Trends in Intragenerational Mobility in the United States and the Western States of Germany (1984-2006)

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Abstract

Using data from the PSID for the United States and the SOEP for the Western States of Germany we show that Shorrocks R measures of the mobility of after tax income are not only sensitive to the length of time over which they are estimated but can also be sensitive to the period chosen for analysis. Using consistent time spans, we confirm the permanent share of after tax income inequality was substantially greater in the United States than in Germany prior to reunification. Since 1989, while there has been little change in the United States, the share of permanent inequality in Germany has significantly increased. As a result, estimates of intragenerational mobility for the U.S. and Germany are much more similar now than they were in the 1980s.

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I. Introduction

There is ample evidence that Germany has consistently experienced lower levels of inequality in disposable equivalent income when compared to the United States during the late 20th century (Gottschalk and Smeeding 2000). However, cross-sectional measures of inequality are calculated at a given point in time and hence they do not distinguish between transitory and permanent components of income volatility. Given that countries differ in the extent of income mobility over time and that this reduces permanent income inequality, it is important to focus on measures of permanent inequality in making cross-national comparisons, as is done in this study for the United States and the Western States of Germany, rather than snapshot measures of income inequality that also include transitory earnings variation.

Studies that have previously examined this topic agree that income mobility was higher and that the proportion of variation in earnings due to permanent inequality was lower in Germany than in the United States during the 1980s (Burkhauser and Poupore, 1997 and Maasoumi and Trede, 2000). Burkhauser and Poupore (1997) provided the first examination of permanent income inequality in the United States and Germany. They report lower cross-sectional inequality and higher income mobility in Germany in spite of more rigid labor markets and a relatively generous social welfare system. This is a surprising finding as one would expect smaller changes in longitudinal disposable income and hence lower mobility for reasons such as the more progressive taxation system in Germany (Chen 2009).

This paper also explores the characteristics of income dynamics over time in the United States and Germany highlighting the relationship between transitory and permanent income variation and intragenerational mobility. Ongoing panel studies for both countries make it possible to study trends in both countries over extended time periods. This paper looks at a period of almost a quarter-century in each country that spans from the mid-1980s, through the 1990s and into the mid-2000s. First, the paper assesses whether measures of income mobility stabilize or not as the time interval in the analyses is extended. As the measure of mobility used in the study is the ratio of permanent to relative income inequality, stability of this measure would imply that in the long-run, there are underlying rates of mobility associated with different societies that can be recovered given data that span a sufficiently long time period. In general, evidence in the paper indicates that measures of mobility derived using the years of data available for this analysis never stabilize. This is due to changing proportions of permanent and transitory income variation over time.

Since the estimates of income mobility for Germany and the United States over the time period considered do not converge to a uniform long-run value, a concern is that empirical researchers starting with data panels that begin at different points in time but a similar number of years of information in their research might arrive at different conclusions. So, the paper also examines the extent to which income mobility estimates are sensitive to the starting year in the analysis. In both Germany and the United States, the ratio of permanent to total inequality of income varies over time and those patterns are significant in the data for Germany but are less prominent for the U.S.

II. Methodology

The relationship between intragenerational economic mobility and the relative magnitudes of permanent and transitory inequality are described in Burkhauser and Couch (2009) and Bayaz, Chen, and Couch (2009). Over time, standard measures of permanent income for individuals average or sum multiple observations in order to reduce the contribution of transitory error at any point in time. Thus, a ratio of permanent to total variation in income shows how static individual positions in the income distribution are. A simple measure of the degree of immobility in the income distribution over time is the ratio of permanent to total inequality during that period. The maximum value of this measure of rigidity of the income distribution over time, the Shorrocks *R* (1981), takes a value of 1 when all variation in income is permanent. In that case, individuals retain their positions in the distribution over time. The value of *R* falls as transitory variation rises.

More formally, the Shorrocks *R* defines mobility as 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* (μ_t) to the mean income over all *t* years (μ).

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

The value of the numerator, which represents permanent inequality, cannot exceed the weighted average of the single year inequalities 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. The values between zero and one show the extent to which the income distribution is equalized as the time interval is extended. Since longer time periods accommodate more opportunities for relative income movements and smooth out life cycle effects, *R* measures the extent to which cross-sectional inequality declines by extending the accounting period. Hence, the *R* measure reflects the proportional contribution of permanent to total income inequality over time.

The calculation of the Shorrocks *R* requires the use of inequality measures that are strictly convex functions. The estimations presented here make use of the Theil index, I_1, which satisfies the strict convexity property. Moreover, it is additively decomposable, mean independent and satisfies the Dalton-Pigou principle of transfers. The Shorrocks *R* is calculated using the following 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, μ is mean income and Y_i is the income of individual *i*. Total income of an individual over *t* years is obtained by $Y_i = \sum_t Y_i^t$. Since earlier studies show the robustness of patterns in cross-national differences by using alternative inequality measures (Shorrocks 1981, Burkhauser et al. 1997, Maasoumi and Trede 2001, Chen 2009), this analysis is restricted to calculations based on the Theil index.[1]

[1] However, one should keep in mind that Theil coefficient emphasizes the changes in the middle of the income distribution whereas another entropy index I_0 places more weight on changes at the bottom of the income distribution. Chen 2009 argues that speed of mobility within a country is sensitive to the choice of inequality indices.

Maasoumi and Trede (2001) use the delta method and the theory of method of moments to build the asymptotic sampling distribution of the Shorrocks mobility index estimated here. The procedure developed by Maasoumi and Trede (2001) provides a basis for calculating standard errors of the Shorrocks *R* necessary to conduct t-tests of differences across point estimates presented in the paper. When making use of that method, the samples of comparison are assumed to be independent. Although this assumption is reasonable for cross-country tests, it is problematic for tests within a country over time. Thus, the method of Biewen (2002) is used to construct confidence intervals for tests of differences in mobility over time within a country. The advantage of Biewen's method is that it automatically takes into account the longitudinal correlation in the data for a country.

III. Data

Data for the study are drawn from the Cross-National Equivalent Files (CNEF), a multi-national longitudinal micro-database distributed by Cornell University (Burkhauser et al., 2001). The CNEF is created to support comparative research by providing comparably defined cross-national variables from the raw data. The CNEF uses the German Socio-economic Panel (GSOEP) for Germany and the Panel Study of Income Dynamics (PSID) for the United States. The GSOEP-CNEF currently contains data covering the years from 1984 to 2008. The PSID-CNEF currently contains data covering the years from 1968 to 2007. This analysis focuses on the survey years of 1985 to 2007 (or income years of 1984 through 2006) for both countries and makes use of information from every second year. The reason for omitting alternative years of data from the analysis is that the PSID

started to collect data biannually in 1997. Consistent data usage over time makes the omission of the alternating years necessary.

