

# The unification bonus (malus) in postwall Eastern Germany

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## Abstract

We investigate the unification bonus as the discounted value of the difference between an Eastern German's actual income and the counterfactual real income stream that would have been experienced under a continuation of economic life in a static GDR from 1990 to 1998. The two main issues tackled in this study are the construction of valid deflators for a comparison of real incomes in transition from a centralized to a market economy and the estimation of counterfactual income streams. Our central result is that 19 percent of East Germans received a present value malus and so can be regarded as unification losers.

**Keywords:** Real income comparison, income distribution and mobility, economies in transition

**JEL code:** D1, D3, P2

## Summary

We investigate the evolution and the distribution of the unification bonus or malus for a representative sample of citizens of the former German Democratic Republic (GDR). The unification bonus is defined as the present discounted value as of July 1, 1990 of the difference between an Eastern German individual's actual real income stream (adjusted for household composition) and the counterfactual real income stream that could have reasonably been expected under a continuation of economic life in a static GDR through 1998. The assumption of a static GDR is both strong and optimistic, so our estimates of the proportion of economic losers from unification in the East can be regarded as an upper bound.

Two central issues are tackled in this study. First, the construction of valid deflators for a comparison of real incomes in transition from a centralized to a market economy and second, the estimation of the hypothetical income streams former GDR citizens would have experienced under a continuation of the GDR. The deflators are calculated from a hitherto unexploited data set of the Federal Statistical Office (Statistisches Bundesamt). This data set also allows us to calculate deflators for different points in the distribution of equilibrated incomes. The hypothetical income streams are based on projections using the German Socio-Economic Panel that was expanded to include households from the German Democratic Republic in June 1990, hardly half a year after the Berlin wall had fallen and just before the wholesale introduction of the deutsche mark to the East.

Our central result is that 19 percent of the East Germans are estimated to have experienced a present value malus from unification. Gains were sufficiently large that on average our sample experienced a cumulative bonus twice the magnitude of 1999 real income. We also find that the percentage of East Germans with an annual unification malus is declining over time from 38 percent in 1991 to 22 percent in 1998, however the rate of decline appears to be larger in the first part of the 1990s than in the second. This trend break fits well with the observed evolution of macroeconomic indicators for Eastern Germany over the same time period.

Unlike any other transition economy, the elderly in the new federal states have experienced a dramatic improvement in their standards of living. Fewer than 2 percent of East Germans above age 65 in 1990 had a negative bonus (i.e. a malus), whereas women between 45 and 54 show the highest proportion with a malus and women between 35 and 44 received the lowest net average bonus.

# 1 The problem

On the eve of German unification then Federal Chancellor Helmut Kohl made the unambiguous claim that following German unification no one would be worse off and many would be much better off.<sup>1</sup> A prediction that a genuine social and economic revolution will lead to a Pareto improvement in the strict sense of no losers whatsoever is hardly one based in human experience. Our purpose in this paper is to attempt to gauge the extent of the discrepancy between Kohl's verbalization of the hopes of many Germans during the euphoria of just over one decade ago and the impressive, though definitely mixed, historical record that has unfolded in the meantime.

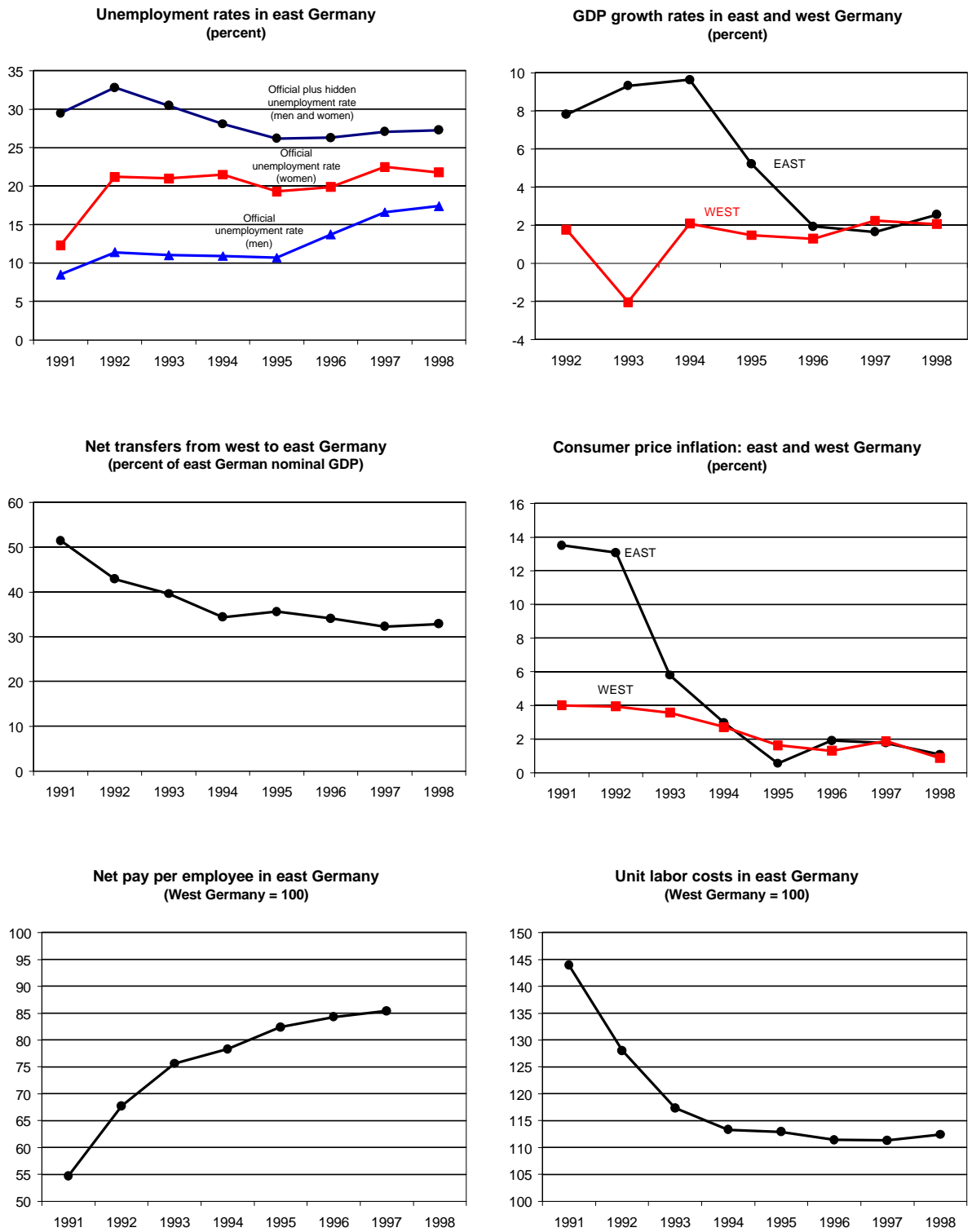
The six panels of Figure 1 capture much of the relevant aggregate story of East Germany's economic transition to the market economy. Simultaneous with significant real income gains, the East German labor market has been characterized by high and persistent unemployment rates. Official registered unemployment does not include roughly half as many people again who participate in active labor market programs (essentially income maintenance schemes) or have accepted the terms of special early retirement pensions. The German Council of Economic Experts counts these individuals – still nearly one million – as hidden unemployed. Hidden and registered unemployment together has hovered at a level well above a quarter of the East German labor force for close to a decade already. The initial strong recovery that followed the immediate collapse of industrial production in the first year of economic unification<sup>2</sup> was followed by a marked deceleration of real economic growth. Indeed, real GDP growth rates in East Germany have even fallen below those in West Germany. The single most important difference between the East German case and all other economies in economic transition has of course been the good fortune of a steady inflow of net transfers from West to East that continue and still amount to approximately one third of the value of East German GDP each year. East Germans experienced a significant burst of inflation in the first years of unification and we note that nominal pay levels were indeed rapidly catching up with West German levels. But as the final panel shows, productivity has not increased nearly fast enough over the past decade to bring down East German unit labor costs in line with those in West Germany.

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1 Less well remembered is that Helmut Kohl was most explicit in including both eastern and western Germany in his "promise". The promise was made in Kohl's speech on June 21, 1990 before the Bundestag. It has been reprinted in *Texte zur Deutschlandpolitik* (1990), 396.

<sup>2</sup> Akerlof, et al. (1991).

**Figure 1: Key Economic Indicators of Postwall Eastern Germany**



Sources: Federal Statistical Office, German Reports, Jahresbericht 1998 der Einheit (Deutscher Bundestag, Drucksache Adjustment Report (1999), Fall 2000 Institutes.

Council of Economic Experts' Annual Bundesregierung zum Stand der Deutschen 13/10823), Collier (2001), 19th Structural Memorandum of the Economic Research

One striking pattern is immediately apparent in the panels of Figure 1: the mid-1990s reveal a break in the trend or even trend reversal. This pattern is also seen in our analysis that follows.

With the aggregate background brushed in with a few broad empirical strokes, we are ready to begin the detailed microeconomic examination of the course of nominal incomes and prices. The object of our empirical attention is what we have chosen to call the *unification bonus* defined as the present discounted value as of July 1, 1990 of the difference between an Eastern German individual's observed real income stream (adjusted for household composition) and the counterfactual real income stream that would have been experienced under a continuation of economic life in a static GDR through 1998. For lack of a better term we call a negative bonus a *unification malus*. While there can be no doubt that such a measure of economic welfare should be systematically related to what is generally understood as the winners and losers from German unification, economic welfare is only one of several dimensions of social welfare. We hope that careful readers will share our reluctance to leap from the distribution of the unification bonus or malus to the grand question of "winners" versus "losers" just quite yet.<sup>3</sup> Still we believe the principal contribution of this paper is that it offers the best estimates to date of the real income gains and losses in Eastern Germany following the reunification of Germany in 1990.

