The Distribution and Redistribution of Income in West Germany Before and After the Wall Came Down*

John A. Bishop, John P. Formby, and Lester A. Zeager

For additional information please contact:

John P. Formby, Department of Economics, Finance, and Legal Studies, University of Alabama, Tuscaloosa, AL 35487-0224 USA, jformby@cba.ua.edu, 205-348-0590 (fax), 205-348-8667 (telephone).

John A. Bishop, Department of Economics, East Carolina University, Greenville, NC 27858-4353 USA, bishopj@mail.ecu.edu, 252-328-6743 (fax), 252-328-6756 (telephone).

Lester A. Zeager, Department of Economics, East Carolina University, Greenville, NC 27858-4353 USA, zeagerl@mail.edu.edu, 252-328-6743 (fax), 252-328-6408 (telephone).

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[T]he instant integration project for East Germany has translated into massive unemployment there and an extraordinary financial cost to come for a decade or more in the West. (Dornbusch, 1993, 881)

I. Introduction

The reunification of East and West Germany has been a large and costly operation. Despite a common culture and language, four decades of development with radically different economic institutions and incentives created enormous disparities in physical and human capital, labor productivity, incomes and wealth (Collier and Siebert, 1991, 196). According to Sinn and Sinn (1992, 209-210), GDP per person in East Germany in 1989 was only 60 percent of the West German level.[1] Nevertheless, when the wall came down, these differences and the problems and costs of unification seemed unimportant to most Germans. Euphoria was pervasive and optimism about a new German economic miracle was widespread.

There was recognition in West Germany that transfers to East Germany would be necessary to rebuild the outdated infrastructure and to assume responsibility for social pensions promised by the former East German regime. However, these costs were thought to be relatively small and, like the Marshall Plan that fostered the first German miracle, they were believed to be temporary. Had the West Germans known the full cost of these transfers and how the costs were to be borne, there certainly would have been less euphoria and possibly even outright opposition. The reason for this is easily explained. Unification, like other economic shocks, creates winners and losers. If the size and distribution of these gains and losses had been fully anticipated, then in a political democracy we would expect opposition from those with net losses. Then, even if unification had been desired and supported by a majority of West Germans, those bearing the brunt of the losses would surely have preferred an alternative distribution of the costs.

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The costs (and benefits) of unification for the Western states could be evaluated from several perspectives. We use longitudinal, household-level data drawn from the German Socio-Economic Panel (GSOEP) for 1984-94. Our sample includes only individuals who were in West Germany in 1989 when the wall came down. To assess the costs of unification, it is necessary to estimate what household incomes would have been in the absence of unification. We focus on post-government income because it gives the most comprehensive measure of economic well-being and includes the burden of taxes.[2]

After unification, the Western states experienced an initial economic boom due to "exports" to the Eastern states, where consumers were switching to cheaper and better quality products from the West. However, as monetary and fiscal authorities in unified Germany came to terms with the costs of unification, the economy entered a sharp recession (1992-93), followed by growth that was slower than the historical average for West Germany. Indeed, the major cost of unification for Western households in the early years was a lower income growth rate, rather than higher taxes.[3] Yet the existing literature offers little or no analysis of these costs.[4] This paper seeks to address the issue others have overlooked.

To estimate these costs we take an approach proposed first by Mirer (1973), who was interested in the distributional impact of the 1970 recession in the United States. We take into account subsequent developments in methods for forecasting incomes from panel data that were not available to Mirer. We find that the costs of unification in 1992-94 fell disproportionately on households below the median income. Our findings suggest further that households at the top of the income distribution bore little, if any, of the costs.

In Section II we give some background information on conditions in West Germany before and after unification. We present the methods used to make comparisons of actual and

estimated incomes in Section III. In Section IV we briefly describe the data used for this study.

The main results are presented in Section V, while the findings from a sensitivity analysis appear

in Section VI. The final section summarizes our conclusions.

