

**German male earnings volatility:
trends in permanent and transitory income components 1985 to 2004**

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Abstract. Deploying data from the German Socio-Economic Panel (GSOEP) this paper seeks to analyze the variability of individual earnings. Changes in inequality of yearly earnings can be the result of changes in the distribution of lifetime earnings (permanent changes) and the result changes in the stability of earnings (transitory changes). While a lot of research has been dedicated to prove that both components rose in the U.S. over the past several decades, little has been done for the German case. Permanent and transitory variances of male earnings over the period 1985-2004 are estimated to determine their importance in the German earnings dynamics. We find evidence that income volatility is substantial and increasing in Germany, particularly among younger cohorts and less qualified workers. Furthermore, trends in the New German Laender indicate a rise in structural inequality, approximating the earnings distribution of the Old German Laender.

Keywords: Earnings Volatility, Earnings Dynamics, Earnings Inequality

JEL classification: D31, E24, J31

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1 Introduction

In the U.S., Great Britain and Canada there has been a growing literature concerning income volatility due to the rising economic inequality in these countries in the last three decades. The bulk of research has been done in the U.S. using data from the „Panel Study of Income Dynamics“ (PSID), a panel surveying households like the German Socio-Economic Panel (GSOEP) used in this paper. Although the U.S. aggregate economy has become more stable over the last twenty years, many researchers reported that individuals and households have faced more volatile economic circumstances since the 1970s. This seems to be consistent with the general perception that globalization, deregulation, and technological change contributed to foster creative destruction and the competitive pressures and risks for firms and workers.

The seminal paper by Gottschalk and Moffitt (1994) documented an increase in men's earnings inequality using data from the PSID over the period 1970-1987 and the higher inequality stemming partly from an increase in earnings volatility. Several subsequent studies confirmed this result focusing on the earnings of male household heads and the exact timing of the trend. Until then changes in inequality were usually quantified by a single measure like the Gini coefficient or a ratio of earnings at the 90th percentile to that at the 10th percentile. But to discover the driving force behind these changes the total inequality had to be deconstructed into its major components. A growing number of researches has solved that alike Gottschalk and Moffitt (1994) by splitting the overall income inequality into a permanent and a transitory component. Thus, one part of the inequality arises from the change of the dispersion of average earnings while another part has its source in the individual income instability.

In 2002 Gottschalk and Moffitt extended their analysis from 1994 to a time horizon from 1967 to 1996. Their results told a rising permanent variance contrary to the transitory component that rose in the beginning of the period and fell after 1991.

Keys (2007) found increasing increasing lifetime earnings inequality over the period 1970-2000. His results confirmed a strong increase in the transitory variance of earnings, family income and consumption for all groups based on race, gender, education, age, and family structure. Dynarski and Gruber (1997) confirmed that volatility of earnings rose in the late 1970s and early 1980s and added evidence that families could indeed smooth earnings variations.

Haider (2001) used PSID data for 1967-1991 and found that „earnings instability increased during the sample period, with most of the increases occurring during the 1970s.“ Shin and Solon (2008) analyzed PSID data for 1969 through 2004. They concluded that men's earnings volatility increased during the 1970s like Haider (2001), but they found no clear trend afterwards until 2000 when the volatility started to rise again. Nichols and Zimmerman (2008) documented with PSID data for the period 1968-2005 that the volatility of family income increased by about 1,5 percent per year with

cyclical deviations, but found a less clearer trend for the individual income volatility.

Dynan, Elmendorf and Sichel (2007) analyzed the standard deviation of household incomes deploying PSID data from the years 1967-2004 and found that the standard deviation of percent changes of income increased one-fourth between the early 1970s and early 2000s. Their result document a widening of the income dispersion particularly at the bottom of the income hierarchy. The volatility rose for households labor earnings as well as for transfer payments.

