



## **Low Income Dynamics among Ethnic Minorities in Great Britain**

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# Low income dynamics among ethnic minorities in Great Britain

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## Non-Technical Summary

In this paper, we find out the likelihood of *remaining poor* (poverty persistence) and *becoming poor* (poverty entry) of the largest ethnic groups in Great Britain, specifically, Bangladeshi, black African, black Caribbean, Indian, Pakistani and white majority (white British). We also consider whether an individual's poverty status in the previous year can make them more at risk of remaining poor in the following year. To answer these questions we used data from *Understanding Society*, a large scale household panel survey which has been following residents of 40,000 UK households every year from 2009-10 onwards.

As in most surveys, not everyone who is requested to give an interview does so. This may be because they are at work, ill, too busy, or may have moved and could not be contacted. If those who are poor are less likely (relative to the non-poor) to give an interview the following year and we just look at the group of people who were interviewed in two consecutive waves to estimate their likelihood of remaining poor, then we will be underestimating poverty persistence (non-random attrition). Similarly, if certain "types" of people are more likely to remain poor, then not accounting for this "type" will result in us under/over-estimating poverty (initial conditions). In order to overcome these two issues we use statistical methods developed by Capellari & Jenkins (2004).

Our results suggest that initial conditions should be accounted for when estimating poverty persistence and poverty entry rates for Indian and black African groups and non-random attrition should be accounted for when estimating these rates for black Caribbean and white majority groups. However neither of these issues is relevant for Pakistani and Bangladeshi groups. We find that not accounting for initial conditions underestimates poverty persistence and entry rates for the Indian group and over-estimates it for the black African group.

Within each group we find that not everyone has the same risk of becoming or remaining poor. For example, individuals living in households where the head of households have a degree, households with employed people and households without children are less likely to be poor or become poor. While these patterns are generally observed there are some exceptions. In terms of initial poverty status the exception is black Africans for whom head of household education does not matter. While living in London is generally found to reduce the risk of initial poverty for ethnic minority groups, it has no effect on black Caribbean and black African groups. We also find that older Pakistani and Bangladeshi individuals are more likely to be poor. The exceptions in terms of poverty entry is that education does not reduce the risk of poverty entry for black African and Bangladeshi groups, and presence of children in the household does not increase the poverty entry risk for Bangladeshi, black Caribbean and black African groups. We also find that living in London reduces the risk of poverty entry for Indians and white majority and ill-health of the head of household increases the poverty entry risk for white majority.

We also find that being poor in one period, itself increases the risk of being poor in the next period (scarring effect) for black African and white majority groups.

Our paper shows:

- the importance of using robust statistical methods to provide estimates of poverty entry and poverty persistence rates or risks
- the poverty entry and poverty persistence risks vary across and within ethnic groups
- the factors which determine these risks, and hence could be policy instruments, are not the same for all groups.

We conclude that one size fits all policies to tackle poverty will not be effective in a country like the UK with multiple ethnic minority groups and policy makers should focus on preventing people from becoming poor rather than just trying to tackle this issue once people have become poor.

# Low income dynamics among ethnic minorities in Great Britain

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## Abstract

Using data from Understanding Society, and robust estimation methods we find that Pakistani and Bangladeshi groups have the highest poverty entry rates (23-26%), followed by Indian, black Caribbean and black African groups (9-11%) and the white majority (6%). Indians and Pakistani's have the highest poverty persistence rates (66%), white majority the lowest (52%), the remaining groups around 55%. We find considerable within group heterogeneity: for most groups, education of the head of household (HoH) and household employment rate reduces poverty entry risk, while the presence of children increases it (education does not matter for black African and Bangladeshi groups and presence of children for Bangladeshi, black Caribbean and black African groups). We also find that living in London reduces the risk of poverty entry for Indians and white majority while ill-health of the HoH increases the poverty entry risk for white majority. The only factor that affects the risk of poverty persistence is household type although the type of household that matters varies across ethnic group. We also show that simple models which ignore initial poverty status and non-random attrition in estimating poverty persistence and poverty entry, underestimate (overestimate) the magnitude of poverty persistence for the Indian (black African) groups. Finally, we find scarring effects of experiencing poverty for black African and white majority groups.

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# 1 Introduction

Despite considerable reductions in poverty rates across all ethnic groups since the 1990s, the pattern of greater disadvantage among ethnic minorities, particularly Pakistani, Bangladeshi and black African groups still persist (Modood et al., 1997; Berthoud and Casey, 1998; Berthoud, 2002; Platt, 2007b). The key underlying questions that we need to answer in order to understand what drives the high rates of poverty prevalent among some ethnic minority groups are: what explains their vulnerability to economic fluctuations, that is, the risk of becoming poor (poverty entry) and their susceptibility of remaining poor (poverty persistence). It is therefore important for designers of policy to identify factors that determine poverty entry and poverty persistence among ethnic minorities. This paper aims to provide accurate and robust estimates of poverty entry and poverty persistence rates as well as factors explaining initial poverty, poverty entry and poverty persistence for different ethnic minority groups in Britain. In addition to individual characteristics that determine poverty persistence, being in poverty itself may make a person more likely to remain poor (often referred to as genuine state dependence (GSD) or scarring (Cappellari and Jenkins, 2004). This could be due to increasing levels of stigma or lower motivation (for example to find a job) as the duration of poverty continues. To our knowledge this is the first paper to document estimates of GSD for different ethnic minority groups in GB.

While ethnic gaps in employment, wage and poverty are well documented, in contrast, the evidence on the extent and characteristics of low-income dynamics among ethnic minorities in Britain is limited due to lack of appropriate data (Smith, 2007; Platt, 2007b,a; Barnard and Turner, 2011). Two studies which analyse low income dynamics separately by ethnic minority group using tax and benefits data of Birmingham residents, a ethnically diverse city, for seven quarters during 1998-99 (Platt (2006, 2003)). While useful these studies are limited in scope as these are not nationally representative, not reflective of the current period, and by design representative of benefit recipients (at least once over the observation period) rather than the entire population. On the other hand, Cappellari and Jenkins (2004), whom we follow closely, do not separately analyse dynamics separately which are likely to be different by ethnic group due to data constraints. Additionally, these studies relate to the period before the financial crisis and subsequent recession. Fisher and Nandi (2015) and Barnes et al 2015 provide recent estimates of poverty persistence across ethnic groups (for adults and children) but do not account for initial conditions or non-random attrition biases.

Estimations of poverty persistence (or poverty entry) is based on a sample of people who are initially poor (or not poor). However, individuals who are initially poor may have different propensities of remaining poor as compared to those who were initially non-poor. In other words, the poor may be a non-random sample of the population and may be more likely to remain poor over time than the population (Heckman, 1981; Jenkins, 2011; Andriopoulou and Tsakoglou, 2015). If that is the case, then if we do not take into account these

initial conditions, we will over-estimate poverty persistence rates in the general population.

Factors such as health status, age, employment status, migrant status may be correlated with poverty as well as attrition (Uhrig, 2008; Watson and Wooden, 2009; Lynn et al., 2012; Schneider, 2013), estimates of poverty dynamics will be biased if we do not account for this non-random attrition. For example, individuals with better economic resources and hence less likely to remain poor may also be more likely to move and attrit. If this were the case, estimations that did not account for this would produce over-estimates of poverty persistence rates.

In this study, we address the limitations of these studies by modeling low-income dynamics among ethnic minorities in the UK using data from Understanding Society (2010-2015) using the approach developed by (Cappellari and Jenkins, 2004). We estimate separate models for each of the ethnic groups considered: black African, black Caribbean, Bangladeshi, Pakistani and Indian groups. To our knowledge, this is also the first study to focus on how poverty persistence and poverty entry varies between and within the five largest ethnic minority groups in Britain using robust estimation methods. By explicitly modeling survey attrition, we control for potential non-random differences among ethnic minorities conditional on poverty status.

Our results suggest that there are important differences in both the magnitude and direction of the association of individual and household characteristics with poverty transitions across ethnic groups. We find high estimated poverty persistence rates (the probability of being poor in period  $t+1$  among those who are poor in period  $t$ ) across all groups, ranging from 66% among Indian and Pakistani groups to 52% among the white majority group (with around 55% for the other groups). Poverty entry rates on the other hand are highest among Bangladeshi and Pakistani groups (26% and 23%), followed by Indians, black African and black Caribbean (9-11%) groups and the lowest for white majority (6%). Current policy aimed at preventing low income in Britain focuses on reducing persistence but as our results show it is also important to implement policies to reduce the likelihood of falling into poverty or low income in the first instance. We also find evidence of scarring effects from being in poverty for Black African and white majority groups. The test for the absence of this scarring effect or GSD cannot be rejected for the other groups. An important finding is that the poverty persistence and poverty entry estimates vary significantly not only *between* ethnic groups, but also *within them*, which we demonstrate using stylised cases based on regression estimates.

We find that the hypothesis of joint exogeneity of initial conditions and non-random attrition is strongly rejected for all groups except Pakistanis and Bangladeshis. The hypothesis of exogeneity of one of the two conditions - initial conditions or non-random attrition holds for all other groups: for the Indian and black African groups we find evidence of bias arising due to non-random attrition only, while for white majority and black Caribbean groups we find evidence of bias arising due to initial conditions only. Not accounting for these biases results in under estimates of poverty persistence rates for Indian group

and over-estimation for black African groups, but makes very little difference for white majority and black Caribbean groups. These results highlight the consequences of ignoring these biases when estimating low income dynamics among ethnic minorities in Britain.

In the next section we provide a short review of the literature relating to living standards among ethnic minorities in the UK. Section 2 outlines the econometric model. Section 2 introduces our data and the descriptive statistics of the variables and instruments used in the analysis. Section 2 contains the results of the model, the tests of instrument validity and state dependence. This section also highlights the implications of the estimation results and shows how they relate to quantities of interest which describe the ‘poverty experience for different types of individuals. Section 2 concludes.

## 2 Background

Ethnic minorities in Britain face higher risks of being unemployed, having part-time jobs or working in low paid occupations than individuals from the white majority (e.g., Modood et al., 1997; Berthoud, 2002; Twomey, 2001; Hills, 2010; Brynin and Güveli, 2012; Longhi et al., 2012) even when differences in educational qualifications Dustmann et al. (2010) or language skills (Dustmann and Fabbri, 2003) have been controlled for, particularly in the case of women (Hills, 2010; Nandi and Platt, 2010). (Longhi et al., 2012) and (Lindley, 2002) find similar patterns for earnings, and for different definitions of ethnic minority group (e.g., considering religion in their definition). In addition, such inequalities not only persist over time (Berthoud and Blekesaune, 2007; Catney and Sabater, 2015), but also across generations (Cheung and Heath, 2007; Algan et al., 2010; Longhi et al., 2012). It is therefore not surprising that studies (Adelman et al., 2003; Berthoud, 2002; Platt, 2007b; Kenway and Palmer, 2007; Nandi and Platt, 2010; Barnard and Turner, 2011), have also found a higher proportion of ethnic minority individuals living in low income households, although with substantial differences between and within ethnic groups.<sup>1</sup> Figures from the Office for National Statistics (ONS) for 2014/2015 show that 14 percent of the individuals from the white majority group lived in low-income (where low income is defined as equivalised household income which is below 60% of the population median) households, while 38 percent of the Pakistani and Bangladeshi, and more than 20 percent of other ethnic minorities did so (Shale, 2016). Despite considerable reductions in poverty rates across all ethnic groups since the 1990s, the pattern of greater disadvantage among individuals from Pakistani, Bangladeshi and black African backgrounds still persist (Modood et al., 1997; Berthoud and Casey, 1998; Berthoud, 2000; Platt, 2007b).

