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Accounting for Poverty Differences between the United States, Great Britain, and Germany*

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Abstract. We propose a framework for comparing the relationship between poverty and personal characteristics across countries (or across years), and use it to compare levels and patterns of relative poverty in the USA, Great Britain and Germany during the 1990s. The higher aggregate poverty rates in the USA and in Britain relative to Germany were mostly accounted for by higher poverty rates conditional on characteristics, which were only partly offset by a more favourable distribution of poverty-relevant characteristics, in particular higher employment rates.

JEL-Classification: C31, D31, D63
Keywords: Poverty, Singh-Maddala Distribution

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1 Introduction

A large amount of research has been devoted to cross-national comparisons of poverty rates, and to describing trends in poverty over time for a number of countries.[1] By contrast, relatively little is known about the multivariate relationship between poverty and personal characteristics such as age, education, employment and sex. Information about this relationship is important, however, for two reasons. First, it helps identify the individuals who are vulnerable to poverty and can therefore improve the targeting of anti-poverty policy measures. Understanding the relationships between poverty and personal characteristics is also essential, second, if one wants to understand the factors giving rise to cross-national differences in poverty rates, or poverty trends for a given country. Poverty in a given country (or in a given year) may be low either because only few individuals in its population have characteristics that make them vulnerable to poverty or because the level of poverty *given* personal characteristics is low. To understand differences in poverty, it is therefore necessary to separate the influence of the distribution of poverty-relevant characteristics from the influence of the function that links poverty with personal characteristics.

This paper proposes a framework for studying the relationship between poverty and personal characteristics, and illustrates it with a cross-national comparison. We provide a shift-share counterfactual approach to account for poverty differences across countries or across time that can be easily implemented. The underlying statistical model addresses the problem that using a Probit or Logit regression model to relate poverty rates to personal characteristics has an undesirable property: higher poverty lines need not lead to higher poverty rates. Following Pudney (1999), this problem can be avoided if the income distribution conditional on personal characteristics ('the conditional income distribution'), is modelled directly. We do so using the Singh-Maddala (1976) specification. The advantages of the Singh-Maddala distribution are threefold: it accommodates sufficient flexibility to model heterogenous income data, estimation is easy, and one can obtain standard errors for all parameters of interest in a straightforward way. In the empirical application, we compare poverty in the USA, Great Britain and Germany – countries of particular interest because of the variations in the generosity of their tax and benefit systems and in the working of their labor markets. The USA is usually seen as the prototype of a liberal market economy with relatively little provision of social security by the state, Germany is regarded as a well-developed welfare state with a highly regulated labor market,

[1] See Jäntti/Danziger (2000) for a comprehensive overview. Also see Atkinson et al. (1995).

and Britain is positioned somewhere between these two extremes.

The rest of the paper is organized as follows. Section 2 describes our methods. Section 3 discusses the data, derived from four different sources: the Cross-National Equivalent File (CNEF), the Panel Study of Income Dynamics (PSID), the British Household Panel Survey (BHPS) and the German Socio-Economic Panel (GSOEP). Our empirical results are presented in section 4. Section 5 sums up and offers some concluding remarks.

2 Methods

In order to compare the relationships between poverty status and socio-economic characteristics, we propose a parametric model that directly specifies the income distribution as a function of individual or household characteristics. We assume that the conditional income distribution has the Singh and Maddala (1976) form, with cumulative distribution function (cdf)

$$F(x) = 1 - \left[\frac{1}{1+(x/b)^a}\right]^q, \tag{1}$$

where equivalent income $x \geq 0$ and parameters $a \geq 0, b \geq 0, q > 1/a$. The parameters a and q determine the shape of the distribution, whereas b is a scale parameter. With three parameters, the Singh-Maddala distribution is a flexible parametric distribution encompassing a wide range of distributional shapes. It is known to provide a good fit of income data in many situations (McDonald (1984); Brachmann et al. (1996)).

The corresponding probability density function (pdf) is

$$f(x) = (aq/b)\left[1+\left(\frac{x}{b}\right)^a\right]^{-(q+1)}\left(\frac{x}{b}\right)^{a-1}. \tag{2}$$

In order to allow the form of the income distribution (and thence poverty rates) to vary with characteristics, we introduce heterogeneity in each model parameter. That is, we assume

$$\begin{aligned} a_i &= \exp(w_i'\beta_1), \\ b_i &= \exp(w_i'\beta_2), \\ q_i &= \exp(w_i'\beta_3), \end{aligned} \tag{3}$$

where w_i is the $K \times 1$ vector of household characteristics of individual $i = 1 \ldots n$ and $\beta_1, \beta_2, \beta_3$ are $K \times 1$ parameter vectors. This is in contrast to Pudney (1999) who estimated a common

distribution semi-parametrically, and introduced individual heterogeneity only through a scale and a location parameter. Our approach is more flexible in that the whole shape of the distribution is determined by individual characteristics, but less flexible in that this shape is summarised parametrically rather than semi-parametrically.[2]

The poverty rate among individuals sharing the same set of characteristics w is defined as

$$p(t, w) = F(t|\beta, w), \tag{4}$$

given a poverty line t and a parameter vector $\beta = (\beta_1, \beta_2, \beta_3)'$. We shall summarise poverty using this 'headcount' poverty measure but, given the estimates of the pdf for incomes, it would be straightforward to also derive alternative summary measures, e.g. those taking account of the distribution of short-falls in income from the poverty line.[3]

The parameters β have no interpretation in themselves, but they can be used to illuminate the nature of the relationship between poverty and individual characteristics via comparisons of predicted poverty rates (which depend on β). We propose considering individuals with a set of benchmark characteristics w and to investigate whether a different set of characteristics w^* is associated with a higher or a lower poverty rate, and by how much. (This is similar to the calculation of 'marginal effects' in logit and probit models.) For example, to examine the impact of having more children on poverty risks for married couples with children, one may examine the change in poverty risk as the number of children is increased from one to two, or two to three. More formally, we consider 'poverty differentials' of the form

$$d(t, w^*, w) = p(t, w^*) - p(t, w) = F(t|\beta, w^*) - F(t|\beta, w). \tag{5}$$

The method of estimation of model parameters and poverty differentials, and their standard errors, is described in the Appendix.

[2] Gottschalk/Danziger (1995) also studied poverty using a parametric model (the three-parameter lognormal distribution). However their focus was on the relationship betweeen poverty, income growth, and income sources. Their model did not allow for individual-level heterogeneity. Thurow (1965) fitted beta distributions to the income distribution, but focused on the relationship between poverty and macroeconomic factors such as inflation and unemployment.

