Vulnerable Households and Variable Incomes

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Abstract

In this paper we examine the concept of "vulnerability" within the context of income mobility of the poor. We test for the dynamics of vulnerable households in the UK using Waves 1 - 12 of the British Household Panel Study and find that, of three different types of risks that we test for, household-specific shocks and economy-wide aggregate shocks have the greatest impact on consumption, in comparison to shocks to the income stream.

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1 Introduction

Recent studies on poverty and income mobility have acknowledged the welfare costs of the economic risks faced by low-income individuals and households. Static poverty measures popular in the economics literature cannot appropriately capture all of the relevant economic circumstances of disadvantaged households or individuals. This, among other things, has led to an interest in identifying those in the income distribution who are not just poor, but are also likely to become poor in the face of untoward economic circumstances. This group of households or individuals are those referred to as *vulnerable*. In this paper we use a panel regression approach to identify the vulnerable in light of the different risks – both idiosyncratic and aggregate risks – faced by UK households using the British Household Panel Survey (BHPS).

A household is typically considered as vulnerable if it is unable to smooth its consumption in light of idiosyncratic income fluctuations. The vulnerable group of households therefore consists of those who are likely to be downwardly mobile in the face of shocks. Identifying this class of the downwardly mobile in the income distribution is a relatively recent approach that has largely appeared in the literature associated with developing countries, particularly those in Sub-Saharan Africa, where the conditions of the poor are particularly subject to sudden shocks (both economic and climatic shocks).

The concept of the vulnerable as a "mobile quantile" in an income distribution however is appealing in the context of both developing and developed countries. Similar to the experience in developing countries, it might also be expected that in developed countries households close to the poverty line are particularly sensitive to economy-wide shocks than to idiosyncratic shocks. Experience from developing countries suggests that government action has proved successful in alleviating the vulnerable from slipping into poverty, for instance through credit provision schemes, or employment schemes. Thus, the starting point for the researcher would be to first identify what is the nature of the risks that the households are exposed to. This is what this paper will attempt to do using the British Panel Household Survey using waves 1-12 which span the years 1991 to 2002.

Broadly speaking we can identify three types of risks that impinge on vulnerable households. First, there are idiosyncratic shocks, which could be proxied by changes in income and resources of the household. In the development-economics literature models of risk-sharing focus on consumption smoothing in the face of idiosyncratic risks (Deaton 1997, Townsend 1994). Risk-sharing between households at the village level mitigate the effect of the idiosyncratic shocks, and only economy-wide shocks prevail as being significantly detrimental to the well-being of the households. This is tested in a number of papers that also model risks associated with household-specific characteristics and economy-wide risks (Amin et al. 2003, Ligon and Schechter 2003). Household level shocks generally involve loss in wage-employed family members, or simply a large family which strains the scant resources available to the household. Natural or climatic shocks are a persistent risk to households in poor countries, but lesser so for developed countries. The other very large risk is that of economy-wide shocks such as inflation which heavily impact the poor and the vulnerable.

Our empirical investigation in this paper will draw upon these simple ideas of testing for the prominence of the relevant risks to which the vulnerable are subject. We are not directly concerned with proposing a particular method for identification of the vulnerable in the UK, or applying a particular method of doing so; rather the focus of the paper is on identifying the nature of the particular shocks that render households as vulnerable. It turns out that, depending on the particular definition of income employed, a variety of patterns of consumption smoothing present themselves. We examine the impact of three different types of risks on consumption – idiosyncratic risks, which are captured by changes in household income, economy-wide shocks which are captured by the year dummies, and the household specific shocks, captured by the household characteristics.

The paper is set out as follows. Section 2 sets out the basic model of individual welfare on which the approach to vulnerability is based. Section 3 shows how this can be used as the basis for modelling the concept of vulnerability. Section 4 presents the empirical estimations and then concludes.

2 Welfare, income and consumption

We begin with an outline of the underlying model that captures the key issues of economic welfare. Although much of our analysis will be based on the economics of the household, the approach to welfare is essentially individualistic: it is the well-being of individual persons that matters, whether the person is living alone or forms part of a larger household unit.

The general model of individual welfare is as follows. Each person has a multiperiod utility function that depends on his or her consumption stream $(c_0, c_1, c_2, ...)$:

$$\sum_{t=0}^{T} \delta^t u(c_t) \tag{1}$$

where δ is a constant discount factor and u is the instantaneous utility function (felicity function) that captures the substitutability of consumption between periods and also the individual's attitude to risk. As far as risk preferences are concerned we focus on two standard models, namely constant absolute risk aversion (CARA) where u takes the form

$$u(c_t) = -\frac{1}{\alpha} e^{-\alpha c_t} \tag{2}$$

and, as an alternative, constant relative risk aversion (CRRA)

$$u(c_t) = \frac{1}{1-\rho} c_t^{1-\rho} \tag{3}$$

where α and ρ in (2) and (3) are the indices of absolute risk aversion and of relative risk aversion respectively.

We need to discuss the relationship between consumption and resources under an appropriate economic model of household decision-making. This will be done by first examining a very special case.

2.1 Perfect foresight

The very special case requires the following assumptions. There is an efficient capital market to which everyone has access; all income variability can be perfectly foreseen (or there is an efficient insurance market to which everyone has access); there is no other source of uncertainty. Under these circumstances the time path of incomes $(y_0, y_1, y_2, ...)$ is not of special interest to the economic agent: it is only their aggregate, the present value of incomes over the period, that is relevant. If A is this present value and p_t the price of consumption at time t evaluated at time 0 then this point can be made using a simple model of intertemporal optimisation.

