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**Poverty Measurement
Under Risk Aversion
Using Panel Data**

Guillermo CRUCES,
Paul MAKDISSI,
et
Quentin WODON

UNIVERSITÉ DE SHERBROOKE
Faculté des lettres et sciences humaines
Département d'économique

Poverty Measurement Under Risk Aversion Using Panel Data

Guillermo Cruces* Paul Makdissi† Quentin Wodon‡

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Abstract

This paper shows how to take into account risk aversion when measuring poverty under income variability. An application to British panel data suggests that income and poverty comparisons between the self-employed and other groups of households are sensitive to assumptions on the degree of risk aversion. The results point to the importance of panel data in order to account for risk aversion and income variability in the measurement of poverty.

Keywords: Poverty, Risk, Self-employment, Panel data

JEL Codes: I32, D81

* STICERD, London School of Economics, Houghton Street, London, WC2A 2AE, United Kingdom; Email: g.a.cruces@lse.ac.uk.

† Département d'économie and CEREF, Université de Sherbrooke, 2500, boulevard de l'Université, Sherbrooke, Québec, Canada, J1K 2R1; Email: paul.makdissi@USherbrooke.ca.

‡ AFTPM, World Bank, 1818 H Street, NW, Washington, DC 20433, USA, Email: qwodon@worldbank.org.

1 Introduction

While some types of workers may have higher expected earnings than other types, they may also have a higher variability in earnings. To the extent that the workers in the first group are risk-averse, and that credit markets do not allow them to fully insure against fluctuations, such variations in earnings may have large negative impacts on welfare. In this case income and poverty comparisons between the two groups of workers may be misleading if they do not consider risk aversion.

In this paper, we show how to take into account income variability when estimating poverty under risk aversion with panel data. While most of the work on risk and poverty focuses on the impact of covariant or idiosyncratic shocks on movements in and out of poverty¹, we follow a different approach by directly incorporating risk into the measurement of income and thereby of poverty. We apply the standard concepts of risk aversion and certainty-equivalent income, and a specific functional form for capturing the effect of risk aversion on utility. We first compute risk-adjusted income measures at the individual and household levels (and for various groups of individuals or households defined according to the occupation of the individual or household head). Thereafter, we use these computed incomes to estimate risk-adjusted poverty measures. The method follows the approach proposed by Makdissi and Wodon (2003) for computing risk-adjusted measures of inequality. In this case, we apply the method to poverty instead, showing also how to construct long term risk-adjusted relative poverty measures when we have many years of data at our disposal.

Two types of effects are at play with our proposed method to compute risk-adjusted poverty measures. First, we may observe lower poverty than at any point in time because we are averaging income over time using panel data, which mitigates the impact of shocks. However, this effect may be more than offset by another effect related to the disutility arising from income fluctuations in the presence of risk aversion. While the net impact of the two effects is uncertain *a priori*, it is likely that as risk aversion increases,

¹See among others Bradbury et al. (2001), Dercon and Krishnan (2000), Jalan and Ravallion (2000), and McCulloch and Baulch (2000).

the second effect takes prominence with respect to the first.

Our empirical illustration of the methodology relies on British household panel data and focuses on a comparison of the poverty of self-employed workers, as compared to that of salaried workers, retirees and the non-working population. We focus on the self-employed, or rather on individuals or households whose head is self-employed, because self-employment has become more common in many OECD countries over the last two decades, growing at double the rate of growth of civilian employment as a whole. In the United Kingdom especially, the non-agricultural self-employment rate basically doubled between the late 1970s and the late 1990s (Parker, 2003).

Furthermore, it is well known that while the self-employed may enjoy higher mean earnings over time, they may also experience a higher variability in income flows. There are several reasons for this. First, as noted in the literature on firm dynamics, small businesses can easily go bankrupt, leading to a higher variance of earnings among the self-employed. As pointed out by Jovanovic (1982), entrepreneurs do not know their exact level of ability before starting a venture. Therefore, the likelihood to fail is high, but those who survive may exhibit high returns to experience by having learned gradually over time how to operate a business. The market-based selection process at work among small firms implies that for any given level of human capital or experience, the inequality in earnings is likely to be wider among the self-employed than among other groups, which incidentally also explains why standard wage regressions have been found to have less explanatory power among the self-employed (Rees and Shah, 1986; Borjas and Broners, 1989).²

Second, the self-employed form a highly heterogenous group, and this heterogeneity may have increased over time (for data on the United Kingdom, see Parker, 1997, 1999). While those working in sectors providing professional services (such as banking, finance and business services, and to a lower extent sectors such as construction) may be doing well, others among the self-employed are often poor, especially in lower skill level service-oriented professions, in agriculture and in small scale manufacturing. For those among the self-employed who are the least qualified, the instability of income is an additional worry apart from the low average level of income

²We are grateful to William Maloney for discussions on this topic.

that they manage to earn.