Some cross-national studies have included the German case. Daly and Valletta (2004) analyzed the structure of labor earnings of male household heads and found substantial similarities between Germany, Great Britain, and the U.S. Over the last two decades each country experienced a rising inequality. In Germany the permanent component of inequality gained importance over the past decade. Throughout the period, Germany showed the lowest level for both persistent earnings inequality and earnings instability.

However, research on the German case is scarce. Prasad (2004) restricted his analysis of the German wage structure of full-time male workers in West Germany. Using data from the GSOEP he found that the German wage structure remained remarkably stable over the period 1984-97, however, with a small rise in wage inequality in the mid-1990s. Germany served for him as a contrast to the U.S. where inequality has risen sharply in the last three decades. The stable wage structure he found could be in parts explained by the higher unemployment of unskilled worker who were eliminated of Prasad's sample and were excluded from his inequality calculations.

Biewen (2000) deployed the GSOEP data from 1990 to 1998 to look at the covariance structure of household income. His results suggested that more than a half of the income inequality in Germany was permanent. Although he found that transitory income shocks in West Germany died out very quickly, he reports that they „continuously gained in size over the 1990“ whereas the dimension of the permanent component remained quite stable. In contrast, the importance of the permanent component grew in East Germany over time and the incomes were much more compressed. The transitory income shocks in East Germany lasted much longer than in West Germany.

2 Data

The following analysis is based on a subsample from the GSOEP for the years 1985-2004. This is a representative panel study of German persons, households and families started in 1984 for West Germany and expanded to East Germany after reunification in 1990. All householdmembers are interviewed individually once they reach the age of 16. The GSOEP consist of seven subsamples including subsamples for guestworkers started in 1984, immigrants started 1994 and high income households from 2002 on. The monthly gross income variable of males between the ages of 20 and

59 served as the basis for the calculations. Women, students and severely disabled persons were dropped from the sample in order to avoid distortions. Men who participated only once and negative incomes were eliminated as well. All earnings are put into 1995 CPI Euro. The entire data set after eliminations has 11427 men and 83666 person-year observations with an average of 11 year-observations per person. We divide the data from 1985 to 2004 into four periods à 5 years.

3 Measuring Volatility

We will apply the method used by Gottschalk and Moffitt (1994, pp.220) and Keys (2007, pp. 6) to estimate the variance of individual earnings. As a first step we remove the effect of life-cycle patterns by regressing the log income on age and age squared over each period, since earnings generally increase with age.

$$\log(y_{it}) = \beta_0 + \beta_1 \text{age} + \beta_2 \text{age}^2 + u_{it}$$

The residual u_{it} is used for the subsequent calculations measuring for each year the individual deviation from the age-earnings profile.

Consider a permanent-transitory decomposition of earnings in any given year t for individual i with μ_i representing the permanent component and v_{it} being the transitory component, which varies over time:

$$y_{it} = \mu_i + v_{it}$$

The permanent component μ_i is the individual mean of the log income calculated for each period. The transitory component v_{it} is the individual, annual deviation of the log income from the individual mean. The variance of y_{it} equals the sum of the variance of the permanent and the transitory component, because they are assumed to be orthogonal.

$$V = \text{Var}(y_{it}) = \text{Var}(\mu_i) + \text{Var}(v_{it})$$

We measure the growth of income volatility comparing the variances of the components of the first period with the second period, i. e. the growth rate of the variances. The variance of the permanent component can be seen as the permanent income inequality showing the entire dispersion of income within the population. The variance of the transitory component can be interpreted as the instability of the individual earnings-profile (Keys, 2006, pp.6).

We want to determine how much of the change in the total variance has arisen from the permanent component and how much from the transitory. We calculate the variances of the transitory component using the following formula:

$$\text{Var}(v_i) = \frac{1}{(T_i - 1)} \sum_{t=1}^{T_i} (y_{it} - \hat{y}_i)^2$$

For each individual and each period we compute the mean of the log income \hat{y}_i . Then we calculate the squared deviations of the individual income and build the sum over the T_i years the individual participated in the survey. Some individuals did not participate during the entire period of 11 years, so that T_i is not identical for all individuals (Keys, 2006, pp.7).

