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ON THE MAGNITUDE OF INCOME MOBILITY IN GERMANY

by

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On the magnitude of income mobility in Germany*

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September 2002

Abstract

This paper documents the magnitude of income mobility in Germany and its distribution across different income positions, using data from the German Socio-Economic Panel. The suggested graphical approach makes it straightforward to identify the portions of the distribution that have the largest impact on aggregate 'income movement' indices *à la* Fields & Ok, and hence offers a starting point to help account for income mobility levels. It appears that most of the contribution to mobility is made by the poorest 10% of the initial distribution. Average relative income changes are much lower and generally constant for the rest of the population.

Keywords: Income mobility; Non-parametric regression

JEL Classification: C14; D31; I32

*Paper presented at the 5th German Socio-Economic Panel conference, Berlin, July 3-4 2002, and forthcoming in *Schmollers Jahrbuch (Journal of Applied Social Science Studies)*, 2003/1. Comments by Jennifer Hunt are gratefully acknowledged. This paper is part of a research project supported by the European Commission under the Transnational Access to major Research Infrastructures programme (Contract No. HPRI-CT-2001-00128) hosted by IRISS at CEPS/INSTEAD Differdange (Luxembourg). Contact: `philippe.vankerm@ceps.lu`.

1 Introduction

The measurement of income mobility, when one is concerned with the movements of individuals *within* the income distribution over time forms a body of vivid theoretical and empirical literature. A wide array of indices have been proposed to capture the extent of mobility in a given society, and empirical analyses commonly use a variety of such mobility indices to help intertemporal or cross-country comparisons.[1] This analysis is an attempt to document in greater detail the magnitude of income mobility in Germany between 1984 and 2000 and its distribution across different income positions, using an intuitive graphical approach. The suggested graphical approach makes it straightforward to identify the portions of the distribution that have the largest impact on aggregate 'income movement' indices *à la* Fields & Ok (Fields & Ok 1996, Fields & Ok 1999*b*), and hence offers a starting point to help account for income mobility levels.

2 Methodology

The paper concentrates on income *movement* indices à la Fields & Ok. These mobility measures are population averages of 'distance' statistics capturing the degree of income change experienced by individuals over a given time interval. Common 'distance' functions are the income difference (Fields & Ok 1996), and the log-income difference (Fields & Ok 1999*b*), either taken in absolute value or not. I focus here on log-income difference, and hence look at relative income changes: two individuals experience equal amounts of mobility if their percentage income changes over time are the same.[2] The mobility index of interest is therefore

$$M(X,Y) = \int\int d(x,y)f(x,y)dxdy \tag{1}$$

where X and Y are two random variables representing the distribution of income in an initial and a final time period, and f is their joint probability density function. $d(x,y)$ is the distance function, i.e. either $(\log(y) - \log(x))$ for an assessment of expected income increases (losses offset gains), or $|\log(y) - \log(x)|$ for an assessment of the overall variability of incomes (losses add to gains).

The cornerstone of this paper is estimating separate mobility levels for different points in the initial income distribution, and expressing the mobility index as a

[1] See Maasoumi (1998), Fields & Ok (1999*a*) and Fields (2000) for a comprehensive survey of existing approaches. Recent examples of applied analysis can be found in Burkhauser & Poupore (1997), Schluter (1998), Canto-Sanchez (2000) or Maasoumi & Trede (2001) among others.