Our empirical results using British household panel data suggest that income and poverty comparisons between individuals or between households whose head is self-employed and other individual or household groups are indeed sensitive to the assumptions on the degree of risk aversion of the individual or households. That is, as the level of risk aversion of the individual or household increases, the poverty measures obtained for individuals or households whose head is self-employed deteriorate much faster than the poverty measures observed for other groups of individuals or households. This in turn may have policy implications for the types of safety nets to be provided for the self-employed. Our results also show the importance of collecting panel data on income in order to be able to appropriately take into account risk in the measurement of poverty.

2 Data and Methodology

The data used here come from waves one to nine – the period 1991 to 1999 – of the British Panel Household Survey³ (Taylor 1995; ESRC 2001). The sample is restricted to individuals or households⁴ with valid derived net annual household income in all waves (on the derivation, see Bardasi, Jenkins and Rigg 2001). Incomes are equivalized with Mc Clement’s scale before housing costs and deflated by the CPI to January 1998 prices. In order to isolate the effect of income variability from growth, incomes are normalized by their annual mean, so that mean income every year is always equal to one. We use a relative poverty line z which is set at half the annual mean income, as done in most applied work on the UK. Given that incomes are normalized, $z = 0.5$. The final data set has nine yearly observations for either 4370 individuals or 2891 households depending on the samples used in the

³The data (and tabulations) used in this paper were made available through the UK Data Archive. The data were originally collected by the ESRC Research Centre on Micro-social Change at the University of Essex, now incorporated within the Institute for Social and Economic Research. Neither the original collectors of the data nor the Archive bear any responsibility for the analyses or interpretations presented here.

⁴We will define precisely the different samples used –whether individuals or households– in the sensitivity analysis below.

estimations.

We compute both short term and long term income and poverty measures. For individual or household i , short term income is the annual equivalized and normalized income at time t , denoted by x_{it} . Denoting the sample size by n , the number of the poor by q , and ordering incomes from the lowest to the highest, the short term *FGT* (Foster, Greer and Thorbecke 1984) poverty measures are

$$FGT(x_t, \alpha) = \frac{1}{n} \sum_{i=1}^q (1 - 2x_{it})^\alpha. \quad (1)$$

To estimate long-term risk-adjusted income and poverty, we assume that utility follows a Constant Relative Risk Aversion (CRRA) function. Denoting by T the number of periods and by ρ the constant Arrow-Pratt relative risk aversion coefficient, the certainty equivalent income y_i is

$$y_i = \begin{cases} \left[\frac{1}{T} \sum_{t=1}^T x_{it}^{1-\rho} \right]^{\frac{1}{1-\rho}} & \text{if } \rho \neq 1 \\ y_i = \prod_{t=1}^T x_{it}^{1/T} & \text{if } \rho = 1 \end{cases}. \quad (2)$$

For the estimation of risk-adjusted poverty, we simply replace x_{it} by y_i in the above expression for the FGT measures (adjusting the number of the poor q accordingly). If there is no risk aversion ($\rho = 0$), y_i is simply \bar{x}_i , the mean of the individual's or household's normalized incomes x_{it} over the nine years, in which case the averaging may well lead to a reduction in the observed poverty measures. However, under relatively high levels of risk aversion, we would expect the poverty measures to increase, especially for those individual or household groups which suffer from a higher volatility in incomes.

Note that cases with reported zero incomes in the surveys at any point in time cannot in principle be included in the estimation, since y_i is not defined for $x_{it} = 0$ when $\rho > 1$ (Equation 2). Such cases were very rare in our data, however. In the case of individuals, for example, only 27 out of 39930 observations had valid zero incomes. For computational convenience, and in order to work with the same data for all values of the risk-aversion parameter, these 27 observations were assigned a value of one tenth of the year's mean income.

3 Sensitivity Analysis

We will consider two types of tests for the sensitivity of our results to methodological assumptions, regarding the way we obtain our adjusted incomes and the relevant samples for the estimations.

The first type of sensitivity analysis concerns the possible bias introduced by the predictable variations in income. When estimating y_i , we are controlling for average growth in mean incomes over time, in order not to consider such growth as variability. Note that this does not affect poverty measurement for any given period since we use relative poverty measures with a poverty line defined in terms of half the mean contemporaneous income. But what about predictable variations in income at the household level? Arguably, some households see their income growing (or being reduced) over time, and if this is predictable, it should not affect negatively the value of y_i .