Previous economic studies that have examined the impact of reunification at the individual level have for the most part exclusively focussed on nominal income mobility in East Germany. Among those Krause and Habich (1993) look at the changes of household income that took place during the early years of transition, Hauser and Fabig (1999) investigate labor and household income mobility between 1990 and 1995 and Steiner and Kraus (1996) analyze the distribution of labor income from 1989 to 1993. All studies use the German Socio-Economic Panel. The main results from these studies have been that income mobility in the East was higher at first and has approached the Western level over time. The probability of falling within the distribution is higher for individuals and households who have experienced unemployment. Women are more at risk to end up in a lower income quantile than men. However due to the lack of anything but extremely crude purchasing power parity indexes that link post-GDR prices in Eastern Germany to prices in the GDR, there are really no satisfactory comparisons of 1990 real incomes with those in 1998.

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<sup>3</sup> Readers will also note that we often fail to take our own advice and in the interest of expository convenience will refer to winners and losers anyway. When we refer to winners we only mean a unification bonus greater than zero.

In his 1992 study Richard Hauser conjectured that inequality would increase in Eastern Germany during the transition process. Indeed this hypothesis was confirmed in a later study by Hauser and Wagner (1996). Similarly Grabka and Otto (2001) calculate that East German market incomes have become more unequally distributed over time. We are concerned in this paper with the distribution of the unification bonus which we believe is a better indicator for welfare gains from transition.

The lack of appropriate purchasing power parities to convert the 1990 Eastern Mark into DM is widely recognized throughout the literature. For example Hauser (1992: 62) does point to the presence of quantity constraints and the extensive use of subsidies in the former GDR that make a satisfactory comparison of the purchasing power of money in divided Germany difficult to achieve. Here is where the main contribution of the present paper is to be found: the combination of forecasts of GDR living standards, tailored to individual and household circumstances, with purchasing-power-parity indexes that link post-GDR prices in Eastern Germany to prices in the GDR on the eve of German economic unification.

The household income data we analyze are also taken from the German Socio-Economic Panel (GSOEP) that began to include Eastern German households (1,944 individuals are in our sample) even before German Economic, Monetary and Social Union actually went into effect on July 1, 1990. Exact price deflators have been constructed from data collected by the German Federal Statistical Office. The assumption of a static GDR economy as the benchmark for our counterfactual has been chosen more for the psychological salience of the final year of the GDR economy than as a realistic forecast of an economy whose time was indeed running out<sup>4</sup>. This is probably the best reason to consider our estimate of the aggregate unification bonus as merely a lower bound for the true bonus. The assumption of static expectations has the additional merit of providing a way to use the cross-section of economic life reported in the first Eastern wave of GSOEP to generate counterfactual real income streams to the present, conditional on individual characteristics. The assumption of static expectations excludes economic growth or equivalently any cohort effects. We have assumed that as an individual's age, household composition and job-related characteristics changed over the past decade, the relevant comparison for judging his or her relative gain or loss would be that of someone else with the same age and other individual characteristics in the 1990 sample. We calculate

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<sup>4</sup> This is the more or less the bottom line of the classified report prepared for the GDR's Politbüro dated October 30, 1989 prepared by the Chairman of the State Planning Commission, see Schürer (1992).

the unification bonus from the perspective of the individual and not the household.

According to our estimates for about 19 percent of the GSOEP sample ages 25 years and above at the time of German unification, real income losses following German economic unification have actually exceeded the gains. On the other hand, we also calculate that aggregate gains of the unification winners have swamped the aggregate losses of the losers. Expressed as a present discounted value (valued in 1991 DM) the average bonus of the 81% unification winners was over 39,000 DM vs. the average unification loss of 15,700 DM of the other 19% of our sample. The vast bulk of the unification malus has been concentrated in the cohorts that were between 35 and 54 years of age in 1990 with the largest unification bonuses going to those 55 years and older in 1990.

One disturbing tendency observed in our data is that figures for 1997 and 1998 point to a falling share of those with a positive annual unification gain, a development that is hardly surprising in light of the dramatic deceleration that occurred in Eastern German GDP growth during the second half of the 1990s. A tentative eyeball-interpretation is that we could indeed be seeing a trend reversal that is obscured by limiting one's attention to the single summary present-value bonus.

Two central issues are tackled in sections 2 and 3: first, the construction of price deflators needed to convert nominal magnitudes into their corresponding real counterparts; second, the estimation of the counterfactual income streams that east Germans could have reasonably expected under a static continuation of the GDR into the late 1990s. In sections 4 and 5 we combine observations, deflators and counterfactuals to produce our empirical results. Given the necessarily tentative nature of such calculations, we conclude our paper with a summary that helps to identify certain structural weaknesses of our estimates that naturally constitute an agenda for future research.

## **2 Getting real: deflators**

The first order of business is the conversion of the GSOEP 1990 East German income data (valued in GDR marks) into meaningful DM magnitudes. Indexes of relative purchasing power used in a comparison involving two very different economic systems need to adjust for differences in the extent of nonprice rationing (i.e. quantity constraints) as well as for differences in the indirect taxation/subsidization of consumer goods, see Collier (1986 and 1989). This is particularly true when one considers the enormous differences between the East and West housing markets and the degree of subsidization with respect to basic foodstuffs and children's clothing (in the East) in pre-unification Germany. The estimates of real household net income used for this paper are based upon

purchasing power parities that provide at least partial correction for the distortion of quantity constraints and the differential impact of indirect taxes/subsidies across the GDR income distribution. In this section we provide the interested reader a brief description of the methodology used to calculate exact price deflators.<sup>5</sup>

The key hypothesis behind the price deflators is that West and East Germans are assumed to have had and still have identical preferences. This is completely within the spirit of conventional applied demand analysis, some would even argue it is the hallmark of economic analysis as opposed to sociological or anthropological analysis. The difficult part of applying the tools of empirical demand analysis to our problem is that these methods have evolved over the decades in the analysis of household budgets in market economies for which quantity constraints are a pathological exception rather than the rule. Certainly for our GDR observations and at least in the initial years following German economic unification, both budget and quantity constraints are an essential part of the story.

This complication means that the presumption of the tangency of budget constraints and indifference surfaces (a necessary condition for utility maximization for households that are solely budget constrained in their expenditure choices) is wholly inappropriate in an economic world of quantity constraints. For this reason it would be invalid to use observed Eastern budgets and quantity data to infer the parameters of the underlying preferences of households without detailed information on the extent and incidence of quantity constraints. One way out of this apparent dead-end is to exploit the existence of the fraternal twin Germany, i.e. the old FRG, to estimate “all-German preferences” from observed budgets and market baskets in West Germany and to transplant the estimated demand system eastwards for the purpose of interpreting the structure of household expenditure observed there.

The West German expenditure data<sup>6</sup> are available according to a consistent classification system for the period 1981-1998. Demand systems were estimated using annual average expenditures for (i) two-adult households (predominantly elderly) whose principal source of income is public pensions and/or public assistance and (ii) two-parent, two children households that are disaggregated into middle-income and higher-income groups. The consumer price indexes for the sixteen categories of expenditure in West Germany have

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<sup>5</sup> The deflators used to convert nominal equivalent incomes into DM at 1991 West German prices are taken from Collier (2001) to which the reader is referred for a full description of both data and methods.

<sup>6</sup> Statistisches Bundesamt Fachserie 15. Reihe 1. (1984-1998).



been assembled for the most part by a straight-forward chaining of the corresponding indexes<sup>7</sup> for base years 1980, 1985, 1991 and 1995. All category price indexes have been set equal to unity for 1991.<sup>8</sup>

The specification used to calculate the corresponding exact deflators is a generalization of the Cobb-Douglas demand system<sup>9</sup> that permits budget shares to vary systematically with real income. As in the simple Cobb-Douglas specification, the compensated price elasticity of each good is minus unity. The point of this generalization is that income elasticities are *not* constrained to be equal to unity which is most desirable because West German data are clearly consistent with Engel's Law, i.e. budget shares do indeed vary systematically with increasing real budgets, and our East German observations (for which we need to forecast out-of-sample) are significantly below West German average levels.

We assume a generalized Cobb Douglas demand system for indirect utility:

$$(1) v(\mathbf{p}_i, y_i) = \prod_{k=1}^K (y_i / p_{ki})^{b_{ki}} = y_i / \prod_{k=1}^K (p_{ki})^{b_{ki}}$$

where  $i$  ( $=1,2$ ) denotes Eastern or Western Germany and  $k$  ( $=1,\dots,K$ ) denotes the sixteen categories of expenditure.<sup>10</sup> The second equality is due to the fact that the budget shares sum to unity in any period. We transform equation (1) into log-form and obtain

$$(2) \ln v_i = \ln y_i - \sum_k b_{ik} \ln p_{ik}$$

So that these preferences are indeed consistent with Engel's law we explicitly let the budget shares vary systematically with real income (indirect utility) itself.

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<sup>7</sup> Statistisches Bundesamt. Fachserie 17. Reihe 7 (1984-1998).

<sup>8</sup> At the risk of restating the obvious: only price and expenditure for West Germany were used in the estimation of the parameters of German preferences.

<sup>9</sup> For an earlier application of the generalized Cobb Douglas demand system used here, see Collier (1986, 1989).