[3] See Seidl (1988) for a survey of poverty indices.

2.1 Accounting for poverty differences

In order to separate the influence of differences in the conditional poverty function on the one hand and differences in the distribution of poverty-relevant characteristics on the other, we propose a decomposition in the spirit of Oaxaca (1973) and Blinder (1973).

Aggregate poverty can be expressed as

$$P(t) = \int_w F(t|\beta, w) dG(w), \tag{6}$$

where $F(t|\beta, w)$ is the conditional poverty function (the poverty rate of the subpopulation with characteristics w), t the poverty line, and $G(\cdot)$ is the distribution of characteristics in the population.

Using this representation, the difference in poverty rates between country 1 and country 2 (or between year 1 and year 2) can be written as

$$\begin{aligned}
P_1(t_1) - P_2(t_2) &= \int_w F(t_1|\beta_1, w) dG_1(w) - \int_w F(t_2|\beta_2, w) dG_2(w) \\
&= \underbrace{\int_w F(t_1|\beta_1, w) dG_1(w) - \int_w F(t_2|\beta_2, w) dG_1(w)}_{\text{differences in conditional poverty function}} \\
&+ \underbrace{\int_w F(t_2|\beta_2, w) dG_1(w) - \int_w F(t_2|\beta_2, w) dG_2(w)}_{\text{differences in distribution of characteristics}} \\
&= [P_{11} - P_{21}] + [P_{21} - P_{22}] = C_I + D_I \qquad (7) \\
&= [P_{11} - P_{12}] + [P_{12} - P_{22}] = D_{II} + C_{II} \qquad (8) \\
&= [0.5\,(C_I + C_{II})] + [0.5\,(D_I + D_{II})] = C_S + D_S \qquad (9)
\end{aligned}$$

in obvious notation. The quantities in (7) and (8) can be estimated by replacing β_1 and β_2 by their estimates $\hat{\beta}_1$ and $\hat{\beta}_2$ and the population distribution function $G(w)$ by the distribution of characteristics in the sample $\hat{G}(w) = (\sum_{i=1}^n v_i)^{-1} \sum_{i=1}^n v_i \, 1\{w_i \leq w\}$, where v_i is the sample weight of individual i.

According to (7), the difference in poverty rates between country 1 and country 2 may be decomposed into a contribution due to cross-national differences in the conditional poverty function, $C_I = [P_{11} - P_{21}]$, and a contribution due to differences in the distribution of household

characteristics between the two countries, $D_I = [P_{21} - P_{22}]$. This is done by asking how high the poverty rate in country 1 would have been if the population there had faced the poverty function of country 2 and vice versa. Alternatively, decomposition (8) uses the same idea in the reverse order, leading to contributions D_{II} and C_{II}. A third decomposition, with a number of desirable properties (notably exact aggregation), is the so-called Shapley value decomposition, for which each contribution is the simple average corresponding contributions in the first two decompositions.[4]

3 Data

Our empirical analysis is based on the Cross-National Equivalent File (CNEF). The CNEF includes panel data for the USA, Great Britain, and Germany, and provides cross-nationally comparable information about income, employment and a number of demographic characteristics.[5] Additional variables were derived directly from the three sample surveys used to build the CNEF: the Panel Study of Income Dynamics (PSID), the British Household Panel Survey (BHPS) and the German Socio-Economic Panel (GSOEP).[6]

We focus on the year 1993 for our cross-national comparisons of poverty and its correlates (for reasons explained shortly) but, to put this analysis in context, we supplement this analysis with a comparison of poverty trends during the 1980s and 1990s.

We counted an individual as poor if the equivalent income of his or her household was less than the relevant country-specific poverty line. Denote household equivalent income by $x = h/e(\theta)$, where h is the individual's household income and $e(\theta)$ an equivalence scale dependent on household type θ. The equivalence scale we chose was the so-called square-root scale, which is now commonly used for cross-country comparisons.[7] This scale deflates household income by the square root of household size, i.e. $e(\theta) = \sqrt{s}$ for household size s. Following recent recommendations and practice of the Statistical Office of the European Commission for cross-

[4] See Shorrocks (1999) and Chantreuil/Trannoy (1999) for details of the Shapley value decomposition and its properties.

[5] The CNEF also includes some data for Canada. They are not used in this paper.

[6] For a more detailed description, see Burkhauser et al. (2001) or Lillard et al. (2002) for the CNEF, The Panel Study of Income Dynamics (2002) for the PSID, Taylor et al. (2001) for the BHPS, and Haisken-DeNew/Frick (2001) for the GSOEP.

[7] See e.g. Atkinson et al. (1995).

national poverty comparisons (Eurostat Taskforce 1998), we set the poverty line equal to 60 percent of contemporaneous national median income. This means that our focus is on relative poverty, and so poverty rates are potentially affected by the degree of inequality as well as the prevalence of low income per se.

Our use of a relative poverty line rather than an absolute poverty line (one that is fixed in real terms across years and countries) is potentially controversial. However, relative poverty lines are widely accepted in Europe.[8] The report of the US Research Council Panel on Poverty and Family Assistance also suggested that the US official poverty line should be updated in line with secular income Growth (Citro and Michael (1995)). As we are mainly interested in a cross-country comparison, it is important to apply the same poverty concept to all countries to ensure comparability.

All income calculations were based on the household post-tax post-transfer income variable that is provided in the CNEF. This variable is the annual sum of total household income from labor earnings, plus income from investments and savings, public and private pensions, and transfers, minus total household taxes and social insurance contributions. For the USA, we use the CNEF variable for which taxes were estimated using the National Bureau of Economic Research TAXSIM model. The CNEF household post-government income variable for Great Britain was constructed by Bardasi et al. (1999). The incomes of East and West Germans were adjusted for purchasing power differences using the indices provided in the CNEF-Codebook. We dropped observations with zero or negative equivalent income from each country's samples. This affected only a tiny fraction of the data, with only one exception. This concerned income for the US samples in income years 1994 and thereafter: these contained a suspiciously high number of zero incomes. Due to these problems, which probably have their root in the nature of the underlying PSID data,[9] no US income data from after 1993 were used in the main parts of our analysis.

As potential correlates of poverty, we chose the list of variables shown in Table 1. These variables characterize the age, education and employment structure of an individual's household and the sex of the household head. In particular, each variable represents the number

[8]The EU Council of Ministers defined people to be poor if their 'resources (material, cultural and social) are so limited as to exclude them from the minimum acceptable way of life in the Member State in which they live' (Council decision, 19 December 1984, quoted by Atkinson (1998)). See Atkinson (1998) for extensive discussion of European poverty lines.