In order to test the robustness of our comparisons to assumptions regarding the predictability of changes in income at the household level over time, we first compute the certainty equivalent income based on a Taylor approximation of (2), which can be used for relatively small values of ρ

$$y_i^T(\rho) = \bar{x}_i - \frac{1}{2}R_A(\rho)\sigma_{x_i}^2. \quad (3)$$

Here, $\sigma_{x_i}^2$ is the variance of the household's stream of incomes and R_A is the Arrow-Pratt measure of absolute risk aversion

$$R_A(\rho) = \frac{\rho}{x_i} \quad (4)$$

We then replace in (3) the observed variance $\sigma_{x_i}^2$.

Finally, as an additional robustness check, we also use a smaller estimated value of $\sigma_{x_i}^2$ in (3), equal to the variance of a trend-line regression for each household. The implicit assumption is that only variations away from the trend line represent risk and should therefore be accounted for in the risk-adjusted measures of income and poverty. Four trends are fitted to the nine observations of each household: $x_{it} = \alpha + \beta t + e_i$, $x_{it} = \alpha + \beta \log t + e_i$, $\log x_{it} = \log \alpha + \beta t + e_i$, and $\log x_{it} = \log \alpha + \beta \log t + e_i$. For each household, the regression with the highest R^2 is chosen, and the detrended

Taylor approximation is

$$y_i^D(\rho) = \bar{x}_i - \frac{1}{2}R_A(\rho)\sigma_{e_i}^2. \quad (5)$$

This procedure is crude and *ad hoc*, but it is still useful to test for the robustness of comparisons of risk-adjusted income and poverty to assumptions regarding the predictability of changes in income over time at the household level.

The second type of sensitivity analysis concerns the relevant samples on which we carry out our analysis, namely whether we should consider individuals or households for our income and poverty measures.

The baseline estimates that we will present correspond to estimates of poverty for all the individuals who were 15 or older in 1991 and remained in the sample during the 9 rounds. This includes both heads of household and other household members. The weights used for the estimation are the last wave's longitudinal enumerated weights provided by the BHPS. The job status corresponds to each individual's most common work status over the period under review. We will consider four different categories: self-employed individuals, salaried individuals, retired individuals, and "others" (unemployed, students and those who are not in any of the other categories). The income variable for each individual is the household's net equivalized income, since poverty is a household-based concept and we want to take into account the needs of households of different size and composition.

One potential drawback of using all the individuals from the balanced panel is that we do not take into account children and family size in the analysis of poverty. While our income measure is equivalized, our sample includes only adults, or more precisely individuals aged 15 years or older for which the employment category is recorded. Note also that in some cases, individuals with different work status will have the same income since we use household income in the analysis and we might have more than one household member per round.

The alternative is to use households as the unit of analysis, and to provide poverty estimates on a household (taking into account household weight) or on a population basis (taking into account household weight and size). Since a household will typically have more than one individual aged 15 or more,

we need a rule to allocate the household as a whole to one of the four employment categories mentioned above. We chose to classify the household as self-employed, salaried, retired, and “other” on the basis of the most usual job status of the household head. The results from these alternative estimations, qualitatively very similar to the ones discussed in the next section, are discussed in the appendix.

4 Application to UK data

Table 1 gives our baseline short term and long term FGT poverty measures with $\alpha = 0, 1$ and 2. Remember that these estimates only take into account individuals aged 15 or over. We discuss household based estimates in the appendix. The average of the nine short term headcounts is 15. percent, which is slightly lower (due to our sample selection) but consistent with other estimates (Jenkins 2000, Jenkins, Rigg and Devicienti 2001). We also report the long term poverty measures for ρ equal to 0, 1 and 2. These are the values typically used in the literature. Arrow (1971) has argued on theoretical grounds that ρ should be around 1, but Friend and Blume (1975) have presented empirical evidence based on portfolio holdings that the coefficient may be around 2, and Hildreth and Knowles (1982) have obtained estimates between 1 and 2.

When using mean income (i.e., when assuming that $\rho = 0$), the long term headcount is much lower (10.1 percent) than the average of the short term measures, due to smoothing introduced by averaging incomes over a relatively long period of time. However, as ρ increases, income is reduced and poverty increases, for both the headcount and the measures of severity of poverty (poverty gap and squared poverty gap). With $\rho = 2$, the certainty equivalent income is 0.9211 (versus 1.000 when $\rho = 0$, which means that 7.7 percent of mean income is “lost” due to risk), yielding a headcount of 16.3 percent. Note in Table 1 that the values for the Taylor approximation are close to the “exact” values for low values of ρ , but start to diverge slightly for $\rho = 2$.

