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# Trends in Intragenerational Income Mobility in the Western States of Germany and the United States (1984 – 2006)

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## Abstract

Using the Shorrocks *R*, we compare trends in intragenerational income mobility for the western states of Germany and the United States (1984 – 2006) and test the sensitivity of our results to the starting point and number of years considered. We find that our mobility estimates do not converge to a constant over time so the starting year chosen for the analysis matters. We conclude that income mobility declined in the western states of Germany over time and is now much closer to income mobility in the United States than was the case in the 1980s.

*JEL Codes: J6, Z13*

## 1. Introduction

There is ample evidence that during the 1980s and 1990s income inequality in the western states of Germany was lower than in the United States (Gottschalk / Smeeding, 2000). However, cross-sectional measures of inequality cannot distinguish between its transitory and permanent components. So, if income mobility were lower in Germany than in the United States, it is possible that the permanent level of income inequality in the two countries would be closer together. Surprisingly, given Germany's more rigid labor markets and more generous social welfare system, when Burkhauser / Poupore (1997) used a Shorrocks *R* to measure income mobility and hence disentangle the permanent and transitory components of income inequality in these two countries over the period 1984 – 1989, they found a greater level of income mobility and hence a smaller component of permanent income inequality in the western states of Germany. These findings were subsequently confirmed by Maasoumi / Trede (2000).

Ongoing panel studies in both Germany and the United States make it possible for us to revisit this work using data from 1984 – 2006. We first use this longer time period to test whether the Shorrocks *R* measure of income mobility

in fact stabilizes as we extend the time interval of our empirical analyses. Stability would imply that in the long-run, there are permanent underlying rates of mobility associated with different societies. We find that even with nearly a quarter-century of data, measures of mobility do not stabilize in either country. Such a finding suggests that Shorrocks *R* estimates of mobility could be sensitive both to the beginning year and the number of years used in the analysis. When we explore these possibilities we find that holding the number of years considered constant, the ratio of permanent to total inequality of income in both countries varies with the starting year of the analysis but the difference is significant only for Germany.

## 2. Methodology

Burkhauser/Couch (2009) describe the relationship between intragenerational economic mobility and the relative magnitudes of permanent and transitory inequality. They observe that standard measures of permanent income for individuals, average or sum observations over time to reduce the extent of transitory error. Thus, a ratio of permanent to total variation in income shows the degree that individuals' positions in the income distribution are static over time. A simple measure of the degree of immobility over time is the ratio of permanent to total inequality during the period. The maximum value of this measure of rigidity in the income distribution over time, the Shorrocks R (Shorrocks, 1981), is 1 when all variation is permanent. In this extreme case, individuals retain their positions in the distribution over time. The value of R falls as transitory variation rises.

More formally, the Shorrocks *R* is the ratio of a multi-year inequality value $I(Y)$ to the weighted average of single-year inequality values $I(Y^t)$ where the weights ($w_t$) are the ratio of mean income in year $t$ ($\mu_t$) to the mean income over all $t$ years ($\mu$).

$$0 \leq R = \frac{I(Y)}{\sum_t w_t I(Y^t)} \leq 1$$

The value of the numerator, which represents permanent inequality, cannot exceed the weighted average of the single year inequalities (total inequality) in the denominator. *R* can take values between zero and one where zero indicates a completely mobile society and one indicates a completely immobile society.

It is necessary to use inequality measures which are strictly convex functions to calculate the Shorrocks R. The Theil index we use in our Shorrocks *R* estimates satisfies the strict convexity property. We calculate this index using the formula:

$$I_1(Y) = \frac{1}{n}\sum_i \frac{Y_i}{\mu}\log\frac{Y_i}{\mu}$$

where $n$ is the number of individuals, $\mu$ is mean income and $Y_i$ is the income of individual $i$. We obtain an individual's total income over $t$ years by $Y_i = \sum_t Y_i^t$. Previous cross-national studies of mobility have found that their results were insensitive to the use of other inequality measures satisfying the strict convexity property in calculating the Shorrocks $R$ (Shorrocks, 1981; Burkhauser / Poupore, 1997; Maasoumi / Trede, 2001, Chen, 2009).