In order to check the robustness of results obtained using every other year of data, R values are calculated using all available data for the period of 1980 to 1996 in the U.S. and 1983 to 2007 in Germany. Section V provides these comparisons of R values calculated using skipped and non-skipped data. The mobility measures calculated using skipped data closely track the mobility series that uses information from every year. Moreover, because of the differences in income inequality in East and West Germany, the analysis is restricted to the Western states of Germany. Grabka et al. (1999) provide information on the differences in inequality in the Eastern and Western German states.

The measure of economic well-being used in the analysis is real post-tax post-transfer household income.[2] 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. The TAXSIM programs provide post-government income for the United States. Tax burden estimates for households in Germany are based on the method developed by Scharwze (1995). In order to abstract from changes in family composition, the analysis focuses on personal income mobility, and hence, the unit of analysis is the person. In addition, we assume that the household members share all income equally. Household incomes are adjusted using the equivalence scale of *0.5* which is the implicit family size adjustment in the US poverty thresholds. The equivalised incomes are assigned to each person in the

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

household for use in the analysis. The samples include only survey respondents who report positive household income in all years of the accounting period considered. Samples are appropriately weighted to represent the population and also to take into account the effect of attrition in both surveys. Appendix A contains more detail on data sources and usage for the analysis contained in the paper.

IV. Results

Table 1 shows the Theil $I_1(Y)$ inequality measures for a sample of persons living in families with positive incomes during the period of 1984 to 2006. Standard errors are in parentheses. Although income inequality increases in West Germany starting in the mid-1990s, it is (statistically) significantly lower than that of the United States during the whole period. Rising income inequality in West Germany can be attributed to reunification (Daly and Valletta 2008). Distributional changes for the United States are consistent with the findings of Gottschalk and Danziger (2005). Slower increases in inequality during the 1990s replaced the sharp increases of the 1980s. And a stable pattern of inequality in the early 2000s leads to rising inequality in the mid-2000s.

Table 1. Cross-Sectional Theil Measures of post-government Income Inequality

Year	W. Germany	United States
1984	0.099 (0.005)	0.192 (0.017)
1986	0.093 (0.007)	0.188 (0.010)
1988	0.101 (0.007)	0.260 (0.033)
1990	0.106 (0.006)	0.205 (0.010)
1992	0.118 (0.009)	0.211 (0.014)
1994	0.129 (0.013)	0.256 (0.018)
1996	0.117 (0.009)	0.215 (0.011)
1998	0.128 (0.008)	0.305 (0.104)
2000	0.128 (0.007)	0.274 (0.018)
2002	0.138 (0.007)	0.271 (0.029)
2004	0.133 (0.007)	0.384 (0.084)
2006	0.154 (0.009)	0.378 (0.025)

Note: Standard errors are in parenthesis. Please see Appendix A for the details about the sample selection.

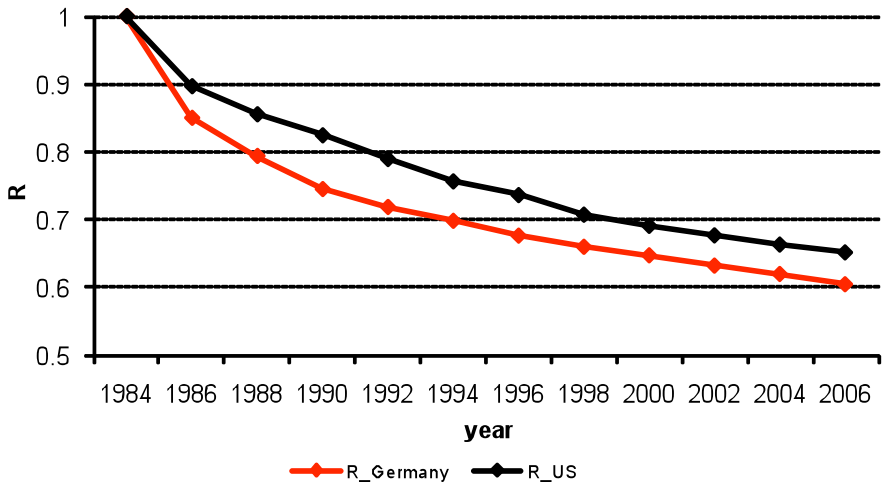
Figure 1 provides stability curves, i.e., series of the Shorrocks *R* measures estimated over different time horizons for both countries. By definition, *R* is equal to 1 when the accounting period is composed of one year. Then the income of each person is aggregated successively over the first two years of data (starting with 1984), the first three years and so on. For the same aggregation period, i.e. 1984 to 2006, Germany has a lower level of *R* which is consistent with having a less permanently rigidity or a more mobile structure of equivalised disposable household income than the United States. Assuming that the samples of the two countries are independent, *R* measures are statistically significantly different from each other for all time horizons. For example, the value of *R* that spans the period of 1984-1986 is 0.897 in the US and 0.850 in Germany. Incorporating all years of data utilized in the study, the value of the Shorrocks *R* declines to 0.653 and 0.605 in the US and Germany respectively.

The stability curves keep declining as the accounting period is extended and additional years of data are added to the calculation of the Shorrocks *R*. However, there is a slowdown in the pace of the decline beyond 1990 in Germany and 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 and Moffitt (2009) also find that transitory variance of family income rose dramatically starting in mid 1980s up until the beginning of 2000s.[3] By disaggregating family income into various components, Gottschalk and Moffitt find that the underlying reasons for rising income instability are

[3] Bayaz, Chen and Couch (2009) show the close correspondence between the Gottschalk and Moffit (1994) measure of mobility and the Shorrocks R measure.

the increasing dispersion of transitory income for transfer and non-labor incomes. In the 2000s, there is a continuing trend towards equalization of relative incomes in both countries so permanent income changes are also important.