Maximising (1) subject to

$$\sum_{t=0}^{T} p_t c_t \leq A, \tag{4}$$

implies the following condition

$$\frac{u'(c_{t+1})}{u'(c_t)} = \frac{p_{t+1}}{\delta p_t} \tag{5}$$

where u' denotes the first derivative of u. In the case of (2) condition (5) would become

$$e^{\alpha[c_t - c_{t+1}]} = \frac{p_{t+1}}{\delta p_t} \tag{6}$$

or equivalently

$$\Delta c_t = -\frac{\kappa_t}{\alpha} \tag{7}$$

where Δ is the difference operator and

$$\kappa_t := \log\left(\frac{p_{t+1}}{\delta p_t}\right).$$

In the CRRA case (3) condition (5) would yield

$$\left[\frac{c_{t+1}}{c_t}\right]^{-\rho} = \frac{p_{t+1}}{\delta p_t} \tag{8}$$

or equivalently

$$\Delta \log(c_t) = -\frac{\kappa_t}{\rho}. \tag{9}$$

Equation (7) or (9) is a difference equation that will determine the time path of an individual's consumption under each of the two specifications for u; in each case the initial condition is determined by aggregate resources A through the budget constraint (4).

2.2 Utility and income

However, the discussion of subsection 2.1 covers no more than a benchmark case. If we introduce a number of important qualifications the analysis becomes considerably more interesting.

First, if variability in resources cannot be perfectly anticipated, or if risks cannot be appropriately insured, then the simple role of aggregate resources ("lifetime income") no longer holds. Instead of completely smoothing the income stream over the period the optimisation process allows a role for current income in the determination of current consumption. Period-to-period changes in c_t will track period-to-period changes in the agent's income y_t as in a Keynesian consumption function.

There are important implications for individual welfare, evaluated each period as history unfolds. Take the situation where the horizon T is effectively infinite. In the benchmark case, because of the strong assumption about perfect foresight or perfect insurance, welfare would be invariant over time: the situation would look much the same had one started the clock at time 1 or time 2 rather than time 0. However, under circumstances where there is less than full insurance shocks to the agent's resources will be reflected as short-run perturbations in the agent's welfare. These perturbations form the basis of our concern with vulnerability.

2.3 Individuals and households

The second important qualification to the benchmark model in subsection 2.1 concerns the role of the household. The benchmark model used only the term "economic agent" and could be taken as a simple representation of the problem facing a person living in isolation. Given that people choose to live in households we obviously need to consider the relationship between individual utility and household income rather than individual income; but more is involved.

For the present discussion a household is simply a grouping of individuals at any moment. Denote by N_{ht} a typical household h at time t; although normal human beings value their family relationships this sort of consideration plays no part in our welfare analysis. Individual incomes fund household consumption: the household provides consumption benefits and other economic services and will do so in a way which effectively provides "local public goods". Consumption will be determined by resources available to the household – in other words household income. Obviously household income Y_{ht} is determined by the incomes y_{it} of individual members of the household

$$Y_{ht} = \sum_{i \in N_{ht}} y_{it}$$

However in addition to this simple point it is important to note that the incomes of individuals may be determined in part by those of other members of the same household; this will be discussed further in section 3 below.

Let c_{it} denote the consumption of individual i. This will be determined by the level of consumption C_{ht} in the household to which i belongs at time t; the way in which this is determined will depend on the scope for economies of scale and the system of sharing within the household. We make the conventional assumption that there is equal sharing within the household and that the economies of scale are independent of household resources. Let a_{ht} be the number of equivalent adults in household h at time t; then we have the following relationship:

$$c_{it} = \frac{C_{ht}}{a_{ht}}, i \in N_{ht} \tag{10}$$

The deflator a_{ht} will be determined by the needs of household members as well as the number of individuals in the household.

3 Vulnerability

Given that risks can neither be fully foreseen nor fully insured against it is important to consider the ways in which economic agents will respond to unforeseen events. Both sides of the domestic balance sheet are likely to be affected as we consider in subsections 3.1 and 3.2.

3.1 Consumption responses

For the moment let us suppose that household incomes are exogenously determined. If one were to take at face value the model in section 2 then there is little to say about the agent's response: you just have to cut back expenditure until it meets income. Under these circumstances income shocks are transferred directly to expenditure shocks and so on to shocks in individual welfare.

However, more can be said if the section 2 model is made richer by allowing for a variety of goods rather than a single consumption variable c; we can focus on household responses involving the separate components of expenditure. It is reasonable to suppose that in response to an unanticipated exogenous income fall there will be some substitution amongst different consumption goods. There is an analogy with the firm's short-run response to market shocks. We may expect similar short-run behaviour of consumption: expenditure on housing is likely to be less flexible than that on some food items.

The effect of this will be to mitigate the seriousness of the income shock as it is transmitted to individual welfare.

3.2 Incomes and resources

However, common sense suggests that a further important economic response to a negative shock will come from the income side of the household accounts. We may distinguish two components.

Atemporal component The first is a straightforward compensatory effect: the economic agent will want to boost income in the current period in order to offset a negative shock. This effect can be seen even if the economic agent is a single person living alone.

Furthermore we can consider the offsetting of the point impact of the shock by members of the household. The entry to unemployment by one person may induce a switch to paid employment by other family members. Income pooling arrangements within the household will enhance the damping of shocks to household resources. To model this effect satisfactorily one needs to introduce an economic cost to the generation of income. For example, if the model of section 2 is extended by introducing a two-argument instantaneous utility function one can model the opportunity cost of time.

Intertemporal component The second component is equivalent to a kind of insurance in the form of self-protection. This can be seen even in the case of a person living in isolation: a negative shock in period t may cause the person to revise his view about the likelihood of future shocks and, as a consequence, make some investment that will make the future negative shock less likely or reduce its impact on consumption. In a multi-person household there will also be an important investment response by other household members that will similarly provide informal insurance.

These economic adjustments by household units can be interpreted as simple coping mechanisms, an idea that is familiar from the literature on development mentioned in the introduction. Each of the economic responses described in section 3.2 is evidently a form of coping with external shocks and will change the relationship between income variations and variations in household consumption and welfare. The extent to which a household is successful at coping will clearly depend on the composition of the household, the resources to which it has access and the attributes of its individual members.

