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Measuring Richness and Poverty

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A micro data application to Germany and the EU-15

Andreas Peichl, Thilo Schaefer and
Christoph Scheicher

2006

Finanzwissenschaftliches Forschungsinstitut an der Universität zu Köln

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Measuring Richness and Poverty*

A micro data application to Germany and the EU-15

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* The authors would like to thank Christian Bergs, Jean-Yves Duclos, Clemens Fuest, Stephen Jenkins, Peter Lambert and Karl Mosler for their helpful contributions. The usual disclaimer applies.

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Measuring Richness and Poverty
A micro data application to Germany and the EU-15

Andreas Peichl*, Thilo Schaefer‡, Christoph Scheicher§

October 2006

Abstract

In this paper, we define a new class of richness measures. In contrast to the often used headcount, these new measures are sensitive to changes in rich person's income and therefore allow for a more sophisticated analysis of richness.
We demonstrate the application of these new measures to analyse the development of poverty and richness over time in Germany, to compare Germany to the other EU-15 countries and to investigate the impact of tax reforms on poverty and richness. The latter analysis is based on micro data provided by the simulation model FiFoSiM using German income tax and household survey micro data. We show that it partly depends on the measure whether the development of richness in Germany is increasing or decreasing. The cross country analysis yields several groups of countries according to their values of poverty and richness indices. The new richness measures show that the effects of flat tax reform scenarios depend on the reform parameters. Using these examples, we show the importance of taking into account the dimension of changes and not only the number of people beyond a given richness line (headcount). We propose to use the new measures in addition to the headcount index for a more comprehensive analysis of richness.

JEL Codes: D31, H23, I32

Keywords: richness, affluence, poverty, tax reform, flat tax

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1 Introduction

The financing problems of the European welfare states and the increasing pressure of global economic competition have given rise to a debate wether the gap between rich and poor is widening. It is widely believed that the rich are getting richer and the poor are getting poorer. Many proposals for reforming the tax and transfer system are critisised for redistributing from the poor to the rich. Given this debate, appropriate measures of poverty and richness are of key importance for an empirical analysis.

Several income poverty indices have been developed in the long tradition of the literature on measuring poverty[1]. For Germany, quantitative studies of income poverty are for example Krause and Wagner (1997) or Hanesch et al. (2000). Since 2000 the German parliament demands regular governmental reports on poverty and richness. In these reports[2] income poverty and richness are measured as the population shares of poor and rich persons (headcount index). Studies comparing European countries are for example de Vos and Zaidi (1997) and Atkinson (1997).[3] Measuring income richness is a less considered field. As far as we know, empirical studies mainly use the headcount ratio to measure income richness. Studies on income richness are for example Krause and Wagner (1997) or Merz (2004).[4]

This paper contributes by defining a new class of richness indices analogously to well-known measures of poverty. Our approach is more sophisticated because it also takes the dimension of changes and not only the number of people beyond a given richness line into account. To demonstrate the usefulness of these new measures we analyse three problems: First, we look at the development of poverty and richness indices over time in Germany (ex post longitudinal analysis). Second, we compare the values of these indices for Germany with different European countries (cross country analysis). Third, we compute the values of these indices for different reform proposals of the German tax and transfer system (ex ante analysis). Our analysis is based on household micro data provided by GSOEP, ECHP and the microsimulation model FiFoSiM.

The empirical application reveals that our new measures change the results of a pure headcount analysis distinctively. The longitudinal analysis leads to ambiguous results for the development of richness in Germany. It depends on the measure, whether richness is increasing (headcount) or decreasing (some of the new measures) regarding various time periods. We show that the results vary considerably with the weight of higher incomes which the new meas-

[1] See for example Zheng (1997) or Chakravarty and Muliere (2004) for recent surveys.

[2] See Bundesregierung (2001) and Bundesregierung (2005).

[3] A microsimulation study of the effects of a minimum pension policy to reduce poverty in several European countries can be found in Atkinson et al. (2002).