The total transitory variance of a period is the mean over all individuals:

$$\sigma_{(v_i)}^2 = \frac{1}{N} \sum_{i=1}^N \frac{1}{(T_i-1)} \sum_{t=1}^{T_i} (y_{it} - \hat{y}_i)^2$$

For the variance of the permanent income the mean income over all periods \hat{y} is calculated.

$$\sigma_{(u)}^2 = \frac{1}{(N-1)} \sum_{i=1}^N (\hat{y}_i - \hat{y})^2 - (\sigma_v^2 / \hat{T})$$

where \hat{T} represents the mean of T_i .

Due to unique we subdivide the population into several demographic groups to control for differences arising from the level of education, income class and age. We define three educational levels as schooling, schooling plus vocational qualification and university degree. The second category are income quartiles. The third kind of groups are defined by age: 20-24, 25-29, 30-34, 35-39, 40-44, 45-49 and 50-54, 55-59.

4 Results

Table 1 shows the basic results of our calculations for Germany as a whole. The first row depicts the variances within the four periods 1985-89, 1990-94, 1995-99, and 2000-2004 for males aged between 20 and 59. The columns 2 to 5 state the numbers the permanent variance within this four periods. Beneath the change of the variance for two subsequent periods is given in parantheseses in percent. Columns 6 to 9 show the transitory variance and changes between periods are stated again in parentheses. To uncover further dimensions of earnings dynamics the variance of males is broken down by education, age, and for the transitory variance by earnings quartiles as well.

After reunification in 1990 the population under observation was joined by the inhabitants of former East Germany. They had lower wage level fostering an increase in both permanent and transitory variance. Both remained relatively stable during the 1990s and started to rise again after 2000. The second finding coincides with some labour market deregulations and work incentives for unemployed to take up work in the low-wage sector. The permanent variance rose by 44.07 percent from the 1990s to 2004. The increase of the transitory variance for the same time horizon is even at 70.2 percent, indicating that the deregulations resulted in a higher earnings volatility for German workforce.

Breaking down the variances into demographic groups several regularities occur. Considering first

the permanent variance we find the highest variance for those who just finished school and those with a university degree. The earnings dispersion for those with a vocational qualification is less pronounced. This does not come as a surprise as this group in Germany has the highest rate of unionization and, therefore, collective agreements often determine their wages.

The youngest age group considered is 20 to 24 years old and shows the highest level of permanent variance for three out of four periods. On the whole, the correlation between age and permanent variance appears to be u-shaped. This mirrors the differences in earning profiles depending on the individual educational level. We find a high dispersion of wages for income earners starting their career due to the wide range of occupational choices. In the first years of work experience – the age group 25-29 – the wages are less dispersed. Growing older the gap between the education specific earnings profiles is widening. Path dependencies of decisions made in the early stages of the career become apparent and hence, dispersion is rising in age. The growth rate of the permanent variance over time is growing steadily and doubles for almost all age groups in the period under observation..

The picture for the transitory variance is ambivalent but for the youngest age group. As expected, they experience a higher level of earnings volatility than others. Ordering the population according to their permanent earnings we find that the lowest quartile has a substantially higher volatility. For the second, third, and fourth quartiles is nearly negligible. Strikingly, the volatility for the lowest quartile is quite stable for the first three periods and doubles after 2000. This gives further evidence to the above mentioned growth of the low-wage sector due to the cut-back on social assistance and increased work incentives for recipients of unemployment benefits.

The permanent and the transitory variance sum to the total cross-sectional variance. We find that the permanent variance is always at a substantially higher level than the transitory variance. This means that structural inequality is the main explanation for the cross-sectional variance, whereas volatility explains just a small part. Our results for Germany show a higher dominance of the permanent component than Gottschalk and Moffitt (1994) and Keys (2006) find for the US. Keeping in mind the differences between the institutional setting of the German and the U.S. labour market this result seems plausible.