Figure 1. Permanent Share of post-government Income Inequality, 1984-2006



In using different panel data sets, researchers may not always be able to temporally align the data from different countries as is done here. The underlying mathematics used in developing the Shorrocks *R* suggests that with a sufficiently long collection of panel data, its value should converge to a constant. If this convergence occurred quickly in different panel data sets as some have suggested might be the case for the United States (see Gittleman and Joyce 1999), researchers might be able to conduct analyses of mobility making use of panel data sets that began at different points in time. The long-run stability 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, the *R* values do not appear to asymptote to a constant.

The most likely reason that the measures of R do not converge to a constant value, even when using many years of data in the calculations, is that underlying influences on mobility change over time so that the structure of mobility is different. Given the vast literature regarding influences on global wage inequality in the 1980s as well as the impact of shifting demographic factors, the idea that the structure of inequality changes over time should not be too controversial.

One way of examining the extent to which mobility may be changing over time using the methods and data employed in this analysis is to calculate the value of R using panels of data that have a constant length while varying the starting years of the calculations. Figures 2a and 2b contain a collection of *R* values for the United States and West Germany similar to those contained in figure 1. However, these series are based on eleven 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 black 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. By choosing a value on the horizontal axis, one can see the variation in *R* values obtained using the same number of annual observations but initiating the observational window in different years.

Figure 2a. R series, United States

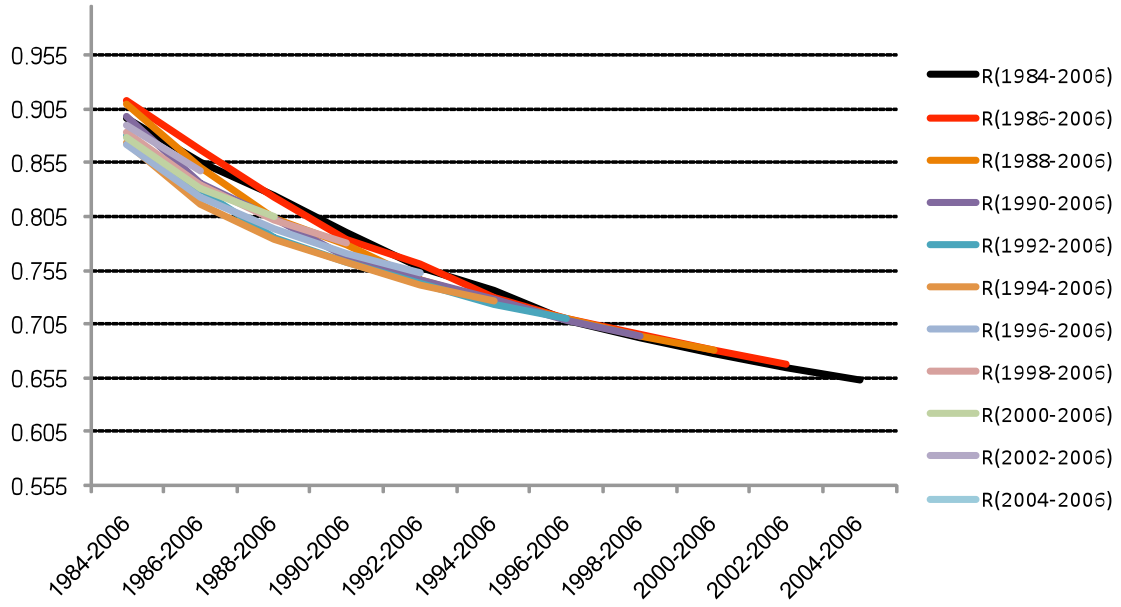
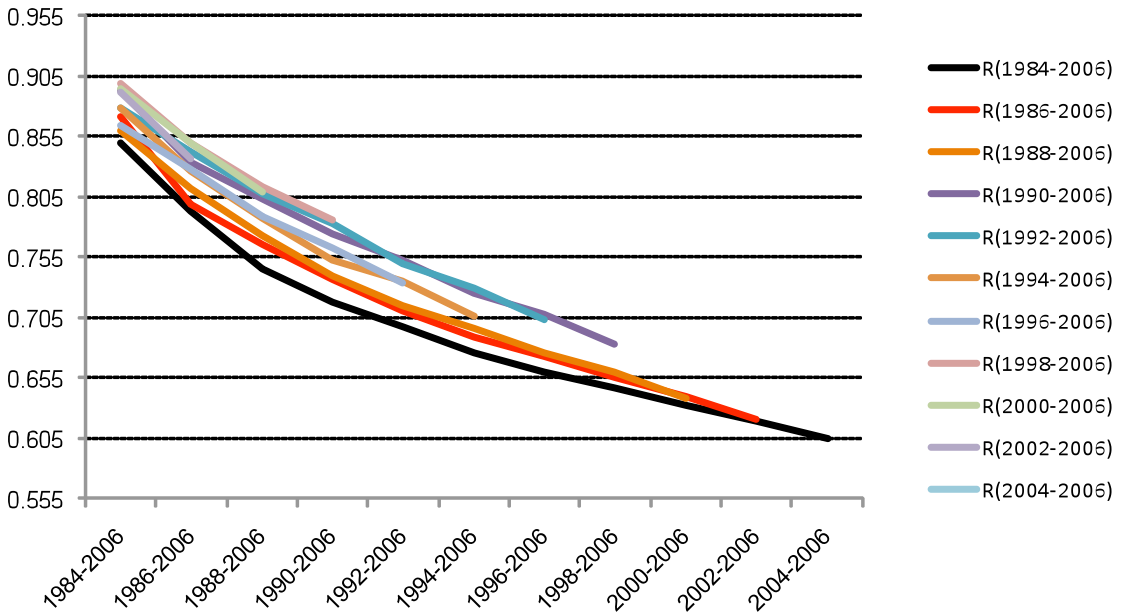


Figure 2b. R series, W. Germany



The spread of the *R* curves over time in West Germany (Figure 2b) appear to be more distinct than in the United States (Figure 2a). For example, in the United States, values

of *R* using information from eleven years of time (there are five years of actual data because alternate years are skipped) roughly lie on top of each other. On the other hand, the *R* values in Germany that are based on an 11 year observational window (again 5 years of data are used in the calculations as alternate years are skipped) appear more distinct from each other than was the case for the U.S.