[9] See the cautionary remarks on the PSID web page and in the documentation of the CNEF (Lillard et al. (2002)).

of household members that fell into each (mutually exclusive) age, education and employment category. Children were defined to be individuals aged 0 to 18 years. The variables summarizing educational qualifications were derived on the assumption that having A-levels, O-levels and CSEs in Great Britain, or Abitur and Lehre (apprenticeship) in Germany, were comparable to having a high-school graduation certificate in the USA.

— Table 1 about here —

The information about household characteristics in the CNEF was supplemented by employment and (for Great Britain) educational data from the original PSID/BHPS/GSOEP files. In our definition, an individual is either employed (dependently employed of self-employed), unemployed, retired or none of these. The aforementioned problems with the PSID income data after 1993, and the fact that 1993 is the most recent year in the PSID for which information on the unemployment and retirement status of an individual are available, makes this year the focus point of our cross-sectional comparisons.

Our definitions meant that there were repeated observations from each household in each year, with the number of repeats per household equal to household size. We took account of this 'clustering' of individuals when calculating standard errors for our estimates (see the Appendix). To maintain representativeness, we also used the sample weights provided in the CNEF.

4 A cross-national comparison of poverty rates and patterns

4.1 Poverty and its correlates

Poverty trends for the USA, Britain and Germany are shown in Figure 1 for selected years during the 1980s and 1990s. Regardless of the year considered, poverty rates in the USA and in Great Britain were much higher than in Germany. Poverty rates in Germany were up to 10 percentage points lower than in the USA and up to 7 percentage points lower than in Great Britain. Poverty rates in the USA increased at the beginning of the 1980s, but stayed relatively stable throughout the rest of the period for which reliable data is available. Poverty rates in

Great Britain ranged between 19 and 22 percent in the period from 1991 to 1999, with a slight downward trend apparent over the 1990s. The poverty rate in Germany fluctuated around 14 percent, with higher numbers for 1992 and 1993 when data for East Germany were included in the GSOEP for the first time. Poverty rates in Germany declined very slightly after 1992, partly reflecting relatively large income increases in East Germany during that period. The relatively flat trend in poverty in each country and the fact that there was no obvious link of poverty with the business cycle shows that focusing on a single year, 1993, is not problematic.

— Figure 1 about here —

The results from our parametric model are presented in terms of poverty differentials, as defined earlier.[10] We start with individuals from certain benchmark households w and examine whether a different set of characteristics w' is associated with a higher or a lower poverty risk. This is done by analyzing the conditional poverty rates $p(t, w)$ and the corresponding poverty differentials $d(t, w', w)$. Our choice of benchmark characteristics is motivated by the partition of the population into policy-relevant subgroups, namely lone mothers, 'double income no kids' households, families with children and pensioners.

Table 2 gives the results for individuals in lone mother households. The benchmark household consists of a lone mother aged between 18 and 41 years, high-school educated and employed, and one child. The first row of the table shows that individuals in these households faced very high poverty risks, ranging from 28 percent in Britain and Germany to almost 53 percent in the USA.

— Table 2 about here —

The rest of Table 2 shows poverty differentials. For example, US individuals belonging to a lone mother households with two children rather than one, but otherwise having the benchmark set of characteristics, was associated with having a poverty rate that was 7.34 percentage points higher. Individuals in lone mother households with more than two children faced even higher poverty risks (row 3). The effects of additional children were of a similar magnitude in the USA and Britain, but lower in Germany.

[10] The estimates of the model parameters are reported in Tables A1, A2, and A3 in the Appendix. The hypothesis that all parameters were jointly equal in all three countries was rejected at all conventional significance levels.

Education-related differentials for lone mother households were very large in the United States, smaller in Germany and much smaller in Britain (rows 4 and 5). In the USA, the poverty risk was reduced by almost 23 percent if the lone mother had more than a high-school degree. Unemployment meant extreme additional poverty risks for lone mothers and their children, especially in Great Britain (row 6). British unemployed lone mothers had poverty rates that were up to 43 percentage points higher than those of employed ones. The effects of unemployment were lower in Germany and the USA, but still higher than that of other characteristics. Non-employment had a similar but less severe effect (row 7).

Older lone mothers faced lower poverty risks in all three countries, although the effect in Britain was not as large as that in the USA or Germany (row 8). Similarly, lone fathers experienced much lower probabilities of being poor than lone mothers with the same characteristics (row 9). The size of this sex differential was extreme in the USA where lone fathers had poverty rates that were almost 25 percentage points lower than those of lone mothers with similar characteristics. The last two rows show that childless single households had considerably lower poverty rates than lone mother households, especially if the person in question was male.

Table 3 gives the corresponding results for individuals in 'double income no kids' households. The benchmark household in this case consists of two adults aged between 18 and 41 years, both high-school educated and employed. The household head is assumed to be male. Poverty risks of these individuals were clearly below average in all three countries (row 1). They were particularly low in Great Britain and Germany (2 to 3 percent). The next three rows of the table show that the double incomes considerably reduced the additional poverty risk associated with children. This is especially true in Germany where the presence of as many as three children was associated with a only 3.05 higher poverty rate.

— Table 3 about here —

Again, poverty differentials by education were very large in the USA and rather limited in Great Britain and Germany (rows 5 and 6). As in the case of lone mothers, unemployment was a major poverty risk, leading to poverty rates of over 50 percent if both adults were affected (rows 7 and 8). Non-employment of one household member had a similar effect (row 9). Poverty rates were slightly lower if both adults were aged between 42 and 64 rather than between 18 and 41 years, but this effect was not statistically significant (row 10). A person with the characteristics described above but living alone had a poverty risk that was 15 to 17

percentage points higher than a person in the corresponding two person household. Finally, the results for 'double income no kids' households confirm the sizeable sex differential in the USA already found for lone parents. Although a female-headed household of the type described did not have significantly higher poverty rates in Great Britain and Germany, the difference was large in the USA (+15.36 percentage points).

Table 4 presents the results for individuals in families-with-children households. Due to its large population share, this household type is of particular interest. Here, the benchmark case was defined as a four-person household consisting of two adults aged 18 to 41 years, one high-school educated and employed, the other non-employed, and two children. The household head is male. The first row of the table shows that the poverty rate for individuals from such households were slightly above the population average in all three countries. Again, the familiar ranking applies: the poverty rate was highest in the United States (32 percent), lower in Great Britain (25 percent) and lowest in Germany (17 percent).