As additional years of data are added to the calculation of the Shorrocks $R$, the influence of transitory error on the estimate of permanent income declines because positive and negative influences tend to offset each other over time. Hence, in a stable economic regime, once enough years of data are added to the calculation of permanent income, its variation relative to the total should not change much. That is, in a system where the proportion of inequality attributable to permanent income is stable over time, the value of the Shorrocks $R$ will asymptote to a constant as more data is added to its computation. If this is the case, then it is possible for researchers to use fairly short panels of data over different time periods and still accurately measure intragenerational mobility across countries. It is this property which we exam below.

## 3. Data

The Socio-economic Panel (SOEP) data for Germany and Panel Study of Income Dynamics (PSID) data for the United States come from the Cross-National Equivalent Files (CNEF). The SOEP-CNEF currently includes data from 1984 to 2008 and the PSID-CNEF includes data from 1968 to 2007. This analysis focuses on survey years 1985 to 2007 (or income years 1984 through 2006) for both countries and makes use of information from every second calendar year. Consistent data usage over time makes the omission of the alternating years necessary.

Our measure of economic well-being is real post-tax post-transfer household income. This variable is the sum of labor earnings, asset flows, private and public transfers, the imputed rental value of owner occupied housing and other income sources of all individuals in a household minus federal income and payroll taxes.[1] To control for the possibility of changes in household composition, we focus on personal income mobility, and hence, the unit of analysis is the person. In addition, we assume that household members share income equally. We adjust household incomes using the equivalence scale value of *0.5*.

[1] The data is adjusted for inflation using CPI indices. Base income year is 1991 for both countries.

We assign these equivalised incomes to each person in the household. These are standard methods in cross national comparisons of income inequality (Atkinson / Rainwater / Smeeding, 1995). Each sample we use includes only survey respondents who report positive household income in all years in that sample. We weight all our samples to represent the population and to take into account attrition.

## 4. Results

Figure 1 provides stability curves, i.e., series of the Shorrocks *R* measures beginning in 1984 but calculated over increasing time intervals for both countries. By definition, *R* is equal to 1 when the accounting period is 1 year. So, both country curves in figure 1 begin in 1984 with the value 1. Incomes are aggregated over the first two years of data and *R* is recalculated and so on. Over successive calculations from 1984 to 2006, Germany has a lower level of *R* which is consistent with a less rigid or more mobile structure of equalized disposable household income of persons than in the United States. Assuming the two samples are independent, the *R* measures across them are significantly different from each other for all time horizons.[2]

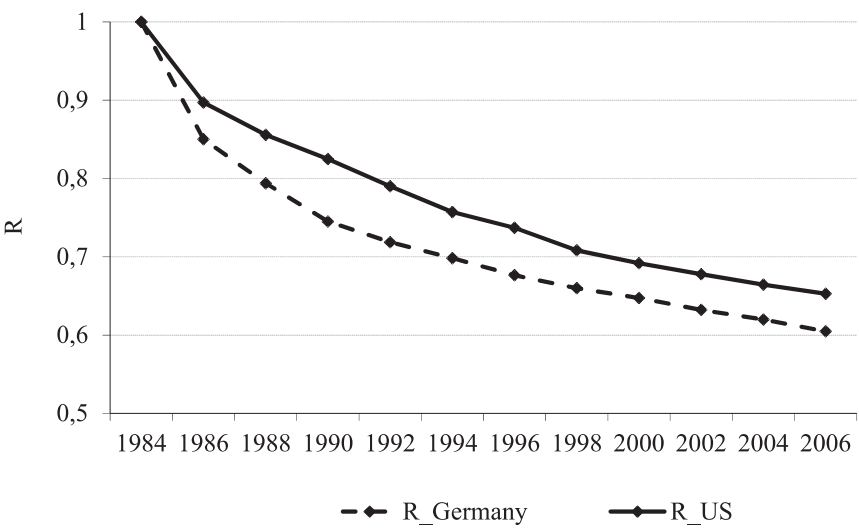



Figure 1: Permanent Share of Post-Government Income Inequality 1984–2006

[2] The relevant t-statistics are available from the authors upon request.