4 Measuring vulnerability

We will use a panel regression approach to identify the effect of any aggregate shocks on the consumption stream of the households. The purpose of the empirical strategy is to identify the different kinds of risks to which the households are exposed, as opposed to proposing a new methodology of identification of the vulnerable. While there are several alternative methods that have been used in this literature, the current method (panel regression approach with various risks acting as regressors) is chosen for a number of reasons. First, the availability of data. The BHPS is the only panel data set available which collects household level data, and we are constrained in our estimations by the availability of specific variables which will enable other analyses. Second, without imposing any restrictions on how the risks affect consumption smoothing, apart from that presented in 2, the focus of the empirical estimation here is to identify any clear indications of the nature of the risks that the households face.

Suppose households' preferences are appropriately represented by a CARA utility function (2) and there are no unforeseen income shocks then, as discussed in section 2, efficient risk sharing by individuals in each household would imply the relationship (7). But if there are unforeseen income shocks Δy_t then an appropriate modification of (7) is

$$\Delta c_t = \nu \Delta y_t - \frac{\kappa_t}{\alpha} \tag{11}$$

where the parameter ν captures the vulnerability of the economic agent to income shocks (Amin et al. 2003, Townsend 1994). On the other hand if preferences are appropriately represented by a CRRA utility function (3) then efficient risk sharing yields (9) in the absence of unforeseen shocks and an appropriate modification in the income-shocks case is.

$$\Delta \log (c_t) = \nu \Delta \ln y_t - \frac{\kappa_t}{\rho}. \tag{12}$$

Equations (11) and (12) form the basis of our estimation strategy which is in common with a number of studies using data from developing countries. The strategy identifies changes or fluctuations in the income stream as an idiosyncratic risk, while the aggregate economy wide shocks or individual (household-specific) shocks are those which impact upon the consumption stream significantly. The significance of the effect of idiosyncratic shocks to the income stream will thus be revealed in the empirics by a significant coefficient of the changes in income variable Δy_{it}, while the impact of the individual shocks will show up as significant coefficients for the household characteristics, X_{it}. Other aggregate economy-wide shocks are captured with the year dummies, introduced as wave dummies. Their significance will indicate the impact of economy-wide shocks which affected the households irrespective of the idiosyncratic shocks to the income stream (i.e. idiosyncratic risks) and household-specific risks. Our estimation strategy thus varies from what is usually undertaken by studies particularly of developing country experiences (Amin et al. 2003, Dercon and Krishnan 2002) but the parallels are clear.

4.1 The British Household Panel Survey

The BHPS follows the same representative sample of individuals over a period of years from 1991 to 2002. Each annual interview round is called a *wave*: there are thus 12 waves of data, providing household and individual level economic statistics and household characteristics' data. The survey is principally household-based, interviewing every adult member of sampled households. Each wave consists of over 5,500 households and over 10,000 individuals drawn from 250 areas of Great Britain. The samples of 1,500 households in each of Scotland and Wales were added to the main sample in 1999, and in 2001 a sample of 2,000 households was added in Northern Ireland.

The following variables have been used for the analysis:

- Expenditure on food, per week per household.

- Household income.
- Number of children per household.
- Household size (i.e. number of individuals present in the household).
- Number of household members unemployed.

The data used for the estimation spreads over a span of 12 waves, of which 11 waves are available with the required data. Waves 1 to 6 and 8 to 12 have been used for the analysis: this is because consumption at the household level is not available for wave 7. Over the entire spread of the 11 waves, we have a complete panel with 1659 individuals per wave.

Expenditure on food and fuel is available per week per household in the BHPS.[1] To obtain individual monthly data, we estimate monthly expenditure on food and fuel by multiplying the above by 4 (accounting for 4 weeks per month) and divided by the household size to obtain the per capita individual expenditures. In our study, as in many other studies of vulnerability, income proxies idiosyncratic risk. Monthly income is estimated from annual estimates (calculated from 1st January to 31st December in each year) that are available. These are scaled down and deflated by household size to obtain per capita monthly estimates. We also use two more definitions of income: namely household net income – net current income and net annual income (Bardasi and Jenkins 2004). The three different definitions of income give us different perspectives on the income smoothing process – while the monthly per capita income allows for all the time specific shocks, the net current income takes into account the household income net of the local taxes, while net annual income does the same over the period of 12 months (net of both taxes and annual pension contributions). Since we are focusing just on income-risk here, changes in family composition are not so important to the analysis. For this reason, therefore, changes in equivalence scale for individual households are not taken into account for our estimations. We further simplify by assuming the simplest form of equivalisation and focusing solely on per-capita quantities.

Figure 1 presents the basic time profiles of the median values of the expenditure and income variables used. While the plot suggests co-trending between income and expenditure, our estimations later on will reveal that their first differences do not necessarily do so. The nature of the income definition involved also proves to be crucial in whether expenditure and income differences co-trend or not.

[1] Expenditure on fuel has not been included for the current analysis because of the short time for which it is available (only last few waves)