To more formally examine whether the visual gaps in the *R* values represent significant statistical differences, two kinds of tests are carried out. First, t-tests are calculated for the differences in mobility measures in the series. For simplicity in calculations, the dependence between samples is initially ignored. Second, since the independence assumption is too restrictive, bootstrapped confidence intervals for the differences in *R* values for some specific sets of differences (that use 5 and 11 years of data) are calculated which automatically take into account the longitudinal correlation of data within an individual country. Results of all of the t-tests are shown in Appendix B. The output for the individual tests are too voluminous to discuss here in detail but can be summarized as containing stronger evidence that mobility has changed in Germany since the mid-1980s. To illustrate patterns in the data that are representative of the overall findings, the discussion will focus on series of R values calculated using moving windows spanning 11 and 5 years of time.

Figures 3 and 4 provide a different visual examination of the differences in *R* values calculated using a constant number of years of data but different starting points. The figures are constructed to show the evolution of the series of *R* values that span a time

period of 11 and 5 years respectively as the observational window for the data moves forward. The horizontal axes of the two figures show the accounting period over which mobility is measured. Results of T-tests indicate that *R* values calculated over a time span of eleven years are not statistically significantly different from each other (at the 0.05 significance level) in the United States. In other words, given that the accounting period is eleven years, *R* measures are not sensitive to the choice of initial year in the analyses. For example, the mobility measure for the accounting period 1984-1994 is 0.757 and it is 0.753 for the accounting period of 1996-2006. Given this small change in the value of *R* (.757-.753=.004), it is unsurprising that the t-test for this difference contained in Appendix B shows that this and other comparisons of values based on 11 years of data are not statistically different than each other.

For Germany (see Figure 3b), using 11 years of data in the calculations, the *R* value indicates 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 1990s is followed by a more stable trend afterwards. The mobility measure for the aggregation period of 1996-2006 is 0.734 which is significantly higher than that of 1984-1994. Results of t-tests contained in Appendix B confirm that the mobility measures based on data series that begin in the 1980s are statistically different from those using data series that begin in the 1990s.

The slightly increasing mobility in the United States and considerably falling mobility in West Germany during the 1990s lead to converging mobility patterns in both countries. Recent work by Daly and Valletta (2008) and Chen (2009) provide supporting evidence

for this finding. Daly and Valletta find higher permanent earnings inequality (which makes up a big share of family income) in West Germany following reunification. Chen (2009) argues that there is convergence in mobility trends because of increasing mobility in the US and declining mobility in reunified Germany between 1980s and 1990s.

Figure 3a. R, 11 years, United States, 1984-2006

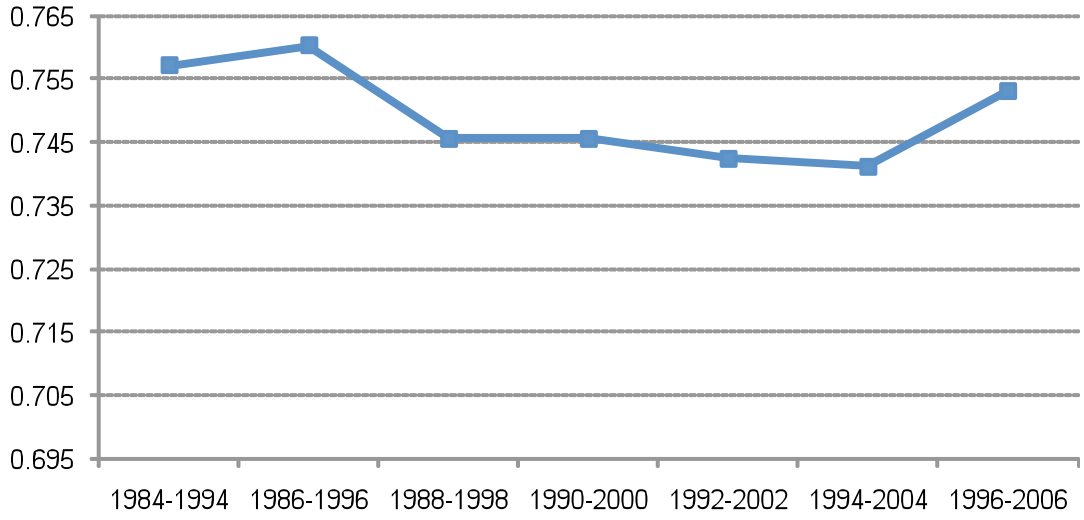
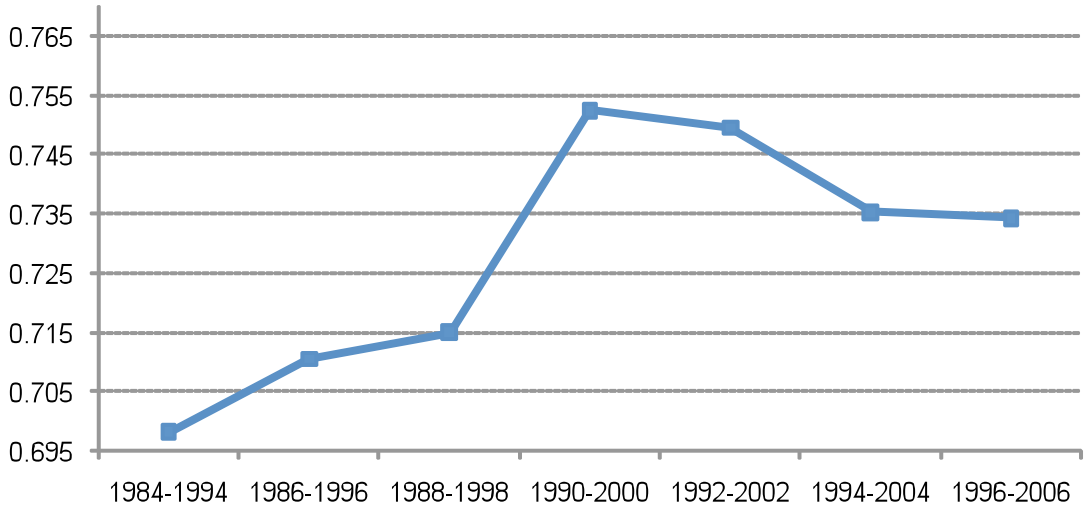


Figure 3b. R, 11 years, W. Germany, 1984-2006



In order to check the robustness of these results, bootstrapped confidence intervals for the differences in mobility measures within a country are calculated. The advantage of this method is that independence is not assumed between the samples being compared. Table 2 reports confidence intervals for pair-wise differences in the *R* calculated using the sample that spans 1984-1994 to the others based on a time span of eleven years. Since the value zero is contained in all 95% intervals for the United States, the differences in the pairs of mobility measures are not statistically significant. Gittleman and Joyce (1999) also do not find any apparent trend in mobility measures with a 10 year time span. In the case of Germany, the results contained in Table 2 also confirm the findings from t-tests. Comparing the difference in the *R* value calculated over the time span from 1984-1994 to the other available values which cover an 11 year time span, only two of the confidence intervals include the value zero. Hence, there is no statistically significant difference between the *R (1984-1994)* and *R (1986-1996)*, *R (1988-1998)*. On the other hand, *R (1984-1994)* differs significantly from all of the other mobility measures (with a starting year in 1990s) which might be a result of reunification.