[2] At least for small percentage change when log-difference approximates percentage change closely.

functional of a *conditional mobility function* as follows:

$$M(X,Y) = \int \left(\int d(x,y) f_{Y|x}(y) dy \right) f_X(x) dx \quad (2)$$

$$= \int m\,(X,Y|X=x)\, dF_X(x) \quad (3)$$

where f_X is the marginal probability distribution function of X, F_X is the cumulative distribution, and $f_{Y|x}$ is the probability distribution function of Y conditional on $X = x$. $m\,(X,Y|X=x)$ is the resulting conditional mobility function that can be plotted to obtain an evocative picture of the distribution of mobility levels across different parts of the distribution.[3]

I use the locally weighted regression (LOESS) technique introduced by Cleveland (1979) to estimate $m\,(X,Y|X=x)$ without imposing any parametric restriction. This method is easily implemented, solves the boundary effect problem of kernel regression and permits a 'robust' estimation that guards against deviant points affecting estimation of $m\,(X,Y|X=x)$.[4] Indirect estimation of $M(X,Y)$ by integration of the robust estimate of $m\,(X,Y|X=x)$ makes it robust to outlying observations, in contrast to standard direct estimation based on unit record data.[5]

Similarly to $M(X,Y)$, the conditional mobility function is decomposable by population subgroups. If $A = (A_1, \ldots, A_K)$ is a partition of the population into K mutually exclusive states, and $P(A_k|X=x)$ denotes the probability that an individual belongs to state k (conditionally on $X = x$), then

$$m\,(X,Y|X=x) = \sum_{k=1}^{K} P(A_k|X=x) m\,(X,Y|X=x;A_k) \quad (4)$$

where $m\,(X,Y|X=x;A_k)$ is the conditional mobility function estimated for individuals of state k. This property allows an assessment of the impact of exogenous attributes on the level of mobility, and helps identify differential roles of individual characteristics at different points of the income distribution. Defining population subgroups by using the experience (or absence of experience) of a set of mutually exclusive events also permits closer investigation of the effects on income mobility of potential 'triggering events', as has been done in the analysis of poverty transitions.

[3]This methodology is closely related to the procedures presented in Schluter & Trede (1999) and Schluter & Van de Gaer (2002). The same objective is indeed shared, but the approach is applied here in the different and greatly simplified context of 'distance-based' mobility measures.

[4]See Cleveland (1979) or Hastie & Loader (1993).

[5]See Cowell & Schluter (1998) on estimation of income mobility measures with dirty data.

3 Data

Income mobility assessment requires repeated income observations over time for a sample of individuals. Such data are available for Germany in the Cross-National Equivalent File (CNEF), which contains constructed annual income variables directly derived from the German Socio-Economic Panel (GSOEP) survey data.[6] These data allow me to study patterns of income mobility over the period 1984–2000. Focus is put on disposable income as a proxy for an individual's living standard. The measure of income adopted is therefore real annual post-government household income converted to a 'single adult equivalent' using the 'modified OECD' scale.[7] Household income is the pooled income of all family members, including labour earnings, asset flows, private transfers, and public transfers minus total household taxes. The latter are not directly available, but simulated and provided with the data (Schwarze 1995). Most of the results pertain to pooled data for West Germany 1984-1992, West Germany 1992-2000, and East Germany 1992-2000.

4 Income mobility in Germany, 1984–2000

Expected annual income *increases* –measured by $M(X, Y)$ with the change in log-income as underlying distance function (the 'directional' index)– have been near 4% in all three samples: 0.037 for West Germany 1984-1992, 0.030 for West Germany 1992-2000 and 0.038 for East Germany 1992-2000. (These estimates were obtained by numerical integration of the robust LOESS estimates of the conditional mobility function.) However, gains have offset losses, and these figures conceal much income mobility. The expected annual income *changes* –measured by the absolute change in log-income (the 'non-directional' index)– have been near 20%: 0.187 for West Germany 1984-1992, 0.195 for West Germany 1992-2000, and 0.173 for East Germany 1992-2000. Surprisingly, the sample with the lowest expected income increases have the highest expected income changes and *vice versa*. Time series of aggregate mobility indices for 1984-2000 are not reported, but are available from the author. No clear trends emerge, except an overall reduction of income variability in East Germany since 1992. It is interesting to note that the 'directional' and 'non-directional' indices measure empirically distinct phenomena, since the correlation

[6] See Wagner et al. (1993) for a presentation of the English-Language Public Users German Socio-Economic Panel, and Burkhauser et al. (2001) for more information on the Cross-National Equivalent File.