— Table 4 about here —

Similarly to the case of lone mothers, a larger number of children was associated with drastically increased poverty rates (rows 2 to 5). These effects were most pronounced in Great Britain, where the poverty rate was increased by over 45 percentage points if the household had six instead of two children. On the other hand, provisions in the German welfare state such as tax breaks for children and transfers ('Kindergeld') seem to cushion better the adverse effects of children on personal income than in the USA or Britain.[11]

As in the previous cases, large poverty differentials by education reflect the more competitive labour market in the USA when compared to Britain or Germany (rows 6 and 7). At almost 30 percentage points, the gap in poverty rates between a household where the earner had more than a high-school degree and a household where the person in question had less than a high-school degree was much larger than the corresponding gap in Britain (15 percentage points) or Germany (12 percentage points).

If the only earner in the household were instead to be unemployed, there would be a large increase in poverty, particularly in Great Britain, while having two earners instead of only one was associated with considerably lower poverty risks (cf. rows 8 and 9). The presence of an

[11] See Jenkins/Schluter (2001) for a detailed comparison of why child poverty rates are higher in Britain than in Germany.

additional non-employed young adult was associated with lower rather than higher poverty rates (although this effect was only statistically significant for Germany; row 10). A possible explanation is that only parents who can afford to let their grown-up children live in their household do so. The older the age of the adult household members, the lower the poverty risk was, although this relationship was only statistically significant for Great Britain (row 11).

As for the cases of lone parent households and 'double income no kids' couples, belonging to a female-headed household meant drastically higher poverty rates in the USA and moderately higher rates in Britain and Germany (row 12). The last two rows of Table 4 compare the situation of a single employed man on the one hand and a non-employed lone mother with two children on the other – these two cases may be regarded as the products of a family split. While the now-single employed man could expect a reduction of his poverty risk by up to 8 percentage points (row 13), the non-employed lone mother and their children faced extreme poverty rates ranging from 58 percent in Germany to 72 percent in the USA (row 14).

Our last example of a representative household type is that of a retired couple. Here, the benchmark household consists of two pensioners aged 65 years or older. Both household members are high-school educated and the household head is male. Table 5 shows that the poverty rates for these kind of individuals were slightly above the population average rate in the USA and Germany but below it in Britain.

— Table 5 about here —

The poverty differentials associated with educational qualifications have the correct signs but standard errors are too large to make reliable inferences (rows 2 and 3). Poverty risks for pensioners living alone were considerably higher than for pensioner couples (rows 4 and 5), especially if the person in question was female. Again, the poverty differential between men and women was much larger in the USA than in Britain or Germany.

To sum up the findings from our parametric poverty model, poverty rates were typically much higher in the USA and in Great Britain than in Germany, but the influence of a given characteristic generally went into the same direction in each country. In all three countries, being in a household with many children was associated with a high poverty risk, most extremely in the USA and Britain and to a lesser extent in Germany. Similarly, the favourable effects of higher educational qualifications were most pronounced in the USA, and much less pronounced in Britain and Germany. In contrast, the effect of unemployment (and to a lesser extent non-

employment) – which was larger than those of any other risk factors – was largest in Great Britain and smaller in the USA and Germany. Among individuals in working age households, the older that household members were, the lower that poverty risks were, in all three countries. The most conspicuous difference between the USA on the one hand, and Britain and Germany on the other, was the large sex differential in the USA.

Taken together, the poverty rates of population subgroups in the USA were not only higher than in Britain and Germany but, in general, were also more dispersed across the population, i.e. more strongly correlated with certain individual and household characteristics. However, the fact that poverty rates for given population subgroups were generally higher in the USA than in Britain, and higher in Britain than in Germany can be only one part of an explanation for higher *overall* poverty rates in the USA and Great Britain. The question of whether this effect was reinforced or counteracted by the distribution of poverty-relevant characteristics in these countries is what we turn to examine now.

4.2 Accounting for cross-national poverty differences

Results derived from the application of our decomposition formulae are shown in Table 6. For example, the difference in estimated poverty rates between the USA and Great Britain $P_{11} - P_{22} = 0.0418$ can be written as the sum of a term representing differences in the conditional poverty function $C_I = 0.0709$ and a term representing differences in the distribution of characteristics $D_I = -0.0291$.

— Table 6 about here —

The contribution due to differences in the conditional poverty function was positive because poverty in the USA would have been lower if the British poverty function had applied there ($P_{11} > P_{21}$). In this sense, conditional poverty in Britain was lower than in the USA. In fact, differences in the conditional poverty function accounted for more than the actual difference in poverty rates (169.76 percent), requiring the contribution of differences in the distribution of characteristics to be negative (-69.76 percent). It was negative because poverty in Great Britain would have been lower if the distribution of household characteristics there had been as in the USA ($P_{21} < P_{22}$). Thus the distribution of poverty-relevant characteristics was more favourable in the USA than in Britain. The decomposition with the roles of the two countries reversed

(see columns 6 and 7) yielded similar results. Columns 8 and 9 give the average effects over the two possible decompositions (the Shapley decomposition).

By similar arguments, the large difference in poverty rates between the USA and Germany (row 2) was mostly accounted for by high conditional poverty rates in the USA. According to our estimates, the poverty rate in the USA would have been some 10 percentage points lower if the German poverty function had applied there (row 2, column 4). On the other hand, if the distribution of household characteristics in Germany had been as in the USA, the German poverty rate would have been about 5 percentage points lower (row 2, column 5). This means that higher conditional poverty rates in the USA were compensated to a large extent by a more favourable distribution of household characteristics (as in the US-Britain comparison).

The decomposition of the poverty difference between Great Britain and Germany (row 3) suggests that Britain also had an advantage in poverty-relevant characteristics over Germany, although this advantage was much smaller in magnitude than that of the USA (columns 5 and 7). Again, this effect was more than offset by higher conditional poverty rates in Great Britain, leading to a higher overall poverty rate.

As Table 1 shows, the advantage of the USA and Britain over Germany is mainly to be found in more favourable employment figures. The average number of employed persons in an individual's household was 1.2990 in the USA, 1.2037 in Britain, and only 0.9261 in Germany (sum of rows 3 to 5, 8 to 10 and row 14). On the other hand, unemployment was higher in Britain and Germany (0.1180 and 0.1283) than in the USA (0.0848, see sum of rows 6 and 11)). Non-employment was particularly high in Germany (0.6008 vs. 0.3195 and 0.3265 in the USA and Britain, sum of rows 7 and 13). Finally, the average number of pensioners in the US was considerably lower than in Britain or Germany (0.1987 vs. 0.3373 and 0.3578, sum of rows 12 and 15 to 17).

In order to test the robustness of our results we also conducted a more conventional decomposition of the poverty rate by population subgroups (defined in terms of household type). The results were similar to those based on our parametric model.[12]

[12]The results are available from the authors on request.