Consistent with Burkhauser / Poupore (1997) we find that the Shorrocks *R* is lower in the western states of Germany than in the United States for the period 1984 – 1989 and show that this continues to be the case over the entire period covering 1984 – 2006. Why Germany, with its relatively rigid labor markets, might have greater income mobility can be explained by factors seen as both positive and negative. Faster wage growth associated with greater specificity in skill requirements for employment in Germany would be a positive reason for greater economic mobility. Less adaptability to changing economic circumstances due to greater worker protections in Germany might result in higher unemployment, inducing more volatility (mobility) in household incomes.

As discussed in the methods section, the stability curves we show in figure 1 decline as more years are added to the calculation of the Shorrocks R. However, there is a slowdown in the pace of the decline beyond 1990 in the western states of Germany and after 1998 in the United States. In the United States, rigidity (R) declines faster due to the dominance of transitory changes in income through 1998. Gottschalk / Moffitt (2009) also report that transitory variance of income rose dramatically during this period.

In using different panel data sets, researchers may not always be able to temporally align the data across countries as is done here. Other researchers (Gittleman / Joyce, 1999) have suggested that, based on analyses using the PSID, calculations of the ratio of permanent to total inequality converge to a constant. If this convergence occurred quickly in different panel data sets, researchers might be able to conduct analyses of mobility making use of panel data sets that began at different points in time. Then, the long-run mobility measures in each individual country would converge to the same constant regardless of the starting point of the analysis. But in figure 1, using data that span 23 years, we do not find that the R values asymptote to a constant.

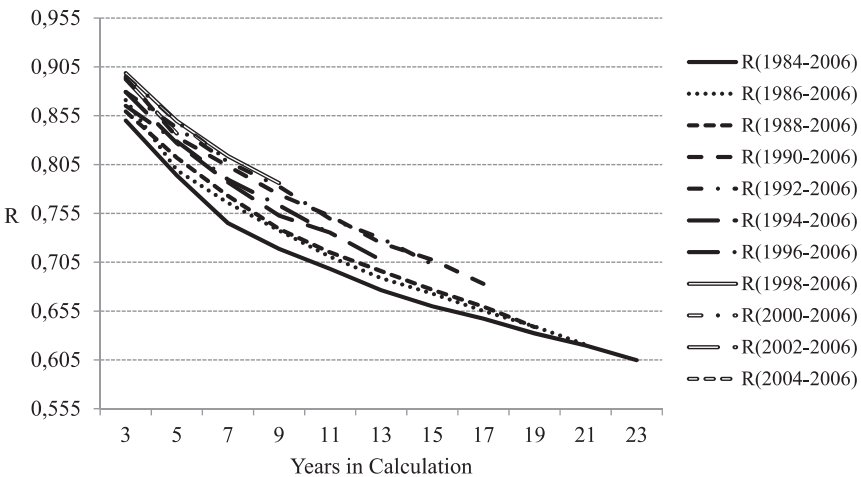
One way of examining the extent to which mobility may be changing over time is to calculate the value of *R* using panels of data that have a constant length while varying the starting years. We do this in figures 2a and 2b which contain a collection of R values for the two countries similar to those in figure 1. However, these series are based on 11 samples for each country that employ different initial years.

For example, the first sample is composed of individuals living in households with positive income during the period of 1984 to 2006. And the first value of *R* for that sample *(1984 – 2006)* (the curve captures the period of 1984 up to 2006) is obtained using the income values from years 1984 and 1986. The next point graphed in that series is an R value calculated using income values from years 1984, 1986 and 1988 and so on. Each of the individual lines then represents a series of R values whose construction begins with a different sample year. The legend of the figure shows the starting and ending year of the data used in constructing the *R* values represented by each line in the figure.

Also, by choosing a value on the horizontal axis, one can see the variation in *R* values obtained using the same number of annual observations in the calculations but initiating the observational window for the data series in different years.