Table 2. 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]

One problem with the calculations based on 11 years of data for Germany is that even the first 11-year window from 1984-1994 covers reunification. By shortening the observational window to 5 years, the first calculation for R will cover the pre-

reunification years from 1984-1988, and there will be many windows of 5 years available that begin in 1990 or later (post-reunification).

Figures 4a and 4b provide the series of *R* values from the German and U.S. data that are available when examining 5 year intervals. In the U.S., the values of *R* contained in figure 4a which are based on 5 year windows exhibit a similar pattern to those contained in figure 3a. However, the range of variation in the values is much larger. The range between the largest and smallest R values in figure 3a is .02 while it is .05 in figure 4a. In part, reflecting this larger variation in values, the t-statistics (contained in the Appendix) for the differences in the R values contained in figure 4a show that in comparison to the first value shown in the series which is based on the window from 1984-1988, that 4 of the 9 differences that can be calculated are statistically significant at a .05 level.

Comparing figures 4b and 3b for Germany, the *R* values based on a 5 year observational window exhibit a fairly similar spread in their values. The range of *R* values in figure 3b vary by about .05 while the variation in figure 4b is roughly .06. Comparing the initial R value which covers the time span from 1984-1988 in West Germany to the seven other available estimates based on a five year window which occurred post-reunification, four of the differences are significant at a .01 level and six of the seven at a .10 level.

Figure 4a. R, 5 years, United States, 1984-2006

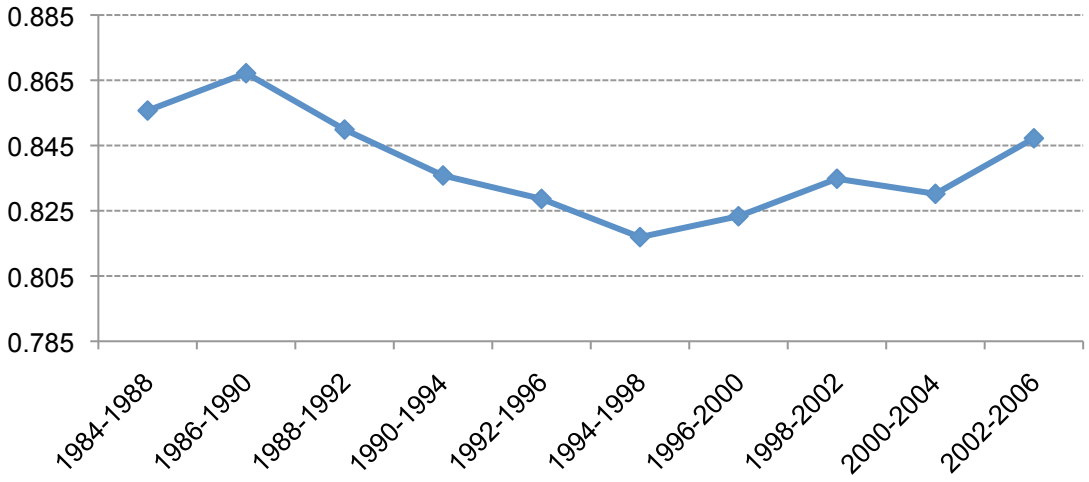
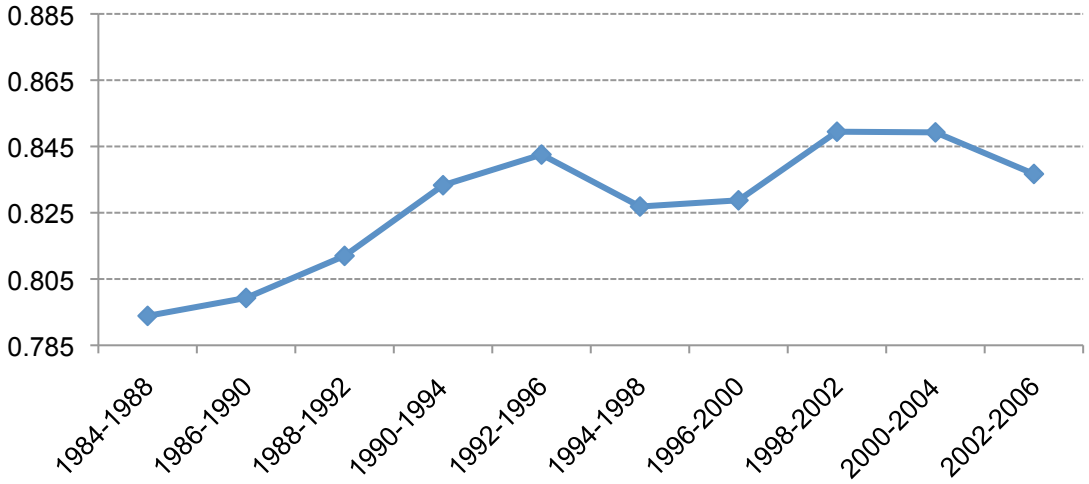


Figure 4b. R, 5 years, W. Germany, 1984-2006



V. Does Skipping Years Matter?

One obstacle to using all available years of data from the CNEF files in this analysis is the change in the frequency of data collection in the PSID beginning with the survey year 1997. In order to alleviate this problem, the analysis contained in the paper thus far used information from every other year, making it possible to examine trends over the longest

time period available. In this section, evidence is provided that skipped years do not significantly alter the results. In using all available data for the U.S. for which the outcome variable used in the analysis is available, it is possible to calculate measures comparable to others presented in the paper beginning in 1980 in the United States. Hence, the largest accounting period in the US based on individual years of data includes 17 years of information (1980 to 1996). Using this information, calculations based on information from every year are compared to the estimates obtained when the calculations make use of alternate years of data.

