government of Germany (2008). The main difference is that we do not consider imputed rental values as income.

Figure 3: Overall change in density from 1999/2000 (period 0)
to 2005/2006 (period 1)

Figure 4 compares the actual period 0 distribution with the counterfactual distribution that would result if conditional employment probabilities were shifted to their period 1 level but all other factors remained constant. The figure shows that the contribution of employment changes to overall distributional change is very moderate.

Figure 4: Counterfactual income distribution if
only conditional employment outcomes are changed
(dashed line) vs. factual distribution (bold line).

This is also confirmed in Table 1 which summarizes what percentage of the overall increase in inequality as measured by various inequality and poverty indices can be explained by changes in conditional employment probabilities. The results show that such changes explain only around 14 percent of the change in inequality, and around 23 percent of the increase in poverty. From Figure 4, it is also clear that the changes in employment and unemployment mainly affected the lower end of the distribution, which is reflected in the higher contribution of these changes to explaining changes in the poverty rate.

Table 1

**Effects of Employment Changes as Percentage of
the Overall Inequality Increase Between 1999 / 2000 and 2005 / 2006**

Gini	13.71	(6.21)
Theil	13.76	(4.64)
Mld	13.72	(5.43)
Poverty rate	22.59	(8.88)

Source: SOEP, own calculations. The numbers in parentheses are bootstrap standard errors which properly take into account the longitudinal sample design and the clustering of individuals in households.

6. Conclusion

In this paper, we examine the popular hypothesis that changes in conditional employment outcomes (which include changes in the risk of being unemployed) were largely responsible for the rise in income inequality and poverty in Germany over the period 2000 to 2005. Using DiNardo / Fortin / Lemieux's semiparametric reweighting technique and data from the Socio-Economic Panel, we find that changes in employment outcomes at the household level explain only around 14 percent of the inequality increase observed, and around 23 percent of the poverty increase observed. This means that other factors such as changes in the wage structure, changes in the population with respect to household types, changes in other socio-economic characteristics (such as age or educational qualifications), and institutional changes such as tax reforms were more important for explaining the overall inequality increase.[8] It also suggests that Krugman's (1994) hypothesis does not play a significant role in understanding differences in inequality trends between Anglo-Saxon and non-Anglo-Saxon countries.

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[8] See Biewen / Juhasz (2010) for an analysis of some of these other factors.

References

Biewen, M. (2000): Income inequality in Germany during the 1980s and 1990s, Review of Income and Wealth 46, 1–20.

Biewen, M./*Juhasz*, A. (2010): Understanding rising income inequality in Germany, IZA Discussion Paper No. 5062, Institute for the Study of Labor (IZA), Bonn.

Cowell, F. A. (2000): Measurement of Inequality, in: A. B. Atkinson/F. Bourguignon (eds.), Handbook of Income Distribution, Volume 1, Amsterdam.

DiNardo, J./*Fortin*, N./*Lemieux*, T. (1996): Labor Market Institutions and the Distribution of Wages, 1973–1992: A Semiparametric Approach, Econometrica 64, 1001–44.

Federal Government of Germany (2008): Lebenslagen in Deutschland. Der 3. Armuts- und Reichtumsbericht der Bundesregierung, Berlin.

Grabka, M. M./*Frick*, J. (2010): Weiterhin hohes Armutsrisiko in Deutschland, DIW Wochenbericht 7/2010, 1–11.

Hauser, R./*Becker*, I. (2003) (eds.): Reporting on Income Distribution and Poverty. Perspectives from a German and a European Point of View, Berlin.

Hyslop, D. R./*Mare*, D. C. (2005): Understanding New Zealand's Changing Income Distribution 1983–98: A Semiparametric Analysis, Economica 72, 469–495.

Krugman, P. (1994): Past and Prospective Causes of High Unemployment, Economic Review, Fourth Quarter 1994, Federal Reserve Bank of Kansas City, 23–43.

OECD (2008): Growing unequal? Income distribution and poverty in OECD countries, OECD, Paris.