Evidence on living standards among ethnic minority groups based on the British Household Panel Survey which started in 1991 also provides evidence of

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<sup>1</sup>See (Berthoud, 2002), (Kenway and Palmer, 2007), (Platt, 2007b), (Barnard and Turner, 2011) and (Weekes-Bernard, 2017) for reviews of the research on poverty and ethnicity in the UK.

higher poverty entry, and poverty persistence rates among some ethnic minority groups particularly Bangladeshi and Pakistani groups. However, the BHPS started with a sample of around 5,000 households and did not include an oversample of ethnic minorities. As a result, these studies are unable to estimate separate models for each of these ethnic groups, put another way, they assume differences in poverty across ethnic groups can only be explained in terms of differences in their individual characteristics and not how these contribute to their levels of income and poverty. The literature on ethnic minorities has consistently reported the existence of substantial heterogeneity between and within ethnic groups (Berthoud, 2000; Clark and Drinkwater, 2007; Platt, 2007b; Clark and Drinkwater, 2009; Dustmann et al., 2010; Nandi and Platt, 2010), suggesting that there is likely to be substantial variations in the degree and determinants of poverty persistence and the 'poverty experience' more generally. Ignoring these ethnic group differences and designing a 'one size fits all policy' to combat low income will therefore be less effective than policies that take into account these ethnic group differences. Adelman et al. (2003) shows that children in households with at least one non-white adult were twice as likely to be in severe and persistent poverty than those where no adult was non-white. After controlling for multiple socio-economic variables and local-economic conditions (Devecienti, 2002) find that non-white individuals (mostly Afro-Caribbean, Indian and Pakistani) are 35 percent less likely to exit poverty at any given moment than the white majority. Cappellari and Jenkins (2004) find that for households with Pakistani or Bangladeshi heads of household, being poor in one period raises the probability of being poor by 16 percent in the next period, with respect to a comparable household with a white majority household head. The higher persistence of poverty in these groups results in longer spells of poverty and shorter spells of non-poverty.

Two studies, Platt (2003) and Platt (2006) analyse poverty persistence among children of different ethnic groups using benefit receipt as a proxy of poverty. These studies use seven quarters of tax and benefits data of Birmingham residents (one of the largest cities in UK and with a higher proportion of ethnic minorities than the national population) during 1998-99. Platt (2003) finds that compared to white British children higher proportions of ethnic minority children, particularly Pakistani and Bangladeshi children, are likely to live in Income Support (IS) recipient households. However, the likelihood of living in an IS recipient household for all seven quarters, that is the likelihood of living in low income households persistently, is lower for ethnic minority children. Using a different approach to measuring poverty persistence, Platt (2006) estimates a discrete time hazard model to estimate the duration and risk of entering and exiting benefit. She finds that Bangladeshi children had lower probabilities of leaving benefits and higher probabilities of re-entry to benefits than the white majority group, while Indian and Pakistani children were as likely to exit benefit but more likely to re-enter benefits. The exception was black Caribbean children who had lower probabilities of re-entry.

Studies based on more recent data have also found that ethnic minority groups are more likely to become and remain poor. Using data from the first



two sweeps of the Millennium Cohort Study (2001-2004) which included an over-sample of ethnic minorities, Platt (2009) find that changes in the household composition and the entry of the main carer into the labour market have strong associations with the dynamics of poverty among children. This study finds that relative to the white majority, children from Pakistani and Bangladeshi origin were less likely to exit and more likely to fall in poverty, while Indian children were only more likely to enter poverty and the black Caribbean and black African children had similar probabilities in both cases. Another study using data from more recent sweeps of the MCS also find similar results (Nandi and Platt (2010)). However, parents are not representative of the whole population and MCS interviews are conducted at key ages of the cohort members (9 months, 3 years, 5 years, etc) and not every year and so income changes within these periods would not be recorded.

Making use of Understanding Society, a new longitudinal household survey with an ethnic minority boost sample that started in 2009, a recent report by Fisher and Nandi (2015) examined the correlates of poverty persistence and found that individuals from most ethnic minorities in the UK not only have higher rates of poverty and low-income, but also higher rates of poverty persistence and entry. They found that between 2009-2012, 31% of black African, 27% of Pakistani, 24% of Bangladeshi and 23% of black Caribbean groups were poor in at least two out of three periods observed, while 15% of Indians and 13% of white majority were. This study also found low education, migrant status and poor English language skills were associated with poverty persistence. In the case Pakistani households, those with persistent poverty were larger and more likely to have children. Barnes et al. 2015 using the same survey data find similar results for children. Specifically they find that Pakistani, Bangladeshi and black African children have higher rates of poverty entry (between 15 to 29 percent) than the white majority (around 5 percent), as well as lower rates of poverty exit (30 percent versus 40 percent for other ethnic groups) (Barnes et al., 2015).

However, with the exception of one study, none of these studies have accounted for two important issues which may lead to biases in estimates of poverty dynamics. First, they do not take into account the biases that may arise from non-random survey attrition as factors such as health status, age, migrant status may be correlated with poverty as well as attrition (Uhrig, 2008; Watson and Wooden, 2009; Lynn et al., 2012; Schneider, 2013). For example, that individuals living with better economic resources and hence less likely to remain poor may also be more likely to move and attrit. (Dercon and Shapiro, 2007; Watson and Wooden, 2009; Lynn et al., 2012; Schneider, 2013). Second, the existing studies did not treat an individual's initial poverty status as endogenous and so did not control for potential differences in the propensity to be poor before the survey begins. In other words, the poor may be a non-random sample of the population; they may be more likely to remain poor over time than the population (Heckman, 1981; Jenkins, 2011; Andriopoulou and Tsakloglou, 2015). The only study to do this for GB is Capellari and Jenkins (2004) estimate low income dynamics (transitions into and out of poverty) using a method that ac-

counts for various sources of observed and unobserved heterogeneity, as well as explicitly addresses these two sources of bias. Their method also allows testing for the existence of genuine state dependence (GSD) or scarring in poverty status. In these studies, the hypothesis (tested on the whole sample) of exogeneity of poverty transitions with respect to both initial conditions and attrition was strongly rejected, remarking the relevance of controlling for these elements to provide unbiased estimates. In addition, these authors find evidence of substantial state dependence, suggesting that around 60 percent of it was genuine state dependence. However, they did not allow the effect of individual and household characteristics on poverty persistence to vary across ethnic groups. As a result, we cannot say whether these findings are applicable to each ethnic minority group as well. In this paper we intend to address these issues by estimating poverty transition models suggested by Cappellari and Jenkins (2004) from Understanding Society, a longitudinal household survey with an ethnic minority boost sample.

## 2. Methodology

### Modeling transitions in and out of poverty

We use an endogenous switching model developed by (Cappellari and Jenkins, 2004) to analyse transitions in poverty status between two consecutive periods,  $t-1$  and  $t$ , as a system of equations consisting of initial poverty status (at  $t-1$ ) and an additional equation for attrition status (at  $t$ ), with free correlations between all the equations.

In the initial period,  $t-1$ , each individual  $i$ ,  $i = 1, \dots, N$ , can be characterised by a latent poverty propensity,  $p_{i,t-1}^*$ , expressed as:

$$p_{i,t-1}^* = \beta' x_{i,t-1} + \mu_i + \delta_{i,t-1}, \quad (1)$$

where  $x_{i,t-1}$  is a vector of explanatory variables at both individual and household level, and the error term  $u_{i,t-1}$  is the combination of an individual specific effect ( $\mu_i$ ) and an orthogonal white noise error ( $\delta_{i,t-1}$ ):  $u_{i,t-1} = \mu_i + \delta_{i,t-1}$ . In this model, both  $\mu_i$  and  $\delta_{i,t-1}$  are assumed to be normally distributed, implying  $u_{i,t-1} \sim N(0, 1)$ . Using  $p_{i,t-1}^*$  we can define  $P_{i,t-1}$ , which takes a value of 1 if  $p_{i,t-1}^* > 0$  and 0 otherwise.

The transitions in and out of poverty can be observed only if the individual provides income data at  $t-1$  and  $t$ , so the model incorporates the propensity of retention,  $r_{i,t}^*$ , as:

$$r_{i,t}^* = \psi' w_{i,t-1} + \eta_i + \xi_{i,t}, \quad (2)$$

where  $w_{i,t-1}$  is a vector of explanatory variables at both individual and household level,  $\psi$  is the vector of parameters, and the error term  $\nu_{i,t}$  is the combination of an individual specific effect ( $\eta_i$ ) and an orthogonal white noise error ( $\xi_{i,t}$ ), so that  $\nu_{i,t} = \eta_i + \xi_{i,t}$ .  $\eta_i$  and  $\xi_{i,t-1}$  are assumed to be normally distributed, which implies that  $\nu_{i,t} \sim N(0, 1)$ . Just as in the case of  $P_{i,t-1}$ , we can define  $R_{i,t} = I[r_{i,t}^* > 0]$ , which takes a value of 1 if  $r_{i,t}^* > 0$  and 0 otherwise.

For all the individuals observed in both periods, the latent propensity of poverty at  $t$ ,  $p_{i,t}^*$ , is characterised as:

$$p_{i,t}^* = [(P_{i,t-1})\gamma'_1 + (1 - P_{i,t-1})\gamma'_2]z_{i,t-1} + \tau_i + \zeta_{i,t-1}, \quad (3)$$

where  $\gamma'_1$  and  $\gamma'_2$  are column vectors of parameters,  $z_{i,t-1}$  is a vector of explanatory variables at both individual and household level as observed at  $t - 1$ , and the error term  $\epsilon_{i,t}$  is the combination of an individual specific effect  $\tau_i$  and an orthogonal white noise error  $\zeta_{i,t-1}$ :  $\epsilon_{i,t} = \tau_i + \zeta_{i,t}$ .  $\tau_i$  and  $\zeta_{i,t}$  are assumed to be normally distributed, implying  $\epsilon_{i,t} \sim N(0, 1)$ . Using  $p_{i,t}^*$  we can define  $P_{i,t}$ , which takes a value of 1 if  $p_{i,t}^* > 0$  and 0 otherwise.

Note that  $\epsilon_{i,t}$  and  $u_{i,t-1}$  are different given that equation 3 is conditional on poverty status in  $t - 1$ . Moreover, unlike equation 1, equation 3 include two sets of parameters reflecting that the determinants of poverty persistence and poverty entry may be different. In this sense,  $\gamma'_1$  provides the relevant coefficients for poverty persistence (i.e., the probability of being poor in  $t$ , given the individual was poor in  $t - 1$ ), while  $\gamma'_2$  for poverty entry (i.e., the probability of being poor in  $t$ , given that the individual was not poor in  $t - 1$ ).

The final component of the model is the definition of the correlations between the error terms,  $u_{i,t-1}$ ,  $\nu_{i,t-1}$  and  $\epsilon_{i,t-1}$ , which we assume to be jointly distributed as a trivariate normal, so that the unobserved heterogeneity can be parameterised as:

$$\rho_1 \equiv \text{corr}(\epsilon_{i,t-1}, \kappa_{i,t}) = \text{cov}(\zeta_i, \omega_i)$$

$$\rho_2 \equiv \text{corr}(\epsilon_{i,t-1}, \vartheta_{i,t}) = \text{cov}(\zeta_i, \tau_i)$$

$$\rho_3 \equiv \text{corr}(\kappa_{i,t}, \vartheta_{i,t}) = \text{cov}(\omega_i, \tau_i)$$

These parameters summarise the association between the unobserved individual-specific factors in each equation.  $\rho_1$  reflects the association between the unobserved individual effects of the initial poverty and the retention equation. A positive (negative) value of  $\rho_1$  would imply that those individuals in poverty at  $t - 1$  were more (less) likely to stay in the sample at  $t$ , compared to the non-poor at  $t - 1$ . Analogously, a positive (negative) value of  $\rho_2$  would imply that those individuals in poverty at  $t - 1$  were more (less) likely to be poor at  $t$ , compared to the non-poor at  $t - 1$ . A positive (negative) value of  $\rho_3$  would imply that those individuals providing income data in two consecutive periods are more likely to be poor at  $t$ , as compared with those who attrited. A sufficient condition for identification in this model is a set of exclusion restrictions, i.e. the inclusion of covariates associated with initial poverty status or retention which have no effect on conditional poverty status (Jenkins, 2011). This implies the inclusion of variables in  $x_{i,t-1}$  and  $w_{i,t-1}$ , which can be excluded from  $z_{i,t-1}$ . Treating as endogenous the initial poverty status, our estimates take into account the possibility that individuals in poverty at the beginning of the observation period could be a non-random sample who are more likely to remain poor over time, which could over-estimate the persistence estimates (Heckman, 1981; Jenkins,

2011). In addition, by explicitly modeling attrition, we control for potential non-random differences potentially correlated with poverty status which may also bias our results. By setting no restrictions on the correlation parameters, we are able to test if the transitions into and out of poverty are exogenous to either initial poverty or retention:  $H_0 : \rho_1 = \rho_2 = 0$  cannot be rejected then this indicates no evidence of initial conditions, similarly, if  $\rho_1 = \rho_3 = 0$  then we could ignore the non-random attrition problem and if  $\rho_1 = \rho_2 = \rho_3 = 0$  both processes would be exogenous and equations (1)-(3) can be estimated using univariate probit models.<sup>2</sup>

### Poverty durations

The probabilities of interest, namely poverty persistence and poverty entry can be estimated using the estimated coefficients in (1) – (3). In addition, closed form solutions exist for durations of interest related to the poverty experience, for further details see Appendix A.