<sup>10</sup> In the interest of avoiding yet another subscript to denote historical time, the reader should note that in this specification prices ( $p$ ), budget constraint ( $y$ ) and *the budget shares* ( $\mathbf{b}$ ) can all vary. By force of habit some readers might mistakenly regard the budget shares as constants which is only true for a traditional Cobb-Douglas world which is only a special case of the Generalized Cobb-Douglas specification.

$$(3) \mathbf{b}_{ki} = \frac{\mathbf{a}_k v_i^{\mathbf{g}_k}}{\sum_{m=1}^K \mathbf{a}_m v_i^{\mathbf{g}_m}}$$

To eliminate the denominator we choose a reference category  $n$  (here food) and drop the country subscript ( $i$ ) for convenience

$$(4) \frac{\mathbf{b}_k}{\mathbf{b}_n} = \frac{\mathbf{a}_k v^{\mathbf{g}_k}}{\mathbf{a}_n v^{\mathbf{g}_n}} = \left( \frac{\mathbf{a}_k}{\mathbf{a}_n} \right) v^{(\mathbf{g}_k - \mathbf{g}_n)}$$

In log-form we get our estimation equation

$$(5) \ln(\mathbf{b}_k / \mathbf{b}_n) = \ln(\mathbf{a}_k / \mathbf{a}_n) + (\mathbf{g}_k - \mathbf{g}_n) \ln v = \tilde{\mathbf{a}}_k + \tilde{\mathbf{g}}_k \ln v$$

Thus we have  $(K-1)$  linear equations with observable prices, budget shares and total budgets. The  $K$ -th equation for the estimated  $K$  parameters is obtained from the condition that all budget shares are required to sum to unity. The log indirect utility can be calculated with this information using equation (2).

The methodological trick that makes it possible to obtain the level of utility corresponding to observed East German quantities is the calculation of Rothbarthian virtual prices<sup>11</sup> that would have led Eastern German households (holding their budgets constant) to freely choose the quantities actually observed in their quantity-constrained environment, e.g. higher prices on housing, lower prices on tobacco and alcoholic beverages, etc. to bring demand in line with supply. Expressed somewhat differently, we are able to sweep away the quantity constraints that we do not observe directly by taking the system of estimated Marshallian demand functions from West Germany to calculate virtual prices that (together with the original budget constraint) would have been consistent with the quantities in the constrained market baskets that we observe. Holding that level of utility constant for the Eastern German household and putting 1991 West German prices into the indirect utility function (all equal to unity since we are using the base year for this calculation), we find the size of the budget that a household would have needed at 1991 DM prices (West!) to attain the utility associated with effective Eastern expenditures valued at actual Eastern prices.

The recipe for the exact deflators is the following:

- 1) Equation (5) is estimated using West German data to obtain estimates of the all German preference parameters  $\tilde{\mathbf{a}}$  and  $\tilde{\mathbf{g}}$  from  $K-1$  estimating equations.

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<sup>11</sup> See Rothbarth (1941) as well as Neary and Roberts (1980).

- 2) Using the preference parameters estimated in step 1) and holding the observed East German budget constraint constant, the level of the indirect utility function and the virtual prices associated with the observed quantities are simultaneously calculated.
- 3) Using the level of East German utility just calculated, we can calculate the DM expenditure total that would have been necessary to attain that level of utility at 1991 West German prices.
- 4) The deflator is obtained by dividing the observed East German expenditure by the 1991-DM expenditure from step 3). The deflator has the dimensionality of Eastern marks per DM (1991 prices).

The original Eastern German family budget surveys for 1989 as well as the first and second halves of 1990 were re-aggregated to conform to the Western German classification system by team working for the Federal Statistical Office<sup>12</sup> and fully comparable family budget surveys in East and West have been conducted since 1991. Thus the time series of annual average family budgets for Eastern and Western Germany for retired two adult households and middle-income/ high-income four person (two adults/two children) households are reasonably consistent both across time and space.

To obtain the consumer price indexes for Eastern Germany at the sixteen category level used here, it was necessary to combine a bridge between the East and West German price levels from the second half on 1993<sup>13</sup> with chained indexes for the Eastern German category price levels<sup>14</sup>. In other words, category by category direct price comparisons between East and West for one point in time have been backcast to 1989 and forward to 1998. When an Eastern German consumer price index computed this way has a value of unity, then the Eastern German price level for that category of expenditure and that year was equal to the West German price level in 1991. The Eastern German price level for the consumption expenditure categories “food” and “rent” have remained below the corresponding West German price levels for those categories 1991 for the entire period under consideration.

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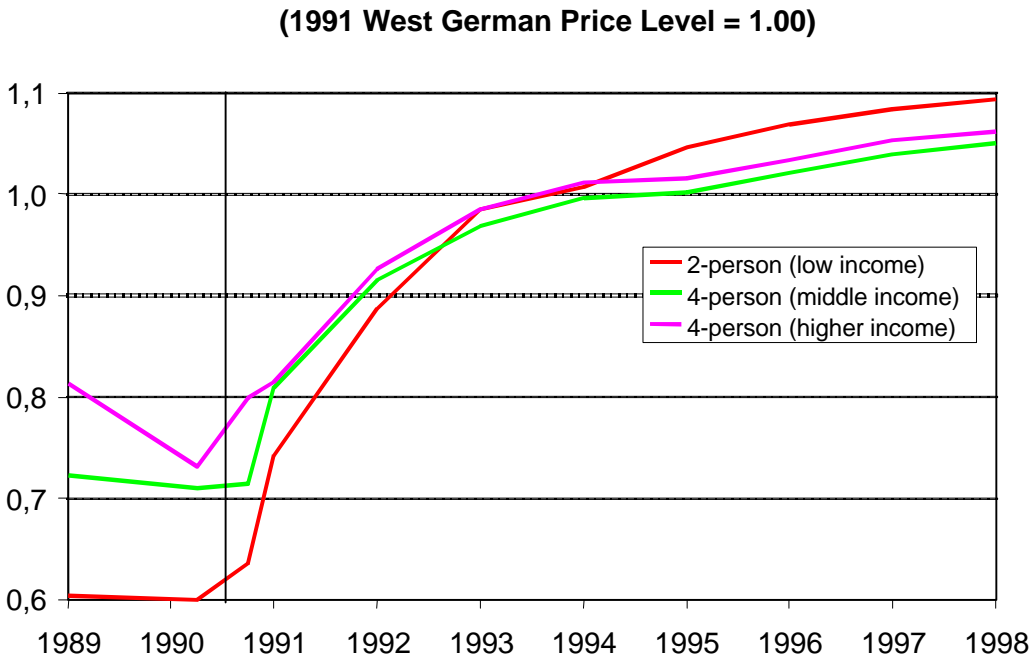
<sup>12</sup> Statistisches Bundesamt (1993a).

<sup>13</sup> The survey is described in Ströhl (1994). Mr. Ströhl graciously provided disaggregated data that made the East/West price bridges for our sixteen categories possible.

<sup>14</sup> For May, June, July, December 1990 [base 1989=100]: Statistisches Bundesamt (1992a: 15-19, 23-27, 63-67). For July 1990, December 1990 [base July 1990-June1991=100]: Statistisches Bundesamt (1992b). 1991 indexes [base July 1990-June1991=100]: Statistisches Bundesamt Fachserie 17. Reihe 7. (1993: 234-262). 1991-1998 taken from unpublished series made available by the Federal Statistical Office.

The ratio of the observed Eastern budget to this minimum budget for 1991 DM Western prices is the exact deflator that we use, where “exact” is meant in the sense of the economic theory of index numbers, i.e. corresponding exactly to the particular specification used to model preferences. The deflators for the three different household types are plotted in Figure 2 . It is important to note that the purchasing power of the Eastern German mark before monetary unification with the West for all three household types turns out to have been in fact greater than the DM at the time.<sup>15</sup> Furthermore the lower a household’s budget constraint, the greater was the purchasing power (i.e. the smaller the deflator used to divide nominal magnitudes valued at Eastern prices).

**Figure 2: Deflators for East German households**



Source: Collier (2001).

<sup>15</sup> Unfortunately it is very easy to confuse deflators (factors that are divided into a nominal magnitude) with purchasing power parities (factors that multiply nominal magnitudes) in order to obtain real magnitudes. While the matter is merely one of multiplicative inverses, the readers are forewarned to watch their steps.

### 3 Back in the GDR

For the purpose of establishing a baseline level of real disposable income, we are extremely fortunate to have the extraordinary data from the German Socio-Economic Panel (GSOEP)<sup>16</sup>. As an individual household micro-data panel, the GSOEP is a rich data source for analyzing income dynamics in relation with various individual and household characteristics. The GSOEP survey began in 1984 in the Federal Republic of Germany (FRG). The GSOEP was expanded to include households from the German Democratic Republic (GDR) in June 1990, hardly half a year after the Berlin wall had fallen and just before monetary union took place. The empirical results presented in this section are based on that 1990 sample representing the Germans residing in the GDR at the time of the survey.<sup>17</sup>

Further sample selection criteria are listed in Table 1. Our analysis covers all GDR respondents who participated in the survey in 1990 (before July) and remained in the panel in each subsequent year through 1998. It contains only German nationals. We have further restricted our sample to respondents 25 years and older at the time of unification in order to include only individuals who already had completed their education at the time of German unification so that our results should not be affected by postwall educational decisions. Thus we have excluded the youngest adult cohorts to avoid the considerable complication entailed in valuing the returns to education. Observations with missing data for income or any of the explanatory variables have also been dropped. The sample used for income estimation consists of 2110 men and women ages 25 to 85. Descriptive statistics of the sample are provided in Table B1 of Appendix B. The average age of the sample selected is 45 for women and 44 for men. The final sample used for the projection of counterfactual income streams through 1998 comprises 1944 men and women.