In Table 2, we compare income and poverty measures for four groups, according to whether the individual is self-employed (6.4 percent of the pop-

ulation), salaried (44.91 percent of the population), retired (31.13 percent of the population), or in neither of these three categories (17.56 percent). Note that since we have observations for a period of nine years, and individuals may change status, we need a rule to allocate them to the various categories. As mentioned earlier, anyone who belonged to one category in at least five periods was classified as such. All others, including the unemployed and students, were classified as “other”. The relatively large proportion of individuals who are classified as retired is due to the fact that we are using a balanced panel. The resulting sample excludes those who entered the labour force during the period in review.

A few findings stand out. First, individuals who are working have higher levels of household income and lower probabilities of being poor than individuals who are not working. Second, despite similar expected levels of household income, individuals who are self-employed tend to be poorer than individuals who are salaried. Although this is not documented here, this is essentially because inequality among the self-employed (a fairly diverse group) is higher than among salaried workers (Parker, 1997), and this translates directly into household income even if in some cases, having one household member self-employed and one member salaried is a way to smooth income shocks. Also, because retirees form a more homogenous group, there is less inequality among them than among the “other” category, which means again that despite roughly similar average levels of income, poverty is lower among retirees than among the “others” (the “homogeneity” of retirees in terms of income is probably due in large part to the social security system).

Does the way in which we account for income variability in risk-adjusted measures of income and poverty affect the ranking of the groups? That is, are our comparisons between groups sensitive to the choice of value for ρ ? They are, to some extent. For example, the straight mean expected long-term relative income ($\rho = 0$) of self-employed individuals, 1.23, is higher than that of salaried individuals, 1.18 (Table 2). By contrast, for ρ equal to one or higher, salaried individuals have a higher risk-adjusted income than self-employed individuals. In terms of poverty, most rankings are robust to the choice of the risk aversion parameter, at least up to $\rho = 2$ (for higher values of ρ , poverty among the self-employed becomes higher than among

retired individuals).

The magnitude of the differences in poverty measures between groups clearly does depend on the assumptions for risk aversion. Poverty measures tend to increase much faster with risk aversion among the self-employed than among other groups, as expected. For instance, the poverty headcount for $\rho = 0$ is 4.52 percent for the self-employed and 15.23 percent for the retired, but this difference becomes relatively lower with higher levels of the risk aversion parameter: for $\rho = 2$, the headcounts are 15.26 and 21.08 percent respectively, with similar patterns for the poverty gap and the squared poverty gap.

We mentioned earlier in the methodological section that while we are controlling for the income variability due to growth in the estimation (since we are using relative poverty measures with a poverty line defined in terms of mean income), we do not control for predictable household level income variability. Are the income and poverty comparisons robust to assumptions regarding the predictability of income variability at the household level? To answer this question, we need to compare the Taylor detrended measures with the “exact” measures in Table 2. In most instances, detrending does not affect the income and poverty comparisons. That is, the detrended Taylor measures yield only slightly higher incomes and slightly lower poverty than the exact measures, suggesting that in the aggregate, the noise in the measure of risk introduced by upward or downward mobility may be limited.

Finally, does the use of individual versus household weights, and the choice of method to classify individuals and households to the four categories of work status affect the results? As mentioned in the methodological section, we estimated another set of income and poverty measures by using household observations instead of individual observations, by classifying households according to the main job status of the household head, and by computing income and poverty measures both with household and population weights (in the later case, we also take into account household size apart from the household weight). The results are given in the Appendix, and they are fairly similar to those for individuals aged 15 years or more presented in Tables 1 and 2.

5 Conclusion

Analysts often rely on cross-sectional statistics on income to assess the level of poverty, but these results do not reflect the risk component associated with income variability. In this paper, we have provided a simple method for estimating (long-term) risk-adjusted measures of poverty. The method is based on the concept of certainty equivalent income, standard in the risk literature. While averaging income data over time using panel data may reduce poverty measures by mitigating the impact of negative shocks, this effect may be more than offset when the disutility from income fluctuations due to risk aversion is taken into account. The application to long-term relative poverty comparisons in Britain suggested that income and poverty comparisons may be affected by the assumptions used to take into account the disutility induced by risk. More generally, the sensitivity of income and poverty comparisons to issues related to income variability shows the importance of collecting panel data in order to be able to appropriately take into account risk in the measurement of poverty.

A Appendix

In this appendix we briefly review the results obtained with alternative definitions of the samples and the weights employed in the calculations.