[4] There is a series of recent papers using the income share of the top percentile as an indicator of richness. See Atkinson (2005), Dell (2005), Piketty (2005) and Saez (2005).

ure accounts for. The cross country analysis yields different groups of countries according to their values of poverty and richness indices. Southern European countries are characterised by rather high poverty and richness, whereas middle and northern European countries can be distinguished by rather small values of poverty and richness. In addition, we show, for example that Ireland's headcount index is almost twice as high as Germany's, but in terms of the of our new measures the values are almost the same. Furthermore, we show that for a flat tax reform in Germany the headcount measure indicates a decline in richness, whereas our new measure illustrates an increase in richness. In fact, the richest of the rich gain and therefore the overall dimension of the rich people's income increases. These examples demonstrate the usefulness of our new measures and that they should be used in addition to the headcount index for a more comprehensive analysis of richness.

The setup of the paper is organised as follows: Section 2 describes well-known poverty indices. In section 3 we define analogue indices of richness and report the main differences. In section 4 we describe the micro data used for the analysis. We analyse the development of poverty and richness in Germany in section 5. Section 6 reports the results of the European cross-country analysis. In section 7 different proposed income tax reform scenarios for Germany are analysed. Section 8 concludes.

2 Poverty indices

Many poverty indices have been proposed in the literature.[5] We focus on a class of indices that contains the two most common measures, the headcount and the FGT[6] indices.

Consider a net income distribution $x = (x_1, x_2, \ldots, x_n) \in R^n_+$, where n is the number of individuals or households. Let π be the poverty line, e.g. 60% of the median income, and $p = \#\{i | x_i < \pi,\ i = 1, 2, \ldots, n\}$ the number of poor persons.

We consider poverty indices φ of the form

$$\varphi(x) = \frac{1}{n} \sum_{i=1}^{n} u\left(\frac{x_i}{\pi}\right) , \tag{1}$$

where $u : R_+ \to R_+$ is decreasing on $[0, 1)$ and vanishes on $[1, \infty)$. Examples are:

- The proportion of poor persons (headcount) is defined as

$$\varphi_{HC}(\mathbf{x}) = \frac{1}{n} \sum_{i=1}^{n} \mathbf{1}_{x_i < \pi} = \frac{p}{n} ,$$

[5] See Zheng (1997) or Chakravarty and Muliere (2004) an overview of the vast literature.
[6] See Foster et al. (1984).

with $\mathbf{1}_{x_i<\pi} = 1$, for $x_i < \pi$ and $\mathbf{1}_{x_i<\pi} = 0$ elsewhere.

- The Foster et al. (1984) indices (FGT) are defined by

$$\varphi_{FGT}(x) = \frac{1}{n}\sum_{i=1}^{n}\left(\left(1-\frac{x_i}{\pi}\right)_+\right)^{\alpha},$$

with $\alpha > 0$ and $y_+ := \max\{y, 0\}$.

- Other examples of this form (1) are the indices by Watts (1968) and Chakravarty (1983).

3 New measures of richness

While all poverty indices of the previous section are well-known, little research has been done on the measurement of richness. The first challenge is to define an affluence or richness line. For an overview of the sparse literature see Medeiros (2006). We define it analogously to the poverty line.

Let ρ be the richness line, e.g. 200% of median or mean income, and $r = \#\{i|x_i > \rho, i = 1, 2, \ldots, n\}$ the number of rich persons.

Often the proportion of rich persons is used as a measure of richness:

$$R_{HC}(\mathbf{x}) = \frac{1}{n}\sum_{i=1}^{n}\mathbf{1}_{x_i>\rho} = \frac{r}{n}.$$

Its definition resembles that of the headcount ratio. But, if we want to compare different tax and transfer reform scenarios, this is not a satisfying definition of richness: If nobody changes his or her status (rich or non-rich), neither a change in a rich person's income nor a transfer between rich persons will change this index.