[7] Total household income is divided by an adjusted household size where the first adult counts for one person, other adults count for 0.5 and children count for 0.3 (see e.g. Eurostat Task Force 1998).

between these indices across the different regions and time periods is only 0.13.

The underlying conditional mobility functions are plotted in Figure 1. The curves for the three separate subsamples are very similar and can be distinguished only at the tails. One clear pattern emerges from both pictures. The highest contribution to aggregate mobility is made by the poorest individuals. Expected income change reaches 80% or more for approximately the poorest 5%. The decline is steep, however, and at about the first decile point the curves stabilise and remain flat until the upper decile of the initial distribution. Between 32% (in East Germany) and 38% (in West Germany 1992-2000) of total expected income change are contributed by the poorest 10%.

Comparing the pictures for the two different distance concepts helps describe the patterns of income mobility in greater detail. For example, according to the plot for the non-directional distance concept, the majority of individuals (those between the 20th and 80th percentiles) experience on average absolute income changes of about 15%. But it appears from the plot for the directional distance that their expected net gain is close to zero: the absolute changes are a mixture of income gains compensated by income losses of the same average magnitude. It is at the tails of the distribution that the expected net gains depart from zero, reflecting the phenomenon of regression to the mean, with the richest 10% expecting income losses and the poorest 20% expecting (substantial) income increases.

I also consider longer term mobility patterns using a time interval of five years and using three-year moving average incomes to smooth out transitory income fluctuations. With these definitions, expected income increases were about 7 % for West Germany 1984-2000 and East Germany 1992-2000, but were nil for West Germany 1992-2000. Overall income changes remain at about 0.20, so that smoothing out transitory income fluctuations offsets the increase in mobility expected from the increase in time interval to five years. The underlying conditional mobility functions are reported in Figure 2. Note that the axis scales are the same as in Figure 1 to allow direct comparison of the two pictures. The shape of the conditional mobility functions remains the same.[8] However, the peak at the bottom of the distribution is greatly reduced. The expected income increases have been higher in East Germany than in West Germany in the 1992-2000 period for almost all percentiles of the distribution (compare the two dashed curves in the bottom panel of Figure 2).

[8]The constancy of the 'flat base U shape' of the conditional mobility functions is also observable across different countries in the 1990s, although aggregate levels of mobility may differ substantially between countries. International comparisons based on a beta release of the Consortium of Household Panels for European Socio-economic Research (CHER) data are available from the author.

Figure 1: Conditional mobility functions for $d(x,y) = |\log(y) - \log(x)|$ (top) and $d(x,y) = (\log(y) - \log(x))$ (bottom). Pooled data for year t to year $t+1$ changes.