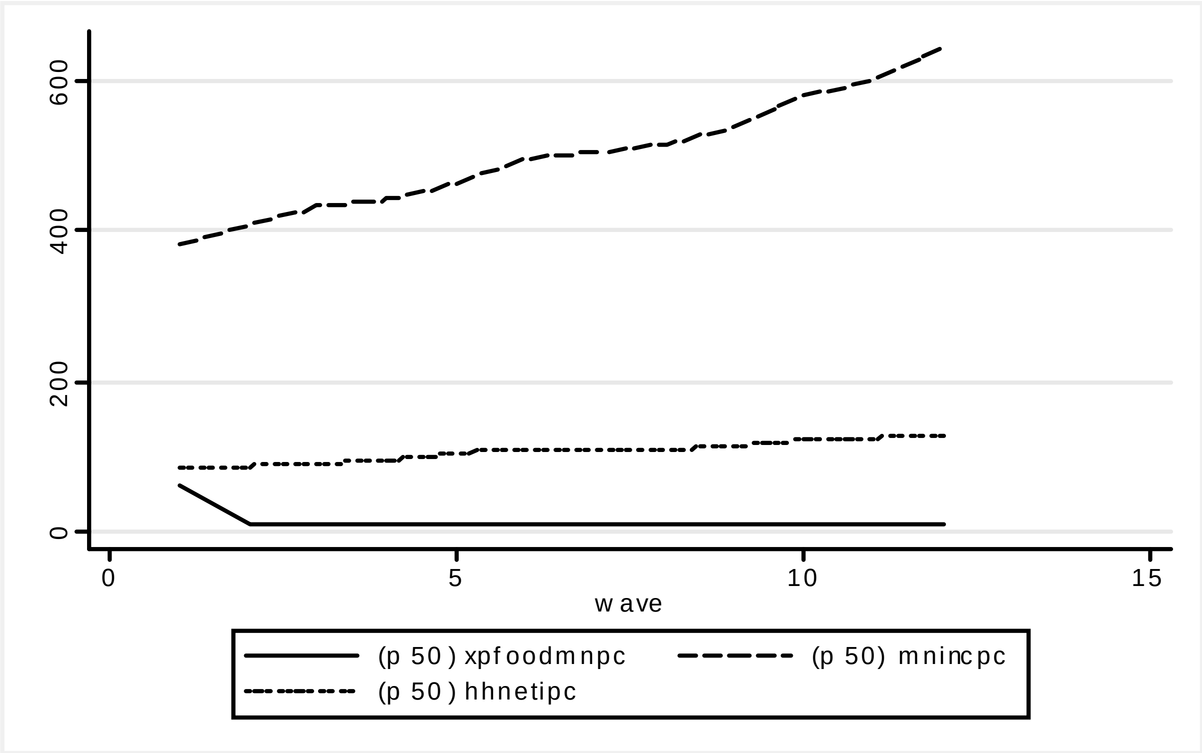

Figure 1: Median expenditure, monthly income per capita and net income per capita. Waves 1 to 12

4.2 The cross section unit used in the estimations

The structure of the BHPS appears to pose a problem in not matching households across the different waves. However individual persons are followed through time so that one can track individuals who belong to the same household over the different waves. As the household compositions may change across the waves (due to a household member leaving the household, or due to the interviewee not being available while survey was being undertaken), after matching the households and persons across the waves, our preferred unit of measurement is the individual across the waves rather than the households. Thus, our unit of consumption (and income) is the person, having accounted for household composition. By tracking per capita consumption and incomes we are also avoiding the possible problems with having to account with economies of scale due to a larger household (though, in our case, first differencing eliminates this problem as well.

4.3 Estimation and results

We estimate, for each specification of the utility function specification – (2) and (3) – three sets of panel regressions.

First we estimate the simplest model based on the CARA specification (2) using the following:

$$\Delta c_{it} = \nu \Delta y_{it} + \phi_t W_t + \varepsilon_{it} \tag{13}$$

where $c_t := C_t/n$,denotes per-capita consumption of the household in wave t, y_{it} is household income per capita at time t, and W_t is a wave dummy, which equals one for observations at time t, zero otherwise. The coefficient ϕ_t captures the coefficient $\frac{1}{\alpha}\kappa_t$ in equation (11). We also assume the error term to be uncorrelated with the RHS variables and to have zero mean. Let us assume the following dynamic structure:

$$\begin{aligned} \text{var}\left(\varepsilon_{ht}\right) &= \sigma_h^2 \\ \text{cov}\left(\varepsilon_{ht}, \varepsilon_{jt}\right) &= 0 \\ \text{cov}\left(\varepsilon_{ht}, \varepsilon_{ht'}\right) &= 0 \end{aligned}$$

$$\sigma_h^2 = \exp\left(\sum_j \beta_j z_{hj}\right)$$

The error term can be expected to vary across households, because of heterogeneity in household size, consumption and income. Taking differences also renders the quantities as stationary. We address the heterogeneity by using standard methods of descaling the observations to get rid of the heterscedasticity.

We estimate equation (13) by fixed and random effects estimation methods and test over three different wave lengths:

(a) Waves 1 to 4

(b) Waves 6 to 12.

(c) All 11 waves

We estimate across three different wave spreads to highlight both short term and medium term effects of the three different kinds of shocks. The wave effects, being economy-wide shocks often manifest themselves more clearly in the medium term and are not revealed in the shorter wave spans. The consumption variable we are working with is not available for wave 7, and has so been excluded from the analysis.

We estimate two sets of regressions. First, we run an empirical application of the Townsend model (13). We then run a similar specification accounting for a number of controls which determine the smoothing relationship.

$$\Delta c_{it} = \nu \Delta y_{it} + \phi_t W_t + \gamma X_{it} + \varepsilon_{it} \tag{14}$$

where, X_t is the set of controls over individuals, over waves 1 to 12 (excluding wave 7). This procedure is undertaken to identify the household characteristics that are driving the dynamic consumption process.

There are a number of ways in which one can estimate the vulnerable subject to an estimated poverty line. The current empirical literature is growing with empirical analyses adopting a number of approaches.[2] Many of these are based on the Townsend (1994) model, and interpretations of this approach have been applied in Amin et al. (2003), Deaton (1997), Jalan and Ravallion (2001), Morduch (2004). The Townsend model presents itself as a benchmark case against which other authors depart from depending upon the assumptions made in their empirical models. In light of our own estimations, a foreword discussing these empirical approaches is sensible. While Townsend's model tests for efficient risk-sharing between households, most of the empirical studies, for both developing and developed countries, have revealed that self-insurance has proven to be the more important compared to inter-household risk sharing. Another finding is that self-insurance in developing countries is limited and risk-coping strategies are costly (Morduch 2004) . This finding may well apply to a developing country context. Such findings are suggestive of a re-modelling of one's estimation strategy.