5 Summary and Conclusions

This paper has proposed a framework for studying the relationship between poverty and personal characteristics, and illustrated it with comparison of poverty levels and patterns in the USA, Great Britain and Germany.

The paper has demonstrated the usefulness of analysing poverty by means of a parametric model of the income distribution, with distributional shape allowed to vary with individual characteristics. We have also shown how estimates from such a model may be used to account for differences in poverty across countries (or across years), differentiating between differences in characteristic-conditioned poverty rates, and differences in the distributions of characteristics.

Application of our methods showed that poverty rates were higher in the USA and in Great Britain than in Germany, but the influence of different characteristics generally went into the same direction. In all three countries, a large number of children was associated with high poverty risks, to the greatest extent in the USA and Britain and to a lesser extent in Germany. Similarly, the favourable effects of higher educational qualifications was most pronounced in the USA, and much less pronounced in Britain and Germany. In contrast, the effect of unemployment (and to a lesser extent non-employment) – which was larger than those of any other risk factors – was largest in Great Britain and smaller in the USA and Germany. In working age households, older age of household members was associated with lower poverty risks in all three countries. The most conspicuous difference between the USA on the one hand and Britain and Germany on the other was the extreme sex differential in the USA.

Despite having a similar structure in all three countries, poverty conditional on personal characteristics was generally higher in the USA than in Britain or in Germany. In fact, most of the poverty difference between the United States and Britain and between the USA and Germany was accounted for by higher conditional poverty rates in the United States. This effect was partly compensated by the more favourable distribution of household characteristics in the USA where higher employment rates protected many households from slipping into poverty and a smaller share of pensioner households in the population kept the overall poverty rate from being even higher. Similarly, most of the poverty difference between Great Britain and Germany was attributable to higher conditional poverty rates in Britain. Differences in population composition played a smaller role than between the USA and Britain or the USA and Germany. However, Britain seems to have had a slight advantage over Germany in form of a more favorable employment structure.

Poverty conditional on personal characteristics reflects both the structure of wages as formed in the labour market and also the intervention of the state through the tax and transfer system, while the composition of the population is determined by all kinds of economic and demographic mechanisms. Our results are consistent with a view that sees a dilemma between high employment rates and a highly dispersed income distribution on the one hand and a more equal income distribution at the cost of higher unemployment on the other hand. For example, the higher employment rate but also the marked educational and sex differentials in the USA are most likely to be a result of a more flexible labour market. On the other hand, the multitude of benefits, transfers and tax regulations in the German welfare system seem to cushion the effects of risk factors such as unemployment, low educational qualifications or a large number of children enough to keep the share of people at the very bottom of the income distribution at a minimum. The British case nicely fits into this picture as a mixture of the other two cases.

6 Appendix

We estimate the model parameters β by maximizing the pseudo log-likelihood function

$$\ln L = \sum_{i=1}^{n} v_i \ln l_i = \sum_{i=1}^{n} v_i \left[\ln(a_i) + \ln(q_i) - (q_i + 1) \ln \left[1 + \left(\frac{x_i}{b_i} \right)^{a_i} \right] - a_i \ln(b_i) + (a_i - 1) \ln(x_i) \right] \tag{10}$$

where v_i is the sample weight of individual i. The asymptotic covariance matrix of the estimates is calculated by the methods described in Binder (1983) (see also Skinner et al. (1989), p. 80). These methods take account of the clustering of our observations at the household level. The covariance matrix of $\hat{\beta}$ was then used to obtain standard errors for the conditional poverty rate $p(t, w)$ and the differentials $d(t, w, w^*)$ via the δ-method.

The variance of $\hat{\beta}$ was estimated as

$$\widehat{\text{var}}(\hat{\beta}) = \left[\frac{\partial^2 \ln L(\hat{\beta})}{\partial \hat{\beta} \partial \hat{\beta}'} \right]^{-1} \widehat{\text{var}} \left(\ln L(\hat{\beta}) \right) \left[\frac{\partial^2 \ln L(\hat{\beta})}{\partial \hat{\beta} \partial \hat{\beta}'} \right]^{-1} \tag{11}$$

with

$$\widehat{\text{var}} \left(\ln L(\hat{\beta}) \right) = \frac{n_h}{n_h - 1} \sum_{j=1}^{n_h} (z_j - \bar{z})(z_j - \bar{z})', \tag{12}$$

and

$$z_j = \sum_{l \in H_j} v_l \frac{\partial \ln L(\hat{\beta})}{\partial \hat{\beta}}, \tag{13}$$

where $\bar{z} = n_h^{-1} \sum_{j=1}^{n_h} z_j$ and H_j denote households $j = 1 \ldots n_h$.

Variance estimates for the conditional poverty rate $p(t, w)$ and poverty differentials $d(t, w^*, w)$ were calculated as

$$\widehat{\text{var}}(p(t, w)) = \left[\frac{\partial p(t, w)}{\partial \hat{\beta}} \right] \widehat{\text{var}}(\hat{\beta}) \left[\frac{\partial p(t, w)}{\partial \hat{\beta}'} \right] \tag{14}$$

and

$$\widehat{\text{var}}(m(t, w^*, w)) = \left[\frac{\partial m(t, w^*, w)}{\partial \hat{\beta}} \right] \widehat{\text{var}}(\hat{\beta}) \left[\frac{\partial m(t, w^*, w)}{\partial \hat{\beta}'} \right]. \tag{15}$$

The estimates of β are shown in Tables A1, A2, and A3.