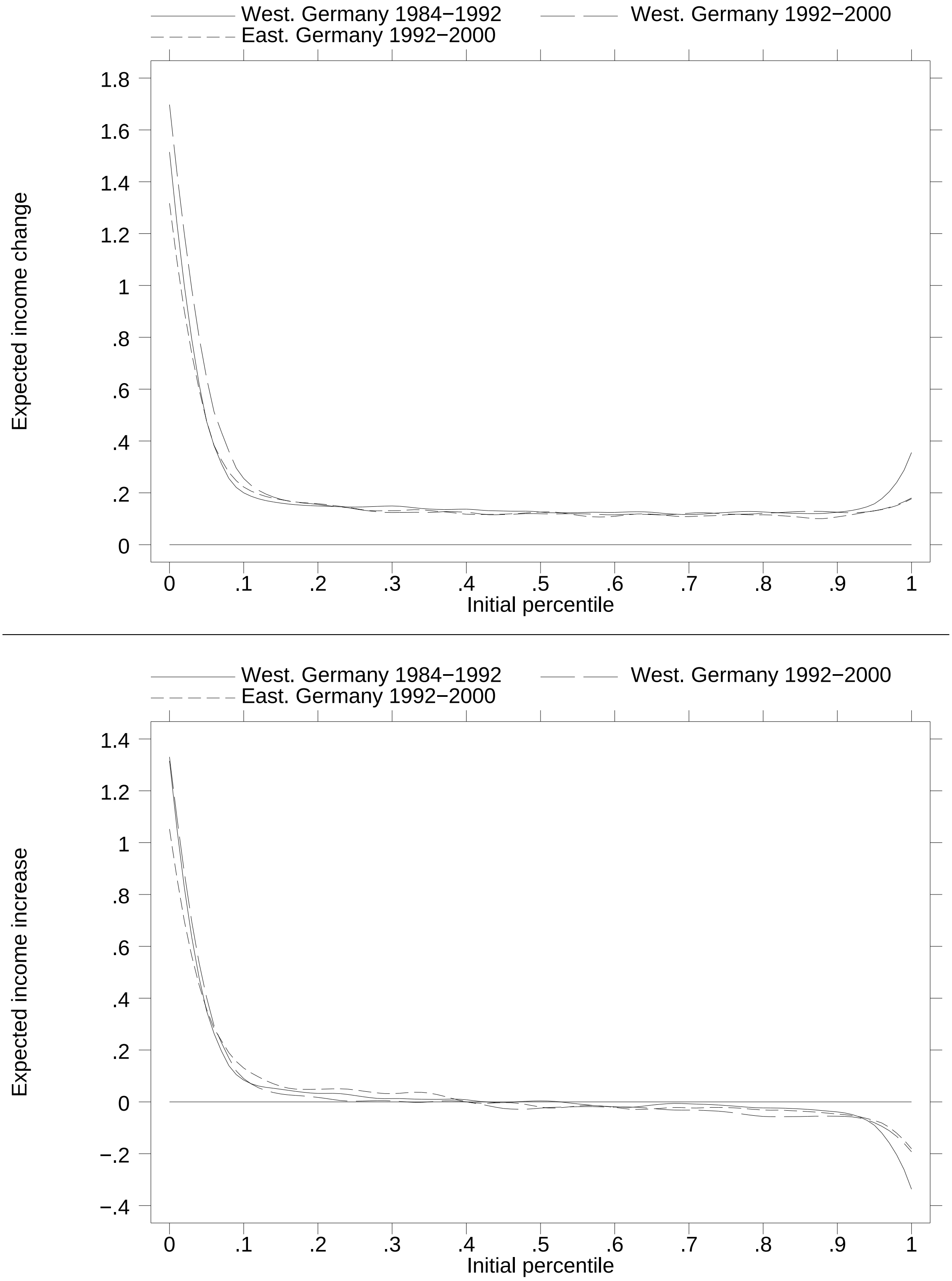