While the estimations done in this paper are based on the Townsend model, one can quite comfortably assign an even more straight-forward em-

[2]See Dercon (2004) for a collection of papers with various methodologies.

pirical interpretation to our estimates. From the point of view of the Townsend model, we are here measuring the extent of vulnerability by a risk-sharing test as proposed by Townsend (1994). This will be measured by the coefficient ν. Efficient risk sharing implies that household consumption tracks only aggregate consumption, but not income. The model tests for full-risk sharing against there being none by testing for the ν coefficient taking values 1 or 0. Many studies (for example Amin et al. (2003)) who adopt an empirical model as derived from Townsend's model have a different interpretation of the ν coefficient. While the Townsend model only tests for ν taking values 1 or 0, Amin et al. (2003) and Dercon and Krishnan (2002) are more empirically geared to test for the impact of idiosyncratic and economic shocks on the consumption stream . Thus while from the Townsend point of view the interpretation of positive values of the ν coefficient is indicative of risk-sharing, from the Amin et al. (2003), or Dercon and Krishnan (2002) standpoint, one can assign the significance of the ν coefficient (positive in sign) as indicative of changes in consumption responding to income shocks i.e. an idiosyncratic risk. Their empirical formulation typically regresses changes in consumption on changes in incomes with time dummies accounting for the presence of economic or other kinds of shocks which perturb the natural relationship between changes in consumption and income.

This is the strategy we will pursue in our estimations using the BHPS, with the intent of identifying the presence of shocks on the consumption stream. We would primarily like to identify the prominent risks (or shocks) to which the households are subject. This will be addressed by treating the ν coefficient as one which will measure the response to an idiosyncratic shock (income shocks). Aggregate economy-wide shocks will be tracked by the wave dummies in the regression, and household-specific shocks will be measured by household characteristics as controls. This will act as a precursor and an informative exercise to pursue more detailed analyses of devising more suitable empirical tools to identify, and track, mobility patterns of the vulnerable in Britain.

4.4 The estimations

Our first run is of equation (13) where we estimate the smoothing coefficient v. A significant positive coefficient of ν would indicate the existence of risk-sharing within households. Table 1 presents results for waves 1- 4 for the CARA model using a variety of specifications – the coefficient of change in incomes is not significant all throughout. We test for this using three different definitions of incomes: first, the monthly income per capita, then two net income variables: net current income and net annual income. We thereafter introduce a number of household characteristics as controls to test for whether they are driving these results. The variables included are number of children in household and the number of unemployed in household.

Column 1 presents the regression of the differences in consumption on differences in income with fixed effects. This is repeated in the following column with random effects, but in neither version is the coefficient on $\triangle y_{it}$ significant. The wave dummies indicate years over which there are significant shocks affecting the households' (individuals') consumption stream – these, as discussed earlier proxy for the presence of any economy-wide shocks. The next specification (columns 3 and 4) runs the same with a different definition of income – that of net current income. Here again the ν coefficient is not significant, but wave 2 shows up to be highly significant. The negative sign suggests that the year corresponding to wave 2 was associated with lower levels of consumption. The Hausman test (Hausman 1978) for testing the appropriateness of a fixed or random effects specification suggests that fit does not improve on introduction of fixed effects. We also run the specifications using the BHPS definition of net annual income – the results here are unchanged for both random and fixed effects specifications (columns 5 and 6). Note the significance of the wave 2 persistently showing up in all specifications.

The next four specifications (using both definitions of net income) include controls to check if any of these factors are driving the results – namely, number of children in the household and number of household members unemployed. For both sets of income variables, the ν coefficient is revealed to be not significant (for both fixed and random effects specifications). Wave 2 and the number of family members not in employment show up as negative and significant for the fixed effects specification for both net current income and net annual income (columns 7 and 9). In the random effects specification of both net income variables (columns 8 and 10), the number of unemployed variable is no longer significant, but the wave 2 variable remains negative and significant. For the fixed effects specification (columns 7 and 8), the number of children show up as positive and significant. We thus observe that the effect of the number of children in the household is not robust to the specification – while not significant in the fixed-effects specification, it is so for the random-effects case.

It may be of concern that the observed income fluctuations Δy_{it} could just reflect annual variations that affect the household or individual as a whole, and not household or individual-specific shocks (like loss of income-earning family member). The economy-wide shocks are controlled in the regression by our wave dummies. Our ν estimates thus detect responses of household consumption to household-specific shocks controlling for economy-wide fluctuations. Further, there is substantial household specific (and hence insurable) risk in these economies.

The following specification tests for the above relationship are based on the CRRA specification. The empirical model that derives from this model is as follows:

$$\Delta \ln c_{it} = \nu \Delta \ln y_{it} + \phi_t W_t + \gamma X_{it} + \varepsilon_{it} \tag{15}$$

While this specification tests for a different specification of the utility function, it empirically also lends itself better to the statistical problems which medium-to-long run time series data present. First differencing renders the variables as stationary, thus preventing any spurious co-trending from accounting for a positive and significant smoothing coefficient.

We run similar specifications as for Table 1 in the case of equation (14), and obtain the results presented in Table 2. It is clear that these conform more with what our models suggests than in the case of the CARA model. Column 1 presents the results with a regression of differences in log consumption on differences in log-incomes for the time period of waves 1 to 4, with fixed effects. The coefficient ν_i is now positive and significant and wave 2 continues to be negative and highly significant. This result holds for also the random effects (column 2) specification. However, when the same specification is run with net (current) income variable, the ν coefficient is no longer positive and significant, for both random and fixed effects specifications, in columns 3 and 4. This result continues to hold when using net annual income (as opposed to net current income), in columns 5 and 6, for both fixed and random effects regressions. Thus there is little evidence of idiosyncratic shocks in either the CARA or the CRRA specification.

We now introduce the controls, which are tabulated in columns 7 and 8 for both fixed and random effects specifications. While ν coefficient continues to remain not significant for net current income, many of the controls which were hitherto insignificant in the CARA specification are now significant. In all specifications we find that the effect of the number of children in household are negative and significant (columns 7 -10) with the two different net income definitions. However, the number unemployed is only significant (and negative) for the net current income definition.

We now introduce the controls, which are tabulated in columns 7 to 10 for both fixed and random effects specifications with net income. While ν coefficient continues to remain not significant for net current income; many of the number of unemployed which was hitherto insignificant in the CARA model is now significant. In all specifications, we find that number of children in household, and number of unemployed individuals are negative and significant.