In Table 2 and Table 3 we present the results of earnings variances distinguishing between the Old and New German Laender. Table 2 depicts the development of earnings dynamics for all four periods from 1985 to 2004. For the New German Laender earnings data is available up from 1990, the year of the reunification. The results for the three periods from 1990 to 2004 are shown in Table 3.

The permanent variance rose for both parts of Germany. Immediately after reunification the permanent variance was lower in the former Eastern part of Germany than in the Western part. The

socialist system in the Eastern part guaranteed a more equal earnings distribution. But that changed rapidly after the fall of the socialist regime as our results indicate. The permanent variance in the New Laender increased steadily by over 20 percent and thus almost doubled over time. But the Old Laender still show a higher permanent inequality as the permanent variance grew by 30.12 and 58.81 percent in the last two periods before 2004.

In contrast, the transitory variance went in the opposite direction for the New and Old German Laender. The earnings volatility increased for the West Germans whereas it fell for the inhabitants of the former East. Indicating inequality in East Germany becoming more severe as the East German economy moves from a egalitarian earnings distribution where inequality are temporal phenomena to a more unequal distribution approaching the West German pattern of permanent and transitory variance..

Considering different educational levels for the Old Laender we find that the permanent variance has especially increased for those with only schooling and those with a university degree. This is in line with the results for Germany as a whole but stand in contrast to the findings for the New Laender. The permanent variance there remains nearly stable for those with only schooling and those with a university degree. The transitory variance shows a small increase over time for the two less educated groups, whereas it even shrinks for the group with a university degrees. This can be interpreted that a higher education still serves as an insurance against earnings volatility in the New Laender. In contrast, the transitory variance in the Old Laender rises substantially between 1985 and 2004, especially for those with a university degree.

5 Conclusions

We analyzed permanent and transitory variance of male earnings for Germany from 1985 to 2004 with special attention to the influence of reunification on East and West German workforce. Assuming that the permanent and the transitory variance sum to the total cross-sectional variance we found that the inequality in Germany is predominantly explained by the permanent variance, i.e. about 80 percent of the inequality is permanent. Nevertheless, both permanent and transitory variance have substantially increased over the period under observation. Furthermore, the increase in permanent and transitory variance is experienced quite differently by population subgroups. For instance, low income earners face the most pronounced increase in earnings volatility.

In addition, we found that inhabitants of the New Laender face a growing structural inequality as the permanent variance grows and converge to West German levels. Following Keys (2006) this leads to the conclusion that policies aimed at reducing inequality should address underlying fundamental determinants of lifetime earnings potential, such as education.