Data availability in the GSOEP allows comparisons between mobility measures based on consecutive versus alternate years of data over a longer period of time in West Germany. Continuous annual income observations are available in the GSOEP for West Germany from 1983 to 2007 rather than the period of 1984 to 2006 used in the earlier analysis. Tables 3 and 4 report the *R* values that cover eleven years for various accounting periods for the U.S. and Germany using the bootstrap method of Bierens.

Table 3. *R* 11 years, United States

Accounting Period	Skipped data	All years	Confidence Interval
1980-1990	0.782 (0.0101)	0.782 (0.0100)	[-0.0059;0.0044]
1982-1992	0.777 (0.0089)	0.784 (0.0089)	[-0.0106;-0.0024]
1984-1994	0.766 (0.0090)	0.766 (0.0087)	[-0.0066;0.0073]
1986-1996	0.766 (0.0080)	0.761 (0.0086)	[-0.0023;0.01176]

Note: Standard errors are in parenthesis. 95% confidence intervals are constructed.

Table 4. *R* 11 years, W. Germany			
Accounting Period	Skipped data	All years	Confidence Interval
1983-1993	0.693 (0.0101)	0.691 (0.0103)	[-0.0053;0.0079]
1985-1995	0.720 (0.0125)	0.722 (0.0116)	[-0.009;0.0036]
1987-1997	0.736 (0.0097)	0.734 (0.0074)	[-0.0052;0.0078]
1989-1999	0.742 (0.0013)	0.739 (0.0013)	[-0.0027;0.0092]
1991-2001	0.759 (0.0172)	0.760 (0.0215)	[-0.0092;0.0058]
1993-2003	0.750 (0.0167)	0.750 (0.0191)	[-0.0064;0.0058]
1995-2005	0.739 (0.0135)	0.742 (0.0130)	[-0.0112;0.0041]
1997-2007	0.755 (0.0102)	0.755 (0.0097)	[-0.0090;0.0080]

Note: Standard errors are in parenthesis. 95% confidence intervals are constructed.

Although values of the mobility measures differ slightly, the differences are not significantly different from each other with only one exception in the United States. The 95% confidence intervals for differences in the values of *R (1982-1992)* with skipped and non-skipped data do not include the value zero. Therefore, *R (1982-1992)* with skipped data (0.777) underestimates the mobility measure obtained using all years (0.784). However, other than that one exception, using skipped data produces results indistinguishable from those obtained using information for every year. Based on these formal tests, a reasonable conclusion is that using alternate years of data in the analysis is unlikely to have had an important influence on results and conclusions of the study.

Further, Figures 5a and 5b graph the mobility measures with a time interval of 5 years using information from all years and skipped data for both countries. The *R* series with

skipped data (blue curve in Figure 5a) closely track the mobility measures obtained using all years in the United States except for the last two estimates. Figure 5b shows that the two curves move closely over time in West Germany. These figures reinforce the view obtained from the more formal statistical evidence contained in tables 4 and 5 that the use of alternate or contiguous years of data has little impact on the analysis.

Figure 5a. R, 5 years, United States, 1980-1996

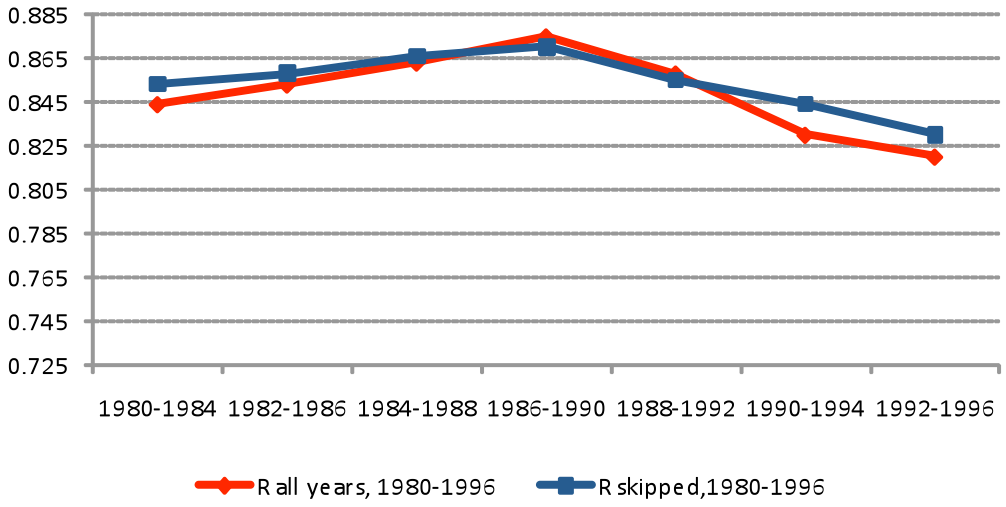
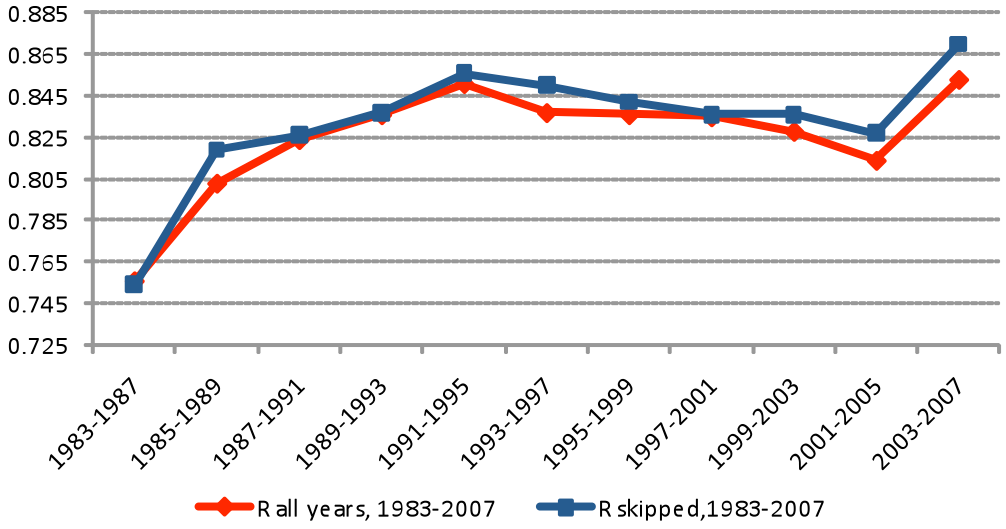


Figure 5b. R, 5 years, W. Germany, 1983-2007



VI. Conclusion

In this paper, an empirical examination is provided of whether mobility measures calculated using information from a quarter of a century of data asymptote to a stable value in the United States and West Germany. For both countries, the value of *R* declines steadily as additional information is added to its calculation but it never appears to approach a steady state. Moreover, the rate of decrease in the value of R appears to differ over the time span examined. A reasonable conclusion is that this is associated with well known underlying influences on the structure of permanent and transitory inequality that occurred during the time period examined.