Thus our regressions for the wave set of waves 1 to 4 reveal the following:

- The ν coefficient is not positive and significant for almost all specifications run, except for under the CRRA specification when using monthly average income (not net income variables). Wave 2 is strongly significant and negative in its effect.

- In the CARA specification, many of the household characteristics used as controls, namely that of number of children and number of unemployed individuals in the household have a negative and significant impact on changes in consumption.

- Overall, the CRRA model seems to describe the dynamics better than the CARA model.

Tables 3 and 4 present the regressions for waves 6-12. Table 3 tabulates the regressions for the CARA specification, and Table 4 for the CRRA specification. Interestingly, the ν coefficient for the monthly income variable now shows up to be positive and significant under both fixed and random effects specifications, columns 1 and 2. Waves 8 and 11 also show up as positive and strongly significant – this result holds across all specifications run. The ν coefficient is significant, but switches signs when using the net (current) income variable, though wave 8 and 11 is still positive and significant. Column 5 and 6 runs the same specifications as above using net annual income, with random and fixed effects – the ν coefficient is not significant, but the waves 8 and 11 are strongly significant again. Columns 7 to 10 introduce the household characteristics. The results repeat themselves as earlier with the net current and net annual incomes. Waves 8 and 11 are strongly significant. Of the controls, the number of unemployed are strongly significant and negative, and number of children is significant as well, though the significance varies across the random and fixed effect specifications.

We now run the CRRA specifications, where the dependent variable is differences in log consumption and the principal right hand side variable is differences in log incomes, presented in Table 4. Columns 1 and 2 run the above specification, using the monthly income (per capita) variable – the ν coefficient is positive and significant. Wave 8 and 11 are again positive and significant. Columns 3 - 4 tabulate the same with net current income as the income variable – the ν coefficient is now no longer significant, under both random and fixed effects specifications. The same is repeated with net annual income, where the ν is just significant under both specifications. Waves 8 and 11 continue to be positive and significant.

Once again we introduce controls for household characteristics. The number of unemployed in household show up as negative and significant in regressions with net current income (fixed and random, columns 7-8). Number of children in family show up significant in some specifications, a result that is not robust for different definitions of income (columns 7-10). The result that the effect of the number of children with a significant positive effect serves to account for the effect of an income shock significantly translating into a consumption shock - the larger household size positively contributes to the income shocks being passed on to consumption.

The regressions for the waves 6 -12 thus reveal the following.

- Under the CARA specification, the ν coefficient is positive and significant for monthly income (per capita), but not for other net income definitions. This result holds under the CRRA specification when using monthly average income (not net income variables).
- Wave 8 and 11 are positive and strongly significant under all specifications.
- As with results for waves 1 to 4, the CRRA specifications seems to describe the impact of the household characteristics better than the CARA model. Number of household members unemployed shows up as a negative and significant variable across all specifications tested. The same holds for the number of children, though the significance of the results are less pronounced than that of the number of unemployed household members.

The following tables – 5 and 6 – present the results for all 12 waves. Table 5 tabulates the regression for the CARA specification, with waves' 8 to 11 dummies, and with controls for the last four regressions. The ν coefficient for the monthly income variable now again is not significant under all CARA specifications. Of the wave dummies, wave 2 and wave 8 consistently show up as negative, and positive respectively, and significant.

Columns 5 and 6 runs the same specifications as above using the net annual income definition, with both fixed and random effects. Here the ν_i coefficient is again not significant, though waves 2 and 8 are still negative, and positive and significant, respectively. The last four columns introduce the controls. The general results hold as with the earlier specifications – ν coefficient is not significant, and waves 2 and 8 are significant. For both net current income specifications, and the net annual income specifications, we find that for the fixed effects regression the number of unemployed in the household is significant (and negative), while in the random effects specification, the number of children in the household are significant.

Now consider the CRRA specification, where the dependent variable is differences in log-consumption and the principal right hand side variable is differences in log-incomes, presented in Table 6. Here, as with the earlier wave sets we find that the ν_i coefficient is significant under some specifications. Columns 1 and 2 run the above specification, with wave dummies using the monthly income (per capita) variable, for both fixed and random effects – the ν coefficient is positive and significant. Wave 8 is again positive and significant. This result repeats itself for specifications with all other income definitions – columns 3 and 4 present regressions with net current income as the income variable, and columns 5 and 6 with net annual household income – we find that in all cases, the ν coefficient is not significant. Wave 2 continues to be negative and strongly significant, while wave 8 is also positive and significant. In addition, waves 3, 4 and 5 also show up to be strongly significant under most specifications. On introducing household characteristics as controls, we find that the number of unemployed continues to be significantly negative influence for both net current income, and net annual income specifications (columns 7 -10), while the number of children in the household shows up as a significant negative influence only under the random effects specifications.

nkids	number of children per household.
nwage	number of household members unemployed.
mnincpc	monthly income per capita
hhneti	net current income
hhyneti	net annual income
lhhneti	natural log of net current income
lhhyneti	natural log of net annual income
dwaven	dummy variable for wave n

	dmnincpc		dhhneti		dhhyneti		dhhneti		dhhyneti	
	F	R	F	R	F	R	F	R	F	R
Δy	0.00086	0.00068	0.00061	0.00090	0.00001	0.00001	0.00061	0.00090	0.00001	0.00001
dwave2	-56.251*	-56.249*	-56.238*	-56.236*	-56.266*	-56.265*	-56.173*	-56.310*	-56.201*	-56.338*
dwave3	0.196	0.197	0.215	0.222	0.209	0.211	0.252	0.179	0.245	0.166
nkids							-0.829	2.073*	-0.804	2.066*
nwage							-1.531†	0.230	-1.559†	0.225
_const	0.171	0.174	0.169	0.162	0.176	0.173	2.722†	-1.660*	2.744†	-1.637*
Notes.	∗: Significant at the 1% level									
	†: Significant at the 5% level									