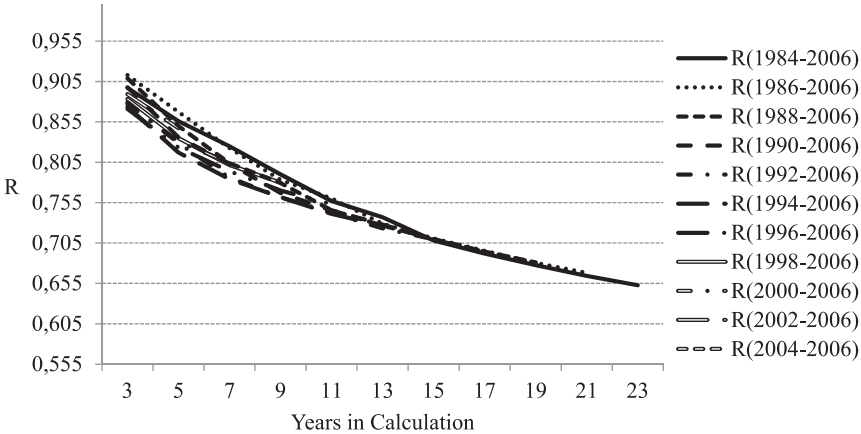
The vertical spread of the different *R* curves over time in the western states of Germany (figure 2a) appears to be more distinct than in the United States (figure 2b). For example, in the United States, values of R using information from 11 years of time (five years of data because alternate years are skipped) roughly lie on top of each other. This can be seen by looking vertically in the graph at the *R* values associated with the indicator for an 11-year window on the horizontal axis. On the other hand, the R values in the western states of Germany based on an 11-year observational window (again using five years of data) appear more distinct from each other than was the case for the United States.

Note: Each line in the figure represents calculations of the Shorrocks *R* using data from the years of the PSID shown in the legend. The first data point for each line uses two data points. Because alternate years are used in the calculation, the first value of the R is calculated using a three-year span of data. The second data point uses three data points that cover a five-year span, etc.




*Note*: Each line in the figure represents calculations of the Shorrocks *R* using data from the years of the SOEP-CNEF shown in the legend. The first data point for each line uses two data points. Because alternate years are used in the calculation, the first value of the R is calculated using a three-year span of data. The second data point uses three data points that cover a five-year span, etc.

Figure 2a: *R* Series for Western States of Germany




*Note*: Each line in the figure represents calculations of the Shorrocks R using data from the years of the PSID shown in the legend. The first data point for each line uses two data points. Because alternate years are used in the calculation, the first value of the R is calculated using a three-year span of data. The second data point uses three data points that cover a five-year span, etc.

Figure 2b: *R* Series for the United States

To more formally examine whether the visual gaps in the R values represent significant statistical differences, we focus on the *R* values calculated using 11 years of time in each country – one of the time spans reported in figures 2a and 2b. Figure 3 allows a visual examination of mobility patterns in the two countries for an 11-year window of time starting at different years where the horizontal axis shows the accounting period over which immobility is measured.

It is immediately obvious that the Shorrocks *R* values for the United States have been relatively stable over time. For example, the immobility measure for the United States in the period from 1984 – 1994 is 0.757, and is 0.753 for the accounting period of 1996 – 2006. Hence mobility does not vary a great deal as the starting year of the analysis is changed.

In contrast, using the same 11-year window for the western states of Germany, we find much higher immobility if the initial year is 1990 (0.752) as opposed to 1984 (0.698) – declining mobility (increasing *R* values) until the beginning of the 1990s is followed by a more stable trend afterwards. The result is that our 11-year windows of immobility which begin in the 1990s in the western states of Germany and in the United States are much closer together than was the case for such windows beginning in the 1980s.