II. Background

In the years leading up to unification, real GDP grew fairly steadily and the

unemployment rate was stable or declining in the former West Germany. By contrast, the

Western states experienced sharper fluctuations in economic activity after unification (Vittas,

1995, 4), including a modest boom (1990-91) and a sharp recession (1992-93). In large measure,

these fluctuations were consequences of unification. The German government financed its initial

transfers to the Eastern states by borrowing (Vittas, 1995, 1), but this choice resulted in a large

fiscal deficit and stimulated an economy already near its output potential. Western states

received further stimulus from Eastern consumers (Akerlof, *et.al.*, 1991, 34):

> *[R]esidents of the East substituted Western products for domestic goods on a
> massive scale. … household budget data show that with the opening of trade,
> Easterners took the chance to buy goods¾especially cars and electrical
> appliances¾that had been unavailable or prohibitively expensive in the GDR
> [German Democratic Republic]. … The switch toward Western goods also
> occurred because the variety and quality of Eastern production had been low by
> Western standards.*

The export factor was probably the main cause of the initial boom in the Western states (Akerlof,

et. al., 1991, 35):

> *Exceptionally strong growth in West Germany has been attributed by most
> observers, including the Bundesbank, to "the immense import pull exerted by the
> economy of the GDR after its western frontiers had been opened."*

The subsequent recession was also closely related to unification. To restrain rising

inflation, the Bundesbank tightened monetary policy. Measures were also taken to reduce the

fiscal deficit. For example, a temporary solidarity surcharge tax was imposed from 1 July 1991 to 30 June 1992 (Heilemann and Reinicke, 1995, 92). These policy responses, which coincided with a contraction in foreign demand, had a major effect on the economy: "the post-unification boom gradually tapered off and gave way from mid-1992 to a deep recession" (Vittas, 1995, 1). Unemployment rates in Western states, which had fallen to 5.5 percent in 1991, began to grow, eventually reaching 8.3 percent by 1994 (Vittas, 1995, 2). But there were signs of recovery in the Western states by 1994, with real GDP growing at 2.3 percent per year.

It is important to keep the larger context in mind while interpreting the results of our analysis. Unification had immediate and profound effects in the Eastern states, but the decision to finance the initial income transfers to Eastern states through borrowing meant that the costs of unification did not begin to settle on Western households until the recession in 1992. Hence, we focus on the years 1992-94 to examine the distribution of the costs of unification among these households. The first step in our analysis is to predict what household incomes would have been if unification had not occurred. We take up this issue in the next section.

III. Methodology

Our conceptual approach to estimating the distributional impact of unification in the Western states of Germany is founded on Mirer (1973), who investigated the incidence of the 1970 United States recession across the distribution of income. Mirer proposed measuring the impact of the recession at the household level by the ratio of actual income to predicted income in the absence of the recession. He based his estimates of predicted incomes on household-level data drawn from the Panel Study of Income Dynamics (PSID). Mirer (1973) plotted the "income realization ratios" against predicted incomes and reasoned that groups with a smaller income

realization ratio bore a larger share of the burden of the recession.

We adopt the basic strategy of Mirer (1973), but use a different method for predicting what incomes would have been in the absence of the recession. He grouped households by the ages of their heads and computed average growth rates for the incomes in each group. He then used the growth rate for the appropriate age group to predict household incomes in the recession year. We experiment instead with several variations on the dynamic panel model

$$y_{it} = \alpha + \beta y_{i,t-1} + x'_{it}\gamma + u_{it}, \tag{1}$$

where y_{it} is income, x'_{it} is a 1 x k vector of explanatory variables, u_{it} is a random disturbance, α and β are scalar parameters, and γ is a k x 1 parameter vector. The lagged-income variable in (1) makes the model dynamic and forces us to sacrifice one wave (1984) of the panel to estimate the model. While our specification differs from Mirer's, the predicted incomes still depend on incomes in previous periods and are generated from panel data.