Table 1: CARA model. Waves 1-4

	dlmnincpc		dlhhneti		dlhhyneti		dlhhneti		dlhhyneti	
	F	R	F	R	F	R	F	R	F	R
Δlog y	0.06438*	0.07306*	-0.00561	-0.00454	0.00449	0.00253	-0.00565	-0.00473	0.00532	0.00292
dwave2	-1.976*	-1.976	-1.978*	-1.975*	-1.975*	-1.975*	-1.968*	-1.974*	-1.965*	-1.974*
dwave3	0.021	0.021	0.019	0.021	0.023	0.022	0.024	0.022	0.028	0.023
nkids							-0.188*	-0.027*	-0.209*	-0.028*
nwage							-0.121*	-0.024*	-0.127	-0.024
_const	0.021†	0.021†	0.025†	0.024†	0.023†	0.023†	0.317*	0.074*	0.338*	0.074*
Notes.	∗: Significant at the 1% level									
	†: Significant at the 5% level									

Table 2: CRRA model. Waves 1-4

	dmnincpc		dhhneti		dhhyneti		dhhneti		dhhyneti	
	F	R	F	R	F	R	F	R	F	R
Δy	0.00018*	0.00020*	-0.00021*	-0.00019*	-0.00000	0.00000	-0.00021*	-0.00019*	0.00000	0.00000‡
dwave8	0.599*	0.598*	0.640*	0.611*	0.636*	0.607*	0.790*	0.643*	0.785*	0.638*
dwave9	0.000	-0.001	0.044	0.015	0.036	0.008	0.164	0.044	0.155	0.037
dwave10	0.047	0.047	0.088	0.059	0.086	0.057	0.173‡	0.086	0.170‡	0.084
dwave11	0.278*	0.278*	0.321*	0.292*	0.317*	0.288*	0.383*	0.318*	0.378*	0.313*
nkids							-0.971*	-0.064†	-0.975*	-0.065†
nwage							-1.123*	-0.093*	-1.130*	-0.092*
_const	0.097	0.096	0.066	0.091	0.071	0.095	1.990*	0.221*	2.007*	0.226*
Notes	*: Significant at the 1% level									
	†: Significant at the 5% level									
	‡: Significant at the 10% level									

Table 3: CARA model. Waves 6-12

	dlmnincpc		dlhhneti		dlhhyneti		dlhhneti		dlhhyneti	
	F	R	F	R	F	R	F	R	F	R
Δlog y	0.01715†	0.02025*	-0.00484	-0.00453	-0.00612†	-0.00623†	-0.00471	-0.00448	-0.00593†	-0.00616†
dwave8	0.059*	0.059*	0.060*	0.058*	0.059*	0.058*	0.079*	0.060*	0.077*	0.059*
dwave9	-0.001	-0.001	0.000	-0.002	-0.002	-0.003	0.015	0.000‡	0.013	-0.001
dwave10	0.009	0.009	0.011	0.009	0.007	0.006	0.022‡	0.010	0.017	0.008
dwave11	0.025*	0.025*	0.026†	0.024†	0.025†	0.023†	0.034*	0.025*	0.032*	0.025†
nkids							-0.119*	-0.001*	-0.117*	-0.001
nwage							-0.129*	-0.008*	-0.130*	-0.008*
_const	0.006	0.006	0.006	0.008	0.008	0.009	0.232*	0.017*	0.235*	0.019†
Notes.	$*$: Significant at the 1% level									
	$\dagger$: Significant at the 5% level									
	$\ddagger$: Significant at the 10% level									

Table 4: CRRA model. Waves 6-12

	dmnincpc		dhhneti		dhhyneti		dhhneti		dhhyneti	
	F	R	F	R	F	R	F	R	F	R
Δy	0.00008	0.00009	0.00001	0.00002	0.00000	0.00000	0.00001	0.00002	0.00000	0.00000
dwave2	-56.755*	-56.755*	-56.817*	-56.757*	-56.861*	-56.805*	-56.644*	-56.855*	-56.690*	-56.902*
dwave3	0.233	0.233	0.170	0.230	0.173	0.228	0.297	0.118	0.297	0.117
dwave4	0.211	0.211	0.147	0.206	0.150	0.205	0.215	0.082	0.217	0.081
dwave5	0.150	0.149	0.089	0.148	0.092	0.147	0.101	0.023	0.103	0.022
dwave8	0.716†	0.716†	0.656†	0.716†	0.658†	0.713†	0.614†	0.623†	0.615†	0.621†
dwave9	-0.053	-0.053	-0.116	-0.056	-0.112	-0.057	-0.168	-0.118	-0.166	-0.119
dwave10	0.042	0.042	-0.019	0.041	-0.016	0.039	-0.072	0.009	-0.069	0.008
dwave11	0.359	0.359	0.300	0.360	0.302	0.358	0.273	0.373	0.275	0.371*
nkids							-0.086	0.789*	-0.073	0.789
nwage							-1.514*	-0.048	-1.512*	-0.050
_const	0.107	0.107	0.160	0.111	0.159	0.113	1.923*	-0.358‡	1.911*	-0.353‡

Notes. ∗: Significant at the 1% level
†: Significant at the 5% level
‡: Significant at the 10% level