Medeiros (2006) proposes to define measures of richness in analogy to the FGT indices. However, Medeiros' FGT indices of richness are not standardised, which would be appropriate for the headcount but not for the FGT indices. Therefore, we propose a standardised approach of richness measures bounded to the unit interval.

There is an obvious difference between the income classes of the poor and of the rich: The incomes of the poor are bounded by 0 and π, but the incomes of the rich only have a lower bound ρ. Therefore, we transform the incomes of the rich, relative to the richness line, $\frac{x_i}{\rho}$, to the unit interval by a strictly increasing transformation function f. We use strictly increasing transformations, because the indices of richness should be sensitive to higher incomes, and assume $\lim_{y\to\infty} f(y) = 1$.

In poverty measurement, the focus axiom is generally accepted, i.e. a poverty index is not modified if a non-poor person's income is changed and this person does not change his or her status. This can be applied analogously to the measurement of richness: A person with an income not higher than ρ should not influence the measure of richness, $f(\frac{x_i}{\rho}) = 0$, for $\frac{x_i}{\rho} \leq 1$. Examples for $f(y)$ are the functions $f(y) = 1 - \frac{1}{y}$ or $f(y) = 1 - e^{1-y}$, for $y > 1$, and $f(y) = 0$ elsewhere.

A second important difference between the measurement of poverty and richness concerns the transfer axiom.[7] In poverty measurement decreasing the income of a very poor person shall have a larger effect than increasing the income of a relatively richer poor (minimal transfer axiom). Because of diminishing marginal utility, a richness index shall be less sensitive to changes of very high incomes. The relative incomes $\frac{x_i}{\rho}$ have then to be transformed by a function which restriction to high incomes is concave.

Taking all this into account, we define measures of richness R by

$$R(\mathbf{x}) = \frac{1}{n} \sum_{i=1}^{n} v\left(f\left(\frac{x_i}{\rho}\right)\right),$$

where $f : R_+ \to [0,1]$ is strictly increasing on $(1, \infty)$, $v : [0,1] \to R_+$ (in particular $[0,1]$) is increasing and $v(f(\cdot))$ is at last concave, that is, has a concave restriction on $[a, \infty[$ for some $a \in R_+$. [8]

If we use $f(y) := 1 - \frac{1}{y}$ for $y > 1$ and $v(y) := y^\alpha$, with $\alpha > 0$, we obtain a richness index R_α,

$$R_\alpha(\mathbf{x}) = \frac{1}{n} \sum_{i=1}^{n} \left(1 - \frac{1}{\left(\frac{x_i}{\rho}\right) \mathbf{1}_{x_i > \rho}}\right)^\alpha = \frac{1}{n} \sum_{i=1}^{n} \left(\left(\frac{x_i - \rho}{x_i}\right)_+\right)^\alpha. \tag{2}$$

This richness index resembles the FGT index of poverty. In this case the richness index decreases by a regressive transfer between a rich and a very rich person. For $0 < \alpha < 1$, $(\frac{x-\rho}{x})^\alpha$ is concave on (ρ, ∞) and for $\alpha > 1$, $(\frac{x-\rho}{x})^\alpha$ is at last, i.e. on $((\alpha+1)\rho/2, \infty)$, concave and by this, the second postulate that distinguishes richness from poverty measurement is fulfilled.

We may also employ $f(y) = 1 - \frac{1}{y^e}$, $e > 0$, for $y > 1$ and $v(y) = y$ and obtain an index similar to that of Chakravarty (1983):

$$R_e(x) = \frac{1}{n} \sum_{i=1}^{n} \left(1 - \left(\frac{\rho}{x_i}\right)^e\right)_+, \; e > 0.$$

[7] C.f. the transfer axioms in Chakravarty and Muliere (2004).

[8] A special case, without transformation f is the Watts (1968) measure of affluence, i.e. $\pi = \rho$, $v(y) = \ln(y)$ for $y > 1$.

Obviously, $f(y) = (1 - (\frac{\rho}{y})^e)$ is concave, for $y > \rho$ and $e > 0$. Many other richness indices can be defined in this way.