The variations on (1) are obtained from alternative specifications of the random disturbance u_{it}. To illustrate a few of the possibilities, let

$$u_{it} = v_i + \varepsilon_{it}, \tag{2}$$

where v_i is a cross-section (individual) effect and ε_{it} is a remainder disturbance. The individual fixed-effects (Within) model treats the v_i as constants. The individual random effects (GLS) model treats the v_i as random variables. The GLS model is sometimes combined with the assumption that the remainder disturbances are generated by an AR(1) process,

$$\varepsilon_{it} = \rho\varepsilon_{i,t-1} + \varsigma_{it}, \tag{3}$$

where ς_{it} is a random disturbance with zero mean and finite variance and ρ is the autocorrelation coefficient. Finally, the OLS model ignores the individual effects v_i in (2), which are simply absorbed into the common intercept α in (1).[5]

Baltagi and Griffen (1997) estimate a dynamic model of gasoline demand using a specification similar to (1) and panel data on 18 OECD countries for 31 years.[6] They compare forecast properties of a wide range of alternative estimators and report that GLS-AR(1) performs best overall. Baltagi and Griffen (1997, 316) report further that "the more traditional GLS, OLS, and Within models also perform quite well, especially compared both to other rival estimators and the naïve, 'no change' model."[7]

We applied several of these estimators to the GSOEP data and encountered some complications. First, we have a relatively short panel (1985-91) for estimating the income-generating process prior to the recession, so our data are poorly suited to estimating the GLS model with an AR(1) adjustment process. The model often fails to converge and is sensitive to the inclusion or exclusion of as little as one year of data. Second, the "Within" estimator is more complicated to use than the other traditional estimators in this application, because cross-section effects for thousands of persons, rather than a few countries, must be included in the forecasting step. The OLS estimator is, of course, simple to use. Moreover, its forecast accuracy is ranked third overall among 17 estimators by Baltagi and Griffen (1997, 315). Thus, we use the OLS model to generate our predicted incomes.

After obtaining OLS estimates of α, β, and γ in (1) based on the pre-recession panel (1985-91), we can set $u_{it} = 0$ (its expected value) and generate predicted household incomes, y^*_{it}, for 1992-94. For 1992, lagged income is observed, but for 1993 and 1994, predicted values must be used. Following Mirer (1973), the impact of the recession on each household is represented by the income realization ratio (r_{it}), defined as

$$r_{it} = (y_{it})/(y^*_{it}). \qquad (4)$$

Households hurt by the recession can be identified as those with $r_{it} < 1$. Also, lower values of r_{it}

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will be associated with greater shares of the burden of the recession. Finally, the distributional impact of unification can be seen by plotting the relationship between r_{it} and y^*_{it}.

IV. Data

Estimation of the distributional impact of German unification on the Western states is greatly aided by the existence of a representative, longitudinal, household survey that has been conducted in the Western states since 1984—the German Socio-Economic Panel (GSOEP). The GSOEP is similar to the PSID—the data source used by Mirer (1973)—and allows us to examine the distribution of income across households in the Western states before and after unification. The English-language, public-use version of the GSOEP is described by Wagner, Burkhauser, and Behringer (1993). We include households from sample A (West Germans) and sample B (foreign guest workers who were living in West Germany in 1994) of the GSOEP.

We focus on household post-government incomes—the standard measure used for welfare analyses in the income distribution literature. In the GSOEP, post-government income includes total household income from labor earnings, asset flows, imputed rental values for owner-occupied housing, private and public transfers, and social security pensions minus family taxes. Labor earnings include wages and salaries, self-employment income, bonuses, overtime, and profit sharing. In a longitudinal study, it is difficult to follow households over time. Thus, we identify household heads in 1984 who were also in the survey each year from 1984 to 1994 (whether or not they were household heads after 1984). We can follow these persons and use their respective household incomes in each year. Table 1 gives the distribution of household incomes in the Western states for 1985 to 1994. The incomes in Table 1 are expressed in constant 1991 Deutschmarks to facilitate comparisons across time.