— Table A1 about here —

— Table A2 about here —

— Table A3 about here —

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8 Figures

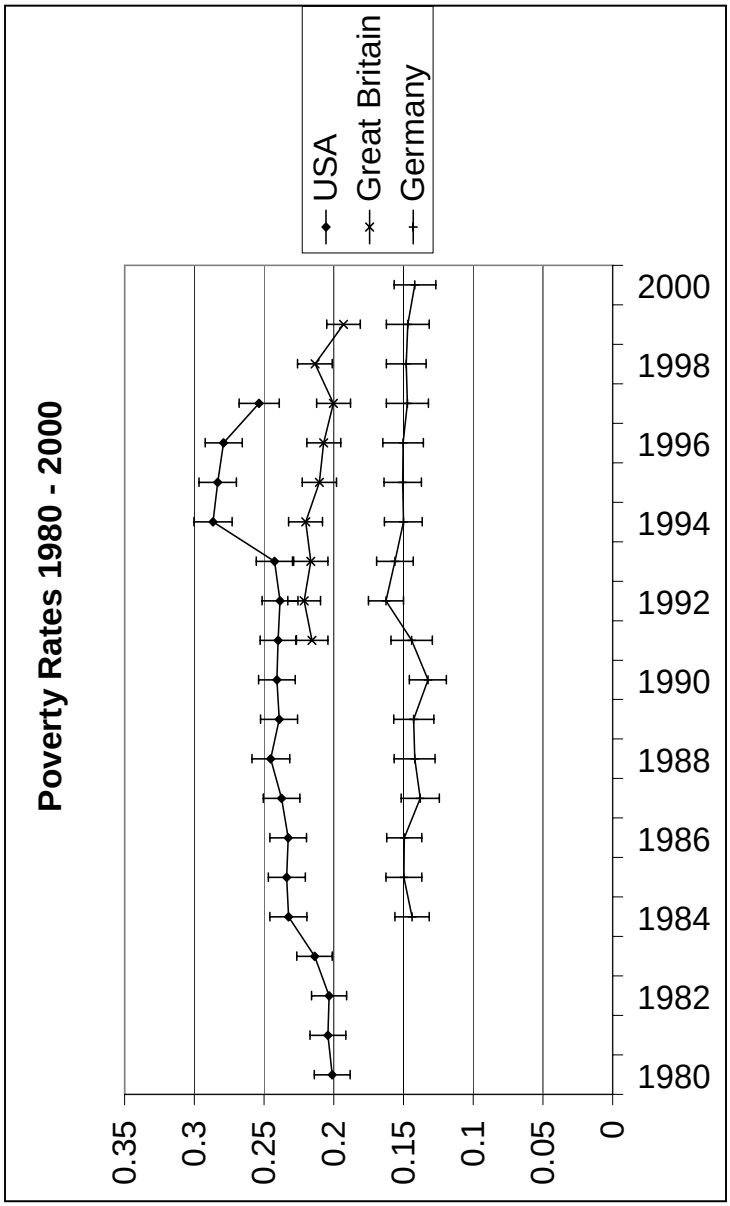

Figure 1: Poverty rates 1980 - 2000
(i) USA 1994 - 1997 based on uncleaned PSID release
(ii) estimates for Germany include East from 1992 on
(Vertical bars show 95 % confidence intervals)

9 Tables

Table 1. Variables and sample means, 1993. (Standard errors in parentheses.)

Variables		USA	Britain	Germany
Poverty rate		24.25	21.65	15.62
		(0.66)	(0.62)	(0.67)
General household characteristics	female household head	0.2210	0.3660	0.3199
		(0.0062)	(0.0077)	(0.0083)
	# of children in household	1.1717	0.6573	0.8097
		(0.0222)	(0.0172)	(0.0222)
# of household members 18 - 41 years	employed, more than high-school	0.3882	0.1238	0.1126
		(0.0097)	(0.0063)	(0.0065)
	employed, high-school	0.3469	0.4303	0.3497
		(0.0103)	(0.0119)	(0.0104)
	employed, less than high-school	0.0755	0.0943	0.0797
		(0.0048)	(0.0056)	(0.0051)
	unemployed	0.0699	0.0795	0.0756
		(0.0044)	(0.00530)	(0.0053)
	non-employed/other	0.2133	0.1931	0.4221
		(0.0073)	(0.0080)	(0.0113)
# of household members 42 - 64 years	employed, more than high-school	0.2498	0.0844	0.0986
		(0.0094)	(0.0057)	(0.0054)
	employed, high-school	0.1650	0.2117	0.2138
		(0.0072)	(0.0086)	(0.0080)
	employed, less than high-school	0.04887	0.2308	0.0689
		(0.0039)	(0.0092)	(0.0046)
	unemployed	0.0199	0.0385	0.0527
		(0.0025)	(0.0036)	(0.0038)
	retired	0.0501	0.0732	0.1193
		(0.0038)	(0.0049)	(0.0056)
	non-employed/other	0.1062	0.1334	0.1787
		(0.0058)	(0.0070)	(0.0080)
# of household members over 64 years	employed	0.0247	0.0224	0.0028
		(0.0025)	(0.0027)	(0.0010)
	retired, more than high-school	0.0370	0.0179	0.0274
		(0.0032)	(0.0021)	(0.0024)
	retired, high-school	0.0570	0.0417	0.1285
		(0.0040)	(0.0035)	(0.0063)
	retired, less than high-school	0.05177	0.2045	0.0826
		(0.0035)	(0.0082)	(0.0046)
	non-employed/other	0.0407	0.0441	0.0067
		(0.0030)	(0.0034)	(0.0016)

Source: CNEF, PSID, BHPS, GSOEP, weighted data.

Standard errors account for clustering of individuals in households.

Table 2.

Poverty and poverty differentials for individuals in lone mother households, 1993.
Mother aged 18 - 41, high-school educated and employed, one child.
(Standard errors in parentheses.)

	USA	Britain	Germany
Poverty rate (in percent)			
	52.92	28.33	28.15
	(2.57)	(1.93)	(3.84)
Poverty differentials (in percentage points)			
Two children (instead of one)	7.34	5.95	4.17
	(0.78)	(0.88)	(1.73)
Three children (instead of one)	15.06	14.04	9.26
	(1.45)	(1.82)	(3.32)
more than high-school (instead of high-school)	-23.22	-3.19	-17.27
	(2.81)	(3.72)	(3.80)
less than high-school (instead of high-school)	12.75	9.57	2.20
	(3.68)	(4.99)	(4.59)
unemployed (instead of employed)	22.27	42.63	34.02
	(3.55)	(4.30)	(5.99)
non-employed (instead of employed)	14.03	38.95	25.46
	(3.69)	(2.77)	(4.93)
Aged 42 - 64 years (instead of 18 - 41)	-11.00	-4.83	-11.80
	(3.60)	(2.43)	(4.73)
Lone father (instead of lone mother)	-24.31	-7.61	-5.76
	(1.74)	(1.40)	(2.28)
Childless female (instead of lone mother)	-6.73	-4.20	-3.40
	(0.85)	(0.84)	(1.76)
Childless male (instead of lone mother)	-28.67	-11.25	-8.11
	(1.91)	(1.60)	(3.42)

Source: CNEF, PSID, BHPS, GSOEP, weighted data.

Standard errors account for clustering of individuals in households.

Table 3.

Poverty and poverty differentials for 'double income no kids' households, 1993.
Two adults aged 18 - 41 years, both high-school educated and employed, male household head.
(Standard errors in parentheses.)