### State dependence

Cappellari and Jenkins (2004) propose two measures of state dependence based on the estimates of poverty persistence and poverty entry (see Appendix A), which they denominate aggregate state dependence (ASD) and genuine state dependence (GSD). ASD is simply the overall poverty persistence which is computed by subtracting the average probability of being poor among those who were not poor at  $t - 1$ , from the average probability of being poor among those who were poor at  $t - 1$ . But as explained earlier GSD measures the scarring effect of being poor and is defined as the average difference in the probability of poverty persistence and poverty entry, at the individual level, so that the observed and unobserved factors affecting poverty persistence and poverty entry for each individual are accounted for. For further details see Appendix B.

### Marginal effects

We follow Cappellari and Jenkins (2004) and define the marginal effect as follows: notice that in equations 1 and 3 a change in any given characteristic will change the numerator and denominator of the expression. In order to keep conditioning events constant, we first estimate the probability of initial poverty separately for those individuals who are initially poor and take their average. We do the same for those who are non-poor. We then substitute the inverse normal of this quantity (separately for poor and non-poor individuals) into expressions 4 and 5. Marginal effects were calculated as the change in this expression for a unit change in each characteristic, holding all else constant, relative to the reference individual.<sup>3</sup> For each ethnic group, the reference individual is defined by setting continuous covariates to the sample median and all other covariates to zero (that is, the reference categories).

<sup>2</sup>Results for these simpler specifications are available on request.

<sup>3</sup>In the case of age and HoH age we define the marginal effect as an very small increase in these variables.

### 3. Data & variables

#### Definitions and sample selection

We use data from Waves 2-6 of Understanding Society, the largest longitudinal household survey in the UK which started in 2009 with 30,000 households including around 4,000 households from an ethnic minority boost sample (Buck and McFall, 2011; Knies, 2017).<sup>4</sup> These survey waves correspond to the calendar years 2010-2015. Adult sample members (16+ and older) are eligible for interviews every year until they die or move out of UK. Understanding Society provides detailed income data for the calculation of disposable household income (total current income net of income tax and social security contributions). In addition to including information about different aspect of people's live, the main advantage of Understanding Society for our analysis is the inclusion of the ethnic minority boost sample designed to ensure at least 1000 adult interviews from black African, Caribbean, Bangladeshi, Indian and Pakistani backgrounds (Berthoud et al., 2009; McFall and Buck, 2013).<sup>5</sup>

We focus on the five main ethnic minority groups in Great Britain<sup>6</sup>: Indian, Pakistani, Bangladeshi, black African and black Caribbean.<sup>7</sup> In addition, for comparative purposes we provide estimates for the white majority group (defined as those who self-reported their ethnic groups as white: English, Welsh, Scottish, Northern Irish or British) who reside in England. Given that 97% to 99% of different ethnic minority groups live in England we use white majority (England) as the comparison group.<sup>8</sup>

We use an income-based concept of relative poverty concept used widely in the UK, Europe and many other countries (Jenkins, 2011). An individual with net real equivalised (BHC) household income below 60 percent of the UK median is considered to be poor.<sup>9</sup> The net (BHC) household income provided with the data was calculated summing up the incomes of all household members net of income taxes and National Insurance contributions. This was then deflated by 2015 prices and adjusted by the standard OECD equivalence scale to compute

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<sup>4</sup>University of Essex. Institute for Social and Economic Research, NatCen Social Research, Kantar Public. (2017). Understanding Society: Waves 1-7, 2009-2016 and Harmonised BHPS: Waves 1-18, 1991-2009. [data collection]. 9th Edition. UK Data Service. SN: 6614

<sup>5</sup>The concept of ethnic minority is associated with multiple factors such as national identity, race, self-identification, religion, migration history, among others (Afkhami, 2012; Burton et al., 2008). However, for comparability with previous research in this area, we use the standard UK census classification of ethnicity.

<sup>6</sup>We excluded Northern Ireland as the ethnic minority oversample did not include NI. But as only 0.5% of the 16+ year old residents of Northern Ireland comprise of the five ethnic minority groups studied and 0.2% of the five ethnic minority groups studied live in Northern Ireland, the results for ethnic minorities are generalisable to the UK with very little coverage error

<sup>7</sup>Additional tests were performed including individuals with mixed backgrounds, but the results were qualitatively similar to those of the main groups.

<sup>8</sup>We also estimate the same models for white majority individuals living in Great Britain, the same geographic coverage as the ethnic minority populations. These are available upon request from authors..

<sup>9</sup>The monthly net equivalised income used to define a household as poor was £907.02 in wave 2, £915.62 in wave 3, £905.68 in wave 4, and £912.13 in wave 5 (constant prices of 2015).

the real net (BHC) equivalised household income.

Our main focus is on poverty experiences of working-age adults, which are closely associated to labour market outcomes.<sup>10</sup> Therefore, we restrict the sample to individuals between 25 to 59 years old in wave 2, who were not in full-time education. After data cleaning and setting the constraints described before, our sample consists of 66,128 observations, mainly from white majority (England) background (54,673) and ranging across ethnic minority groups from 1,727 observations for the black Caribbean group, to 3,403 observations for the Indian group (see Table 2 for sample sizes of all groups).

### Variables and sample description

Following previous work on poverty dynamics we use as covariates a set of variables related to the economic and social characteristics of the individual and the household (Cappellari and Jenkins, 2004; Ayllón, 2013; Kanabar, 2017). Given that the main element in our definition of poverty is household income, many of our variables are defined at the level of household head (HoH). In this analysis, we define as HoH the person in the household who owns or is responsible for the tenancy of the dwelling. Where more than one individual owns or rents the accommodation, we select as HoH the oldest of these individuals.<sup>11</sup> Specifically, we include age, gender, educational qualifications and health of the head of household as well as age and gender of the individual. We also include whether the benefit unit claims disability or incapacity benefit, number of employed persons in the household (in some specifications this is converted to a binary dummy variable corresponding to nobody in the household being in paid employment), the household composition (lone parent household, couple with children, multifamily household, single person household, couple with no children). The age variables are standardised by subtracting the mean (in a given ethnic group) and dividing by the standard deviation. We also include wave, year and region dummies (London; South and East England; Midlands, Wales and South West England, and North East and North West England, Yorkshire, Scotland)<sup>12</sup> Appendix C presents the mean of all the variables in our estimation by ethnic minority group. In all cases the information reported for these variables correspond to the initial period ( $t - 1$ ).

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<sup>10</sup>Although these elements are relevant to explain poverty experiences in other age groups, due to the relevance and particular characteristics of poverty in other age groups (e.g., children or pensioners) a single model for all the population would be inadequate.

<sup>11</sup>In a few households none of the members owned or rented the dwelling (less than 3 percent in our sample), so we select as HoH the individual who answered the household characteristics questionnaire in the survey, or otherwise the oldest household member. This definition is similar to that of household reference person often identified in the BHPS and Understanding Society who is expected to have the best information about the household.

<sup>12</sup>A richer set of characteristics was initially contemplated, but due to insufficient variation within individuals transitioning into and out of poverty in our sample the set of variables was considerably limited. The variables as well as the specific categorisation of discrete variables included vary across the models for the ethnic group. The choice is based on the models that converged.

The information in Appendix C supports the evidence on how the socio-economic characteristics of ethnic minorities not only substantially differ from those of white majority, but also across ethnic groups. Among the most pronounced dissimilarities, we find that the percentage of female HoH in the Indian, Pakistani and Bangladeshi groups is significantly lower than in the white majority, but larger among black African and black Caribbean households.<sup>13</sup>

We also find variation in educational qualification of the HoH, as reported in previous studies (e.g., (Hills, 2010)). For all groups other than the Bangladeshi, the proportion of individuals in households where the HoH has a university degree or higher qualification is higher than that among the white majority group. Moreover, the Bangladeshi and Pakistani groups have higher than average proportions of individuals living in households where the HoH does not have any qualifications.

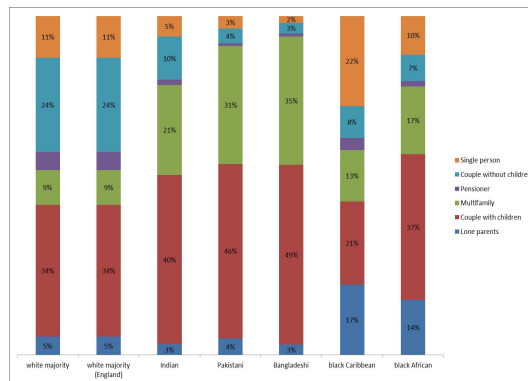


Figure 1: Household composition by ethnic group

In terms of the composition and type of household (see Figure 1), compared with white majority, Indian, Pakistani and Bangladeshi are more likely to live in multi-family households but less likely to live in single person households; black Caribbean and black African are more likely to live in single parent households; black Caribbean are less likely to be in households of couples with children and more likely to be in single person households. We also find, compared to white majority all ethnic minorities are more likely to have at least one child (0 to 18 years old), especially the Pakistani and Bangladeshi groups. Indeed, more than 40 percent of the households in these groups had at least one 0 to 4 years old child in the household, and more than 50 percent include at least one 5 to 11 years old. In contrast, less than 25 percent of the individuals in the white majority group lived in households with members in each of these age groups.

<sup>13</sup>

Table 1. Poverty inflow and outflow rates and income missingness by ethnic groups (row %)

Poverty status, year t-1	Poverty status, year t		
	Not poor	Poor	Missing
White majority			
Sample with non-missing income at t			
Not poor	82.52	5.43	12.05
Poor	41.30	44.80	13.90
White Majority (England)			
Sample with non-missing income at t			
Not poor	82.90	5.35	11.75
Poor	42.14	44.55	13.31
Indian			
Sample with non-missing income at t			
Not poor	75.87	7.38	16.75
Poor	34.17	50.42	15.41
Pakistani			
Sample with non-missing income at t			
Not poor	62.60	18.04	19.35
Poor	28.11	54.06	17.83
Bangladeshi			
Sample with non-missing income at t			
Not poor	58.02	20.55	21.43
Poor	35.51	46.73	17.76
Black Caribbean			
Sample with non-missing income at t			
Not poor	72.69	8.75	18.57
Poor	37.95	45.78	16.27
Black African			
Sample with non-missing income at t			
Not poor	66.58	8.70	24.71
Poor	27.99	47.22	24.79

Table 1 shows the pooled year-on-year poverty entry and poverty persistence rates of the ethnic groups studied in this paper. As expected there is variation across the ethnic groups. We find poverty entry rates for all ethnic minority groups to be higher than the white majority: around 5% for white majority group, 8-9% for Indian, black Caribbean and black African groups and 18-21% for Pakistani and Bangladeshi groups. Poverty persistence rates are also higher among ethnic minority groups compared to white majority, with Indian and



Pakistani groups reporting the highest persistence rates (50-54%), followed by the rest (46-47%) and the lowest for white majority (45%). There appears to be less variation in poverty persistence than in poverty entry rates highlighting the importance of tackling poverty entry. This table also shows that not accounting for attrition and non-response bias may result in inaccurate estimates of poverty entry and persistence given that for almost all groups the attrition rate is lower among the poor than non-poor. The exceptions are black African for whom this does not vary and for white majority for whom the opposite is true.

### Identification and instruments

Identification in the most general version of the model requires finding a set of variables in  $x_{i,t-1}$  (from equation 1) and  $w_{i,t-1}$  (from equation 2), uncorrelated with  $\tau_i$ , the unobserved individual effect in equation 3. Put another way, to satisfy the exclusion restrictions we require variables associated, on one hand, with the initial poverty status and, on the other, with the propensity to remain in the sample in the next period, but such that conditional on controlling for such instruments neither one nor the other influence the propensity to remain in or escape from poverty.

In the case of the initial poverty equation, following the work of Heckman (1981) and Cappellari and Jenkins (2004), we use as instruments individual characteristics defined before the individual joined the labour market. In our case, Understanding Society includes a variety of information about parental characteristics when the individual was 14 years old, such as presence in the household, education and labour market participation, in addition to information about migration trajectories, school leaving age, country of birth (both for the individual and their parents). Not all of these were suitable instruments for all groups, so that each ethnic minority group has its own set of instruments to satisfy the exclusion restrictions, highlighting the significant heterogeneity across ethnic groups and, hence, underscoring our approach to separately model poverty dynamics.