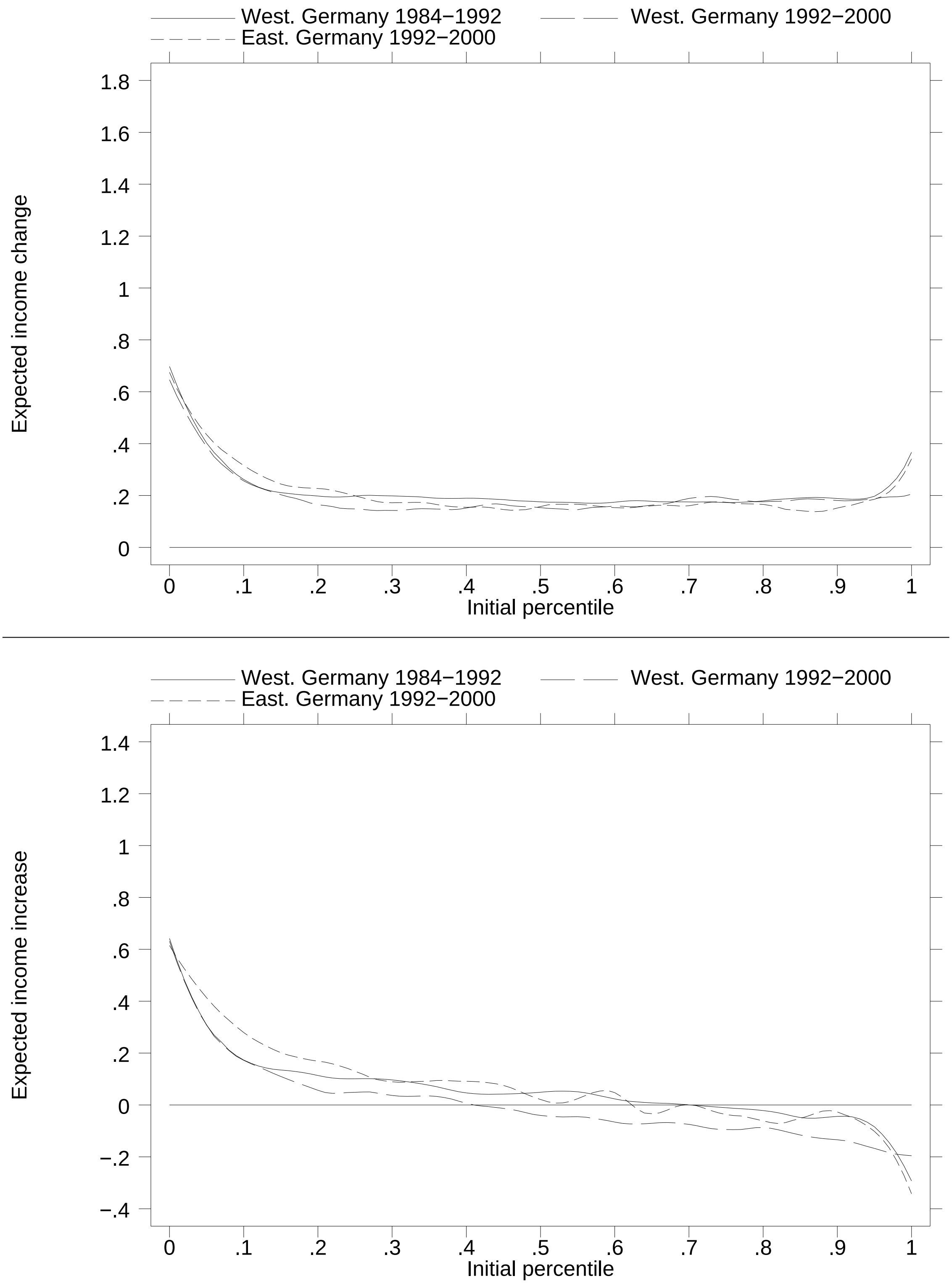