We now illustrate the two considerable advantages of our new measures by small examples:

Example 1: A change in a rich person's income should change the measure of richness: Consider two populations with income distribution

$$\mathbf{x} = (5, 5, 5, 11, 11) \text{ and } \mathbf{y} = (5, 5, 5, 100, 100)\,.$$

Let $\rho_{\mathbf{x}}$, $\rho_{\mathbf{y}}$ be 200% of the median income. Then $\rho_{\mathbf{x}} = \rho_{\mathbf{y}} = 10$ and we obtain

$$R_{HC}(\mathbf{x}) = R_{HC}(\mathbf{y}) = 40\%\,,$$

and

$$R_1(\mathbf{x}) = 3,64\% \text{ and } R_1(\mathbf{y}) = 36,00\%\,.$$

The latter appears to be the more plausible result since $R_1(x) < R_1(y)$.

Example 2: A richness index shall be less sensitive to changes of very high incomes: Let:

$$\mathbf{x} = (5, 5, 5, 11, 9989) \text{ and } \mathbf{y} = (5, 5, 5, 1000, 9000)\,,$$

where $\mathbf{y}$ is obtained from $\mathbf{x}$ by a progressive transfer of 989 monetary units between the two rich persons. Again we obtain

$$R_{HC}(\mathbf{x}) = R_{HC}(\mathbf{y}) = 40\%\,,$$

but more plausible results for R_1:

$$R_1(\mathbf{x}) = 21,80\% \text{ and } R_1(\mathbf{y}) = 39,78\%\,.$$

4 Data sources

We use three different data sources for our analysis. For the analysis of the development of the indices in Germany we use panel data from the GSOEP. Data from the ECHP is used for the cross country comparison, whereas data provided by the microsimulation model FiFoSiM is used for the analysis of tax reforms. All three sources are described in the following subsections.

4.1 GSOEP

The German Socio-Economic Panel (GSOEP) is a representative panel study of private households in Germany since 1984. It includes in each wave the incomes of the previous year. In 2003, GSOEP consists of more than 12,000 households with more than 30,000 individuals. The data include information on earnings, employment, occupational and family biographies, health, personal satisfaction, household composition and living situation.[9]

4.2 ECHP

The European Community Household Panel (ECHP) is a survey on income (including social transfers etc.), labour, poverty, housing, health, as well as various other social indicators concerning living conditions of private households and persons in the member states of the EU. The data was collected by national institutions in the member states. In the first wave (in 1994) the sample contained 60,500 nationally representative households in the then 12 Member States. Data of the ECHP is available for the 8 years from 1994 to 2001.[10]

4.3 FiFoSiM

FiFoSiM is a microsimulation model for the German tax and transfer system using income tax and household survey micro data.[11] The approach of FiFoSiM is innovative in so far as it creates a dual database using two micro-data sets for Germany: FAST98 and GSOEP.[12] FAST98 is the income tax scientific use-file 1998 containing a 10%-sample of the official German federal income tax statistics.[13] FAST98 includes the relevant data from income tax files of nearly 3 million households in Germany. A specific feature of FiFoSiM is the simultaneous use of both databases allowing for the imputation of missing values or variables in the other dataset.[14]

The layout of FiFoSiM follows several steps: First the database is updated using the static ageing technique[15] which allows controlling for changes in global structural variables and a differentiated adjustment for different income components of the households. Second, we simulate the current tax system in 2006 using the modified data. The result of this simulation is the benchmark for different reform scenarios which are also modelled using the modified database.

[9] See SOEP Group (2001) or Haisken De-New and Frick (2003) for a more detailled introduction to GSOEP.

[10] See Statistical Office of the European Communities (1996) for a detailed description of the ECHP.

[11] C.f. Fuest et al. (2005) for a detailed description of the FiFoSiM simulation model.

[12] In the last years several tax benefit microsimulation models for Germany have been developed (see for example Peichl (2005) or Wagenhals (2004)). Most of these models use either GSOEP or FAST data. FiFoSiM is so far the first model to combine these two databases.