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<sup>16</sup> For more information on the GSOEP see Wagner/Burkhauser/Behringer (1993) and Projektgruppe Sozio-oekonomisches Panel (1995).

<sup>17</sup> A small fraction of interviews were conducted after monetary union went into effect on July 1, 1990. We have only included respondents who participated in the panel before that date so that all income variables from 1990 are expressed in GDR marks.

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**Table 1: Sample selection**

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	Cases left in sample
Respondents GSOEP 1990-1998	2528
Interview conducted prior to July 1990	2409
German nationality	2403
Respondents above age 25	2144
Non-missing values for income	2117
Sample used for regression (excludes missing values 1990)	2110
Sample used for income forecast (excludes missing values 1990-1998)	1944

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We calculate household equivalent income using the so-called "modified OECD equivalence scale" which assigns a weight of unity for the first adult living in a household and then adds 0.5 for each additional adult living in the household and/or 0.3 for each child under the age of 16. This particular equivalence scale has been chosen largely because it appears with increasing frequency in the income inequality literature. Nonetheless it is with some trepidation that we use weights that have evolved for market economies to adjust the GDR household incomes in our sample for 1990. The theory and practice of computing household equivalence scales for centrally planned economies in which quantity constraints, in-kind benefits and indirect taxation for distributive purposes all play a large role is entirely lacking at present so there is not much to do here beyond recognize this serious difficulty — and move on.

The natural logarithm of household equivalent income is used as a dependent variable in our income forecast regression. Regressions have been run separately for women and men. The coefficient estimates are reported in Table 1. From these regressions we obtain our equivalized income forecasts.<sup>18</sup>

As explanatory variables we include information on age, schooling, additional education, job characteristics such as the occupational status, tenure and whether someone is employed or receiving a pension. Thus our default category is “not participating in the labor force or unemployed”. Further regressor variables include a dummy variable for working in the manufacturing or production sector and a dummy variable for living in Berlin. Variables for firm size and industrial sectors, as used by Puhani and Steiner (1996) and Franz and Steiner (1999) for

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<sup>18</sup> Granting more than a passing resemblance, this specification should not be confused with Mincer-type earnings or wage equations. The crucial difference is in our goal of predicting *household equivalent* incomes and not *individual earnings*. Household equivalent income is the more appropriate measure for welfare comparisons which is what we are after.

explaining East German wages, were not found significantly related to household equivalent income and are therefore not included in the estimation equation presented here.

One of the most important explanatory variables for predicting future income is the individual's age. The shape of the age-income profile however strongly depends on the assumed underlying functional form of the relationship between age and equivalence income. By using a spline function one can better allow for non-linearities in this relationship while retaining a simple specification.<sup>19</sup> We have chosen a specification using a linear spline function with five different linear splines, corresponding to five age groups (25-34, 35-44, 45-54, 55-64, 65 years of age and older).

In Figure 3 we can see the resulting age-income locus for the spline function thus specified. For the purpose of comparison, a different age-income specification using a linear plus a quadratic age term, is also shown.<sup>20</sup>

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<sup>19</sup> Linear splines capture the relationship between two variables as a piecewise linear function, in other words a function composed of linear segments joined at knots.

<sup>20</sup> Both curves belong to the profile of a person who worked as a skilled employee, having zero years of tenure and who falls into each of the reference categories used in the estimation equation for all remaining variables.

**Table 2: OLS regression: equivalized income (logarithm) in 1990**

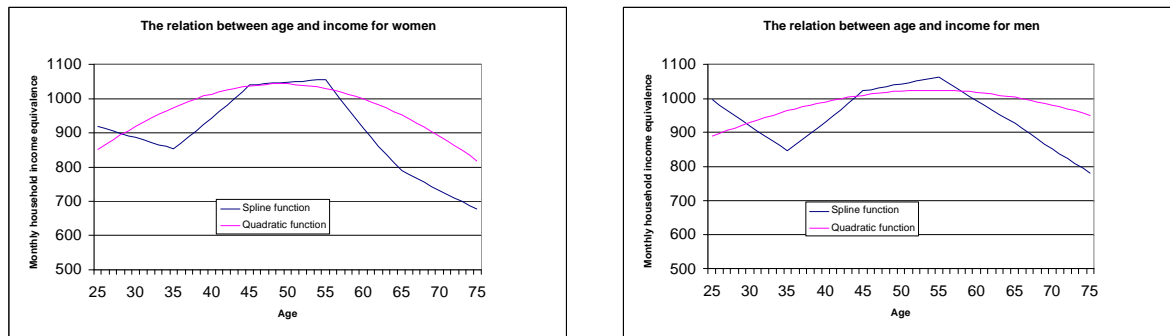
	<b>Women</b>		<b>Men</b>	
	Coefficient Estimate	Robust Stan. Error	Coefficient Estimate	Robust Stan. Error
<b>Age group</b>				
25-34	-0.0050	0.0043	-0.0164	0.0051
35-44	0.0198	0.0033	0.0188	0.0037
45-54	0.0015	0.0041	0.0039	0.0039
55-64	-0.0291	0.0075	-0.0136	0.0058
Above 64	-0.0154	0.0048	-0.0171	0.0071
<b>Schooling</b>				
(Basic level secondary schooling, 9 years)				
No schooling	-0.2696	0.1436	-0.1628	0.1812
Middle secondary schooling, 10 years	0.0357	0.0251	0.0506	0.0218
High school diploma, 13 years	0.0710	0.0386	0.1561	0.0359
Other	0.2003	0.0742	-0.0062	0.0926
<b>Additional education</b>				
(Apprenticeship)				
No degree	-0.0863	0.0324	-0.0086	0.0827
College degree	0.0750	0.0222	0.0365	0.0248
University degree	0.1649	0.0415	0.0671	0.0408
<b>Employment status</b>				
Employed	0.1927	0.0363	0.1959	0.0619
Pensioner	0.1316	0.0652	0.1001	0.0787
<b>Job characteristics</b>				
(Employees with high qualification)				
Tenure	0.0064	0.0027	0.0035	0.0026
Tenure squared	-0.0001	0.0001	-0.0001	0.0001
Unskilled	-0.0902	0.0253	-0.0472	0.0458
Skilled worker	-0.0807	0.0277	-0.0064	0.0288
Master craftsman	0.0902	0.0541	0.0195	0.0354
Farmer	-0.1026	0.0407	-0.0873	0.0328
Self employed	-0.0765	0.0718	0.0143	0.0503
Executives	0.1076	0.0464	0.1940	0.0463
<b>Industrial sector</b>				
Production sector	-0.0239	0.0189	-0.0456	0.0195
<b>Region</b>				
Berlin	0.0715	0.0346	0.1464	0.0319
Constant	6.5959	0.0454	6.6757	0.0695
R-squared	0.3485		0.2707	

Source: GSOEP, Sample C "German residents in the GDR", 1990.

Note: Robust standard errors. Reference categories in parentheses. According to the F-test for women tenure and tenure squared are jointly significant at the 1%-level, for men tenure and tenure squared are jointly significant at the 10%-level



**Figure 3: Age-income profiles for women and men**



*Source: Authors' calculations based on GSOEP waves 1990 to 1998*

From these profiles it is obvious that a specification quadratic in age would not be sufficiently flexible to reflect the age-income profile we observe. The spline function has the advantage of being more flexible in these two variables, a property which seems to be particularly valuable for younger age groups for both men and women. For the youngest age group the quadratic specification had the greatest positive slope which seems to be at odds with the data, while the more flexible specification displays a negative relationship between equivalent income and age for younger age groups. We see that our estimates reveal the first spline to have a negative relationship between age and equivalized income<sup>21</sup>. This certainly reflects family formation and children that together work to lower these individuals' equivalized incomes quite substantially compared to their younger counterparts who are more likely to be single. This relationship between equivalent income and age will be crucial in estimating the income forecasts which is done in the next section of the paper.

Schooling is in general significantly related with the income measure: The more schooling one has the higher the household equivalent income. The same is true for formal training. Occupational status seems to be of more importance for women's income than for men's, judging from the calculated standard errors of the coefficient estimates. Both the linear and the quadratic terms of tenure are jointly significant for women only. Being employed raises equivalized income by 19.3% for women and 19.6% for men<sup>22</sup>. The pensioner dummy shows an effect different from zero for female household equivalent income. The industrial sector dummy is only significant in the men's regression, where a job

<sup>21</sup> Although this effect is not statistically significant different from zero for women.

<sup>22</sup> The impact of the individual employment status turns out quite low due to the equalization procedure. Household equivalized income is less sensitive than individual income with respect to individual differences.

in the manufacturing or production sector is associated with lower income. Residing in East Berlin, the former capital of the GDR, has a positive effect for both women and men. East Berlin women were found to have a 7% higher equivalized income compared to the rest of the GDR whereas for East Berlin men the comparable difference was 15%.

## 4 Contrary to fact conditional

This section combines results from the two foregoing sections to get the real income forecasts and the real observed incomes (valued at 1991 West german DM prices). The critical assumption behind our forecasts of a counterfactual 1990s of continued life in the GDR is that of static expectations regarding individual income. The estimated unification bonus is thus a lower bound for the true magnitude since static expectations for a hypothetical GDR economy in the last decade of the twentieth century is optimistic, even wildly so. We have experimented with three different variations of static expectations to see the sensitivity of our calculations. First, the word static is taken literally and we simply assume the same household equivalent income for each persons in the sample for the following years from 1991 to 1998 as calculated from the GSOEP 1990 wave for the former GDR. Second, we assume a constant annual income growth rate of 3 percent. This rate is slightly lower than the reported growth of nominal incomes in the 1980s to allow for a slight hidden inflation<sup>23</sup>. The third variant of income projections is based upon a life-cycle, made in GDR.