Table 1 reveals that incomes grew fairly steadily from 1985 until 1991, but became stagnant or declined from 1991 to 1994, at least for households at or below the third quartile. According to the standard deviations in Table 1, the dispersion of incomes in the Western states was higher after 1991. The disruption of household income growth is a reflection of the 1992-93 recession, which is directly associated with unification policies. The increase in dispersion is a consequence of continued growth at the top of the distribution after 1991. Table 1 suggests that we compute the costs of unification at the household level by estimating the income losses that households experienced relative to the income predictions from the pre-recession (1985-91) panel. These matters are addressed in the next section.

V. Results

This section reports the estimation results for equation (1), predicted incomes for households in 1992-94, and income realization ratios at different points in the distribution of incomes. Table 2 presents estimates for the OLS models used to forecast household incomes. The estimates for the pre-recession panel (1985-91) are given in column (1) and corresponding estimates for 1992-94 are given in column (2). The parameter estimates in column (1) will be used to generate y^*_{it} in the denominator of r_{it} in equation (4). The reasons for estimating the model on the 1992-94 panel will be explained later in this section.

We experimented with several explanatory variables in x'_{it} in (1), including age, employment status, marital status, education indicators, and time. The coefficients of these variables were frequently significantly insignificant and did not influence predicted incomes appreciably. We do not believe that these variables are without influence on incomes; it is likely that much of their affect is being captured by the lagged income variable in (1). Therefore, we

report the most parsimonious specification of x_{it}, which includes only a time variable that increases by one each year.

The estimates in column (1) are based on 17,856 person-year observations. The coefficients have the expected signs and are significantly different from zero at the 1-percent level. The adjusted R^2 is reasonable for such a model. Also, the root mean square error (165) is less than one percent of the 1991 sample mean (54,400), which is given in Table 1. While the in-sample predictions of the model are quite accurate at the mean of the distribution, it is also well known that predictions based on regression estimates tend to reduce dispersion. This tendency could create a distortion in the values of r_{it} in the tails of the income distribution, since the numerator is an observed income and the denominator is a predicted income. To investigate this issue, we also estimate equation (1) using the 1992-94 sample.[8] We use the estimates to generate in-sample predictions, which can then be used in place of observed incomes in the numerator of r_{it}. The dispersions of the variables used to compute the ratio should then be comparable, because their distributions arise from the same statistical process.

Application of the OLS model to the 1992-94 panel, for which there are 7,652 observations in person-years, yields results similar to the 1985-91 panel, except for the coefficient of time, as column (2) of Table 2 shows. In 1985-91 the coefficient of time is positive and statistically significant at the 1-percent level, while in 1992-94 the sign of the coefficient is reversed. The sign reversal is a reflection of the recession in the latter period. Once again, the root mean square error is small relative to the means of household income in 1992-94, which are given in Table 1.

Using the estimated parameters from Table 2, we can use equation (1) to produce forecasts of household incomes for 1992-94. Table 3 reports the actual incomes, in-sample

(1992-94) forecasts, and out-of-sample (1985-91) forecasts at selected quantiles in each year. Inspection of Table 3 reveals that the forecasts tend to be higher than actual incomes for those households at or below the sample means. Above the sample means, the forecasts tend to be lower than actual incomes at the start of the recession (1992) and at or above actual incomes when the recession ends (1994). The standard deviations in Table 3 show that the forecast distributions tend to have less dispersion than the actual distributions.

Table 3 also presents the income realization ratios at selected quantiles. The ratio of actual incomes to out-of-sample forecasts is presented first. Here the ratios are smallest at the first quartile and increase as we move up the distribution. This pattern means that the burden of the recession in 1992 was greatest in the lower tail of the distribution. Strikingly, positive values of the ratio for the third quartile and above suggest that the recession's effects were not being felt among the upper-income households by 1992. The ratio of in-sample to out-of-sample forecasts in the last column is designed to correct the tendency of regression models to reduce dispersion of incomes. It shows less pronounced patterns than the first ratio, as one would expect.