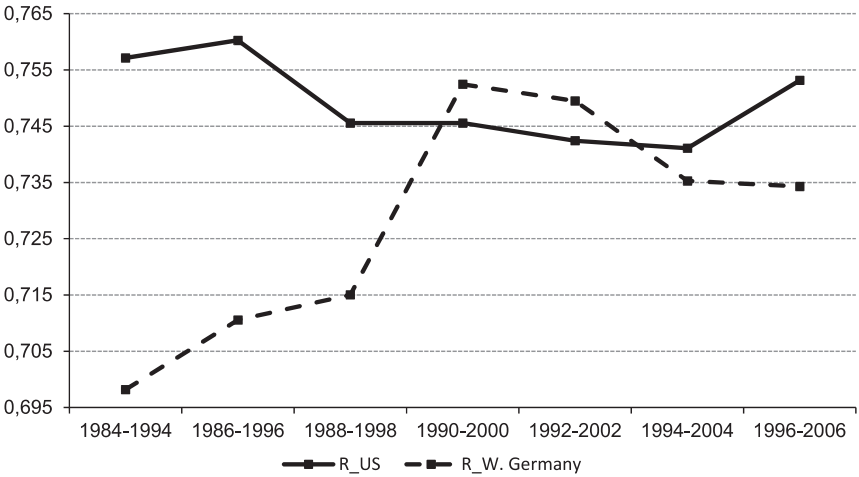



Figure 3: *R* Values for Western States of Germany and United States (11-Year Window)

We test whether the differences in each country's *R* values over time reported in figure 3 are statistically significant using the method of Biewen (2002). Table 1 contains the confidence intervals for pair-wise differences in the *R* calculated using data from 1984–1994 to the others based on a time span of 11 years. Since the value zero is contained in all of the 95% intervals for the United States, the differences in the pairs of mobility measures are not statistically significant. Gittleman/Joyce (1999) also find no trend in mobility measures for the United States with a 10-year time span.

In contrast, when we compare the difference in the R value calculated using data from 1984–1994 to the other available values which also cover an 11-year time period for the western states of Germany, only two of the confidence intervals include the value zero. There is no statistically significant difference between the *R (1984–1994)* period and next two time periods *R (1986–1996)* and *R (1988–1998)*, but all subsequent time periods beginning in 1990 have significantly higher *R* values. This result suggests a change in mobility occurred for those living in the western states of Germany following reunification.

*Table 1*

**95% Confidence Intervals for Mobility Differences, Reference Period 1984–1994**

| Year | United States | W. Germany |
|---|---|---|
| 1986–1996 | [-0.0135 ; 0.0071] | [-0.0239 ; 0.0007] |
| 1988–1998 | [-0.0063 ; 0.0289] | [-0.0352 ; 0.0008] |
| 1990–2000 | [-0.0081 ; 0.0306] | [-0.0882 ; -0.0125] |
| 1992–2002 | [-0.0050 ; 0.0348] | [-0.0826 ; -0.0205] |
| 1994–2004 | [-0.0080 ; 0.0401] | [-0.0685 ; -0.0068] |
| 1996–2006 | [-0.0202 ; 0.0277] | [-0.0675 ; -0.0054] |

## 5. Conclusion

Using methods similar to Burkhauser/Poupore (1997), we find measures of income mobility calculated using the Shorrocks *R* for the western states of German and the United States from 1984–2006 do not asymptote to a stable value in either country. This suggests that estimates of income mobility could be sensitive to the beginning year and the number of years used in the analysis. We test this possibility using constant observational windows of 11 years drawn from different time periods. In the United States, there are no significant changes in mobility calculated in this way over the sample. However, income mobility in the western states of Germany has fallen significantly relative to its level in the first 11 years of the sample.

One implication of this finding is that in some settings, using a constant observational window in different time periods will result in significantly different estimates of mobility. A more important implication is that mobility among Germans living in the western states appears to have declined since reunification and is now closer to mobility in the United States than was the case in the 1980s. Providing evidence of the exact sources of the changes in the western states of Germany that might have led to this reduction in mobility since reunification is beyond the scope of this study. The most likely candidate for study is changes in returns to education and wage rates of those living in the western states of Germany associated with the increased supply of workers from the previously separated eastern states of Germany now available to employers.

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