The notion of a life cycle of income in a static economy enables us to exploit the cross section of economic life reported in the first Eastern wave of GSOEP in 1990 for the purpose of generating our (third) counterfactual forecasts of real income streams. Our forecasts use the regression coefficients reported in Table 1. As mentioned earlier, the sample was restricted to persons 25 years and older at the time of the GSOEP survey in 1990 to prevent the forecasts from being distorted by endogenous education decisions.

The assumptions concerning the life cycle forecast can be summarized as follows. Static expectations generates us a pure age effect, so we implicitly assume no cohort effect. The education decision is ignored due to the sample selection of persons 25 years and older in 1990. The mortality rates implicit in our forecasts are the mortality rates that prevailed in the unified Germany for the sample selected. The retirement decision was assumed truly static in the sense that we implemented the retirement decision from our 1990 GDR sample.

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<sup>23</sup> This growth rate was calculated from Ministerrat der Deutschen Demokratischen Republik, Staatliche Zentralverwaltung für Statistik, Zentrales Zählbüro (1989).

For projection purposes we can distinguish between time-variant and time-invariant variables. The former capture the basic idea of a life cycle that can be estimated from a cross-section. From these cross-section estimates we forecast future incomes by assuming that the latter variables do not change over the life cycle and the former variables by definition would change. The only time-variant variables in this sense are age, a variable that increments by one from year to year, and job-related characteristics. As soon as a woman (man) reaches the pension age of 60 (65), both the participation and job-related dummies are set to zero and the pension dummy is set to unity. These ages are the modal 1990 East German pension age for women and men. A detailed description and documentation of the procedure for obtaining income forecasts is provided in appendix A.

These forecast incomes are valued in 1990 East German marks as suits the counterfactual of a frozen GDR. They are transformed by using the deflators from Section 2 above. Also the observed equivalized incomes are likewise transformed into 1991 German marks using deflators calculated for each year. The differences between observed and forecast real equivalized monthly income are the annual unification bonuses (if positive) or maluses (if negative).

## **5 Evolution and distribution of the unification bonus (malus)**

One of the central empirical results of this paper is the summary statistic that the proportion of East Germans with a present value unification malus through 1998 was 19 percent, using a five percent real annual interest rate for discounting. This result, as all following, is based on the weighted income projection with the sample weights accounting for selection into the sample in 1990 and selection of staying in the panel until 1998. These calculations assume a individual perspective and not a household perspective and the persons are at least 25 years old in 1990.

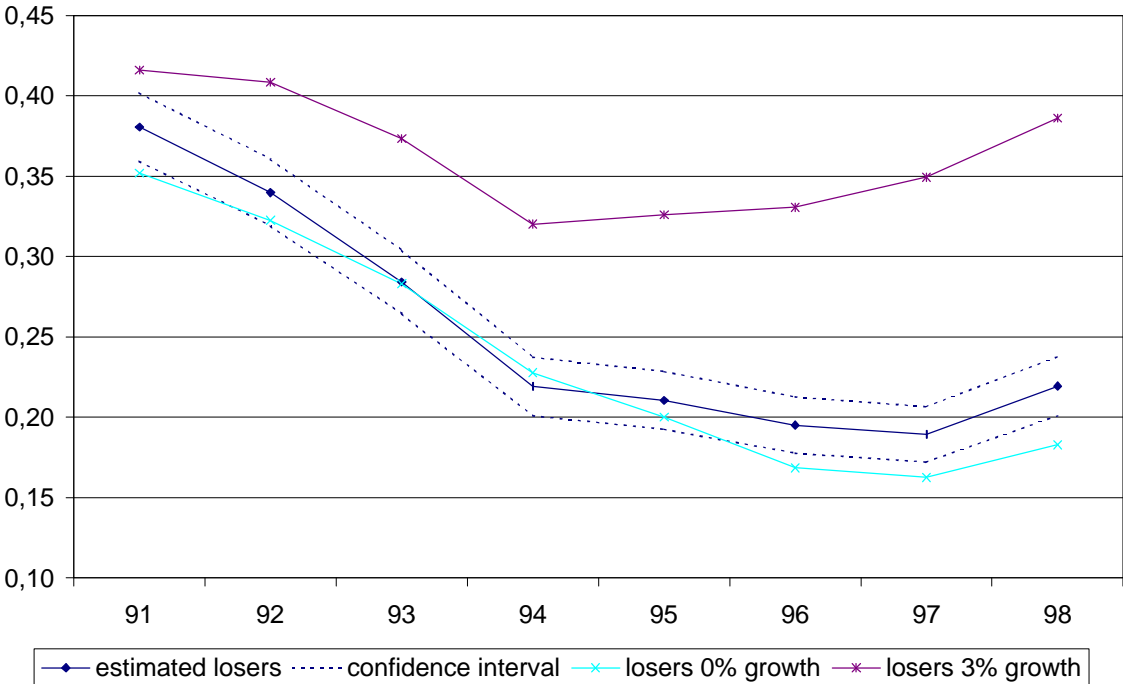
The evolution of the annual incidence of a unification malus over time is displayed in Figure 4. It illustrates the very rapid decline of the share of losers in the first years following German social and monetary union in mid 1990. This first episode ends in 1994. From that time on malus incidence declines at a much slower speed and eventually in 1998 the trend even reverses. At this point in time it is not possible to tell whether this trend reversal is significant and/or continued.

Figure 4 also shows that basically all the three different measures calculated here yield more or less the same overall pattern. For the upper line of Figure 4 a three percent growth has been assumed. In this case the counterfactual obtained in the former GDR is on average larger so the bonus (malus) is smaller (greater

in the sense of more negative). From Figure 4 we can see that income should have increased at least three percent p.a. in the former GDR for an increase over time of the malus incidence.

It can also be seen in Figure 4 that the bonus (malus) calculated with our life cycle projection tracks quite closely the zero percent growth scenario. From the confidence bands drawn in the figure (dotted lines) it can be seen that our life cycle projection differs significantly from the zero growth scenario only at the very beginning in 1991 as well as the end of the time interval from 1996 onwards. In 1994 the proportion of losers is even higher (although not significantly) than in a scenario of zero percent growth which we see as the most mechanical manifestation of the static expectations assumption. This graph illustrates our life cycle projection as a compromise between the two mechanical growth rate scenarios of zero or three percent.

**Figure 4: Incidence of unification malus over time**

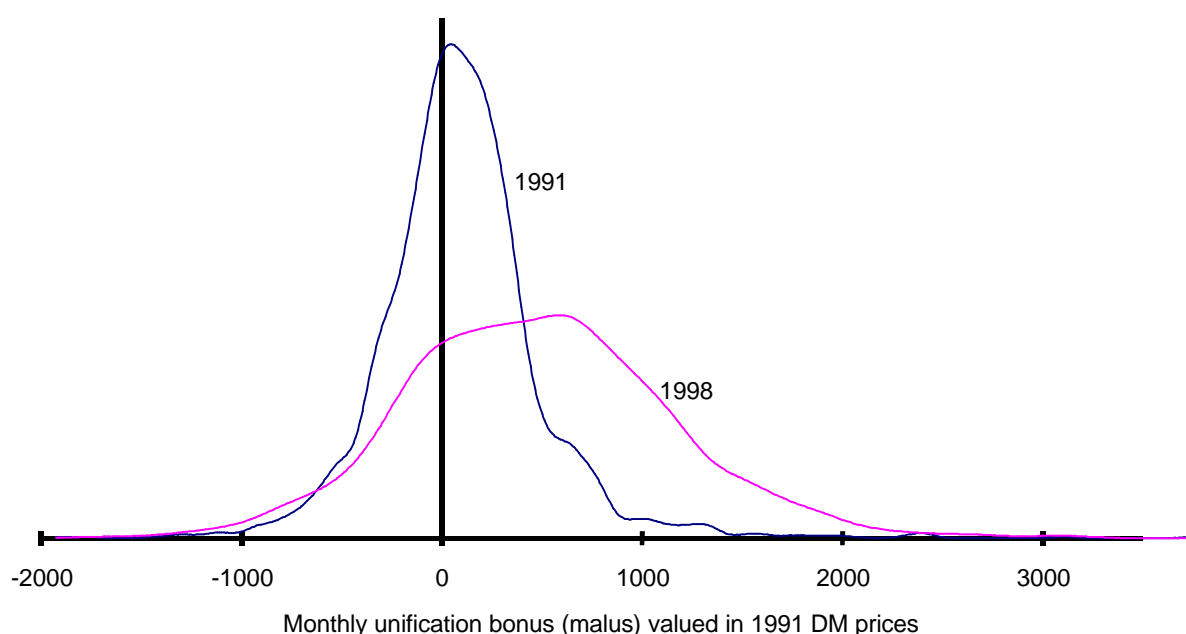


Source: Authors' calculations based on GSOEP waves 1990 to 1998

Having followed the time path of the incidence of a unification malus, we now turn to the evolution of the entire bonus/malus distribution over time. This can

be seen in Figure 5 where kernel densities<sup>24</sup> of the unification bonus (malus) are plotted for 1991 and 1998. The areas under the curves and to the left of the origin are equal to the proportion of persons experiencing a unification malus for the particular year. This proportion fell from 38 percent in 1991 to 22 percent in 1998. But so did the variance of the bonuses. The existence of a substantial proportion of losers from unification can be seen as unifying the results from the income inequality and income mobility literature discussed in the introduction.