For the results discussed in the main body of the paper, we used a balanced panel of 4370 individuals. The BHPS is a complex survey with many different weights (e.g., individual cross section enumerated and respondent weights, as well as longitudinal enumerated and respondent weights for the individuals present in all the rounds). We chose to weight the observations for our main results by the last round's longitudinal enumerated weights.

As discussed in the sensitivity analysis section, we could also rely on household level analysis, weighted (or not) by household size. These are the estimations presented in tables A1 to A4, using data on 2891 households present in the nine rounds of the survey from 1991 to 1999.

Note that there are no panel household weights in the BHPS, because the survey follows all individuals as households split. We thus used for

each round the household’s cross sectional weights. Note also that for the intertemporal results (i.e., income averages and risk adjusted incomes over the 9 years), we used the weights of the last round. Using weights of a different round did not make much difference in the results. Moreover, as discussed in the text, we chose to classify the household as self-employed, salaried, retired, and “other” on the basis of the most usual job status of the household head (irrespective of who the head is, since over a long period it can rotate within a household).

Tables A1 and A2 present our results using households rather than individuals aged 15 and over as the unit of observation, weighting by household weights and household size (these results are representative of the whole population). Tables A3 and A4 present the results when we use household weights only, representing the proportion of households. Note that household-based poverty measures are larger than population-based measures. While this may sound counter-intuitive, it is essentially due to the use of our equivalence scale (per capita measures would result in the more usual result of higher poverty measures on a population as opposed to a household base because then larger households tend to be considered as much poorer.)

The more important finding is that in terms of our risk adjusted poverty estimates, essentially all the conclusions mentioned in the main body of the text apply also for these alternative results. For example, income and poverty measures for the households assigned to the self-employed group are much more sensitive to the assumptions made for risk aversion than other groups of households.

References

- [1] Arrow, K.J. (1971), *Essays in the Theory of Risk-Bearing*, North-Holland, Amsterdam.
- [2] Bardasi, E., S.P. Jenkins, and J.A. Rigg (2001), Documentation for derived current and annual net household income variables, BHPS waves 1-9.
- [3] Borjas, G.J. and S.G. Bronars (1989), Consumer Discrimination and Self-Employment, *Journal of Political Economy* 97: 581-605.
- [4] Bradbury, B., S. P. Jenkins, and J. Micklewright, editors, 2001, *The Dynamics of Child Poverty in Industrialised Countries*, Cambridge University Press, Cambridge.
- [5] ESRC (2001), Economic and Social Research Council Research Centre on Micro-Social Change, *British Household Panel Survey* [computer file]. Colchester, UK: The Data Archive [distributor], 28 February 2001-Data files and associated documentation. SN: 4340.
- [6] Dercon, S., and P. Krishnan (2000), Vulnerability, Seasonality and Poverty in Ethiopia, *Journal of Development Studies* 36:25-53.
- [7] Foster, J., J. Greer, and E. Thorbecke (1984), A class of decomposable poverty measures, *Econometrica* 52: 761-65.
- [8] Friend, I. and M. E. Blume (1975), The Demand for Risky Assets, *American Economic Review* 65: 900-922.
- [9] Hildreth, C. and G.J. Knowles (1982), Some Estimates of Farmers' Utility Functions, Technical Bulletin 335, Agricultural Experimental Station, University of Minnesota.
- [10] Jalan, J., and M. Ravallion (2000), Is Transient Poverty Different? Evidence for Rural China, *Journal of Development Studies* 36:82-99.
- [11] Jenkins, S. P. (2000), Modelling household income dynamics, *Journal of Population Economics* 13: 529-567.

- [12] Jenkins, S.P., J.A. Rigg, and F. Devicienti (2001), Dynamics of Poverty in Britain, Department of Work and Pensions Research Report Number 157, Leeds:CDS.
- [13] Jovanovic, B. (1982), Selection and Evolution of Industry, *Econometrica* 50:649-670.
- [14] McCulloch, N., and B. Baulch (2000), Simulating the Impact of Policy Upon Chronic and Transitory Poverty in Pakistan, *Journal of Development Studies* 36:100-130.
- [15] Makdissi, P., and Q. Wodon (2003), Risk-Adjusted Measures of Wage Inequality and Safety Nets, *Economics Bulletin* 9(1): 1-10.
- [16] Parker S. C. (1997), The Distribution of Self-Employment Income in the United Kingdom: 1976-1991, *Economic Journal*, 107:455-466.
- [17] Parker S. C. (1999), The inequality of employment and self-employment incomes: a decomposition analysis for the UK, *Review of Income and Wealth* 45:263-74.
- [18] Parker S. C. (2003), The Distribution of Wealth of Older Self-Employed Britons, *Fiscal Studies* 24:23-43.
- [19] Rees, H. and A. Shah (1986), An Empirical analysis of Self-employment in the U.K., *Journal of Applied Econometrics* 1:95-108.
- [20] Taylor, M.F. (ed.) (1995): British Household Panel Survey User Manual Volume A: Introduction, Technical Report and Appendices. Colchester: ESRC Research Centre on Micro-Social Change, University of Essex.