[13] Cf. Merz et al. (2005) for a description of FAST98.

[14] See Rässler (2002) for an introduction to statistical matching procedures and imputation techniques.

[15] Cf. Gupta and Kapur (2000) for an overview of the techniques to modify the data for the use in microsimulation models.

The modelling of the tax and transfer system uses the technique of microsimulation.[16] FiFoSiM computes individual tax payments for each case in the sample considering gross incomes and deductions. The individual results are multiplied by the individual sample weights to extrapolate the fiscal effects of the reform with respect to the whole population. After simulating tax payments and received benefits we can compute the disposable income for each household. Based on these households' net incomes we estimate the distributional effects of the analysed tax reforms. A detailed description of the FiFoSiM simulation model can be found in Fuest et al. (2005).

5 Development of poverty and richness in Germany

Table 1 presents the results of the longitudinal analysis of the development of the indices of relative poverty and richness for Germany from 1983 to 2002.[17]

		φ_{FGT}			R_α	
year	φ_{HC}	$\alpha=1$	$\alpha=2$	R_{HC}	$\alpha=1$	$\alpha=2$
1983	12.46	3.13	1.43	5.97	1.29	0.50
1984	13.01	3.30	1.55	5.66	1.35	0.55
1985	12.39	3.16	1.51	5.54	1.17	0.43
1986	12.07	3.02	1.41	5.13	1.11	0.37
1987	12.13	3.26	1.54	5.77	1.07	0.34
1988	12.33	3.21	1.53	5.29	1.12	0.40
1989	11.83	3.35	1.76	5.44	1.21	0.45
1990	12.98	3.66	1.92	5.57	1.16	0.40
1991	12.52	3.43	1.67	5.76	1.12	0.37
1992	13.30	3.73	1.90	6.00	1.21	0.40
1993	12.96	3.74	1.89	6.78	1.47	0.50
1994	14.38	4.45	2.37	7.00	1.46	0.51
1995	13.87	4.23	2.24	6.75	1.40	0.47
1996	13.29	4.12	2.17	6.79	1.42	0.49
1997	13.10	4.00	2.09	6.72	1.21	0.38
1998	12.19	3.68	1.87	6.65	1.29	0.41
1999	13.62	4.20	2.18	7.17	1.39	0.45
2000	13.46	4.14	2.05	6.59	1.31	0.42
2001	15.10	4.51	2.18	7.86	1.64	0.57
2002	15.44	4.57	2.14	7.52	1.48	0.48

Table 1: Values (in %) of the poverty and richness indices using GSOEP data (Household Post-Government Income), modified OECD-Scale, until 1990 only West Germany.

[16] Cf. Gupta and Kapur (2000) or Harding (1996) for an introduction to the field of microsimulation.
[17] The poverty (richness) line is 60% (200%) of the median income.

The values of the headcount indices both for poverty and richness have been increasing in the 20 years of our analysis. Therefore one could make the case of "the rich getting relatively richer while the poor are getting relatively poorer". But when looking at the newly defined measures of richness R_α this hypothesis does not hold for an increasing sensitivity parameter α. From 1983 to 2002, for example, R_1 has increased, whereas R_2 has decreased. Therefore a more sophisticated analysis of the development of richness yields different results than just counting the number of people above a certain income (richness) line. This development could be explained by the relatively increased fraction of the upper middle class with high incomes, whereas the fraction of households with extremely high incomes remains constant.

When taking a closer look at the development of the indices over time, one has to divide the data into the periods of 1983-1990 (only West-Germany) and 1991-2002 (East and West Germany). During the pre-reunification period, the measures of richness decreased on the whole, but nevertheless oscillating between periods. After reunification there is an overall increase in the measures of richness and poverty which can be explained by the income differences between East and West Germany. The new measures of richness R_α can yield distinctively different results than the ordinary headcount index, which can be illustrated for several examples: From 1983 to 1984 and from 1987 to 1988 the headcount index indicates a decrease in richness whereas R_α indicates an increase. From 1986 to 1987 and from 1997 to 1998 it is the other way around, R_{HC} is increased while R_α is decreased. These effects can be explained by changes in the income structure. If R_{HC} decreases while R_α increases, the number of people above the richness line declines (headcount), whereas the dimension of richness is increasing. The rich are getting richer. Therefore, we propose to use the new measures in addition to the headcount index for a more comprehensive analysis of richness.