The selection of instruments for the retention equation takes advantage of the *paradata* available in Understanding Society, i.e., information about the process of data collection (such as the interview conditions, the characteristics of the interviewers and their assessment on the attitudes and cooperation of the respondents). Since the assignation of interviewers is exogenous to the household, it is unlikely that we will observe a correlation between their characteristics and the poverty transitions of the survey respondents, but a highly experienced interviewer or one that has interviewed the same household before may be more successful to get a full interview, thus we expect to observe an important correlation between the interviewers characteristics and the probability of having a successful interview in the future. In some cases we make use of whether an individual belongs to the original sample<sup>14</sup>, as an instrument in the retention

<sup>14</sup>In the BHPS and Understanding Society the household members of the sample selected and their descendants are considered to be Original Sample Members (OSM) and are followed wherever they go as long as it is within the UK while those who join a household of any such

equation, as in the study by Cappellari and Jenkins (2004). Other variables in the paradata may be correlated with poverty transitions as well as attrition, such as the number of calls required to get an initial interview (as households with unemployed or inactive individuals may be more likely to be present at home when the interviewer calls, than those where a larger fraction of individuals working full-time)<sup>15</sup>. As in the case of dealing with initial conditions, the instrument used to satisfy the exclusion restriction was not the same across ethnic minority groups.

#### **4. Estimation results**

We estimate the model described in Section 2 separately for each ethnic group. Our central interest is in poverty dynamics and therefore we do not discuss or report the results for 2, individuals interested in these results should contact the authors.

##### **Initial poverty status**

We first summarise the results for 1 which are consistent across groups and then briefly consider group specific results.

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OSM, are considered to be Temporary Sample Members (TSM) and are only interviewed as long as they are living with an OSM. In other words, OSMs are more likely to re-interviewed than TSMs

<sup>15</sup>However, for the Bangladeshi group this variable qualifies as an instrument based on the test

Table 2: Marginal effects for initial poverty at  $t - 1$  by ethnic minority group.

Covariate	WM	WME	IN	PK	BG	BC	BA
Age standardised	0.02	0.02	0.02	0.04	0.07	0.05	0
	(0)	(0)	(0.02)	(0.01)	(0.02)	(0.03)	(0.01)
Female	0	0	0.01	0	0.03	n/a	-0.01
	(0)	(0)	(0.02)	(0.01)	(0.02)	n/a	(0.02)
HoH age standardised	-0.02	-0.01	-0.02	-0.01	-0.04	-0.02	0
	(0)	(0)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)
HoH female	0.01	0.01	0.01	-0.04	-0.05	-0.04	-0.05
	(0)	(0.01)	(0.04)	(0.03)	(0.04)	(0.05)	(0.03)
HoH GCSE (11 years f/t education)	-0.03	-0.03	-0.05	-0.06	n/a	n/a	-0.01
	(0.01)	(0.01)	(0.06)	(0.04)	n/a	n/a	(0.05)
HoH A-level (13 years f/t education)	-0.06	-0.05	-0.17	-0.04	-0.01	n/a	-0.02
	(0.01)	(0.01)	(0.06)	(0.04)	(0.05)	n/a	(0.04)
HoH degree	-0.08	-0.07	-0.33	-0.19	-0.11	-0.16	-0.07
	(0.01)	(0.01)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)
HoH limiting illness	0.01	0.01	0	0.03	n/a	n/a	-0.01
	(0)	(0)	(0.04)	(0.03)	n/a	n/a	(0.03)
Nobody working in household	0.43	0.43	n/a	n/a	0.33	n/a	0.41
	(0.02)	(0.02)	n/a	n/a	(0.04)	n/a	(0.06)
Number of workers in household	n/a	n/a	-0.28	-0.21	n/a	-0.34	n/a
	n/a	n/a	(0.02)	(0.02)	n/a	(0.06)	n/a
Benefit unit claims disability/incapacity benefit	-0.07	-0.07	-0.24	-0.27	-0.19	-0.27	-0.14
	(0.01)	(0.01)	(0.09)	(0.05)	(0.04)	(0.07)	(0.05)
Lone parent household	0.04	0.04	n/a	n/a	n/a	-0.09	0.13
	(0.01)	(0.01)	n/a	n/a	n/a	(0.06)	(0.06)
Couple with children	0.05	0.05	0.01	0.09	0.19	0.16	0.16
	(0.01)	(0.01)	(0.04)	(0.03)	(0.06)	(0.06)	(0.05)
Multifamily household	0.05	0.06	0.14	0.07	0.09	n/a	0.16
	(0.01)	(0.01)	(0.04)	(0.03)	(0.06)	n/a	(0.06)
Single person household	0.08	0.09	n/a	n/a	n/a	-0.09	0.12
	(0.01)	(0.01)	n/a	n/a	n/a	(0.06)	(0.06)
Couple no children	-0.01	-0.01	-0.11	-0.06	n/a	n/a	n/a
	(0.01)	(0.01)	(0.07)	(0.07)	n/a	n/a	n/a

Table 2: Marginal effects for initial poverty at  $t - 1$  by ethnic minority group (continued)

Covariate	WM	WME	IN	PK	BG	BC	BA
Waves 2-3	0.02	0.02	n/a	n/a	0.24	n/a	-0.03
	(0.01)	(0.02)	n/a	n/a	(0.12)	n/a	(0.06)
Waves 3-4	0.01	0	n/a	n/a	0.13	n/a	-0.02
	(0.01)	(0.01)	n/a	n/a	(0.1)	n/a	(0.05)
Waves 4-5	0	0	n/a	n/a	0.11	n/a	-0.01
	(0.01)	(0.01)	n/a	n/a	(0.07)	n/a	(0.04)
2010	-0.03	-0.03	-0.07	-0.04	-0.23	-0.04	0.01
	(0.01)	(0.01)	(0.06)	(0.04)	(0.08)	(0.07)	(0.09)
2011	-0.01	-0.01	-0.01	0.01	-0.17	0.04	0.02
	(0.01)	(0.01)	(0.04)	(0.03)	(0.08)	(0.05)	(0.08)
2012	-0.01	-0.01	0.03	-0.03	-0.13	0.08	0
	(0.01)	(0.01)	(0.04)	(0.03)	(0.07)	(0.05)	(0.06)
2013	0	0	0.02	-0.02	-0.07	0.09	0
	(0.01)	(0.01)	(0.04)	(0.03)	(0.06)	(0.05)	(0.04)
South East and East of England	0.01	0.01	n/a	n/a	n/a	n/a	n/a
	(0.01)	(0.01)	n/a	n/a	n/a	n/a	n/a
Midlands, Wales and South West	0.05	0.05	n/a	n/a	n/a	0.14	n/a
	(0.01)	(0.01)	n/a	n/a	n/a	(0.07)	n/a
North East, North West, Scotland and Yorkshire	0.04	0.05	n/a	n/a	n/a	n/a	n/a
	(0.01)	(0.01)	n/a	n/a	n/a	n/a	n/a
London	n/a	n/a	-0.16	-0.18	-0.1	0.04	-0.04
	n/a	n/a	(0.04)	(0.05)	(0.04)	(0.06)	(0.03)
<b>N</b>	68,414	54,673	3,403	2,512	1,771	1727	2,042
<p>Notes: ** refers to significant at 1% level. * refers to significance at 5% level. Standard errors clustered at household level. n/a refers to model specification which excludes relevant variable. Base groups: male, HoH male, HoH no qualification, At least one person working in household or zero individuals working in household, benefit unit doesn't claim disability/incapacity benefit, pensioner household (plus other for particular ethnic minority group specification), Waves 5-6, calendar year 2014, reference geographic region varies depending on ethnic minority group specification (in case of WME specification Wales and Scotland are excluded).</p>							

Table 2 highlights the importance of employment. Households where there was at least one or more individuals in employment were significantly less likely to be in poverty.

Consistent with previous research our results highlight the importance of education. For all groups except black Africans, those living in a household where the HoH had a degree were significantly less likely to be in poverty at  $t - 1$  as compared one who had no educational qualifications. While the pattern was the same for black Africans, the coefficient was not statistically significant at 5%. The minority gap in education has been closing over the years which we have also found (see Appendix C). However, the relationship between education and earnings and hence poverty is more complicated among ethnic minorities. Ethnic minority employees are more likely to be overqualified than white employees (25%), the highest being for black Africans (40%) and Bangladeshis

(39%) (Brynin and Longhi, 2015).

As expected, for all groups, individuals living in households defined as ‘couple with children’ are more likely to be poor than those living in other household types (the exact comparison group varies by ethnic group).<sup>16</sup>

We also control for whether any individual in the benefit unit within a household may be receiving particular types of benefit income specifically related to poor health. The results highlight that across all groups, being in receipt of such benefits reduced the likelihood of being in poverty, however, it is important to emphasise that these benefits are likely to be spent on particular services such as care and support, and therefore the income received from such benefits is unlikely to improve living standards in the traditional sense of a transfer from the state to the individual. Indeed our results echo the findings of previous research on the use of disability adjusted poverty lines (Morciano et al., 2015).

We also find that individuals from white majority, Indian, Pakistani and Bangladeshi groups, living in London are less likely to be poor.

While sex of the individual or the head of household does not play a role in determining initial poverty, age does. We find that older Pakistani and Bangladeshi individuals are more likely to be poor *ceteris paribus*.

### **Poverty entry**

We first discuss the factors which affect poverty entry consistently across ethnic minority groups and then go on to consider group specific results.

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<sup>16</sup>Note that among particular ethnic minority groups such as Indian, Pakistani and Bangladeshi there is a very low proportion of lone parent households and therefore we include these in the base group. For Black Africans lone parent households are also more likely to be in poverty relative to the base group (couple with no children and pensioners).

Table 3: Marginal effects for poverty entry at  $t$  by ethnic minority group.

Covariate	WM	WME	IN	PK	BG	BC	BA
Age standardised	0	0.04	0	0.02	0.01	0.01	0.01
	(0)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Female	0	0.04	0.01	-0.03	-0.02	n/a	-0.01
	(0)	(0.01)	(0.02)	(0.02)	(0.03)	n/a	(0.02)
HoH age standardised	0	0.04	-0.03	-0.05	-0.01	-0.03	0.02
	(0)	(0.01)	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)
HoH female	0	0.04	-0.01	0	-0.03	-0.01	0.03
	(0)	(0.01)	(0.04)	(0.05)	(0.05)	(0.02)	(0.03)
HoH GCSE (11 years f/t education)	-0.01	0.02	-0.01	-0.07	n/a	n/a	-0.05
	(0)	(0)	(0.07)	(0.07)	n/a	n/a	(0.06)
HoH A-level (13 years f/t education)	-0.03	0.01	-0.11	-0.08	-0.05	n/a	-0.05
	(0.01)	(0)	(0.07)	(0.08)	(0.05)	n/a	(0.06)
HoH degree	-0.03	0	-0.15	-0.21	-0.13	-0.04	-0.07
	(0.01)	(0)	(0.07)	(0.11)	(0.09)	(0.02)	(0.06)
HoH limiting illness	0.01	0.05	0.01	0.03	n/a	n/a	0.05
	(0)	(0.01)	(0.04)	(0.05)	n/a	n/a	(0.04)
Nobody working in household	0.04	0.07	n/a	n/a	0.11	n/a	0.19
	(0.01)	(0.01)	n/a	n/a	(0.12)	n/a	(0.11)
Number of workers in household	n/a	n/a	-0.08	-0.13	n/a	-0.03	n/a
	n/a	n/a	(0.02)	(0.06)	n/a	(0.02)	n/a
Benefit unit claims disability/incapacity benefit	0	0.04	-0.03	-0.07	-0.06	0.03	-0.08
	(0)	(0.01)	(0.06)	(0.08)	(0.08)	(0.03)	(0.05)
Lone parent household	0.03	0.07	n/a	n/a	n/a	0	0.09
	(0.01)	(0.01)	n/a	n/a	n/a	(0.03)	(0.06)
Couple with children	0.02	0.06	-0.1	0.24	0.21	-0.01	0.04
	(0)	(0.01)	(0.05)	(0.07)	(0.13)	(0.03)	(0.04)
Multifamily household	0.01	0.05	0.02	0.26	0.14	n/a	-0.03
	(0.01)	(0.01)	(0.05)	(0.07)	(0.08)	n/a	(0.04)
Single person household	0.02	0.07	n/a	n/a	n/a	0.01	-0.05
	(0.01)	(0.01)	n/a	n/a	n/a	(0.03)	(0.04)
Couple no children	-0.01	0.03	-0.09	0.09	n/a	n/a	n/a
	(0)	(0.01)	(0.06)	(0.1)	n/a	n/a	n/a

Table 3: Marginal effects for poverty entry at  $t$  by ethnic minority group (continued).