**Table 1: Short Term and Long Term Relative Poverty
Share of Individuals Aged 15 and Over, Britain 1991-1999**

Year	Mean Income	Headcount	Poverty Gap	Squared Poverty Gap
Short term				
1991	1.0000	0.1409	0.0331	0.0135
1992	1.0000	0.1606	0.0384	0.0163
1993	1.0000	0.1625	0.0377	0.0148
1994	1.0000	0.1622	0.0379	0.0157
1995	1.0000	0.1554	0.0355	0.0135
1996	1.0000	0.1574	0.0343	0.0130
1997	1.0000	0.1561	0.0368	0.0149
1998	1.0000	0.1575	0.0366	0.0147
1999	1.0000	0.1471	0.0349	0.0159
Long term				
Exact				
$\rho=0$	1.0000	0.1009	0.0147	0.0035
$\rho=1$	0.9604	0.1292	0.0222	0.0065
$\rho=2$	0.9211	0.1632	0.0393	0.0183
Taylor				
$\rho=0$	1.0000	0.1009	0.0147	0.0035
$\rho=1$	0.9555	0.1314	0.0224	0.0073
$\rho=2$	0.9110	0.1641	0.0430	0.0355
Taylor detrended				
$\rho=0$	1.0000	0.1009	0.0147	0.0035
$\rho=1$	0.9692	0.1234	0.0207	0.0079
$\rho=2$	0.9384	0.1417	0.0350	0.0317

Source: Authors' estimates using rounds 1-9 of the BHPS, 4370 individuals per round, weighted by the last round's longitudinal enumerated weight. The poverty line is defined as half the mean contemporaneous income, and all incomes are normalized by the contemporaneous mean income. See text for details on sample, weights and poverty measures.

**Table 2: Long Term Poverty Measures with Different Levels of Risk Aversion
Share of Individuals Aged 15 and Over, Britain 1991-1999**

	Mean income			Headcount			Poverty Gap			Squared Poverty Gap		
	$\rho=0$	$\rho=1$	$\rho=2$	$\rho=0$	$\rho=1$	$\rho=2$	$\rho=0$	$\rho=1$	$\rho=2$	$\rho=0$	$\rho=1$	$\rho=2$
Exact												
Self Employed	1.2302	1.1371	1.0498	0.0452	0.0778	0.1526	0.0048	0.0100	0.0330	0.0017	0.0030	0.0134
Salaried	1.1817	1.1475	1.1140	0.0181	0.0263	0.0432	0.0019	0.0031	0.0085	0.0003	0.0006	0.0032
Retired	0.8233	0.7936	0.7635	0.1523	0.1812	0.2108	0.0187	0.0264	0.0420	0.0035	0.0071	0.0189
Other	0.7648	0.7133	0.6603	0.2421	0.3186	0.3893	0.0439	0.0677	0.1160	0.0123	0.0219	0.0576
Taylor												
Self Employed	1.2302	1.1204	1.0105	0.0452	0.0819	0.1429	0.0048	0.0109	0.0525	0.0017	0.0030	0.0499
Salaried	1.1817	1.1415	1.1012	0.0181	0.0283	0.0425	0.0019	0.0039	0.0165	0.0003	0.0012	0.0295
Retired	0.8233	0.7897	0.7561	0.1523	0.1855	0.2232	0.0187	0.0263	0.0440	0.0035	0.0071	0.0247
Other	0.7648	0.7140	0.6631	0.2421	0.3170	0.3776	0.0439	0.0672	0.1057	0.0123	0.0248	0.0650
Taylor detrended												
Self Employed	1.2302	1.1571	1.0841	0.0452	0.0661	0.0990	0.0048	0.0076	0.0339	0.0017	0.0023	0.0397
Salaried	1.1817	1.1561	1.1305	0.0181	0.0233	0.0324	0.0019	0.0031	0.0092	0.0003	0.0006	0.0096
Retired	0.8233	0.7983	0.7732	0.1523	0.1780	0.2036	0.0187	0.0243	0.0377	0.0035	0.0058	0.0174
Other	0.7648	0.7260	0.6871	0.2421	0.3037	0.3272	0.0439	0.0642	0.0966	0.0123	0.0322	0.1104

Source: Authors' estimates using rounds 1-9 of the BHPS, 4370 individuals per round, weighted by the last round's longitudinal enumerated weight. The poverty line is defined as half the mean contemporaneous income, and all incomes are normalized by the contemporaneous mean income. See text for details on sample, weights and poverty measures.