6 Relative poverty and richness in the EU-15

Table 2 presents the results of the cross country analysis comparing the values of the indices for the EU-15 countries in 2000.[18]

The values of these indices vary significantly across countries. The highest (lowest) values of richness in terms of the headcount measure can be found in Portugal (Denmark), whereas poverty is the highest (lowest) in Ireland (The Netherlands). When looking at the more sophisticated measures of richness, this order remains.

The cross country analysis yields 5 groups of countries in comparison to the EU-15 average:

1) High poverty and high richness: Greece, Ireland, Portugal, Spain, UK

[18]The median and therefore the poverty (60%) and richness (200%) lines are computed for each country respectively.

		φ_{FGT}			R_α	
	φ_{HC}	$\alpha = 1$	$\alpha = 2$	R_{HC}	$\alpha = 1$	$\alpha = 2$
Austria	16.08	4.99	2.82	6.50	0.97	0.25
Belgium	14.41	3.65	1.76	9.96	1.43	0.47
Denmark	15.53	4.72	2.41	5.28	0.57	0.17
Finland	15.94	4.78	2.59	8.59	0.94	0.29
France	16.29	5.28	2.96	8.28	1.24	0.34
Germany	13.50	4.15	2.10	6.60	1.29	0.41
Greece	22.96	9.25	5.31	12.08	2.28	0.66
Ireland	27.46	8.12	3.40	12.03	1.49	0.44
Italy	20.25	7.38	4.33	7.96	1.26	0.38
Luxembourg	13.36	3.15	1.19	9.32	1.29	0.36
Netherlands	11.85	4.52	2.82	7.10	1.04	0.30
Portugal	23.61	8.31	4.34	13.34	3.80	1.37
Spain	20.16	7.15	4.34	11.85	2.26	0.68
Sweden	13.67	5.20	3.17	6.72	0.82	0.24
United Kingdom	19.73	6.82	3.76	12.62	2.00	0.63
EU-15	17.65	5.83	3.15	9.22	1.51	0.47

Table 2: Values (in %) of the poverty and richness indices using ECHP data (Household Total Net Income), modified OECD-Scale, 2000.

2) High poverty and low richness: Italy

3) Average poverty and richness: Belgium, Finland, France

4) Low poverty and high richness: Luxembourg,

5) Low poverty and low richness: Austria, Denmark, Germany, Netherlands, Sweden

When comparing the countries, one can see distinctive differences between the measures. Ireland, for example, has almost twice the amount of rich people in terms of the headcount than Germany, but in terms of the R_α it is almost the same. The reason for this might be that there are a lot of people only just above the richness line in Ireland, whereas in Germany there are less people above that line, but more often well above. Furthermore, France and the Netherlands, for example, have higher values for the headcount index, but smaller values of R_α than Germany. Therefore, the usefulness of our new richness measures in addition to the headcount measure becomes evident.

7 Poverty and richness effects of flat tax reform proposals in Germany

We analyse the effects of two flat tax reform proposals on poverty and richness in Germany.[19] As the Benchmark for our ex ante analysis we use the simulated population under the current German income tax law for the year 2006 (status quo) provided by the microsimulation model FiFoSiM.

The considered tax reform scenarios are revenue-neutral combinations of tax base simplification with single tax rates as described in Fuest et al. (2006). Tax base simplification is modelled as the abolition of a set of specific deductions from the tax base included in the German income tax system.[20] We look at two (revenue-neutral) flat tax reform scenarios. The first one has a low marginal tax rate of 26% and a basic tax allowance of 7664 euros (which corresponds to the current tax system). The second flat tax scenario has a higher marginal tax rate of 32% and a higher allowance of 11650 euros.