Figure 2: Conditional mobility functions for $d(x,y) = |\log(y) - \log(x)|$ (top) and $d(x,y) = (\log(y) - \log(x))$ (bottom). Pooled data for year t to year $t+5$ changes using three-year moving average incomes.



As a final illustration, I now present a rudimentary inspection of the effect of a potential mobility-triggering event: the change in the labour market participation of the household head.[9] Individuals are classified into three groups according to the change in the declared labour market participation of the household head between two consecutive interviews: (i) individuals with no change in the labour market participation of the household head, (ii) individuals living in a household whose head increased participation (i.e. either moved from inactive to working or moved from part-time to full-time work), and (iii) individuals living in a household whose head reduced participation (i.e. either moved from working to inactive or moved from full-time to part-time work). Separate conditional mobility functions are estimated for each of these three groups. If the change in the labour market participation of household head is a powerful explanation of mobility, we should observe the contribution of the 'no change' group to be low, i.e. the curve should be close to zero. The other two curves should reproduce the observed mobility patterns by combining upward and downward mobility movements.

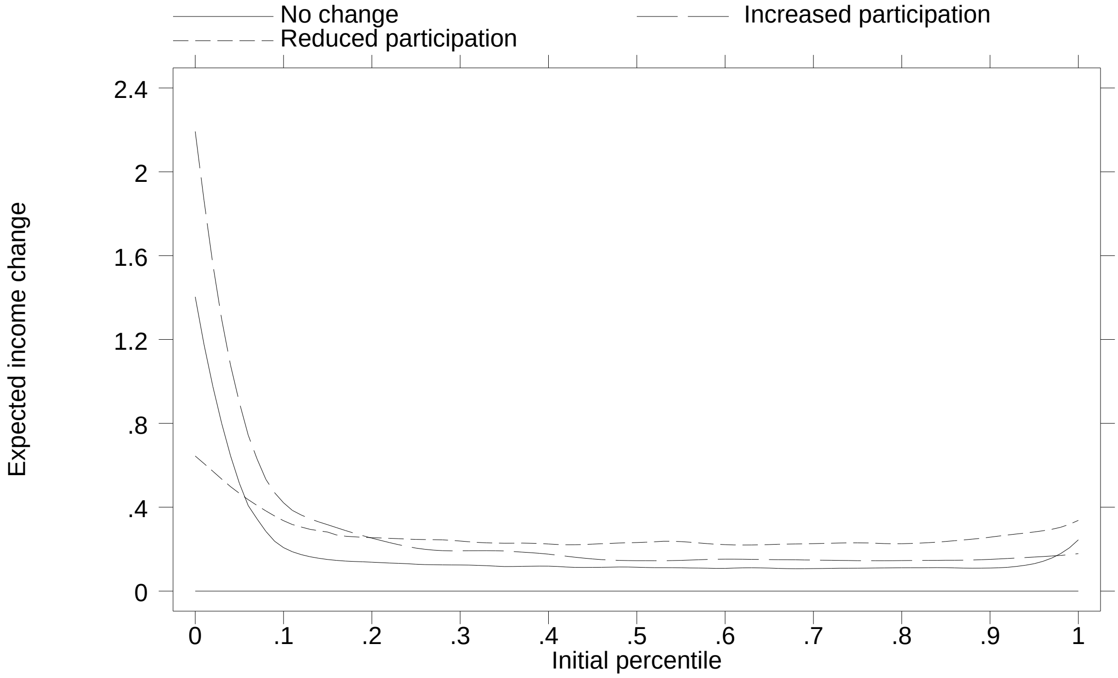
Figure 3 presents the subgroup conditional mobility functions (with all data for East and West Germany pooled). The striking observation is that the crude events defined here are far from sufficient to explain the observed income changes. Although most of the results conform to intuition (e.g. increased participation leads to higher expected income gains and reduced participation tends to be associated with lower –generally negative– expected gains; see the bottom panel of Figure 3), there is not enough difference between the curves of the three groups to account fully for most of the mobility. Crucially, the curve for the 'no change' group exhibits substantial (absolute) mobility, especially at the lower tail. Within-group mobility remains high and supplementary explanations are therefore clearly required to account for a larger share of income mobility.[10]