**Table A1: Short Term and Long Term Relative Poverty
Share of Population, Britain 1991-1999**

Year	Mean Income	Headcount	Poverty Gap	Squared Poverty Gap
Short term				
1991	1.0000	0.1340	0.0347	0.0148
1992	1.0000	0.1471	0.0384	0.0168
1993	1.0000	0.1537	0.0370	0.0140
1994	1.0000	0.1562	0.0369	0.0150
1995	1.0000	0.1484	0.0364	0.0136
1996	1.0000	0.1543	0.0357	0.0136
1997	1.0000	0.1538	0.0393	0.0171
1998	1.0000	0.1595	0.0409	0.0175
1999	1.0000	0.1446	0.0358	0.0160
Long term				
Exact				
$\rho=0$	1.0081	0.1088	0.0165	0.0040
$\rho=1$	0.9685	0.1308	0.0242	0.0070
$\rho=2$	0.9293	0.1645	0.0398	0.0166
Taylor				
$\rho=0$	1.0081	0.1088	0.0165	0.0040
$\rho=1$	0.9629	0.1342	0.0251	0.0079
$\rho=2$	0.9177	0.1687	0.0480	0.0422
Taylor detrended				
$\rho=0$	1.0081	0.1088	0.0165	0.0040
$\rho=1$	0.9771	0.1277	0.0225	0.0075
$\rho=2$	0.9462	0.1448	0.0379	0.0313

Source: Authors' estimates using rounds 1-9 of the BHPS, 2891 households per round, weighted by the cross sectional household weight and by size. The poverty line is defined as half the mean contemporaneous income, and all incomes are normalized by the contemporaneous mean income. See text for details on sample, weights and poverty measures.

Table A2: Long Term Poverty Measures with Different Levels of Risk Aversion
Share of Population, Britain 1991-1999

	Mean income			Headcount			Poverty Gap			Squared Poverty Gap		
	$\rho=0$	$\rho=1$	$\rho=2$	$\rho=0$	$\rho=1$	$\rho=2$	$\rho=0$	$\rho=1$	$\rho=2$	$\rho=0$	$\rho=1$	$\rho=2$
Exact												
Self Employed	1.1276	1.0416	0.9583	0.0813	0.0970	0.1898	0.0107	0.0182	0.0443	0.0039	0.0058	0.0177
Salaried	1.1419	1.1102	1.0790	0.0233	0.0291	0.0434	0.0024	0.0038	0.0084	0.0004	0.0008	0.0033
Retired	0.8596	0.8272	0.7945	0.1351	0.1621	0.1896	0.0166	0.0242	0.0407	0.0032	0.0070	0.0196
Other	0.6461	0.6016	0.5567	0.3980	0.4756	0.5445	0.0707	0.1013	0.1475	0.0183	0.0299	0.0592
Taylor												
Self Employed	1.1276	1.0294	0.9312	0.0813	0.1220	0.1878	0.0107	0.0209	0.0776	0.0039	0.0064	0.0923
Salaried	1.1419	1.1050	1.0681	0.0233	0.0294	0.0404	0.0024	0.0048	0.0150	0.0004	0.0016	0.0270
Retired	0.8596	0.8223	0.7851	0.1351	0.1656	0.2054	0.0166	0.0240	0.0445	0.0032	0.0070	0.0300
Other	0.6461	0.5984	0.5508	0.3980	0.4748	0.5633	0.0707	0.1019	0.1495	0.0183	0.0324	0.0768
Taylor detrended												
Self Employed	1.1276	1.0565	0.9853	0.0813	0.1108	0.1310	0.0107	0.0162	0.0606	0.0039	0.0051	0.0847
Salaried	1.1419	1.1187	1.0954	0.0233	0.0269	0.0328	0.0024	0.0037	0.0078	0.0004	0.0008	0.0052
Retired	0.8596	0.8317	0.8038	0.1351	0.1577	0.1878	0.0166	0.0219	0.0376	0.0032	0.0055	0.0210
Other	0.6461	0.6121	0.5781	0.3980	0.4596	0.4968	0.0707	0.0947	0.1293	0.0183	0.0359	0.1004

Source: Authors' estimates using rounds 1-9 of the BHPS, 2891 households per round, weighted by the cross sectional household weight and by size. The poverty line is defined as half the mean contemporaneous income, and all incomes are normalized by the contemporaneous mean income. See text for details on sample, weights and poverty measures.