	USA	Britain	Germany
Poverty rate (in percent)			
	8.77	1.77	3.23
	(1.44)	(0.45)	(1.28)
Poverty differentials (in percentage points)			
One child (instead of no children)	2.60	1.07	0.71
	(0.41)	(0.20)	(0.44)
Two chilrden (instead of no children)	6.13	3.23	1.69
	(0.95)	(0.57)	(0.98)
Three children (instead of no children)	10.90	7.74	3.05
	(1.64)	(1.44)	(1.68)
Both more than high-school (instead of high-school)	-7.24	0.18	-3.03
	(1.45)	(1.12)	(1.26)
Both less than high-school (instead of high-school)	20.33	6.64	0.31
	(4.40)	(3.14)	(1.87)
One person unemployed (instead of employed)	18.10	10.32	9.31
	(2.25)	(1.32)	(1.87)
Two persons unemployed (instead of employed)	45.09	49.83	35.21
	(6.03)	(6.91)	(8.91)
One person non-employed (instead of employed)	13.32	13.54	9.28
	(1.58)	(1.32)	(1.53)
Both 42 - 64 years old (instead of 18 - 41)	-4.14	-0.69	-2.48
	(1.96)	(0.57)	(1.38)
One person household (instead of two person)	15.48	15.30	16.81
	(1.69)	(1.34)	(2.22)
Female household head (instead of male)	15.36	1.41	1.83
	(2.13)	(0.41)	(0.66)

Source: CNEF, PSID, BHPS, GSOEP, weighted data.

Standard errors account for clustering of individuals in households.

Table 4.

Poverty and poverty differentials for individuals in couples-with-children households, 1993.
Two adults aged 18 - 41 years, one high-school educated and employed,
the other non-employed, two children, household head is male.
(Standard errors in parentheses.)

	USA	Britain	Germany
Poverty rate (in percent)			
	31.99	24.79	17.32
	(2.03)	(1.81)	(3.06)
Poverty differentials (in percentage points)			
Three children (instead of two)	6.56	8.24	3.50
	(0.79)	(1.08)	(3.50)
Four children (instead of two)	14.28	19.39	8.03
	(1.57)	(2.40)	(2.95)
Five children (instead of two)	23.05	32.66	13.85
	(2.28)	(3.59)	(4.66)
Six children (instead of two)	32.52	45.67	21.21
	(2.87)	(4.13)	(6.64)
Earner more than high-school (instead of high-school)	-15.94	-4.80	-11.10
	(1.95)	(2.78)	(2.89)
Earner less than high-school (instead of high-school)	13.77	10.05	1.19
	(2.93)	(3.44)	(2.89)
Earner unemployed (instead of employed)	24.93	36.01	28.06
	(3.23)	(3.31)	(4.14)
Both adults high-school and employed	-17.09	-19.79	-12.40
	(1.66)	(1.59)	(1.90)
Additional non-employed person aged 18 - 41	-1.83	-0.99	-5.10
	(2.18)	(1.65)	(1.58)
Adults aged 42 - 64 (instead of 18 - 41)	-5.96	-9.11	-6.36
	(3.42)	(2.49)	(3.87)
Female household head	27.68	7.81	7.30
	(1.99)	(1.40)	(1.54)
Single male employed (instead of family)	-7.74	-7.72	2.72
	(2.19)	(1.80)	(3.82)
Lone mother and children (instead of family)	40.37	45.44	41.00
	(3.08)	(2.73)	(4.53)

Source: CNEF, PSID, BHPS, GSOEP, weighted data.

Standard errors account for clustering of individuals in households.

Table 5.

Poverty and poverty differentials for individuals in retired couple households, 1993.
Two pensioners aged 65 years or older, both high-school educated, male household head.
(Standard errors in parentheses.)

	USA	Britain	Germany
Poverty rate (in percent)			
	31.64	12.10	22.32
	(3.92)	(2.69)	(6.40)
Poverty differentials (in percentage points)			
Both more than high-school (instead of high-school)	-2.49	-11.79	-17.78
	(6.86)	(2.75)	(6.85)
Both less than high-school (instead of high-school)	17.41	20.07	12.29
	(6.56)	(4.06)	(12.18)
One male pensioner (instead of couple)	5.80	17.13	15.78
	(2.94)	(3.71)	(4.50)
One female pensioner (instead of couple)	30.33	25.55	21.25
	(3.41)	(5.00)	(4.80)

Source: CNEF, PSID, BHPS, GSOEP, weighted data.

Standard errors account for clustering of individuals in households.

Table 6. Decomposition of cross-national poverty differences, 1993.
(The numbers in parentheses are percentages of the total difference.)

1	2	$P_{11} - P_{22}$	$\underbrace{P_{11} - P_{21}}_{C_I}$	$\underbrace{P_{21} - P_{22}}_{D_I}$	$\underbrace{P_{12} - P_{22}}_{C_{II}}$	$\underbrace{P_{11} - P_{12}}_{D_{II}}$	C_S	D_S
US	GB	0.0418	0.0709	-0.0291	0.1276	-0.0858	0.0993	-0.0575
		(100)	(169.76)	(-69.76)	(305.42)	(-205.42)	(237.44)	(-137.44)
US	G	0.0520	0.1025	-0.0505	0.1460	-0.0939	0.1243	- 0.0722
		(100)	(197.01)	(-97.01)	(280.63)	(-180.63)	(238.94)	(-138.94)
GB	G	0.0150	0.0159	-0.0009	0.0272	-0.0122	0.0216	0.0066
		(100)	(106.36)	(-6.36)	(181.51)	(-81.51)	(143.67)	(-43.67)

C_I, C_{II} is the part of the poverty difference accounted for by differences in the conditional poverty function

D_I, D_{II} is the part of the poverty difference accounted for by differences in the distribution of characteristics

C_S (Shapley) is the average over C_I and C_{II}

D_S (Shapley) is the average over D_I and D_{II}

Table A1. Parameter estimates for β_1. (Standard errors in parentheses.)