Covariate	WM	WME	IN	PK	BG	BC	BA
Waves 2-3	0	0.04	n/a	n/a	-0.01	n/a	-0.03
	(0.01)	(0.01)	n/a	n/a	(0.14)	n/a	(0.06)
Waves 3-4	0	0.04	n/a	n/a	0	n/a	-0.04
	(0.01)	(0.01)	n/a	n/a	(0.1)	n/a	(0.05)
Waves 4-5	0	0.03	n/a	n/a	-0.02	n/a	-0.04
	(0)	(0.01)	n/a	n/a	(0.08)	n/a	(0.04)
2010	0	0.04	0.09	0.08	-0.02	0.03	0.07
	(0.01)	(0.01)	(0.06)	(0.09)	(0.19)	(0.04)	(0.11)
2011	0	0.03	0.02	0.06	-0.06	-0.01	0.03
	(0.01)	(0.01)	(0.05)	(0.07)	(0.12)	(0.04)	(0.09)
2012	0.01	0.04	-0.04	0.05	0	-0.02	0.05
	(0.01)	(0.01)	(0.06)	(0.07)	(0.11)	(0.04)	(0.08)
2013	0.01	0.04	-0.09	0.01	0.02	-0.03	-0.01
	(0)	(0.01)	(0.06)	(0.08)	(0.09)	(0.04)	(0.05)
South East and East of England	0.01	0.05	n/a	n/a	n/a	n/a	n/a
	(0.01)	(0.01)	n/a	n/a	n/a	n/a	n/a
Midlands, Wales and South West	0.02	0.06	n/a	n/a	n/a	0.03	n/a
	(0.01)	(0.01)	n/a	n/a	n/a	(0.04)	n/a
North East, North West, Scotland and Yorkshire	0.02	0.06	n/a	n/a	n/a	n/a	n/a
	(0.01)	(0.01)	n/a	n/a	n/a	n/a	n/a
London	n/a	n/a	-0.05	0	0.01	0.05	-0.02
	n/a	n/a	(0.03)	(0.06)	(0.05)	(0.03)	(0.03)
<b>N</b>	<b>68,414</b>	<b>54,673</b>	<b>3,403</b>	<b>2,512</b>	<b>1,771</b>	<b>1727</b>	<b>2,042</b>
Notes: ** refers to significant at 1% level. * refers to significance at 5% level. Standard errors clustered at household level. n/a refers to model specification which excludes relevant variable. Base groups: male, HoH male, HoH no qualification, At least one person working in household or zero individuals working in household, benefit unit doesn't claim disability/incapacity benefit, pensioner household (plus other for particular ethnic minority group specification), Waves 5-6, calendar year 2014, reference geographic region varies depending on ethnic minority group specification (in case of WME specification Wales and Scotland are excluded).							

Table 3 shows three factors were found to be consistently important across the most of the ethnic minority groups: HoH education, number or presence of individual(s) in employment and household type. As expected, individuals living in a household where the HoH has a degree are significantly less likely to enter poverty, the reduction in probability of entering poverty ranged from 0.03 and 0.04 for white majority and black Caribbean groups, 0.15 for Indian and 0.21 for Pakistani (while negative the marginal effects for black African and Bangladeshi groups were not statistically significant at 5% level of significance). Similarly, individuals living in a household where there was a higher number of individuals in employment were less likely to enter poverty but the marginal effects are not statistically significant for Bangladeshi, black Caribbean and black African groups.<sup>17</sup>

<sup>17</sup>For the WME and BA group we instead included a dummy which was equal to 1 if the

In terms of household type for the white majority England, Bangladeshi and Pakistani groups, couples with children are more likely to enter poverty relative to the base group while for the Indian group the opposite is true (for Bangladeshi this is significant only at the 10% level). Note the reference group includes pensioner households, but for Pakistani and Indian groups it also includes single person and lone parent households which comprise only 8% of these groups as opposed to 16% for the white majority, while for Bangladeshi it also includes couples with children. Also for the white majority group all groups with the exception of couples with no children are more likely to enter poverty. We find some other factors that are relevant for specific groups in explaining poverty entry (see Table 3): For the Pakistani group HoH age had a negative impact on poverty entry, holding all else constant (10% level of significance); living in London reduces the risk of poverty entry for Indians and white majority but increases that for black Caribbeans (but the p-values are 0.12 and 0.09), and ill-health of the HoH increases the poverty entry risk for white majority.

### Poverty persistence

Similar to Cappellari and Jenkins (2004) we find that there are fewer statistically significant estimated coefficients in the poverty persistence equation in specifications which also control for initial poverty. However, this is to be expected: the approach we follow controls for potential sources of bias due to initial conditions and non-random attrition. For example, when we estimated a model which ignored initial conditions (results available upon request), we found more statistically significant coefficients for the transition equation. In addition, the lack of statistically significant coefficients in the transition equation is related to the relatively low number of individuals at risk of poverty persistence, compared to poverty entry (Cappellari and Jenkins, 2004). For this specific study, this is exacerbated by the relatively low sample sizes for each of the ethnic minority groups despite the boost sample in UKHLS.<sup>18</sup>

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individual lived in a household where nobody was in paid employment.

<sup>18</sup>For the Pakistani and Bangladeshi group no covariates were statistically significant in determining poverty persistence.



Table 4: Marginal effects for poverty persistence at  $t$  by ethnic minority group.

Covariate	WM	WME	IN	PK	BG	BC	BA
Age standardised	0.01	0.01	-0.01	0.03	0.05	-0.03	0.02
	(0.01)	(0.01)	(0.03)	(0.03)	(0.05)	(0.02)	(0.02)
Female	-0.01	0	-0.03	0.01	0.06	n/a	0.01
	(0.01)	(0.01)	(0.03)	(0.02)	(0.06)	n/a	(0.03)
HoH age standardised	0.01	0.01	0.03	-0.01	0.03	0.06	-0.02
	(0.01)	(0.02)	(0.04)	(0.03)	(0.04)	(0.05)	(0.03)
HoH female	0.03	0.03	0.04	-0.05	0.07	0.02	-0.05
	(0.02)	(0.02)	(0.06)	(0.05)	(0.06)	(0.03)	(0.06)
HoH GCSE (11 years f/t education)	0.03	0.04	0.09	0.07	n/a	n/a	0.25
	(0.02)	(0.03)	(0.08)	(0.06)	n/a	n/a	(0.15)
HoH A-level (13 years f/t education)	0.01	0.02	0.02	0.09	-0.07	n/a	0.23
	(0.03)	(0.03)	(0.08)	(0.06)	(0.09)	n/a	(0.12)
HoH degree	0.02	0	-0.02	-0.02	0.04	0.04	0.1
	(0.06)	(0.04)	(0.1)	(0.08)	(0.08)	(0.05)	(0.1)
HoH limiting illness	-0.01	0	-0.03	0.03	n/a	n/a	-0.03
	(0.02)	(0.02)	(0.07)	(0.05)	n/a	n/a	(0.04)
Nobody working in household	-0.11	-0.08	n/a	n/a	-0.03	n/a	0.16
	(0.07)	(0.05)	n/a	n/a	(0.09)	n/a	(0.09)
Number of workers in household	n/a	n/a	-0.05	-0.02	n/a	0.13	n/a
	n/a	n/a	(0.05)	(0.06)	n/a	(0.08)	n/a
Benefit unit claims disability/incapacity benefit	0.02	0	-0.04	-0.1	-0.04	0.12	-0.07
	(0.04)	(0.03)	(0.11)	(0.1)	(0.13)	(0.1)	(0.07)
Lone parent household	0.05	0.05	n/a	n/a	n/a	0.13	0.07
	(0.03)	(0.04)	n/a	n/a	n/a	(0.09)	(0.07)
Couple with children	0.03	0.04	0.12	-0.03	0.02	-0.02	0.05
	(0.03)	(0.04)	(0.07)	(0.07)	(0.11)	(0.04)	(0.07)
Multifamily household	-0.05	-0.05	0.06	-0.05	0	n/a	0.23
	(0.04)	(0.04)	(0.08)	(0.06)	(0.09)	n/a	(0.1)
Single person household	0.13	0.13	n/a	n/a	n/a	0.06	0.07
	(0.04)	(0.04)	n/a	n/a	n/a	(0.06)	(0.08)
Couple no children	0.07	0.07	0.2	0.04	n/a	n/a	n/a
	(0.03)	(0.03)	(0.09)	(0.15)	n/a	n/a	n/a

Table 4: Marginal effects for poverty persistence at  $t$  by ethnic minority group (continued).

Covariate	WM	WME	IN	PK	BG	BC	BA
Waves 2-3	-0.05	-0.02	n/a	n/a	-0.16	n/a	-0.05
	(0.05)	(0.05)	n/a	n/a	(0.22)	n/a	(0.07)
Waves 3-4	-0.03	0	n/a	n/a	-0.07	n/a	0.02
	(0.04)	(0.04)	n/a	n/a	(0.18)	n/a	(0.09)
Waves 4-5	0.02	0.03	n/a	n/a	-0.19	n/a	-0.01
	(0.03)	(0.03)	n/a	n/a	(0.15)	n/a	(0.05)
2010	0.08	0.05	-0.1	0.14	0.06	0.14	0.24
	(0.06)	(0.06)	(0.1)	(0.08)	(0.19)	(0.11)	(0.24)
2011	0.06	0.02	0.07	0.02	-0.02	0.18	0.13
	(0.05)	(0.05)	(0.09)	(0.07)	(0.19)	(0.1)	(0.17)
2012	0.06	0.04	-0.05	0.09	-0.02	0.07	0.03
	(0.04)	(0.04)	(0.09)	(0.07)	(0.18)	(0.08)	(0.09)
2013	0.04	0.03	0	0.07	-0.04	0.05	0.18
	(0.03)	(0.03)	(0.09)	(0.07)	(0.12)	(0.07)	(0.13)
South East and East of England	0.01	0	n/a	n/a	n/a	n/a	n/a
	(0.04)	(0.04)	n/a	n/a	n/a	n/a	n/a
Midlands, Wales and South West	0.03	0.03	n/a	n/a	n/a	0.06	n/a
	(0.04)	(0.04)	n/a	n/a	n/a	(0.06)	n/a
North East, North West, Scotland and Yorkshire	0.06	0.06	n/a	n/a	n/a	n/a	n/a
	(0.04)	(0.04)	n/a	n/a	n/a	n/a	n/a
London	n/a	n/a	0.04	-0.08	-0.07	0.1	-0.02
	n/a	n/a	(0.07)	(0.08)	(0.08)	(0.07)	(0.03)
<b>N</b>	<b>68,414</b>	<b>54,673</b>	<b>3,403</b>	<b>2,512</b>	<b>1,771</b>	<b>1727</b>	<b>2,042</b>
Notes: ** refers to significant at 1% level. * refers to significance at 5% level. Standard errors clustered at household level. n/a refers to model specification which excludes relevant variable. Base groups: male, HoH male, HoH no qualification, At least one person working in household or zero individuals working in household, benefit unit doesn't claim disability/incapacity benefit, pensioner household (plus other for particular ethnic minority group specification), Waves 5-6, calendar year 2014, reference geographic region varies depending on ethnic minority group specification (in case of WME specification Wales and Scotland are excluded).							

Household type is the only factor we find which is important in determining poverty persistence across ethnic groups (see Table 4). The results show that it is not the same household types however which are important, for example in the case of the white majority group single person and couple with no children households are significantly more likely to persist in poverty relative to pensioner households. Whereas for the Indian group couples with no children are more likely to persist in poverty relative to the base group (pensioners, single person, lone parents and other household types). For the black Caribbean group multifamily households are more likely to persist in poverty relative to pensioner, lone parent, single person and other household types.

## Implications for modeling low income dynamics

By modeling the most general version of the model for each group it is possible to test the correlations between each of the individual regression equations and determine which sources of bias, if any, should be controlled for. Put another way, we are able to make recommendations for the preferred framework which should be used when modeling low income dynamics for each ethnic minority group.

Table 5 describes a range of tests using the correlation estimates  $\rho_1, \rho_2$  and  $\rho_3$  and also tests of exogeneity of initial conditions and non-random attrition. A common finding across all groups is that  $\rho_1$  is insignificant, put another way, there is no relationship between factors determining initial poverty status and income retention.  $\rho_2$  is negative and statistically significant for the Indian, black Caribbean and white majority groups, which implies that individuals who are initially poor are less likely to be poor at  $t$  relative to individuals who initially non-poor (i.e. mean reversion).  $\rho_3$  is statistically significant for the Indian, Black Caribbean and Black African groups and positive for the Indian group. In other words, compared to those who attrited, Indians who were observed in both periods were less likely to be currently poor (persist or fall into poverty) while black Caribbean and black African groups who were observed in both periods were more likely to be currently poor.

Table 5: Equation correlations to identify evidence of initial conditions and non-random attrition.