Table 1. Variances of Permanent and Transitory Real Annual Earnings, 1985-2004

Results	Permanent Variance ^a (percent change in parantheseses ^b)				Transitory Variance ^a (percent change in parantheseses ^b)			
	1985- 1989	1990- 1994	1995- 1999	2000- 2004	1985- 1989	1990- 1994	1995- 1999	2000- 2004
Males	14.63	18.63 (27.34)	18.99 (1.89)	27.35 (44.07)	2.89	3.46 (19.58)	3.46 (-0.02)	5.88 (70.20)
By education								
Only schooling	14.82	11.89 (-19.81)	20.09 (68.97)	38.91 (93.74)	2.44	2.15 (-11.87)	4.08 (89.67)	6.34 (55.48)
Vocational qualification	12.09	17.24 (42.63)	15.99 (-7.28)	20.05 (25.42)	2.97	3.25 (9.29)	2.84 (-12.46)	5.20 (82.88)
University	29.23	39.95 (36.69)	35.88 (-10.19)	40.47 (12.78)	2.08	1.66 (-20.38)	5.37 (223.93)	7.53 (40.26)
By age								
20-24	22.59	17.29 (-23.45)	27.53 (59.17)	43.03 (56.34)	5.75	7.43 (29.33)	6.47 (-12.93)	9.16 (41.48)
25-29	10.79	11.77 (9.07)	11.14 (-5.38)	18.29 (64.16)	4.04	2.17 (-46.20)	2.52 (16.22)	5.60 (121.93)
30-34	10.24	15.51 (51.42)	13.93 (-10.20)	19.91 (42.92)	2.53	2.85 (12.59)	3.27 (14.81)	3.78 (15.62)
35-39	13.96	25.35 (81.64)	18.70 (-26.21)	20.98 (12.14)	2.09	4.96 (137.51)	2.66 (-46.24)	5.94 (122.87)
40-44	14.71	19.31 (-31.27)	23.87 (23.61)	26.31 (10.23)	3.39	2.70 (-20.32)	4.58 (69.67)	6.26 (36.64)
45-49	14.33	21.71 (51.49)	17.74 (-18.29)	32.86 (85.22)	2.91	7.04 (141.72)	0.83 (-88.24)	2.42 (192.33)
50-54	16.37	19.95 (21.88)	25.68 (28.74)	31.10 (21.12)	2.75	1.72 (-37.24)	5.47 (216.90)	7.00 (28.15)
55-59	16.26	20.26 (24.59)	23.45 (15.78)	42.70 (82.07)	4.86	5.68 (16.99)	4.20 (-26.03)	6.17 (46.85)
By permanent earnings								
Lowest quartile					8.47	8.81 (4.13)	10.80 (22.55)	19.79 (83.20)
Middle 2 quartiles					0.86	1.68 (96.22)	0.94 (-43.70)	1.06 (12.10)
Top quartile					1.17	1.46 (24.81)	0.88 (-40.12)	1.20 (37.06)

Source: Own calculations using the German Socio-Economic Panel (GSOEP)

Notes: All numbers are reported in percent. Only males with positive wage and salary earnings, aged 20-59 are considered, no students and no physically damaged persons; a. Variances are log monthly earnings, deflated by CPI to prices (in Euros) of 1995; b. "Percent change" is measured as the difference between to subsequent periods.

Table 2. Variances of Permanent and Transitory Real Annual Earnings, Old Laender 1985-2004

Results	Permanent Variance ^a (percent change in parantheseses ^b)				Transitory Variance ^a (percent change in parantheseses ^b)			
	1985- 1989	1990- 1994	1995- 1999	2000- 2004	1985- 1989	1990- 1994	1995- 1999	2000- 2004
Males	14.63	13.10 (-10.50)	17.04 (30.12)	27.06 (58.81)	2.89	2.23 (-22.85)	3.37 (50.93)	5.95 (76.87)
By education								
Only schooling	14.82	13.09 (-11.51)	20.18 (54.13)	40.64 (101.41)	2.44	2.02 (-17.06)	4.15 (105.15)	6.26 (50.86)
Vocational qualification	12.09	10.30 (-14.79)	12.80 (24.25)	18.62 (45.48)	2.97	2.02 (-31.96)	2.44 (20.91)	4.92 (101.43)
University	29.23	26.63 (-9.06)	30.30 (13.77)	41.47 (37.73)	2.08	1.63 (-21.85)	5.62 (245.83)	8.99 (59.92)
By age								
20-24	22.59	16.98 (-24.84)	26.31 (55.01)	47.29 (79.70)	5.75	7.36 (28.01)	6.75 (-8.30)	10.02 (48.50)
25-29	10.79	8.06 (-25.42)	11.14 (-38.23)	18.05 (62.03)	4.04	1.65 (-59.19)	2.91 (76.47)	4.93 (69.59)
30-34	10.24	9.99 (-2.54)	12.20 (22.10)	20.17 (65.37)	2.53	1.37 (-45.62)	2.74 (99.06)	4.13 (50.93)
35-39	13.96	18.35 (31.47)	17.08 (-6.91)	20.48 (19.90)	2.09	2.74 (31.38)	3.25 (-18.72)	6.17 (89.54)
40-44	14.71	12.24 (-16.76)	18.83 (53.86)	25.74 (36.73)	3.39	0.95 (-71.95)	2.45 (157.64)	7.16 (192.48)
45-49	14.33	14.81 (3.42)	16.48 (11.27)	31.93 (93.71)	2.91	5.17 (77.31)	0.87 (-83.20)	2.62 (202.21)
50-54	16.37	13.19 (-19.37)	25.28 (91.64)	30.01 (18.72)	2.75	1.13 (-59.05)	4.97 (341.62)	5.91 (18.91)
55-59	16.26	14.20 (-12.72)	21.11 (48.70)	42.13 (99.57)	4.86	2.87 (-40.91)	4.84 (68.64)	5.78 (19.53)
By permanent earnings								
Lowest quartile					8.47	5.08 (-39.96)	10.44 (105.32)	20.20 (93.56)
Middle 2 quartiles					0.86	1.13 (32.24)	0.93 (-18.08)	0.99 (6.90)
Top quartile					1.17	1.46 (24.91)	0.88 (-40.05)	1.16 (32.09)