**Table A3: Short Term and Long Term Relative Poverty
Share of Households, Britain 1991-1999**

Year	Mean Income	Headcount	Poverty Gap	Squared Poverty Gap
Short term				
1991	1.0000	0.1540	0.0373	0.0157
1992	1.0000	0.1705	0.0427	0.0187
1993	1.0000	0.1751	0.0408	0.0158
1994	1.0000	0.1734	0.0411	0.0175
1995	1.0000	0.1659	0.0370	0.0136
1996	1.0000	0.1698	0.0375	0.0142
1997	1.0000	0.1662	0.0405	0.0170
1998	1.0000	0.1745	0.0425	0.0175
1999	1.0000	0.1578	0.0405	0.0196
Long term				
Exact				
$\rho=0$	0.9928	0.1182	0.0165	0.0038
$\rho=1$	0.9518	0.1486	0.0255	0.0076
$\rho=2$	0.9109	0.1827	0.0442	0.0201
Taylor				
$\rho=0$	0.9928	0.1182	0.0165	0.0038
$\rho=1$	0.9467	0.1507	0.0260	0.0087
$\rho=2$	0.9007	0.1851	0.0491	0.0409
Taylor detrended				
$\rho=0$	0.9928	0.1182	0.0165	0.0038
$\rho=1$	0.9608	0.1422	0.0231	0.0078
$\rho=2$	0.9289	0.1639	0.0392	0.0309

Source: Authors' estimates using rounds 1-9 of the BHPS, 2891 households per round, weighted by the cross sectional household weight. The poverty line is defined as half the mean contemporaneous income, and all incomes are normalized by the contemporaneous mean income. See text for details on sample, weights and poverty measures.

Table A4: Long Term Poverty Measures with Different Levels of Risk Aversion
Share of Households, Britain 1991-1999

	Mean income			Headcount			Poverty Gap			Squared Poverty Gap		
	$\rho=0$	$\rho=1$	$\rho=2$	$\rho=0$	$\rho=1$	$\rho=2$	$\rho=0$	$\rho=1$	$\rho=2$	$\rho=0$	$\rho=1$	$\rho=2$
Exact												
Self Employed	1.2319	1.1330	1.0360	0.0690	0.0990	0.1886	0.0086	0.0162	0.0433	0.0029	0.0048	0.0181
Salaried	1.1740	1.1403	1.1065	0.0200	0.0275	0.0465	0.0020	0.0036	0.0105	0.0003	0.0008	0.0049
Retired	0.8132	0.7814	0.7491	0.1749	0.2074	0.2361	0.0220	0.0316	0.0504	0.0042	0.0089	0.0233
Other	0.6807	0.6305	0.5812	0.3356	0.4362	0.4980	0.0560	0.0891	0.1405	0.0149	0.0289	0.0641
Taylor												
Self Employed	1.2319	1.1197	1.0076	0.0690	0.1039	0.1653	0.0086	0.0174	0.0668	0.0029	0.0050	0.0732
Salaried	1.1740	1.1357	1.0974	0.0200	0.0286	0.0430	0.0020	0.0040	0.0146	0.0003	0.0012	0.0234
Retired	0.8132	0.7776	0.7420	0.1749	0.2107	0.2506	0.0220	0.0313	0.0509	0.0042	0.0088	0.0285
Other	0.6807	0.6259	0.5711	0.3356	0.4371	0.5064	0.0560	0.0910	0.1474	0.0149	0.0354	0.1088
Taylor detrended												
Self Employed	1.2319	1.1551	1.0783	0.0690	0.0986	0.1210	0.0086	0.0134	0.0503	0.0029	0.0040	0.0665
Salaried	1.1740	1.1494	1.1248	0.0200	0.0238	0.0338	0.0020	0.0032	0.0079	0.0003	0.0006	0.0047
Retired	0.8132	0.7863	0.7595	0.1749	0.2011	0.2345	0.0220	0.0287	0.0444	0.0042	0.0072	0.0214
Other	0.6807	0.6410	0.6012	0.3356	0.4170	0.4483	0.0560	0.0818	0.1228	0.0149	0.0357	0.1179

Source: Authors' estimates using rounds 1-9 of the BHPS, 2891 households per round, weighted by the cross sectional household weight. The poverty line is defined as 1/2 of mean contemporaneous income, and all incomes are normalized by the contemporaneous mean income. See text for details on sample, weights and poverty measures.

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