**Figure 5: Kernel density estimates of the German unification bonus 1991 and 1998**



*Source: Authors' calculations based on GSOEP waves 1990 to 1998*

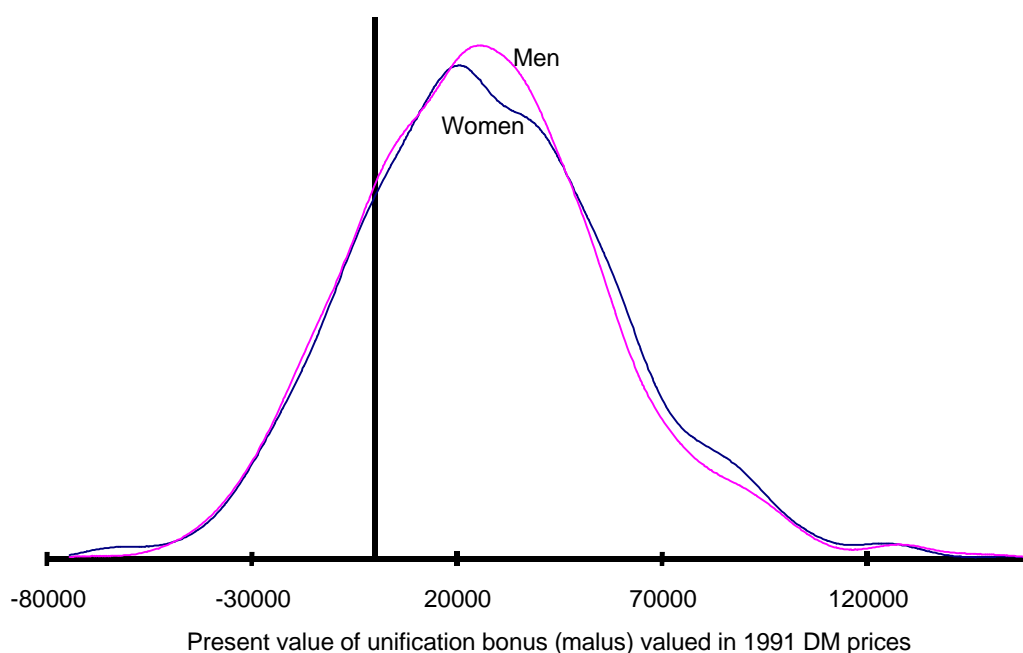
Comparing the kernel densities of the present value of the cumulative annual bonuses for 1990-98 for women and men separately in Figure 6, one does not see a major difference between the sexes. The mode of the distribution for women is a little bit lower and occurs at a somewhat lower value of the present value bonus.

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<sup>24</sup> For the kernel density estimation we used the Gaussian kernel. The density estimate is evaluated at 500 points and we used a bandwidth  $h$  that was chosen optimally according to the formula  $h^{opt} = 1.06 \cdot s \cdot n^{-1/5}$  where  $s$  is the estimated standard deviation and  $n$  is the sample size.

Tables 3-6 provide a variety of present value summaries of net gains and losses for individuals using our life cycle forecast.<sup>25</sup> Inspection of Tables 3 and 4 shows that the share of East Germans experiencing an annual unification malus has fallen from 38% in 1991 to 22% in 1998. These are the numbers we also saw illustrated in Figures 4 and 5. Individuals relatively hardest hit over the past decade were people between the ages of 35 and 44 at the time of German unification. Indeed the women of those cohorts show the only increase in the proportion of losers between 1991 and 1998. In 1998 41% of them experienced a net loss due to unification. Without a doubt the clear winners of unification were those retired or approaching retirement age upon the creation of the German monetary, economic and social union. Indeed by 1998 it is pretty hard to find a Pareto loser among those men and women age 55 and older in 1990.

**Figure 6: Kernel density estimates of the German unification bonus for women and men**



*Source: Authors' calculations with GSOEP waves 1990 to 1998*

<sup>25</sup> For comparison with the alternative counterfactuals in Appendix B we provide Tables B2 and B3 that are forecast equilized incomes using the constant growth rates of 0% and 3%.

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**Table 3: Unification malus incidence in 1991**

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Age group (1990)	Women	Men	Total
25-34	0.39	0.43	0.41
35-44	0.38	0.42	0.40
45-54	0.47	0.41	0.45
55-64	0.38	0.49	0.43
65 and above	0.13	0.06	0.11
All ages, 25 and above	0.36	0.40	0.38

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*Source: Authors' calculations based on GSOEP waves 1990 to 1998*

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**Table 4: Unification malus incidence in 1998**

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Age group (1990)	Women	Men	Total
25-34	0.24	0.23	0.23
35-44	0.41	0.36	0.38
45-54	0.29	0.29	0.29
55-64	0.28	0.09	0.06
65 and above	0.03	0.02	0.03
All ages, 25 and above	0.21	0.23	0.22

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*Source: Authors' calculations based on GSOEP waves 1990 to 1998*

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**Table 5: Incidence of a cumulative unification malus  
(negative present value of 1991-98 actual less forecast equivalized incomes)**

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Age group (1990)	Women	Men	Total
25-34	0.17	0.19	0.18
35-44	0.28	0.28	0.28
45-54	0.30	0.23	0.27
55-64	0.08	0.16	0.12
65 and above	0.01	0.02	0.01
All ages, 25 and above	0.18	0.20	0.19

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*Source: Authors' calculations based on GSOEP waves 1990 to 1998*

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Table 5 may be regarded our preferred summary table according to which 19% of our sample suffered a cumulative present value unification malus through 1998. We see the incidence of a unification malus is slightly greater for men than for women, although among the middle-aged cohorts women have been hit harder with the highest cell incidence in Table 5 of 30% losers found for 45 to 54 year-old women. One is also struck by extremely small proportion of losers among the elderly.

Granting the potential political importance of the incidence of a unification malus, one is curious to know the average size of the unification bonus which is tabulated in Table 6 for the same age/sex groups. The present value of cumulative unification bonuses is expressed both in 1991 DM West German prices as well as a percent of real adult equivalent income in the GDR in 1990. For all age-gender combinations we see that there was in fact a positive net unification bonus on average, i.e. winners could have compensated losers and remained winners in all cells of the table. We note that women between the ages of 35 and 44 at the time of German economic unification received the lowest average net cumulative bonus, especially when compared to their parents in retirement age with approximately 2.5 times larger average unification bonuses. Thus we see that gender differences in the unification bonus are swamped by age differences.

At this point it is most interesting to compare the results of direct public surveys with the results of our calculations. The German weekly newspaper *Die ZEIT*<sup>26</sup> on the occasion of the tenth anniversary of German unification in 2000 repeated an opinion survey of East Germans it conducted in 1993. The new survey found that the proportion of self-reported losers from unification had fallen from 24 to 19%. Another survey on subjective well-being in East Germany asked whether individual living conditions improved or deteriorated since 1990 (Habich, Noll, and Zapf 1999). Whereas in 1993 23% of the respondents claimed a deterioration, by 1998 this share had fallen to only 16%. For those who might find the combination of econometrics, assumption and data in this paper somewhat mysterious, perhaps the proportions of self-proclaimed unification losers from these public opinion surveys helps to demonstrate a broad consistency between quite disparate and independent sources of evidence.

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<sup>26</sup> September 28, 2000.



**Table 6: Present value as of July 1, 1990 of cumulative 1991-98 unification bonuses/maluses**

Age group	Mean present value gain					
	Women		Men		Total	
	1991 DM (West)	relative to 1990 real income	1991 DM (West)	relative to 1990 real income	1991 DM (West)	relative to 1990 real income
25-34	26,363	1.69	27,228	1.75	26,790	1.72
35-44	19,017	1.20	22,493	1.37	20,812	1.29
45-54	20,652	1.20	25,231	1.46	22,882	1.33
55-64	41,038	3.02	25,743	1.62	34,318	2.40
65 and above	50,284	4.60	51,240	4.12	50,584	4.45
All, 25 and above	30,166	2.19	27,427	1.77	28,892	1.99

*Source: Authors' calculations based on GSOEP waves 1990 to 1998*

## 6 Conclusion

This paper provides the first application of newly calculated purchasing power parities between East and West Germany in order to provide a statistical picture of the evolution and distribution of the real economic gains and losses due to German unification within the new federal states. In contrast to previous studies we attempt to correct for two special aspects of GDR socialist reality that have prevented researchers from fully exploiting the unique 1990 nominal net household income data in East Germany from the GSOEP survey to compare with household income data from later surveys. The measurement of economic welfare attainable under the old GDR regime is greatly complicated by the fact that significant microeconomic quantity constraints (e.g. housing and automobiles) are known to have existed along with a system of indirect taxes and consumer price subsidies. Together these characteristics of GDR socialism meant that the relative purchasing power of the old GDR mark was quite different depending upon one's place in the income distribution. Similarly the system of material balances and quantity constraints as opposed to market supply and demand also had a significant distributional impact. The deflators that we have constructed, differentiated by equivalized income, are the keys needed to release the changes in economic welfare locked in the observed changes in nominal incomes.