Variables		USA '93	Britain '93	Germany '93
General household	female household head	-0.0300	-0.0826	0.0427
characteristics		(0.0410)	(0.0336)	(0.0489)
	# of children in household	0.0246	0.0643	0.0381
		(0.0136)	(0.0163)	(0.0338)
# of household members	employed, more than high-school	0.4948	0.3450	0.6067
18 - 41 years		(0.0362)	(0.0699)	(0.0758)
	employed, high-school	0.3249	0.5227	0.4051
		(0.0330)	(0.0387)	(0.0739)
	employed, less than high-school	0.2174	0.4434	0.4108
		(0.0555)	(0.0894)	(0.0702)
	unemployed	0.0587	0.1265	0.2708
		(0.0507)	(0.0435)	(0.0513)
	non-employed/other	0.0733	0.0536	0.1732
		(0.0376)	(0.0357)	(0.0609)
# of household members	employed, more than high-school	0.6275	0.4541	0.6974
42 - 64 years		(0.0470)	(0.0759)	(0.1071)
	employed, high-school	0.4070	0.5181	0.5495
		(0.0445)	(0.0444)	(0.0659)
	employed, less than high-school	0.3258	0.4068	0.4801
		(0.0617)	(0.0397)	(0.0748)
	unemployed	-0.0019	0.1686	0.1101
		(0.1008)	(0.0638)	(0.1101)
	retired	-0.0012	0.2622	0.2120
		(0.0798)	(0.0730)	(0.0768)
	non-employed/other	-0.0688	0.2644	0.0352
		(0.0440)	(0.0562)	(0.0559)
# of household members	employed	0.4987	0.4527	0.2644
over 64 years		(0.1527)	(0.1840)	(0.3054)
	retired, more than high-school	0.0164	0.5624	0.3456
		(0.0521)	(0.1062)	(0.1210)
	retired, high-school	0.2433	0.3376	0.2307
		(0.0620)	(0.1188)	(0.1160)
	retired, less than high-school	0.1045	0.3762	0.1984
		(0.0484)	(0.0442)	(0.1225)
	non-employed/other	0.1816	0.2984	0.0656
		(0.0974)	(0.1036)	(0.2239)
Constant		0.3907	0.5234	0.5241
		(0.0579)	(0.0465)	(0.0768)

Source: CNEF, PSID, BHPS, GSOEP, weighted data.

Standard errors account for clustering of individuals in households.

Table A2. Parameter estimates for β_2. (Standard errors in parentheses.)

Variables		USA '93	Britain '93	Germany '93
General household	female household head	-0.3189	-0.0310	-0.2095
characteristics		(0.1100)	(0.0477)	(0.0624)
	# of children in household	-0.1348	-0.1778	-0.1020
		(0.0216)	(0.0186)	(0.0436)
# of household members	employed, more than high-school	-0.1206	0.1465	-0.1098
18 - 41 years		(0.0528)	(0.0629)	(0.0781)
	employed, high-school	0.0949	0.0073	-0.0086
		(0.0624)	(0.0371)	(0.0781)
	employed, less than high-school	-0.0672	-0.1504	0.0178
		(0.1120)	(0.0565)	(0.0486)
	unemployed	0.0079	0.1136	-0.0611
		(0.1165)	(0.0905)	(0.0618)
	non-employed/other	-0.0317	-0.0512	-0.1226
		(0.0630)	(0.0505)	(0.0610)
# of household members	employed, more than high-school	-0.0842	0.1876	-0.1333
42 - 64 years		(0.0554)	(0.0655)	(0.0756)
	employed, high-school	-0.0709	0.0258	-0.1472
		(0.0598)	(0.0410)	(0.0730)
	employed, less than high-school	-0.1279	0.0037	-0.1010
		(0.1673)	(0.0376)	(0.0787)
	unemployed	0.2702	-0.0604	-0.2505
		(0.3250)	(0.0861)	(0.1348)
	retired	-0.1715	-0.0221	-0.2190
		(0.2021)	(0.1043)	(0.0997)
	non-employed/other	0.1757	-0.1608	0.0594
		(0.1351)	(0.0516)	(0.0893)
# of household members	employed	-0.4744	-0.1692	0.4666
over 64 years		(0.1822)	(0.2020)	(0.2588)
	retired, more than high-school	0.5736	0.1087	-0.1921
		(0.1457)	(0.1328)	(0.1511)
	retired, high-school	-0.0762	-0.1212	-0.1280
		(0.1270)	(0.2029)	(0.1058)
	retired, less than high-school	0.3617	-0.2284	-0.0911
		(0.1955)	(0.0857)	(0.1408)
	non-employed/other	-0.3210	-0.1373	-0.1385
		(0.3444)	(0.1666)	(0.2859)
Constant		10.4829	9.4487	10.9022
		(0.1190)	(0.0786)	(0.1506)

Source: CNEF, PSID, BHPS, GSOEP, weighted data.

Standard errors account for clustering of individuals in households.

Table A3. Parameter estimates for β_3. (Standard errors in parentheses.)

Variables		USA '93	Britain '93	Germany '93
General household	female household head	0.1223	0.1189	-0.1671
characteristics		(0.1749)	(0.1041)	(0.1502)
	# of children in household	-0.0144	-0.1400	-0.0195
		(0.0414)	(0.0410)	(0.1089)
# of household members	employed, more than high-school	-0.7647	-0.7333	-1.2677
18 - 41 years		(0.0942)	(0.1408)	(0.1960)
	employed, high-school	0.1729	-0.6091	-0.4246
		(0.1708)	(0.0952)	(0.2134)
	employed, less than high-school	0.0920	-0.7556	-0.2507
		(0.2278)	(0.1518)	(0.1722)
	unemployed	0.2942	0.3159	0.2349
		(0.2058)	(0.2346)	(0.2099)
	non-employed/other	0.0245	-0.1332	-0.3038
		(0.1252)	(0.0915)	(0.1605)
# of household members	employed, more than high-school	-1.0072	-0.8188	-1.6755
42 - 64 years		(0.0984)	(0.1489)	(0.1916)
	employed, high-school	-0.3514	-0.7867	-1.0899
		(0.1355)	(0.1001)	(0.1807)
	employed, less than high-school	-0.0715	-0.4617	-0.6081
		(0.3647)	(0.0980)	(0.2204)
	unemployed	0.2154	-0.3087	-0.5200
		(0.5592)	(0.1975)	(0.3084)
	retired	-0.1769	-0.3818	-0.5713
		(0.2602)	(0.2110)	(0.2259)
	non-employed/other	0.2590	-0.4742	0.0251
		(0.2093)	(0.1124)	(0.2184)
# of household members	employed	-1.2672	-1.0660	-0.4551
over 64 years		(0.3018)	(0.4437)	(0.5969)
	retired, more than high-school	0.6465	-0.7843	-1.1154
		(0.2178)	(0.3043)	(0.3094)
	retired, high-school	0.1851	-0.6874	-0.3866
		(0.2291)	(0.3782)	(0.2402)
	retired, less than high-school	0.9455	-0.4138	-0.1159
		(0.4012)	(0.2033)	(0.2754)
	non-employed/other	-0.2841	-0.3574	-0.4292
		(0.5054)	(0.3380)	(0.5377)
Constant		1.2754	1.4991	2.0420
		(0.1767)	(0.1469)	(0.3230)

Source: CNEF, PSID, BHPS, GSOEP, weighted data.

Standard errors account for clustering of individuals in households.