The effects of these tax reform scenarios are calculated in the microsimulation model FiFoSiM. We abstract from behavioural adjustments in this paper, i.e. we assume that the economic agents do not change their labour or savings supply in response to these tax reform scenarios.

Table 3 presents the values of the measures for the different tax reform scenarios in the manner of the governmental reports on poverty and richness.[21] In this methodology, the median and therefore the poverty and the richness line vary in each case.[22]

scenario	φ_{HC}	φ_{FGT} $\alpha=1$	φ_{FGT} $\alpha=2$	R_{HC}	R_α $\alpha=1$	R_α $\alpha=2$
status quo	15.21	4.34	2.53	6.25	1.52	0.57
flat tax 1	15.22	4.34	2.53	6.64	1.77	0.73
flat tax 2	15.20	4.33	2.52	5.63	1.39	0.55

Table 3: Values (in %) of the poverty and richness indices using FiFoSiM (variable poverty and richness lines).

The values for the poverty indices do not change significantly for the revenue-neutral reform scenarios in comparison to the status quo.[23] The richness indices however change due to the

[19] In this paper we focus on questions of poverty and richness. We analyse the effects of these tax reforms on equity and efficiency elsewhere (see Fuest et al. (2006)).

[20] Our choice of simplification measures is influenced by the German policy debate about existing tax breaks and deductions. Naturally, this analysis is restricted by the availability of data.

[21] These results are based on the enhanced GSOEP tax benefit module of FiFoSiM, because of the better representation of the whole population at both ends of the income distribution.

[22] Our results, when using the same methodology, are in line with these reports (see Bundesregierung (2001) and Bundesregierung (2005)).

[23] When analysing poverty, one has to take into account that the lowest deciles of the income distribution

fact that the tax base simplification measures affect higher income groups the most.[24] The various reform scenarios change these indices into different directions. The flat tax with a high marginal rate and basic allowance (flat tax 2) decreases these indices, whereas the flat tax with a low marginal rate and basic allowance (flat tax 1) increases the richness measures. This information might be interesting for politicians, but an increasing measure of poverty (or a decreasing index of richness) does not necessarily indicate a worse situation for people with low (high) incomes as a result of the changing poverty (richness) line.

		φ_{FGT}			R_α	
scenario	φ_{HC}	$\alpha = 1$	$\alpha = 2$	R_{HC}	$\alpha = 1$	$\alpha = 2$
status quo	15.21	4.34	2.53	6.25	1.52	0.57
flat tax 1	15.28	4.35	2.53	6.30	1.67	0.69
flat tax 2	15.19	4.33	2.52	5.86	1.46	0.58

Table 4: Values (in %) of the poverty and richness indices using FiFoSiM (fixed poverty and richness line).

To account for this weakness of relative measurement, we fix the poverty and richness lines at the value of the status quo taxation and calculate the measures again (see table 4). Not surprisingly, there is again no large variation in the values of the poverty measures, because all reform scenarios guarantee large basic allowances. Nevertheless the flat tax with a high basic allowance (flat tax 2) decrease the poverty, whereas the flat tax with a low basic allowance increases the poverty indices.

Obviously, the richness indices react stronger than the poverty measures. The flat tax alternative with low marginal rate and basic allowance (flat tax 1) increases the indices. Whereas the the flat tax with high marginal rate and basic allowance (flat tax 2) decrease the headcount measure as well as our measure for $\alpha = 1$. For $\alpha = 2$, however, the flat tax scenario (flat tax 2) increases R_2 slightly. This is caused by the greater reliefs of the very high incomes resulting from decreasing effective marginal tax rates[25]. When a higher weight α is attached to changes of high incomes, the measures of richness R_1 and R_2 might indicate an increase in richness in contrast to the conventional headcount measure. E.g. the difference between status quo and flat tax 1 (with lower top tax rate) is greater in R_1 than in R_{HC}, because rich people would become even richer.[26] Hence, the importance of more sophisticated measures of richness is evident.[27]

seldom pay income taxes (see Fuest et al. (2006)). Therefore, a reduction of income poverty through tax reforms is naturally restricted. A reform of the benefit system, like an increase in the social assistance for instance, would be a more effective measure.