To explore the influence of external forces on the extent of mobility over time, calculations of the Shorrocks *R* were conducted using windows of eleven and five years of time coverage. In the United States, the results were somewhat dependent on the width of the window used in the calculations. Based on the observational window of 11 years, there were no statistically significant changes in mobility observed based on the calculations provided here. However, in using a 5 year observational window, statistically significant changes consistent with increased mobility and declining permanent inequality are found.

In Germany, using the 11 year observational window, statistically significant evidence is provided that income mobility has fallen and that permanent inequality has risen. In examining the German data, one analytical problem is that the first 11 year window spans

German reunification. The observational window was shortened to 5 years to allow a calculation of the Shorrocks *R* using data prior to reunification. In comparing that value to comparable figures obtained after reunification, evidence is presented that economic mobility declined in West Germany following reunification.

One potential problem with the analysis provided in this paper is that the PSID began collecting information every other year in the late 1990s. In order to make use of PSID and GSOEP data over as long a common interval as possible, alternate years of information from each are employed in the analysis. To check the sensitivity of the results to this potential concern, where possible, comparable estimates are calculated using contiguously available years of data. Both trends and estimates based on contiguous and alternate years of data lie close together, indicating this potential problem is unlikely to have had an important influence on the analysis.

In this paper, we examine the trends in income mobility and do not examine the underlying reasons for changing patterns of mobility. An interesting extension of this work would be examining the factors that lie behind the changes in income mobility and the converging mobility trends of both countries during the 1990s. Some researchers investigate the determinants of income mobility or examine the contribution of various factors like demographics, labor market activities, or different income sources to explain the patterns of income mobility (Gittleman and Joyce, 1999, Gottschalk and Moffit, 2009 and Chen 2009).

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Appendix A

Data used in this study is obtained from the Cross-National Equivalent Files (2010 release). Estimates in Table 1 are based on the period of 1984 to 2006. The sample with the longest accounting period consists of people living in families with positive income in all years 1984 through 2006. Hence, this study covers a different period of analysis than Burkhauser and Poupore (1997) which examine the period of 1983 through 1988. The total household income is equivalence scale adjusted using the following formula;

$$EI = \frac{D}{H^{0.5}}$$

where *EI* is equivalent income, *D* is total disposable household income, *H* is the household size and *0.5* is the elasticity of scale with respect to household size. Burkhauser and Poupore (1997) use a different equivalence scale which is based on the U.S. poverty thresholds.

The measure of economic well-being used in this study is post-tax, post-transfer household income. In the CNEF, there are two measures of household post-government income for the United States. Other than the household tax component, the two variables are the same. One of them (I11102XX) uses PSID generated household tax payments whereas the other one (I11113XX) uses NBER TAXSIM model to estimate household taxes. Since PSID generated household tax payments are not available starting with the income year 1991, we use I1113XX to obtain a consistent time series of incomes. A previous study by Burkhauser and Poupore (1997) use the tax routine provided by PSID in their analysis. The tax burdens include income taxes and payroll taxes.

Household post-government income 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.

Labor earnings include wages and salary from all employment (including self-employment income), as well as irregular payments like bonuses, Christmas pay, 13th and 14th month pay (in Germany), holiday pay and so on. Asset flows include income from interest, dividends and rent. Private transfers include child support, alimony, and income from non-household members. Public transfers in the US include AFDC payments, supplemental security income, unemployment compensation, worker's compensation and the face value of food stamps. Public transfers in Germany include housing allowances, child benefits, subsistence assistance and special circumstances benefits from the Social Welfare Authority, government student assistance, maternity benefits, unemployment benefits and assistance and unemployment subsistence allowance. Private pensions in the US include retirement income from private pension plans, Veterans administration pensions, and annuities. Social security pensions in the US include social security payments received by the head, partner and other family members. And it includes payments from old age, disability and widowhood pension plans in Germany. Moreover, the data is adjusted for inflation using CPI indices for both countries. Base income year is 1991 for both countries.

Appendix B

Tables from 1 to 20 provide the results of t-tests for the differences in mobility. In the first table, reference year is 1984 i.e. all comparisons are made with reference to the *R* values from the sample of 1984 to 2006. The first entry, -1.44 is the t-value from the test that compares the mobility values *R (1984-1986)* and *R (1986-1988)*.

Table 1. United States,
t-values compared to reference year 1984

time span	1986	1988	1990	1992	1994	1996	1998	2000	2002	2004
3	-1.44	-0.99	-0.07	1.46	1.93	2.42	1.31	1.75	0.66	-0.47
5	-0.95	0.45	1.47	2.11	3.16	2.84	1.54	2.00	0.70	
7	0.18	1.56	1.61	3.18	3.46	2.38	1.66	1.64		
9	0.49	0.77	1.70	2.31	2.11	1.44	0.76			
11	-0.22	0.79	0.83	1.07	1.09	0.29				
13	0.56	0.72	0.63	0.96	0.73					
15	-0.18	-0.12	-0.07	-0.11						
17	-0.23	-0.17	-0.11							
19	-0.16	-0.20								
21	-0.23									

Table 2: W. Germany,
t-values compared to reference year 1984

time span	1986	1988	1990	1992	1994	1996	1998	2000	2002	2004
3	-1.34	-0.66	-3.70	-1.74	-1.74	-0.83	-3.99	-4.18	-3.65	-5.05
5	-0.34	-1.17	-2.68	-2.67	-1.71	-1.76	-1.64	-4.28	-3.08	
7	-1.43	-1.96	-3.12	-3.49	-1.91	-2.51	-5.08	-5.29		
9	-1.29	-1.37	-2.79	-3.28	-1.92	-2.58	-4.85			
11	-0.83	-1.08	-2.57	-2.92	-2.15	-2.18				
13	-0.79	-1.22	-2.50	-2.94	-1.86					
15	-0.79	-0.98	-2.32	-2.30						
17	-0.47	-0.69	-1.66							
19	-0.42	-0.36								
21	-0.04									