EM group	$cov(\zeta_i, \omega_i) = 0$	$cov(\zeta_i, \tau_i) = 0$	$cov(\omega_i, \tau_i)$	Initial conditions	Non random attrition	Joint exogeneity
	$\rho_1 = 0$	$\rho_2 = 0$	$\rho_3 = 0$	$\rho_1 = \rho_2 = 0$	$\rho_1 = \rho_3 = 0$	$\rho_1 = \rho_2 = \rho_3 = 0$
WM	NR	R**	R*	R**	R*	R**
WME	NR	R**	NR	R**	NR	R**
IN	NR	R*	R**	NR	R**	R**
PK	NR	NR	NR	NR	NR	NR
BG	NR	NR	NR	NR	NR	NR
BC	NR	R**	R*	R***	NR	R**
BA	NR	NR	R**	NR	R**	R**

NR=Not reject, R= reject. \* significant (at least) at 5% level, \*\* significant (at least) at 1% level.

These results underline the heterogeneity between different ethnic groups and the importance of modeling low income dynamics separately for each ethnic group. Table 5 implies non-random attrition should be accounted for when modeling low income dynamics for the Indian and black African groups. For the black Caribbean and white majority groups there is evidence of bias due to initial conditions. Finally, we test for joint exogeneity of both initial conditions and non-random attrition, which would imply estimating low income dynamics using univariate probits models for each equation, in all groups except Pakistani and Bangladeshi this was rejected at conventional levels of significance.

Using the recommendations based on the tests of exogeneity of initial conditions or non-random attrition, in Table 6 we compare the estimates of poverty

entry and persistence derived from the most general model versus simpler (and in some cases preferred (in bold)) specifications. In doing so, we highlight the magnitude of the differences in estimates of poverty entry and persistence rates if one were to ignore these one or both sources of bias, which is particularly pertinent given the renewed government interest in the publishing low income dynamics among specific subgroups in the UK (DWP, 2018).

Table 6: Poverty entry and persistence rates based on raw data versus alternative model specifications

Poverty entry						
Ethnic group	observed	observed	$P_{i,t-1}:\text{exog}$	$R_{i,t}:\text{exog}$	Both:exog	Both:endog
	(ignoring missing data)	(with missing data)				
white majority	6.1%	5.4%	5.7%	6.2%	6.3%	5.5%
white majority (England)	6.1%	5.35%	5.4%	<b>6.1%</b>	6.1%	5.7%
Indian	8.9%	7.38%	<b>19.5%</b>	8.8%	8.8%	19.1%
Pakistani	22.4%	18.0%	21.7%	22.6%	<b>22.6%</b>	26.1%
Bangladeshi	26.2%	20.6%	30.0%	25.7%	<b>25.7%</b>	29.7%
black Caribbean	10.7%	8.75%	8.8%	<b>10.9%</b>	10.8%	9.3%
black African	11.6%	8.7%	<b>9.2%</b>	11.7%	11.7%	8.9%
Poverty persistence						
white majority	52%	44.8%	49.4%	<b>52.0%</b>	52.0%	47.3%
white majority (England)	51.8%	44.55%	47.2%	<b>51.6%</b>	51.6%	48.6%
Indian	50.4%	59.6%	<b>65.7%</b>	59.2%	59.1%	65.7%
Pakistani	65.8%	54.1	64.3%	65.6%	<b>65.6%</b>	69.0%
Bangladeshi	56.8%	46.73%	60.2%	56.2%	<b>56.3%</b>	59.9%
black Caribbean	54.7%	45.8%	45.7%	<b>54.4%</b>	54.9%	55.1%
black African	62.8%	47.2%	<b>54.6%</b>	62.2%	62.2%	52.4%
Notes: observed (ignoring missing data) refers to entry and persistence rate based on raw data not accounting for missing data.						
Observed (with missing data) accounts refers to entry and persistence rate based on raw data accounting for missing data.						
Entry and persistence rates based on model estimated using sample including individuals who have missing income data at period $t$ .						

The preferred specification for the Indian and black African group as implied by the results in Table 5 is a sample selection model, as there is evidence of a bias arising due to non-random attrition. Table 6 shows that the estimate of poverty entry and persistence for this type of model is 10% and 66% respectively, this leads to significantly higher estimates of poverty entry and persistence than that observed in the raw data or based on the univariate model (9% and 50-60% respectively) which is consistent with  $\rho_3$  being negative (more likely to observe the non-poor in both periods). For the black African groups, the poverty entry and persistence rates based on the preferred model is 9% and 55% which is lower than the observed rates as well as the ones based on the univariate model (12% and 63%). This is consistent with  $\rho_3$  being positive (more likely to observe the poor in both periods).

The results from Table 5 implies that there is no bias due to initial conditions or non-random survey attrition for the Pakistani or Bangladeshi sample, therefore the optimal specification for modeling low income dynamics for this

group is a univariate probit model. Table 6 shows that the estimate of poverty entry (persistence) based on such a model for the Pakistani and Bangladeshi sample respectively is 22% (66%) and 26% (56%) is very close to that observed in the raw data (22%, 66% for Pakistanis and 26%, 57% for Bangladeshis).

The results from Table 5 shows that there is no sample selection issue for the white majority and Black Caribbean groups, but there is evidence of bias due to initial conditions. Therefore, an endogenous selection model, such as a bivariate probit, is the preferred framework for modeling low income dynamics for this group. Table 6 shows that the estimate of poverty entry and persistence for black Caribbean from such a model (11% and 54%) based on our sample is close to the raw poverty entry rate observed in the data (11% and 55%) as well as the univariate model (11% and 55%). For white majority (England) the poverty entry and persistence rates based on the preferred model is 6% and 52% which are the same as those based on the univariate model or raw estimates. In other words, although there is evidence of endogenous selection, this has almost no effect on the poverty entry and persistence estimates for these groups. Finally, the most general version of the model should be used to analyse low income dynamics among the white majority group, as Table 5 shows there is evidence of a bias arising due to initial conditions and non random attrition. Indeed, the estimates of poverty entry and persistence based on the most general version of the model are closest to those observed in the raw data (accounting for missing values).

**Justification of instruments and sensitivity tests** The first two rows of Tables D1-D7 in Appendix D test the relevance of the instruments. In all cases there is a strong association, in the expected direction, between the instrument and the outcome of interest. The frameworks (with the exception of the univariate probit) we use require the instruments to be uncorrelated with conditional poverty status. An alternative way to test for instrument validity is to rely on functional form for identification, such that the instruments we use to control for initial conditions and non random attrition are over identifying and testable. We therefore include the (interacted) instrument as an additional covariate in 3. The results suggest that both the instruments for initial conditions and non-random attrition are independently and jointly insignificant, implying that the instruments are valid.<sup>19</sup> Whilst we rely on the errors to be trivariate normal for model tractability, we also estimate a test of normality of the residuals for each of the equations in our system. Although the analytical tests rejected the hypothesis of normality in most cases, quantile plots (not reported) show that the quantile distribution of the residuals is very close to the normal distribution, particularly for the initial poverty equation.

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<sup>19</sup>The only exception is the instrument (mother not work when aged 14) used to control for initial conditions in the Indian group, however this was only significant at the 10% level.

## Stylised simulations

Tables 3 and 4 shows that the determinants of poverty persistence and poverty entry among ethnic minority groups can differ to those of the white majority, even in groups usually assumed to be similar, such as the Indians. More generally, it is of interest to understand how this affects within group variation in poverty persistence or poverty entry. In this section we present the estimated probability of poverty persistence and poverty entry ( $s_{it}$  and  $e_{it}$ , in the terminology of 2). In addition we estimate steady state measures of unconditional poverty and the mean and median duration (in years) of a poverty or non-poverty spells for hypothetical individuals with the same observable characteristics, and study the changes in these indicators after one or more of their attributes is modified.

For each ethnic minority group we define a reference individual. The reference individual is an adult male whose age is set to the median in his ethnic group, he has no qualifications, is living in a two person (couple) household with children, and only one person in the household works.<sup>20</sup> From this reference point (1), we see how the estimated probabilities change when (2) the individual's age is decreased by 10 years, (3) the individual's age is increased by 10 years, (3) the individual is female, (4) the HOH is female, (5) the individual is female and the HOH is female, (4) the HoH has a degree, (5) no members in the household work, and (6) a benefit unit within the household is in receipt of disability/incapacity benefit. All other characteristics are set to zero, so refer to the base category of each variable. Here we focus on changes in characteristics which significantly change the quantities of interest compared to the reference individual, full results for each ethnic minority group can be found in Tables E1-E7 in Appendix E.

**Indian** The estimated poverty persistence and entry rate for the reference individual is 0.75 and 0.4 respectively. His unconditional poverty rate is 0.62 and his mean (median) duration of a poverty is 3.98 (2.4) years. His mean (median) spell of non-poverty is 2.49 (1.35) years.

If the reference individual lives in a household where the HoH has a degree, then his poverty persistence (entry) rate falls to 0.64 (0.2); indicating that higher education reduces both persistence and entry for this group. His unconditional rate of poverty is 0.36. In terms of poverty spells, this falls significantly relative to the reference individual, his estimated mean (median) spell length of poverty is 2.81 (1.57) years and estimated mean (median) spell length of non-poverty is 4.95 (3.07) years respectively. If the reference individual lives in a household where there are no members in work then his probability of poverty persistence is 0.83. The probability he enters poverty increases to 0.58; and his unconditional rate of poverty is 0.77. These figures underline the importance of paid employment for avoiding and persisting in poverty. In terms of duration of poverty spells, this also increases, his estimated mean (median) spell length

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<sup>20</sup>For the black African, white majority and white majority (England group) the reference person has at least one person working in the household.

of poverty is 5.82 (3.68) years and estimated mean (median) spell length of non-poverty falls to 1.73 (0.81) years. If the reference male lives in a household where someone claims disability/incapacity benefit then his poverty persistence and entry rate is 0.65 and 0.327 respectively. His unconditional poverty rate is 0.48; in terms of duration of poverty spells, this falls relative to the reference individual, his estimated mean (median) spell length of poverty is 2.84 (1.6) years and estimated mean (median) spell length of non-poverty is 3.14 (1.8) years. As we have suggested that the fact that such income streams are not subtracted from disposable income (given their intended use) disguises the actual living standards for disabled/incapacitated individuals and highlights the need for disability adjusted poverty lines.

**Pakistani** The reference person has a poverty persistence and entry rate of 0.64 and 0.54 respectively. His unconditional rate of poverty is 0.6, and his estimated mean (median) spell of poverty is 2.81 years (1.57). His estimated spell of non-poverty is 1.85 and 0.89 years.

If the reference male lives in a household where the HoH holds a degree, then his estimated poverty persistence and entry rate falls (the latter significantly) to 0.58 and 0.25 respectively. Similarly his unconditional poverty rate falls significantly relative to the reference individual, to 0.37 as does his mean (median) estimated spell in poverty, 2.4 and 1.28 years respectively. His mean (median) estimated spell of non-poverty is 4 (2.41) years. If the reference individual lives in a household where nobody is in employment, then his poverty persistence and entry rate increase significantly to 0.69 and 0.73 respectively. His unconditional poverty rate is 0.7; his estimated mean (median) spell of poverty also increases to 3.20 (1.85) years and his estimated mean (median) spell of non-poverty falls to 1.36 (0.52) years. Finally, if the reference male lives in a household where someone claims disability/incapacity benefit then his poverty persistence and entry rate is 0.49 and 0.4 respectively. His unconditional poverty rate is 0.44; in terms of duration of poverty spells, this lower compared to the reference individual, his estimated mean (median) spell length of poverty is 1.96 (0.97) years and estimated mean (median) spell length of non-poverty is 2.5 (1.36) years.

**Bangladeshi** The estimated poverty persistence and entry rate for the reference individual is 0.66 and 0.49 respectively. His unconditional poverty rate is 0.59 and his mean (median) duration of a poverty is 2.93 (1.66) years; his mean (median) non-poverty spell is 2.04 (1.03) years. If his age decreases by ten years then his poverty persistence (entry) rate decreases to 0.53 (0.49). His unconditional rate of poverty also decreases to 0.51, as does his mean (median) duration of poverty 2.12 (1.29). His mean (median) duration of non-poverty falls to 2.04 (1.03) years. If instead the reference individual's age increases by 10 years then we find an opposite pattern, poverty persistence and entry rates increase, as do poverty spells. Similarly, poverty estimates increase if instead the reference individual is female albeit not to the same extent as a 10 year increase in men's age.