Consistent with the general macroeconomic picture, we find a clear and overwhelming economic bonus on average for East Germans. Just as much a part of the story of postwall economic reconstruction are those who have suffered a unification malus, understood here to be a negative present-value of annual differences between the course of actual income and a counterfactual forecast of income in a frozen GDR. About 19 percent of the East German population older than 25 in 1990 and who remained in the sample until 1998 are identified as having experienced a unification malus. We have found that in contrast to what has been observed in other economies in transition from the old socialist order, elderly East Germans have not only gained much more than other age groups, but that for all intents and purpose our sample of East German elderly survived the fall of communism in a way that both Helmut Kohl and Vilfredo Pareto could score as an improvement in economic welfare. At the other end of the bonus distribution, the smallest average unification bonus was found for women between the ages of 35 and 44 at the time of German unification. Thirty percent of that group were identified as unification losers.

We are confident that our estimated proportion of economic ‘losers’ represents an upper bound since it was calculated under the assumption of static expectations for our GDR counterfactual. The GDR economy was riding a downward trend at the time of its political demise and few believe that it would have been able to even maintain 1989 living standards over the past decade. Thus while allowing for the psychological salience of the last days of the GDR, as an economic matter we have almost certainly overstated the number of economic losers.

To break the stranglehold of quantity constraints on the interpretation of consumer behavior under socialism it was necessary to import demand parameters from elsewhere. For most economists it would appear natural to assume that East Germans were actually just West Germans who were significantly poorer and more repressed. This critical assumption is necessary to justify using West German household budgets to construct deflators for East German households. Indeed had socialism changed consumer preferences, the use of West German preferences to interpret East German reality would represent a fundamental misspecification. Few would confuse the GDR with North Korea however.

Our attention has been limited to household income and its power to purchase consumer goods and services. The transformation of the East German economy of course involved a fundamental redefinition of many property rights. The capital gains from owning a modest family house on prime postwall land, the value of the family farm or the loss of a bargain housing rental to the heirs of an expropriated owner are not touched upon in this paper. In particular we have not attempted to assess the unification bonus with respect to asset holdings – as

opposed to equivalent income in this study – due to the lack of such data in the GSOEP.

It is also important to add what may seem to be an obvious qualification given the title of the paper, we have nothing to say here about the unification bonus or malus for West Germans. Between four and five percent of West German GDP every year has been the size of the net West to East transfer during the past decade. Comparing the average East German welfare gains with the average West German losses is a most interesting question, though probably a better use of scarce research time would be to identify the policy mistakes that still leave nearly one third of the East German potential working force in a social safety net financed by West Germany.

Having struggled to extract meaning from these data, we feel an obligation to provide a short list of promising leads for future research. The first item is an empirical matter regarding the housing rental component of the deflators used here. The critical housing cost PPP to bridge the gap between East and West in 1993 was not part of the survey of the German Federal Statistical Office of prices and is better characterized as expert opinion than a statistical average from a well designed survey. Furthermore housing constitutes probably the single most important expenditure item in family budgets and happens to have one of the most dramatic relative price changes in the move from socialism to social market.

The issue of the appropriate equivalence scale within a market economy at a point in time is just about as subtle as any in the measurement of economic welfare (cf. Lewbel 1997). Our choice of using the modified OECD scale has only the virtue in being comparable with a vast empirical literature on income distribution and while we find ourselves good company, we still believe that it is unlikely that one scale is going to fit all places and all times, least of all for economic transitions from central planning to market allocation. It is certainly our hope that future researchers will be able to remedy this weakness.

While the deflators upon which our estimates of the unification bonus are based do attempt to correct for the spillover of demand across aggregate spending categories, say, from consumer electronics to alcoholic beverages, this is only part of the story. What is still missing is the breadth of product variety in a market economy that was missing in the centrally planned economies. For example one could travel, but as a general rule one could not travel on holiday in the West. What is the value of the introduction of that single ‘new product’ with the fall of the Wall? This has been found to be an important shortcoming of traditional consumer price indexes for market economies, e.g. Hausman’s (1999) study that documents the welfare gains from the introduction of the new product

cell-phones in the U.S. To that extent we have further reason to believe that our estimates of unification 'losers' is an upper bound.

We conclude on a substantive note and point to a disturbing pattern that one can see in the evolution of the annual unification bonus over time. Completely consistent with the marked slowdown in GDP as seen in the first set of figures of this paper, the number of 'losers' appears to be rising at the end of our period of investigation. This comes as no surprise to those familiar with the economic and political situation in the new federal states. One may presume that GDR policy makers did not intend to waste a over a quarter of the East German labor force *either*. What the communist leadership lacked was the capacity to tap the West German taxpayer on anything approaching the scale of the unification bonus that we have estimated.

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## Appendix A: Illustrative calculation of the unification bonus for a woman with a median present value bonus

In the tables to follow we provide an illustrative calculation of the present value unification bonus. We have selected the case of the woman in our sample who happened to have received the median bonus. She was 34 years of age at the time of German monetary union in mid-1990, living in Saxony (i.e., not in Berlin). There were two children under age 16 living in her household. This illustrative calculation reveals her (median) bonus for the postwall period through 1998 was 24,754 DM.

The first step of the calculation is presented in Table A1 where the actual equivalized income from observed household net income is calculated for each year using the modified OECD equivalence scale<sup>27</sup>. As the 1990-income has been reported before monetary union it is given in East German marks (M), the amounts of the following years are expressed in nominal DM.

**Table A1: Calculation of nominal equivalized monthly income**

Year	1990	1991	...	1998
Actual monthly household net income	1600 M	2100 DM		3600 DM
Household size	4	4		3
Number of children under 16 in the household	2	2		0
Actual equivalised income calculated according to the modified OECD equivalence scale	761.9 M	1000 DM		1800 DM
Natural log of equivalized income calculated according to the modified OECD equivalence scale	6.6358	6.9078		7.4955

*Source: Authors' calculations based on GSOEP waves 1990 to 1998*

The log of nominal equivalized income in 1990 is the dependent variable for the linear regressions reported in the main text. The coefficient estimates presented

<sup>27</sup> The use of the OECD equivalence scale with its lower weights on children as opposed to, say, the scale implicit in the German Social Assistance scheme (Bundessozialhilfegesetz) can also be interpreted as a rough procedure to incorporate the extensive subsidization of children's clothing and childcare facilities in the former GDR. For the impact of different equivalence scales see Burkhauser, Smeeding and Merz (1996) or Atkinson, Rainwater and Smeeding (1995).



here are used to forecast equivalized income (in GDR prices) for 1991 to 1998. A crucial distinction is drawn between the individual's time-variant and time-invariant characteristics displayed in Table A2. This is relevant for the life cycle forecasts. Two other forecasts were obtained by simply assuming a zero or three percent growth rates for the counterfactual income streams in a GDR assumed to have survived the fall of the Berlin Wall. Obviously the time-invariant variables are held constant over the forecasted time periods. The time-variant variables are adjusted each year as described in Table A2.

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**Table A2: Time-variant and time-invariant variables for the income forecasts**

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*Time-variant Variables*

**Age** increases by one from year to year.

Age groups (25-34, 35-44, ...) are then adjusted accordingly.

**Tenure, Tenure squared:** set to zero at age 61 for women and age 66 for men. These are the gender-specific empirical retirement ages from our 1990 GSOEP cross-section.

**Labor force status:** Out of the labor force and unemployed [default], **Employed:** switches to zero as people reach the gender-specific empirical retirement age (61 for women and 66 for men), **Pensioner:** switches to one as people reach the gender-specific empirical retirement age

**Occupational status** (Unskilled, Skilled worker, Master craftsman, Farmer, Self employed, Executives) set to zero as people reach the gender-specific empirical retirement age

**Production sector** switches to zero at the gender-specific empirical retirement ages

*Time-invariant Variables*

**Schooling**

Basic level secondary schooling (9 years) [default],

No schooling, Medium level secondary schooling 10 years, High school diploma 13 years, Other diploma

**Additional education**

Apprenticeship [default],

No degree, College degree, University degree

**Job characteristics**

Employees with high qualification [default]

**Region**

Berlin [default]

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The impact of the most important time-varying variable can be seen from Figure 3 where the equivalent income – age profile is plotted. Under the assumption of static expectations we can use cross-section data to construct the life cycle of individuals, e.g. we assume there are no cohort or time effects, and proceed to the income forecasts. For the example of the woman from Saxony with the median-present-value-bonus, we adjust the time-varying variables over the relevant time period from 1990 to 1998 according to the description in Table A2. The median woman enters another age group over the time period and her tenure increases, whereas all other characteristics remain the same because

she continued working. At the empirical retirement age of 60 for women and 65 for men the retirement dummy switches to one and the participation dummy to zero. In the first two rows of Table A3 we present the fitted/forecasted values.

Due to the fact that the regression explains far less than one hundred percent of the variance, the income forecast for 1990 can of course differ quite substantially from the actual income in that year as seen in this illustrative case (third row of Table A3). To eliminate such an artificial fall from the actual equivalent income in 1990 to the fitted values of equivalent income in subsequent years, we calculate the growth rate of the preliminary income forecasts between two successive years using the preliminary income forecasts. This estimated growth rate is then used to adjust the true 1990 equivalent income, also shown in the last row of Table A3. Thus one is able to generate the forecasts for income valued at 1990 GDR prices.

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**Table A3: Adjustment of monthly income forecasts**

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	1990	1991
Logarithm of equivalized income forecast	6.6979	6.7222
Logarithm of actual equivalized income	6.6358	-6.9078
Unadjusted equivalized income forecast	838.68	859.31
Preliminary income forecast	838.68	859.31
Growth rate of preliminary income forecast	-	0.0246
Actual equivalized income	761.91	-
Equivalized income forecast (equals the preliminary income forecast times the growth factor)	761.91	780.65

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*Source: Authors' calculations based on GSOEP waves 1990 to 1998*

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To convert these income forecasts into income forecasts valued in 1991 West German marks we use the purchasing power parities from Collier (2001). A middle income Eastern German household in 1989 would have needed about 38 percent more DM income East Mark income in order to reach the same level of utility achieved at Eastern German prices with quantity constraints.