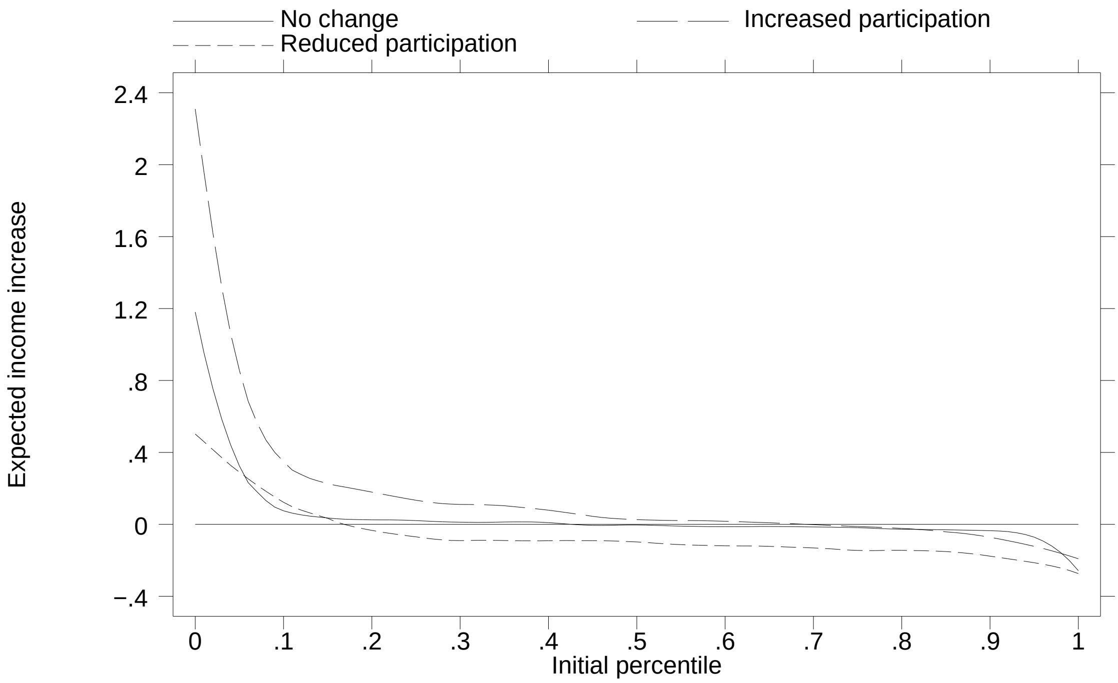
Interesting results emerge from the pictures, however. Note, for instance, that reduced participation appears to be associated with higher (absolute) income changes than increased participation, at least if one disregards the mobility of the poorest 10% or 20%. Finally, the decomposition shows the regression to the mean effect at both tails of the income distribution: expected income gains are positive for the poorest in all groups, even those experiencing reduced participation. Symetrically, expected income gains are negative for the richest even if they experience increased participation.

[9]The person identified as household head in the GSOEP is "the person who knows best about the general conditions under which the household acts" (Haisken-De New & Frick 2001).

[10]Inadequacy of the household head's labour market status to describe the labour market attachment of the whole household is a potential explanation for poor results here.

Figure 3: Subgroup conditional mobility functions according to labour market participation, for $d(x, y) = |\log(y) - \log(x)|$ (top) and $d(x, y) = (\log(y) - \log(x))$ (bottom). Pooled data for Germany 1984-2000.





5 Conclusion

This paper provides a broad-brush analysis of income mobility patterns in Germany between 1984 and 2000, using a simple graphical methodology to decompose aggregate mobility indices à la Fields and Ok.

The methodology suggested provides an evocative means of identifying the location in the distribution of individuals experiencing the higher levels of mobility, while linking this identification to a standard class of distance-based mobility indices. Application to the German Socio-Economic Panel Cross-National Equivalent File reveals that it is among the poorest 10% (and the richest 5% to a smaller extent) that mobility is the largest. Mobility is much lower and relatively constant for the remaining majority of the population (between the 10th and the 95th percentile). An interesting constancy of this general pattern is observed over time in Germany (both in West and East samples) as well as in several other European countries. An illustration of a subgroup decomposition into potential triggering events shows how the methodology could be used to try identify the sources of mobility. The rudimentary approach applied here, although picking up some of the income changes, is insufficient to capture a large fraction of the overall mobility levels.

Several observations require much deeper investigation, in particular, the striking difference between the mobility levels of the very poorest and the rest of the population. Is this only due to measurement error or temporary income fluctuations, or is some more substantial process at work? How much of these patterns can be accounted for by 'events-based' decompositions? Deeper investigation is beyond the scope of the present paper, but the methodology suggested may serve as a tool for further research in this area.

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[contract HPRI-CT-2001-00128]

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