If the reference individual lives in a household where the HoH has a degree, then his poverty persistence (entry) rate is 0.66 (0.25), highlighting the importance of higher education on reducing entry poverty for this group. His unconditional poverty rate is 0.42; and his mean (median) duration of poverty is 2.94 (1.67) years and his mean (median) duration of non-poverty is 4 (2.41) years. If the reference individual lives in a household where nobody is in work then his poverty persistence (entry) rate is 0.72 (0.74), highlighting that employment has a strong effect on both poverty entry (in particular) and persistence. His unconditional rate of poverty is 0.72 and his mean (median) duration of poverty is 3.56 (2.1) years. His mean (median) estimated period of non-poverty falls to 1.35 (0.52) years. The final stylised case considers the case where the reference individual lives in a household where one individual (not necessarily himself) is in receipt of disability/incapacity benefit; in this case his poverty persistence and entry rate is 0.5 and 0.34 respectively. His unconditional poverty rate is 0.4 and his estimated mean (median) spell of poverty is 2.02 (1.01). Finally, the estimated mean (median) non-poverty spell for this individual is 2.97 (1.69).

**Black Caribbean** The reference male's probability of persisting and entering poverty is 0.31 and 0.15 respectively. His unconditional rate of poverty is 0.18; and his mean (median) duration of poverty is 1.45 (0.59) years and his mean (median) duration of non-poverty is 6.66 (4.26) years. If his age decreases by ten years then his poverty persistence rate decreases to 0.23. His mean (median) duration of poverty also falls to 1.3 (0.48) and consistent with this his duration non-poverty increases. If instead the reference individual's age increases by 10 years then we find an opposite pattern, poverty persistence increases, as do poverty spells.

If the reference individual lives in a household where the HoH has a degree, then his poverty persistence (entry) rate is 0.25 (0.14), highlighting the importance of higher education on reducing poverty persistence and particularly entry for this group. His unconditional poverty rate is 0.09; and his mean (median) duration of poverty is 1.33 (0.49) years and his mean (median) duration of non-poverty is 13.22 (8.81) years. If the reference individual lives in a household where nobody is in work then his poverty persistence (entry) rate is 0.38 (0.39), highlighting that employment has a strong effect on poverty entry and to a lesser extent persistence. His unconditional rate of poverty is 0.16 and his mean (median) duration of poverty is 1.62 (0.72) years. His mean (median) estimated period of non-poverty falls to 2.56 (1.4) years. The final stylised case considers the case where the reference individual lives in a household where one individual (not necessarily himself) is in receipt of disability/incapacity benefit; in this case his poverty persistence and entry rate is 0.25 and 0.14 respectively. His unconditional poverty rate is 0.16 and his estimated mean (median) spell of poverty is 1.33 (0.5). Finally, the estimated mean (median) non-poverty spell for this individual is 7.15 (4.6).



**Black African** The reference male's probability of persisting and entering poverty is 0.11 and 0.14 respectively. His unconditional rate of poverty is 0.14; and his mean (median) duration of poverty is 1.13 (0.32) years and his mean (median) duration of non-poverty is 7.03 (4.52) years. If instead the HoH is female then his estimated poverty persistence rate declines to 0.06, albeit poverty entry increases to 0.17. In terms of durations, these are not dissimilar to the reference case.

If the reference individual lives in a household where the HoH has a degree, then his poverty persistence (entry) rate is 0.23 (0.07), highlighting the importance of higher education on reducing poverty entry for this group, but not persistence, indeed the estimated persistence rate is higher than in the reference case. His unconditional poverty rate is 0.08; and his mean (median) duration of poverty is 1.07 (0.26) years and his mean (median) duration of non-poverty is 6.41 (4.09) years. If the reference individual lives in a household where nobody is in work then his poverty persistence (entry) rate is 0.3 (0.34), highlighting that employment has a strong effect on both poverty persistence entry. His unconditional rate of poverty is 0.33 and his mean (median) duration of poverty is 1.42 (0.57) years. His mean (median) estimated period of non-poverty falls to 2.94 (1.67) years. The final stylised case considers the case where the reference individual lives in a household where one individual (not necessarily himself) is in receipt of disability/incapacity benefit; in this case his poverty persistence and entry rate is 0.03 and 0.05 respectively. His unconditional poverty rate is 0.05 and his estimated mean (median) spell of poverty is 1.03 (0.2). Finally, the estimated mean (median) non-poverty spell for this individual is 19.18 (12.95). Again, clearly highlighting the effect disability and incapacity benefits can have on determining living standards for this group when not subtracted from disposable income.

**White Majority England** The estimated poverty persistence and entry rate for the reference individual is 0.46 and 0.20 respectively. His unconditional poverty rate is 0.28 and his mean (median) duration of a poverty is 1.86 (0.91) years; his mean (median) non-poverty spell is 4.80 (2.96) years. If his age increases by one standard deviation then his poverty persistence (entry) rate increases to 0.49 (0.23). His unconditional rate of poverty also increases to 0.31, as does his mean (median) duration of poverty 1.97 (0.98). His mean (median) duration of non-poverty falls to 4.42 (2.70) years. Suppose now that the reference individual is female, then her poverty persistence (entry) rate is 0.47 (0.20), her unconditional rate of poverty is 0.28. Her mean (median) duration of poverty is 1.87 (0.91) years and her mean estimated duration of non-poverty is 4.91 (3.04) years.

If the reference individual lives in a household where the HoH has a degree, then his poverty persistence (entry) rate is 0.35 (0.15), highlighting the importance of higher education on reducing poverty persistence & entry poverty for this group. His unconditional poverty rate is 0.19; and his mean (median) duration of poverty is 1.54 (0.66) years and his mean (median) duration of non-

poverty is 6.47 (4.13) years. If the reference individual lives in a household where nobody is in work then his poverty persistence (entry) rate is 0.54 (0.15), highlighting that employment has a strong effect on poverty persistence but not on entry, indeed the entry rate is lower than that of the reference individual. His unconditional rate of poverty is 0.25 and his mean (median) duration of poverty is 2.16 (1.12) years. His mean (median) estimated period of non-poverty increases to 6.54 (4.17) years. The final stylised case considers the case where the reference individual lives in a household where one individual (not necessarily himself) is in receipt of disability/incapacity benefit; in this case his poverty persistence and entry rate is 0.39 and 0.29 respectively. His unconditional poverty rate is 0.32 and his estimated mean (median) spell of poverty is 1.62 (0.72). Finally, the estimated mean (median) non-poverty spell for this individual is 3.43 (2.01).

**White Majority** The estimated poverty persistence and entry rate for the reference individual is 0.35 and 0.07 respectively. His unconditional poverty rate is 0.1 and his mean (median) duration of a poverty is 1.54 (0.66) years; his mean (median) non-poverty spell is 13.73 (9.17) years.

If the reference individual lives in a household where the HoH has a degree, then his poverty persistence (entry) rate is 0.25 (0.02), highlighting the importance of higher education on reducing poverty persistence & entry poverty for this group. His unconditional poverty rate is 0.03; and his mean (median) duration of poverty is 1.34 (0.5) years and his mean (median) duration of non-poverty is 43.26 (29.64) years. If the reference individual lives in a household where nobody is in work then his poverty persistence (entry) rate is 45 (0.2), highlighting that employment has a strong effect on poverty persistence and to a lesser extent, also on entry. His unconditional rate of poverty is 0.26 and his mean (median) duration of poverty is 1.8 (0.86) years. His mean (median) estimated period of non-poverty is 5.08 (3.16) years. The final stylised case considers the case where the reference individual lives in a household where one individual (not necessarily himself) is in receipt of disability/incapacity benefit; in this case his poverty persistence and entry rate is 0.28 and 0.07 respectively. His unconditional poverty rate is 0.08 and his estimated mean (median) spell of poverty is 1.38 (0.54). Finally, the estimated mean (median) non-poverty spell for this individual is 15.23 (10.21).

The results highlight significant within group heterogeneity among each of the ethnic groups, evidenced by the difference between mean and median poverty (non) durations for individuals with identical characteristics. The within group differences are particularly high for individuals with different educational qualifications, households with no members in work and also those where an individual is in receipt of particular benefit income. Moreover, the results indicate there is more variation in poverty entry than poverty persistence which suggest policies to get individuals out of low income should focus on factors which determine or influence entry into the state.

**State dependence** The effects of remaining in poverty have been shown to have a significant and negative impact on individuals health, wellbeing etc and also on the state, if for example poverty is linked to unemployment (Arulampalam et al., 2001). Cappellari and Jenkins (2004) propose two direct measures of state dependence, Aggregate State Dependence (ASD) and the Genuine State Dependence (GSD). ASD is the simple difference of poverty propensity at  $t$  between the poor and non-poor at  $t - 1$ , while GSD takes into account individuals (observed and unobserved) heterogeneity, and so reflects scarring - the propensity to be poor simply because they were been poor in the last period. In other words, being poor in one period could make the individual demotivated and so not try to get out of poverty in the next period or make others stigmatise him/her and make it harder for them to do so. Columns one and two of Table 7 show ASD and GSD estimates for each group based on the most general model presented in section 2. White majority and black Africans show the highest levels of GSD (0.40 and 0.36), followed by Indian, Pakistani and black Caribbean (0.29-0.31) and Bangladeshi group the lowest (0.18).

Table 7: Aggregate and Genuine State Dependence

Study	ASD	GSD	Test of GSD $H_0 : \gamma_1 = \gamma_2$
Cappellari and Jenkins (2004)	0.61	0.47	Reject (p=0.00)
white majority	0.43	0.36	Reject (p=0.00)
white majority (England)	0.43	0.35	Reject (p=0.00)
Indian	0.51	0.31	Not rejected (p=0.12)
Pakistani	0.43	0.29	Not rejected (p=0.15)
Bangladeshi	0.24	0.18	Not rejected (p=0.12)
black Caribbean	0.45	0.31	Not Rejected(p=0.84)
black African	0.53	0.40	Reject (p=0.05)

One method of testing for GSD is to directly test the model coefficients (entry and persistence) in 3; if the null hypothesis that the coefficients for entry and persistence are statistically identical from one other is rejected then this would imply evidence of GSD. The results of a test of this type are shown in column 4 of Table 7, which indicates the presence of GSD for white majority and black African groups and rejects it for all other groups. Even though the estimated poverty persistence rates for the other ethnic minority groups are higher this finding suggests that they don't suffer any direct scarring due to being poor in the last period.

## Conclusion

Evidence has shown that ethnic minority groups in the UK are disadvantaged across a number of dimensions, resulting in high levels of economic disadvantage as measured by low earnings, lowincome, and high incidence of poverty entry persistence (Platt, 2007b; Fisher and Nandi, 2015; Weekes-Bernard, 2017). Lack of longitudinal data with sufficiently large sample sizes for different ethnic minority groups has resulted in limited empirical research addressing the individual

and household level characteristics that affect poverty entry and poverty persistence among individuals across and within different ethnic minority groups. This evidence is vital to allow policy makers to design policies to tackle poverty effectively among UK's ethnic minority groups.

Using a unique longitudinal household survey which oversamples ethnic minorities, *Understanding Society*, we investigate the extent of low income dynamics among ethnic minorities in the UK and control for biases which arise due to initial-conditions and non-random attrition using the method developed by Cappellari and Jenkins (2004). First, our results indicate that initial conditions should be accounted for when modelling poverty dynamics among Indian and black African groups, and non-random attrition should be accounted for when modelling poverty dynamics among black Caribbean and white majority groups. Neither of these biases is important for the Pakistani and Bangladeshi groups. We find that not accounting for initial conditions underestimates poverty persistence and entry rates for the Indian group and over-estimates it for the black African group.

Second, whilst our results highlight substantial between group heterogeneity we do observe some common patterns. We find education of the head of household, employed people in the household and children in the household are crucial in explaining initial poverty and poverty entry risks. While these patterns are generally observed across groups there are some exceptions highlighting the extent of between group variation in explaining poverty risks. In terms of initial poverty the exception is black Africans for whom head of household education does not matter. While living in London is generally found to reduce the risk of initial poverty for ethnic minority groups, it has no effect on black Caribbean and black African groups. We also find that older Pakistani and Bangladeshi individuals are more likely to be poor. The exceptions to poverty entry patterns are that education does not reduce poverty entry risks for black African and Bangladeshi groups, and presence of children in the household does not increase the poverty entry risk for Bangladeshi, black Caribbean and black African groups. We also find that living in London reduces the risk of poverty entry for Indians and white majority and ill-health of the HoH increases the poverty entry risk for white majority.