As we move to 1993 and 1994, the basic pattern persists. The recession created by unification imposes the greatest burden on households in the lower tail of the distribution of incomes, though the impact of the recession begins to be felt at higher quartiles as we come to 1994. Also, the basic pattern is more pronounced when we use actual incomes in the numerator of the income realization ratio. In view of the tendency of forecasts to reduce dispersion, we use in-sample forecasts, rather than actual incomes, in the remainder of the paper.

Figure 1 illustrates the distributional impact of unification on Western households in 1992, 1993, and 1994. It plots the ratio of in-sample forecasts of household income to the out-of-sample forecasts, as reported in the last column of Table 3. The picture illustrates clearly that

low-income households received smaller proportions of their predicted income than high-income households each year. Figure 1 also shows that households up to the third quartile began to feel the impact of these costs by 1994. On the other hand, households at the 90th percentile never receive incomes below the predictions based in the pre-recession panel (1984-91), which suggests that they bore little, if any, of the burden of unification.

Table 4 displays the characteristics of the heads of the households that bore a disproportionate share of the costs of unification in 1992. The corresponding household characteristics for 1993 and 1994 are similar to those in Table 4. We learn that households below the median and especially those below the first quartile had heads who were older, less educated, less likely to be married, and less likely to be employed than the households above the median. It is not surprising that these households would be more vulnerable to a recession than other households. Yet, attitudes toward unification would surely have been less euphoric if Germans had anticipated this distribution of costs in 1990. It is possible that, with perfect foresight, alternative policies for funding unification and burden sharing would have been developed.

VI. Sensitivity Analysis

To examine the sensitivity of the results to the inclusion of household size and composition, we take an approach recommended by Atkinson (1992). He suggests making comparisons within like household structures (e.g., single persons, married couples with no children at home, married couples with one child at home, etc.). We developed versions of Figure 1 for families with children, families without children, persons age 55 or older, and foreign guest workers. In each case, the patterns obtained were similar to Figure 1.

Taking still another approach, we generated the numbers for Figure 1 using an equivalence scale—the familiar square root rule. Again, we obtained similar patterns. We incorporated household weights along with the square root rule, but the results changed little. Likewise, applying the square root rule to college graduates alone or to those with less than a high school education had little effect on our basic results. This sensitivity analysis indicates that the results are robust with respect to household size and composition.

VII. Conclusions

German unification imposed large costs on Western states. We investigate the distribution of these costs during 1992-94. The costs of unification during this period were primarily in the form of slower income growth, which is more "hidden" than direct taxes. We estimate the distribution of the costs by predicting what household incomes would have been in 1992-94 in the absence of unification, using data from 1984-91. To control for the tendency of regression to reduce dispersion, we also estimate post-unification incomes using 1992-94 data. Then, taking the ratio of the latter to the former predictions, we obtain an "income realization ratio" along the lines proposed by Mirer (1973), which allows us to study the distributional impacts of a recession that most observers attribute to unification policies.

The results suggest that the burden of the recession fell disproportionately on the households at or below the median of the income distribution. Surprisingly, we find that the households in the top decile bore little, if any, of the burden of unification through this period. The households shouldering the heaviest burden had heads who were older, less educated, and less likely to be married or employed than households that escaped the burden of unification. Had these findings been anticipated in 1990, unification may have faced stiffer opposition.

Endnotes

[1] Collier and Seibert (1991, 196) place the estimate at less than 50 percent of the average West German income.

[2] Unfortunately, the GSOEP did not include the "solidarity surcharge" (7.5% of income taxes) that was imposed on 1 July 1991 and was canceled in 3 June 1992. The surplus tax was later incorporated into the GSOEP survey in 1995.

[3] Schwarze (1996, 3) figures that Western transfers to the Eastern states amounted to about nine percent of disposable income in the Western states in 1992-93. However, in the early 1990s these transfers were financed largely through borrowing (Vittas, 1995, 1), rather than higher taxes.

[4] There have been studies tracking changes in the distribution of incomes in Germany since unification, but not predicting what incomes would have been without unification. For examples, see Schwarze (1996), Grabka, Schwarze, and Wagner (1999), and Biewen (1999). Frick, et. al, (1995) focus on the distribution of incomes in the Eastern states in the early years after unification.