Source: Own calculations using the German Socio-Economic Panel (GSOEP)

Notes: All numbers are reported in percent. Only males with positive wage and salary earnings, aged 20-59 and residence in the Old German Laender are considered, no students and no physically damaged persons; a. Variances are log monthly earnings, deflated by CPI to prices (in Euros) of 1995; b. "Percent change" is measured as the difference between to subsequent periods.

Table 3. Variances of Permanent and Transitory Real Annual Earnings, New Laender 1990-2004

Results	Permanent Variance ^a (percent change in parantheseses ^b)				Transitory Variance ^a (percent change in parantheseses ^b)			
	1985- 1989	1990- 1994	1995- 1999	2000- 2004	1985- 1989	1990- 1994	1995- 1999	2000- 2004
Males		12.98	15.84 (22.02)	21.04 (32.88)		7.11	3.70 (-48.06)	5.53 (49.68)
By education								
Only schooling		29.47	37.18 (26.15)	27.29 (-26.60)		4.95	3.12 (-37.06)	6.82 (118.74)
Vocational qualification		10.21	13.78 (34.93)	17.74 (28.74)		5.88	3.65 (-37.84)	6.53 (78.90)
University		28.72	23.10 (-19.59)	28.14 (21.86)		2.43	1.66 (-31.39)	1.88 (-29.17)
By age								
20-24		14.78	27.12 (83.45)	26.98 (-0.45)		7.33	5.72 (-21.89)	6.02 (5.19)
25-29		10.42	8.95 (-14.15)	17.85 (99.54)		4.18	1.40 (-66.41)	7.94 (465.18)
30-34		9.94	13.35 (34.34)	14.49 (8.59)		6.71	5.25 (-21.83)	2.04 (-61.07)
35-39		16.63	14.80 (-10.99)	18.43 (24.48)		10.43	1.13 (-89.20)	4.45 (294.82)
40-44		12.57	22.86 (81.81)	19.73 (13.69)		7.33	9.42 (28.53)	1.55 (-83.50)
45-49		15.33	12.76 (-16.74)	25.27 (98.00)		12.49	0.72 (-94.24)	1.43 (99.60)
50-54		9.69	14.69 (51.60)	25.18 (71.41)		3.64	6.64 (82.39)	12.29 (85.04)
55-59		21.35	15.90 (-25.54)	27.65 (73.93)		21.05	2.60 (-87.66)	7.77 (199.19)
By permanent earnings								
Lowest quartile						15.99	11.20 (-29.97)	17.25 (54.05)
Middle 2 quartiles						3.73	0.99 (-73.50)	1.32 (34.07)
Top quartile						4.43	0.99 (-77.72)	1.37 (38.74)

Source: Own calculations using the German Socio-Economic Panel (GSOEP)

Notes: All numbers are reported in percent. Only males with positive wage and salary earnings, aged 20-59 and residence in the New German Laender are considered, no students and no physically damaged persons; a. Variances are log monthly earnings, deflated by CPI to prices (in Euros) of 1995; b. "Percent change" is measured as the difference between to subsequent periods.

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