Table 3: United States,
t-values compared to reference year 1986

time span	1988	1990	1992	1994	1996	1998	2000	2002	2004
3	0.45	1.88	3.71	4.37	5.87	4.37	4.59	2.75	1.58
5	1.59	2.75	3.63	5.07	4.97	2.81	3.51	2.04	
7	1.47	1.52	3.19	3.50	2.33	1.57	1.55		
9	0.28	1.16	1.68	1.55	0.92	0.25			
11	1.00	1.04	1.28	1.29	0.51				
13	0.17	0.07	0.40	0.17					
15	0.06	0.10	0.07						
17	0.06	0.04							

19	-0.03

Table 4: W. Germany,

time span	t-values compared to reference year 1986								
	1988	1990	1992	1994	1996	1998	2000	2002	2004
3	0.74	-1.65	-0.46	-0.46	0.30	-1.97	-1.88	-1.58	-2.60
5	-0.89	-2.55	-2.53	-1.51	-1.57	-1.50	-4.40	-3.01	
7	-0.53	-2.06	-2.39	-0.98	-1.37	-3.69	-3.75		
9	-0.12	-1.90	-2.38	-0.89	-1.55	-3.72			
11	-0.30	-2.01	-2.26	-1.46	-1.46				
13	-0.45	-1.84	-2.23	-1.10					
15	-0.23	-1.69	-1.61						
17	-0.25	-1.29							
19	0.03								

Table 5: United States,

time span	t-values compared to reference year 1988							
	1990	1992	1994	1996	1998	2000	2002	2004
3	1.19	2.90	3.48	4.45	3.12	3.48	2.01	0.83
5	1.13	1.81	2.97	2.62	1.20	1.69	0.24	
7	0.03	1.41	1.61	0.74	0.15	-0.06		
9	0.87	1.35	1.25	0.64	-0.04			
11	0.00	0.22	0.30	-0.54				
13	-0.10	0.23	0.00					
15	0.05	0.01						
17	0.00							

Table 6: W. Germany,

time span	t-values compared to reference year 1988							
	1990	1992	1994	1996	1998	2000	2002	2004
3	-2.86	-1.17	-1.17	-0.31	-3.18	-3.26	-2.80	-4.10
5	-1.63	-1.80	-0.82	-0.90	-1.13	-3.37	-2.03	
7	-1.68	-2.00	-0.65	-0.96	-3.20	-3.21		
9	-1.79	-2.27	-0.78	-1.43	-3.50			
11	-1.76	-1.94	-1.16	-1.15				
13	-1.44	-1.79	-0.65					
15	-1.46	-1.36						
17	-1.05							

Table 7: United States,

time span	t-values compared to reference year 1990						
	1992	1994	1996	1998	2000	2002	2004
3	1.98	2.60	3.57	2.03	2.52	0.96	-0.56
5	0.59	1.63	1.17	0.08	0.46	-0.99	
7	1.40	1.61	0.72	0.12	-0.09		
9	0.40	0.37	-0.23	-0.94			

11	0.23	0.31	-0.56
13	0.33	0.10	
15	-0.03		

Table 8: W. Germany,

time span	t-values compared to reference year 1990						
	1992	1994	1996	1998	2000	2002	2004
3	0.94	0.94	1.71	-0.53	-0.20	0.14	-1.38
5	-0.57	0.37	0.25	-0.49	-1.61	-0.31	
7	-0.21	0.67	0.66	-0.58	-0.33		
9	-0.35	0.99	0.51	-0.62			
11	0.13	0.76	0.82				
13	-0.23	0.87					
15	0.20						

Table 9: United States,

time span	t-values compared to reference year 1992					
	1994	1996	1998	2000	2002	2004
3	0.54	0.96	-0.47	0.19	-1.01	-2.68
5	1.08	0.54	-0.50	-0.14	-1.73	
7	0.17	-0.65	-1.19	-1.63		
9	0.01	-0.64	-1.46			
11	0.09	-0.80				
13	-0.23					

Table 10: W. Germany,

time span	t-values compared to reference year 1992					
	1994	1996	1998	2000	2002	2004
3	0.00	0.69	-1.25	-1.10	-0.87	-1.75
5	0.77	0.66	-0.20	-0.46	0.38	
7	0.87	0.89	-0.35	-0.07		
9	1.40	0.92	-0.19			
11	0.74	0.81				
13	1.17					

Table 11: United States,

time span	t-values compared to reference year 1994				
	1996	1998	2000	2002	2004
3	0.33	-1.15	-0.42	-1.59	-3.38
5	-0.70	-1.53	-1.23	-3.02	
7	-0.84	-1.37	-1.87		
9	-0.59	-1.33			
11	-0.84				

Table 12: W. Germany,

time span	t-values compared to reference year 1994				
	1996	1998	2000	2002	2004

3	0.69	-1.25	-1.10	-0.87	-1.75
5	-0.09	-0.64	-1.41	-0.59	
7	-0.11	-1.28	-1.10		
9	-0.54	-2.03			
11	0.05				

Table 13: United States,

time span	t-values compared to reference year 1996			
	1998	2000	2002	2004
3	-1.98	-0.92	-2.26	-4.90
5	-1.06	-0.70	-2.67	
7	-0.55	-0.87		
9	-0.70			

Table 14: W. Germany,

time span	t-values compared to reference year 1996			
	1998	2000	2002	2004
3	-1.98	-1.88	-1.65	-2.47
5	-0.58	-1.24	-0.46	
7	-1.45	-1.25		
9	-1.42			

Table 15: United States,

time span	t-values compared to reference year 1998		
	2000	2002	2004
3	0.83	-0.78	-3.15
5	0.38	-1.07	
7	-0.22		

Table 16: W. Germany,

time span	t-values compared to reference year 1998		
	2000	2002	2004
3	0.42	0.67	-0.68
5	0.01	0.39	
7	0.46		

Table 17: United States,

time span	t-values compared to reference year 2000	
	2002	2004
3	-1.36	-3.50
5	-1.60	

Table 18: W. Germany,

time span	t-values compared to reference year 2000

	2002	2004
3	0.37	-1.49
5	1.45	

time span	Table 19: United States t-values compared to reference year 2002
	2004
3	-1.60

time span	Table 20: W. Germany, t-values compared to reference year 2002
	2004
3	-1.60