The GSOEP wave that we use as a basis for our forecasts was conducted in spring 1990. We have chosen to convert (Spring) 1990 income by 1989 purchasing power parities because people already anticipated the monetary union of July 1, 1990 in the first half of 1990. For this reason we would expect the 1989 official household budget data used for the calculated purchasing

power parities to be cleaner in the sense of being more representative of what the GDR economy really looked like before monetary union.

As Gottschalk and Smeeding (1998) have noted in the context of absolute international income comparisons, it is questionable “whether a single index is appropriate for all points in the distribution”. Precisely for this reason we use the three different purchasing power parities corresponding to different points of the GDR household income distribution as estimated by Collier (2001).

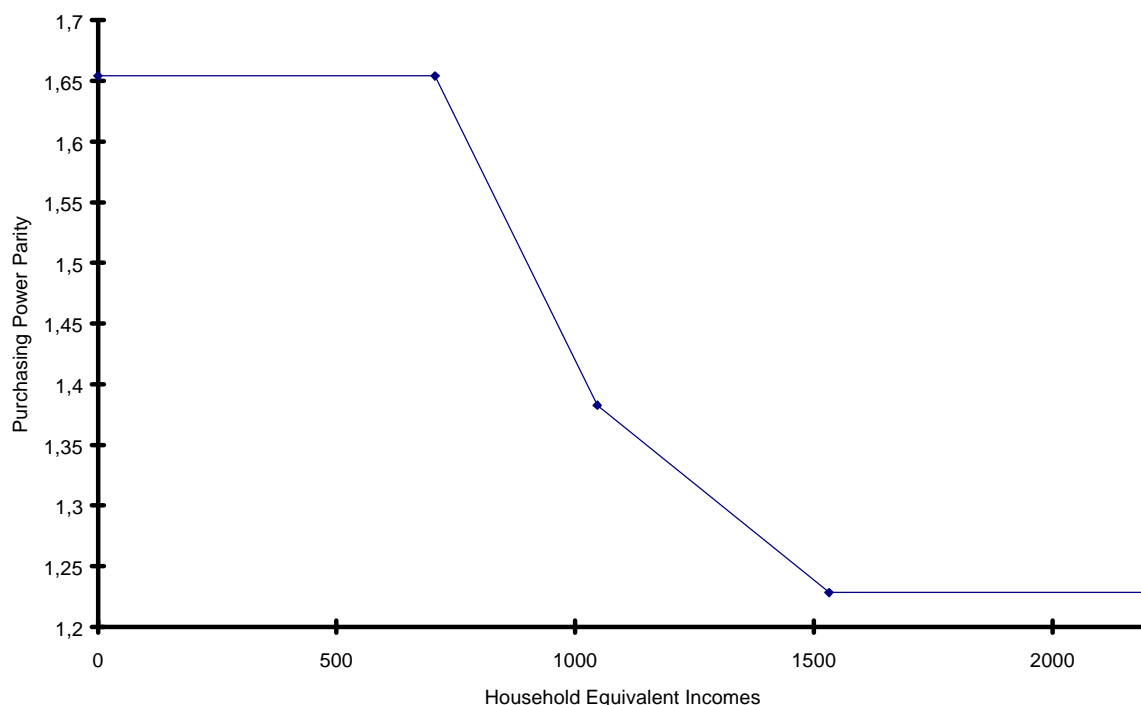
We have transformed reported household incomes by using the modified OECD equivalence scale under the assumption that in the type II and III households one of the two children is under age sixteen and the other is older. Thus we “equivilize” the household incomes in the three household types by dividing by 1.5 for type I and 2.3 for both types II and III.

These three household equivalent incomes with their respective purchasing power parities have been plotted using linear interpolation between the points as seen in Figure A1. With this empirical relationship between equivilized income and purchasing power parity of that income, we are able to convert nominal 1990 East German household equivalent incomes into 1991 DM values. This conversion is shown for our illustrative case of the median present-value-bonus woman in Table A4. Because the household equivalent income for this case is 762 Eastern Marks in 1990, slightly exceeding the first threshold of 707 Marks in Figure A1, her equivilized income has been deflated by a factor of 0.6238 obtained by interpolation. This results in a monthly real household equivalent income of 1222 in 1990 valued in DM for the year 1991.

For 1991 the median bonus woman had a forecast household equivalent income (recall that counterfactual incomes are always valued in constant GDR Marks) of 781 DM. This amount is slightly higher than her income in 1990 and so a higher deflator of 0.6302 is used to yield a real household equivalent income forecast of 1239 DM (1991) as seen in Table A4.

Similarly deflators for all other years are used to deflate observed monthly nominal incomes from GSOEP –the disposable income for eastern German households in unified Germany- to obtain real monthly incomes valued in 1991 DM.

**Figure A1: Purchasing Power Parities for different household equivalent incomes for 1990**



With the real household equivalent income and the real household equivalent income forecasts now measured in common units (1991 DM), we take differences to obtain our estimate of the annual real monthly unification bonus. In Table A4 below we see that the illustrative monthly bonus in 1991 was 109 DM (valued in 1991 Western prices).

Assuming a five percent annual real interest rate that translates into a monthly real interest rate of 0.407 percent, we transform the monthly bonus or malus into an annual bonus or malus. For this illustrative case we multiply the monthly malus of 109 DM by 11.69 to obtain the annual malus of 1270 DM in Table A4. Performing month-to-year calculations for each year from 1991 to 1998 and discounting each annual value using the five percent real annual interest rate, we find that the median unification bonus turns out to have had a present value of 24,754 DM in 1991 West German prices as of July 1, 1990.

Similar calculations were performed for each of the 1944 cases in our sample. These individual calculations - after sample re-weighting - are the data behind the tables and figures of the text.

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**Table A4: Calculation of real monthly/annual/present-value bonuses**

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	1990	1991
Household equivalent income	761.91	1000
Appropriate deflator	0.6238	0.7422
Real household equivalent income	1221.50	1347.41
Household monthly equivalent income forecast	761.90	780.65
Appropriate deflator	0.6238	0.6302
Real monthly household equivalent income forecast	1221.50	1238.78
Monthly unification bonus	0	108.63
Annual unification bonus (using five percent real annual interest rate)	0	1269.67
Present value unification bonus (for median woman) in 1991 DM at July 1. 1990	24,754	

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*Source: Authors' calculations based on GSOEP waves 1990 to 1998*

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## Appendix B

**Table B1: Sample characteristics 1990**

	<b>Women</b>		<b>Men</b>	
	Mean	Stan. Dev.	Mean	Stan. Dev.
<b>Individual characteristics</b>				
Age	45.27	13.39	44.15	11.86
Married	.78	.41	.88	.32
<b>Schooling</b>				
(Difference from basic level secondary schooling, 9 years)				
No schooling	.003	.05	.004	.06
Medium level secondary schooling, 10 years	.45	.50	.44	.50
High school diploma, 13 years	.12	.32	.19	.39
Other	.01	.10	.007	.08
<b>Additional education</b> (Difference from apprenticeship)				
No degree	.12	.32	.03	.16
College degree	.24	.43	.27	.44
University degree	.08	.27	.14	.35
<b>Job characteristics</b>				
Unskilled white/blue collar	.18	.38	.07	.25
Skilled worker	.11	.32	.34	.47
Master craftsman	.01	.11	.07	.25
Farmer	.05	.21	.12	.32
Self employed	.02	.13	.03	.18
Employees with high qualification	.38	.49	.25	.44
Executives	.01	.11	.03	.17
Tenure	10.23	10.34	14.05	11.60
Employed	.76	.42	.91	.28
Pensioner	.15	.36	.06	.23
<b>Region</b>				
(Difference from East Berlin)				
Mecklenburg-Vorpommern	.11	.31	.11	.31
Brandenburg	.15	.35	.15	.36
Sachsen-Anhalt	.19	.39	.18	.39
Thüringen	.19	.39	.19	.39
Sachsen	.30	.46	.30	.46
<b>Household characteristics</b>				
Children under 16 years in household	.48	.50	.50	.50
Household size	3.04	1.18	3.19	1.08
Total household income	1832.38	720.39	1963.37	634.41
Equivalent income (modified OECD-scale)	979.15	303.49	1029.35	291.90
Number of observations	1142		968	

*Source: Authors' calculations based on GSOEP waves 1990 to 1998*

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**Table B2: Share of losers (present value is negative of 1991-98 actual less constant 1990 equivalized income)**

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Age group (1990)	Women	Men	Total
25-34	0.13	0.18	0.15
35-44	0.13	0.16	0.15
45-54	0.25	0.21	0.23
55-64	0.22	0.26	0.24
65 and above	0.03	0.04	0.03
All ages, 25 years and above	0.16	0.19	0.17

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*Source: Authors' calculations based on GSOEP waves 1990 to 1998*

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**Table B3: Share of losers (present value is negative of 1991-98 actual less 3% per year trend equivalized income)**

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Age group (1990)	Women	Men	Total
25-34	0.31	0.32	0.31
35-44	0.28	0.36	0.32
45-54	0.36	0.36	0.36
55-64	0.36	0.44	0.39
65 and above	0.10	0.08	0.09
All ages, 25 years and above	0.29	0.34	0.31

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*Source: Authors' calculations based on GSOEP waves 1990 to 1998*

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