[5] For more extensive discussions of dynamic panel models, see Hsiao (1986) and Baltagi (1995).

[6] Baltagi and Griffen (1997, 304) note that, "By selecting a generic data set and specification, we hope to provide insights into how these estimators perform for a general class of empirical studies." Thus, we feel justified in using their findings to guide our choice of estimator.

[7] These methods may not yield the best parameter estimates (Baltagi and Griffen, 1997, 309-313), but that is not a concern here. For our purposes, the forecast properties of the estimators are all that matter.

[8] Performing this step provides an additional reason to choose the OLS estimator over the GLS-AR(1) alternative, since the 1992-94 panel is even shorter than the pre-recession panel (1985-91) used to estimate the parameters in column (1) of Table 2.

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Table 1
The Evolving Distribution of Household Incomes in the Western States: 1984-1994

Order Statistic	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
First Quartile	278	283	303	316	325	327	338	336	336	330
Sample Median	400	415	441	450	470	479	504	502	504	491
Sample Mean	441 (256)	445 (223)	480 (282)	489 (259)	508 (276)	522 (295)	544 (297)	558 (317)	559 (313)	554 (336)
Third Quartile	549	556	594	612	636	647	702	708	711	707
Ninth Decile	724	729	790	809	829	865	937	955	968	957

Note: Incomes are expressed in hundreds of 1991 Deutschmarks. The numbers in parentheses are standard deviations.

Table 2
Parameter Estimates for the OLS Models Used to Forecast Incomes

Variable	Parameter Estimates from 1985-91 Sample (1)	Parameter Estimates from 1992-94 Sample (2)
Intercept	90.229*	124.764*
	(2.982)	(17.116)
Lagged Income	0.815*	0.922*
	(0.005)	(0.006)
Time	4.485*	-9.719*
	(0.622)	(2.102)
Adjusted R^2	0.639	0.783
Root Mean Square Error	165.169	150.096
Observations	17,856	7,652

* Statistically different from zero at the 1-percent significance level.

Table 3
Actual Incomes versus Income Forecasts by Order Statistics: 1992-94

Order Statistic	Actual Income (1)	In-Sample Income Forecast* (2)	Out-of-Sample Income Forecast** (3)	Income Realization Ratios	
				(1) / (3)	(2) / (3)
1992					
First Quartile	338	368	396	0.85	0.93
Sample Median	509	516	526	0.97	0.98
Sample Mean	558 (317)	557 (273)	562 (240)	0.99	0.99
Third Quartile	706	691	680	1.04	1.02
Ninth Decile	936	885	851	1.10	1.04
1993					
First Quartile	336	358	400	0.84	0.90
Sample Median	505	515	538	0.94	0.96
Sample Mean	559 (313)	561 (292)	579 (257)	0.97	0.97
Third Quartile	712	696	698	1.02	1.00
Ninth Decile	968	911	887	1.09	1.03
1994					
First Quartile	331	347	403	0.82	0.86
Sample Median	491	502	540	0.91	0.93
Sample Mean	554 (336)	552 (288)	584 (254)	0.95	0.95
Third Quartile	708	692	707	1.00	0.98
Ninth Decile	957	928	915	1.05	1.01

* Based on the 1992-94 Sample   ** Based on the 1985-91 Sample
Note: Incomes are expressed in hundreds of 1991 Deutschmarks. The numbers in parentheses are standard deviations.

Table 4
Characteristics of Household Heads by Sample Percentiles

Percentiles of Sample	Mean Age	Proportion of High School Graduates	Proportion of College Graduates	Proportion Married	Proportion Employed
0-25	61	0.51	0.05	0.37	0.36
25-50	52	0.59	0.12	0.79	0.68
50-75	50	0.61	0.18	0.88	0.81
75-90	50	0.71	0.26	0.91	0.86
90-100	50	0.77	0.42	0.92	0.92

Note: The numbers are based on 1992 data.

**Figure 1
Household Income Realization Ratios
by Predicted Income Quantile**