Table 5: CARA model. All waves

	dmnincpc		dhhneti		dhhyneti		dhhneti		dhhyneti	
	F	R	F	R	F	R	F	R	F	R
Δlog y	0.04014*	0.04200*	-0.00259	-0.00260	-0.00533‡	-0.00564†	-0.00245	-0.00254	-0.00521	-0.00554
dwave2	-1.997*	-1.997*	-1.999†	-1.999*	-1.998*	-1.998*	-1.986*	-1.997*	-1.984*	-1.996*
dwave3	0.030†	0.030*	0.028†	0.028†	0.028†	0.028†	0.040*	0.030†	0.040*	0.030†
dwave4	0.029†	0.029†	0.026†	0.026†	0.027†	0.026†	0.035*	0.027†	0.037*	0.028†
dwave5	0.023‡	0.023†	0.022‡	0.022‡	0.022‡	0.022‡	0.029†	0.023‡	0.029†	0.023†
dwave8	0.064*	0.063*	0.063*	0.062*	0.064*	0.063*	0.064*	0.063*	0.066*	0.064*
dwave9	-0.007	-0.007	-0.008	-0.009	-0.008	-0.01	-0.01	-0.008	-0.009	-0.008
dwave10	0.004	0.004	0.004	0.003	0.003	0.00	0.00	0.003	0.000	0.003
dwave11	0.023†	0.023†	0.021‡	0.021‡	0.023‡	0.022‡	0.02	0.021‡	0.018	0.022‡
nkids							-0.061*	-0.005	-0.063*	-0.005
nwage							-0.073*	-0.010*	-0.075*	-0.010*
_const	0.010	0.009	0.013‡	0.013‡	0.013‡	0.014‡	0.139*	0.028*	0.142*	0.029*
Notes.	∗: Significant at the 1% level*									
	†: Significant at the 5% level									
	‡: Significant at the 10% level									

Table 6: CRRA model. All waves

Thus our regressions for the wave set waves 2–12 reveal the following:

- Under the CARA specification, the ν_i coefficient is not significant for any of the income definitions. This result changes, as in other wave set results, under the CRRA specification where one obtains a strongly significant relationship using the monthly average income and net annual income definition specifications.

- Wave 2 is strongly significant and negative under all specifications, and wave 8 is positive and significant under all specifications. Under the CRRA specification we find many other wave years (waves 3, 4 and 5) to be positive and significant.

- As with the results waves for $1-4$, and waves $6-12$, the CRRA specifications seems to describe the impact of the household characteristics better than the CARA model. Number of household members wage employed shows up as a significant variable across all specifications tested.

4.5 Summary

We can now summarise our findings under some broad generalisations:

- Under the CARA specification, the ν coefficient is not positive and significant for any of the income definitions used, save for a few instances with the monthly per capita income definition. Instances of its significance are mostly under the shorter wave-span sets run first. It could be indicative of the shorter wave span results as being more relevant than for the composite 11 wave set. Idiosyncratic shocks, therefore, are of short term impact, if at all.

- We find waves 2 (negative), wave 8 and 11 (positive) to be strongly significant in the relevant wave-set runs. This holds irrespective of whether under a CARA or CRRA specification. The effect of economy-wide shocks is very clear. Under the full wave-set, other waves 3,4 and 5 also show up as positive and significant.

- Across the results for all wave-sets we find that the number of unemployed in household to be robustly negatively associated with changes in consumption. This result varies under the CARA and CRRA specification for the entire wave span (1-12), but again can be attributed to a much larger variation being explained under the larger wave set compared to the smaller waves' sets where a smaller amount of variation is being explained. The number of children in the family have shown up as significantly negatively associated with changes in consumption, though results are more robust under the CRRA specification.

The results that we obtain shed considerable light on the dynamics of consumption smoothing across British households. Of the three different shocks that we test for, idiosyncratic, economy-wide and household-specific, we find that in contrast to the developing country experience, the effect of idiosyncratic shocks is less pronounced than that of the other two shocks. The coefficient of the changes in income is mostly insignificant across all our specifications, and only so under specifications with the CRRA utility function. What is clearly detrimental to the smoothing capacities of the households are the economy-wide shocks and the households-specific characteristics. Wave 2 is strongly significant (and negative) all throughout the results, as is wave 8, and under CRRA utility specifications, waves 3, 4, and 5. Of the different household characteristics that we test for, the number of children in the household and the number of wage employed in the household show up as negative and significant, and the results are again more robust under the CRRA utility function specification.

By using two different utility specifications, we have, to some degree, ensured the robustness of our findings. While in our theoretical framework we have approached the consumption smoothing process from the point of view that the vulnerable individual in the face of a risk will adopt some coping strategy to smooth their consumption in the following period, due to the lack of appropriate instruments and a policy variable which acts as a coping mechanism as one of our right hand side variables, we do not test for this. This would be the most relevant extension to this work – that is to test for certain policy variables, or coping strategies (like employment other than in those in the formal sector), or credit schemes made available for vulnerable households, which testify that consumption smoothing is endogenous in light of the availability of adequate coping strategies.

5 Conclusion

Recent work on mobility of those with low incomes has focused on the issue of vulnerability and the well-being of vulnerable households. In this paper we have sought to give economic meaning to vulnerability in terms of the risks faced by households. Using a panel regression approach we have shown how to model the extent to which both idiosyncratic and aggregate shocks impact on the consumption stream of UK households using the British Household Panel Survey. The approach is a departure from earlier empirical studies of identification of the vulnerable in the UK in that it draws upon a theoretical and empirical framework which enable the researcher to identify the vulnerable in light of economy-wide aggregate shocks and idiosyncratic shocks that are likely to render these households as poor. This sheds light on the mobility of both the poor and the would-be-poor in the face of shocks to the consumption stream.

We find that depending on the specific definition of incomes used, there is a variety of patterns of consumption smoothing under the different kinds of risks. We have tested for the impact of three different types of risks on consumption – idiosyncratic risks, captured by fluctuations in household income, economy-wide shocks, affecting all households captured with the year dummies, and the household-specific shocks, captured by the household-characteristics. In summary, with the CRRA utility framework, we find some evidence of consumption being affected by the idiosyncratic income shocks. But risks to which households seem to be most exposed to are those of the household level shocks and economy-wide shocks. Of the household specific shocks, we find that the number of unemployed and the number of children in the family to be significantly affecting consumption. These results are robust to utility function specification – the particular risk-preference model – and across the different wave sets. On the other hand, years corresponding to waves 2 and 8 in particular, and under the CRRA definition of the utility framework, waves 3, 4 and 5 show up as strongly significant in their impact. In the case of wave 8, the effect is negative and strongly significant, corresponding to year 1992. The findings are strongly indicative of specific policy tools that could be made available for the vulnerable. Given that economy-wide and household-specific shocks show up as most significant, there are policies that governments may introduce to arrest the vulnerable from slipping below the poverty line.

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