[24] See Fuest et al. (2006) for a detailed analysis of the distributional effects of these measures.

[25] See Fuest et al. (2006).

[26] See also the examples of section 3.

[27] See the appendix for a more detailed analysis of the effects on subgroups of the population.

8 Conclusions

In this paper, we propose a new class of richness measures. In contrast to the headcount, the values of these new indices will increase with rich persons income. We apply these indices to longitudinal data of Germany, cross country data of the EU-15 and we simulate different flat tax reform scenarios for Germany.

The analysis leads to ambiguous results for the development of richness in Germany. The headcount index and R_1 indicate an increase whereas when increasing the sensitivity parameter α, the new measure R_2 decreases from 1983 to 2002.

The cross country analysis yields several groups of countries according to their values of poverty and richness indices. Southern European countries (e.g. Greece, Portugal, Spain) and the Anglo-Saxonian countries can be characterised by rather high poverty and richness, whereas middle and northern European countries (e.g. Austria, Denmark, Germany, Netherlands, Sweden) can be distinguished by rather small values of poverty and richness. The comparison of the countries reveals distinctive differences in the values of the measures. Therefore, the usefulness of our new richness measures in addition to the headcount measure becomes evident.

Furthermore we find that the (revenue-neutral) flat tax reform scenarios have only small effects on poverty but some influence on richness. Nevertheless, we show that the two scenarios change the indices into different directions. A flat tax with a low marginal tax rate and basic allowance increases poverty and richness, whereas a flat tax with higher tax parameters decreases both. Hence, the first one redistributes in favour of the very high incomes at the expense of the low incomes, whereas the second does the opposite. Therefore, the effects of flat tax reform scenarios on richness (and poverty) crucially depend on their design.

Moreover, our analysis shows that new richness measures lead to different results in comparison to the headcount index for some of the periods, countries and reform scenarios. Our approach is more appropriate, because it also takes the dimension of changes and not only the number of people beyond a given richness line into account. This approach is therefore especially useful for the analysis of decreasing top tax rates, which has been a popular trend in many OECD countries during the last years.[28]

To sum up, our proposed new class of richness measures accounts for changes in the dimension of high incomes and therefore allows for a distinct analysis of structural changes at the top of the income distribution. We propose to use the new measures in addition to the headcount index for a more sophisticated analysis of richness.

[28] Cf. OECD (2006).

Appendix

scenario	φ_{HC}	φ_{FGT} $\alpha=1$	φ_{FGT} $\alpha=2$	R_{HC}	R_α $\alpha=1$	R_α $\alpha=2$
single, no children						
status quo	2.12	0.91	0.77	9.47	2.07	0.72
flat tax 1	2.15	0.95	0.80	9.59	2.24	0.83
flat tax 2	2.09	0.93	0.80	9.12	2.04	0.74
single parents						
status quo	39.41	15.68	11.40	0.51	0.12	0.05
flat tax 1	39.62	15.70	11.41	0.52	0.14	0.06
flat tax 2	39.44	15.67	11.39	0.48	0.12	0.05
couple, no children						
status quo	1.99	0.80	0.68	10.07	2.34	0.82
flat tax 1	2.09	0.90	0.76	9.87	2.37	0.88
flat tax 2	1.95	0.85	0.74	9.76	2.25	0.80
couple with children						
status quo	8.18	3.61	3.39	2.46	0.52	0.16
flat tax 1	7.88	3.65	3.29	2.62	0.58	0.20
flat tax 2	8.09	3.72	3.49	2.36	0.51	0.17

Table 5: Values (in %) of the poverty and richness indices using FiFoSiM (fixed poverty line) for subgroups

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