Household type is the only factor we find which is important in determining poverty persistence across ethnic groups. However, the results show that it is not the same household types which are important for all groups. For example, in the case of the white majority group single person and couple with no children households are significantly more likely to persist in poverty relative to pensioner households. Whereas for the Indian group couples with no children are more likely to persist in poverty relative to the base group (pensioners, single person, lone parents and other household types). For the black Caribbean group multifamily households are more likely to persist in poverty relative to pensioner, lone parent, single person and other household types.

Third, by modelling poverty dynamics for each ethnic minority group separately not only have we been able to show the heterogeneity between groups, but also that there exists substantial heterogeneity *within* the ethnic minority

groups. Such heterogeneity affects the 'poverty experience' as defined by periods in and out of poverty for each group. We find there is greater in-group variation in poverty entry rates than persistence rates. On the other hand, for the white majority group our results suggest the variation in poverty persistence and entry rates is relatively similar.

Another aspect of the poverty dynamics which is of central interest to policymakers is state dependence, specifically genuine state dependence (GSD) as this reflects the scarring effects of poverty. There is evidence of scarring among black African and white majority groups. This highlights the detrimental impact that one episode of poverty can have on an individual's future prospects of escaping low income and thus the urgent need for policies that target poverty entry. Although the estimated poverty persistence rates for the other ethnic minority groups are similar or higher, this test shows it is only these two groups, who experience poverty scarring.

Another important finding relates to the role of benefit income in measuring living standards, specifically, that those receiving benefit income reduces poverty persistence, poverty entry and poverty spell lengths for some groups. However, it is unlikely these individuals' standard of living will have improved due to the fact that someone in the household (potentially them) is in receipt of disability or incapacity benefit; such benefits are intended to cover specific expenses such as the cost of care. This highlights one pitfall of income-based measures of living standards which do not account for disability based; recent work has sought to resolve this by defining so-called disability-adjusted poverty lines (Morciano et al., 2015).

These results show that having a 'one size fits all' poverty reduction policy is not likely to be very effective and highlights the importance of customising policies for different ethnic groups and individuals with specific characteristics. The analysis highlights the key role of education and employment, although the link between education and employment (and hence income) is tenuous particularly for black African groups. Once we control for initial conditions and non-random attrition our results suggest that most of the observable factors affect initial poverty and poverty entry risk and not poverty persistence risks, and that there is greater variation within groups in poverty entry rates rather than poverty persistence rates, suggesting that measures to reduce entry into poverty may be more effective than reactive policies for getting people out of poverty. The lack of poverty scarring for most ethnic minority groups is an area that requires further research. It is important to identify the protective factors that buffer most ethnic groups (other than white majority and black African groups) against the scarring effects of poverty.

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## Appendix A: formulae to compute poverty persistence and poverty entry.

Using the estimates from equations 1 to 3 we can characterise the poverty transitions process, providing conditional estimates of the probabilities of poverty

entry, poverty exit, poverty persistence, and so on.<sup>21</sup> In this paper, we focus on the estimation of the probability of poverty persistence  $s_{it}$  (i.e., the probability of an individual to be poor at  $t$ , given that she was poor at  $t - 1$ ) and poverty entry  $e_{it}$  (i.e., the probability of an individual to be poor at  $t$ , given that she was not poor at  $t - 1$ ). Cappellari and Jenkins (2004) show that the expressions for each of these probabilities is:

$$s_{it} \equiv Pr(P_{i,t} = 1 | P_{i,t-1} = 1) = \frac{\Phi_2(\gamma'_1 z_{i,t-1}, \beta' x_{i,t-1}, \rho_2)}{\Phi(\beta' x_{i,t-1})} \quad (4)$$

$$e_{it} \equiv Pr(P_{i,t} = 1 | P_{i,t-1} = 0) = \frac{\Phi_2(\gamma'_2 z_{i,t-1}, -\beta' x_{i,t-1}, -\rho_2)}{\Phi(-\beta' x_{i,t-1})} \quad (5)$$

where  $\Phi(\cdot)$  and  $\Phi_2(\cdot)$  correspond to the univariate and bivariate cumulative normal distributions, respectively.

If we assume a stationary environment, the mean duration of a poverty spell would be given by  $1/(1 - s_{it})$ , while its median duration by  $\log(0.5)/\log(s_{it})$  (Cappellari and Jenkins (2004)). In a similar fashion, the expression for the mean duration of a non-poverty spell is  $1/e_{it}$  and the median duration by  $\log(0.5)/\log(1 - e_{it})$ , which will be used in Section 2 to analyse the duration of poverty for different types of individuals.

## Appendix B: formulae to compute ASD and GSD.

A key element of our analysis is testing the existence of true state dependence in poverty status among ethnic minorities. Cappellari and Jenkins (2004) propose two measures based on the estimates of poverty persistence and poverty entry (see Appendix A), which they denominate aggregate state dependence (ASD) and genuine state dependence GSD. ASD results from subtracting the average probability of being poor among those who were not poor at  $t - 1$ , from the average probability of being poor among those who were poor at  $t - 1$ :

$$ASD = \frac{\sum_{i \in \{P_{i,t-1}=1\}} Pr(P_{i,t} = 1 | P_{i,t-1} = 1)}{\sum_i P_{i,t-1} = 1} - \frac{\sum_{i \in \{P_{i,t-1}=0\}} Pr(P_{i,t} = 1 | P_{i,t-1} = 0)}{1 - \sum_i P_{i,t-1} = 0}. \quad (6)$$

The GSD measure is defined as the average difference in the probability of poverty persistence and poverty entry, at the individual level, so that the unobserved factors affecting poverty persistence and poverty entry for each individual are accounted for. The expression for the GSD measure is:

$$GSD = \frac{1}{N} \sum_i [Pr(P_{i,t} = 1 | P_{i,t-1} = 1) - Pr(P_{i,t} = 1 | P_{i,t-1} = 0)]. \quad (7)$$

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<sup>21</sup> Additional probabilities may be estimated taking using the results of the retention process, as detailed in Cappellari and Jenkins (2004), but we focus on  $s_{it}$  and  $e_{it}$  because one of the advantages of using a first order Markov model is the availability of simple expressions to calculate the mean and median duration of the spells (Cappellari and Jenkins, 2004).

It is convenient to note that all the estimates for poverty persistence, poverty entry, ASD and GSD can be calculated for the whole sample, and not only for the *balanced panel* (individuals observed at both  $t$  and  $t - 1$ ), which is one of the advantages of this model.



## Appendix C: Descriptive statistics of the sample by ethnic group.

	White majority	White majority (England)	Indian	Pakistani	Bangladeshi	black Caribbean	black African
Individual characteristics							
Age	44.82	44.76	42.13	39.40	39.33	45.03	40.96
Age squared	2100.02	2095.56	1859.76	1629.46	1619.90	2105.06	1754.74
Female	0.56	0.55	0.52	0.54	0.50	0.65	0.59
Highest educational qualification							
No qualification	0.08	0.07	0.09	0.19	0.31	0.08	0.07
GCSE or vocational	0.32	0.33	0.22	0.31	0.31	0.32	0.19
A-levels or other higher	0.34	0.33	0.27	0.21	0.15	0.34	0.29
Degree	0.27	0.28	0.43	0.29	0.23	0.26	0.44
Head of household characteristics							
Age	47.01	46.99	45.55	43.88	44.27	47.10	43.47
Age squared	2317.57	2316.95	2185.44	2068.83	2080.57	2312.39	1985.70
Female	0.44	0.43	0.28	0.34	0.28	0.64	0.51
Long standing illness	0.33	0.33	0.24	0.32	0.31	0.36	0.19
Highest educational qualification							
No qualification	0.09	0.08	0.11	0.23	0.33	0.11	0.06
GCSE or vocational	0.32	0.32	0.21	0.28	0.29	0.32	0.18
A-levels or other higher	0.33	0.32	0.26	0.19	0.14	0.32	0.29
Degree	0.27	0.27	0.41	0.30	0.23	0.25	0.47
Household characteristics							
disability or incapacity benefit recipient in HH	0.12	0.11	0.08	0.12	0.11	0.10	0.06
number of employed persons in HH	1.65	1.66	1.87	1.40	1.36	1.27	1.40
Proportion of members 1st generation	0.03	0.03	0.48	0.36	0.41	0.28	0.51
Proportion of members 2nd generation	0.12	0.12	0.22	0.23	0.17	0.42	0.12
Household composition							
Lone parents	0.05	0.05	0.03	0.04	0.03	0.17	0.14
Couple with children	0.34	0.34	0.40	0.46	0.49	0.21	0.37
Multi-family	0.10	0.09	0.21	0.31	0.35	0.13	0.17

## Appendix C: Descriptive statistics of the sample by ethnic group (continued)

	White majority	White majority (England)	Indian	Pakistani	Bangladeshi	black Caribbean	black African
Head of household characteristics							
Household composition							
Pensioner household	0.05	0.05	0.01	0.01	0.01	0.03	0.01
Couple with no children	0.24	0.24	0.10	0.04	0.03	0.08	0.07
Single person household	0.11	0.11	0.05	0.03	0.02	0.22	0.10
Region of residence	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lives in London	0.05	0.07	0.39	0.21	0.71	0.63	0.66
South East and East of England	0.22	0.29	0.13	0.13	0.08	0.10	0.14
Midlands Wales and South West	0.33	0.33	0.34	0.25	0.11	0.21	0.10
North East, North West, Yorkshire, Scotland and NI	0.40	0.32	0.14	0.42	0.10	0.06	0.10
Lives in England	0.75	1.00	0.97	0.97	0.98	0.99	0.98
Interview wave							
Wave 1	0.30	0.29	0.32	0.32	0.33	0.32	0.35
Wave 2	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Wave 3	0.23	0.23	0.23	0.23	0.22	0.23	0.21
Wave 4	0.22	0.22	0.21	0.21	0.20	0.21	0.19
Interview year	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2010	0.17	0.16	0.12	0.12	0.13	0.14	0.14
2011	0.27	0.27	0.28	0.28	0.29	0.29	0.30
2012	0.24	0.24	0.24	0.24	0.22	0.24	0.23
2013	0.22	0.22	0.22	0.21	0.22	0.21	0.20
2014	0.10	0.11	0.14	0.14	0.13	0.12	0.12
2015	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Number of observations	74,476	56,021	3,472	2,548	1,795	1,744	2,069

## Appendix D: Sensitivity checks and instrument validity

**Table D1: White majority**

Model test statistics

Null hypothesis for tests	Test statistic	p-value
Inclusion of dummy whether father is born in UK in equation 1	6.6	0.01
Inclusion of original sample membership status in equation 2	13.4	0.00
Exclusion of dummy whether father is born in UK from 3	1.9	0.39
Exclusion of original sample membership from 3	2.0	0.36
Exclusion of dummy whether father is born in UK and original sample membership from 3	3.8	0.43
Normality of composite error in 1	1008	0.00
Normality of composite error in 2	2250	0.00
Normality of composite error in 3	2010	0.00

**Table D2: White Majority (England)**

Model test statistics

Null hypothesis for tests	Test statistic	p-value
Inclusion of dummy whether father is born in UK in equation 1	9.2	0.00
Inclusion of original sample membership status in equation 2	8.9	0.00
Exclusion of dummy whether father is born in UK from 3	4.1	0.13
Exclusion of original sample membership from 3	1.7	0.43
Exclusion of dummy whether father is born in UK and original sample membership from 3	5.8	0.21
Normality of composite error in 1	8950	0.00
Normality of composite error in 2	1750	0.00
Normality of composite error in 3	1460	0.00

**Table D3: Indian**

Model test statistics

Null hypothesis for tests	Test statistic	p-value
Inclusion of dummy whether mother was in employment when respondent was age 14 in equation 1	10.1	0.00
Inclusion of original sample membership status in equation 2	4.9	0.03
Exclusion of dummy whether father is born in UK from equation 3	3.2	0.2
Exclusion of original sample membership from equation 3	0.9	0.65
Exclusion of dummy whether father is born in UK and original sample membership from equation 3	4.76	0.31
Normality of composite error in 1	48	0.00
Normality of composite error in 2	5444	0.00
Normality of composite error in 3	4888	0.00



**Table D4: Pakistani**

Model test statistics

Null hypothesis for tests	Test statistic	p-value
Inclusion of father having post schooling qualifications in equation 1	4.1	0.04
Inclusion of whether interviewer thought survey respondent was suspicious of study equation 2	8.88	0.01
Exclusion of father having post schooling qualifications from equation 3	1.06	0.59
Exclusion of whether interviewer thought survey respondent was suspicious of study equation from 3	0.2	0.90
Exclusion of father having post schooling & survey respondent being suspicious of survey from equation 3	4.92	0.30
Normality of composite error in 1	164	0.00
Normality of composite error in 2	4200	0.00
Normality of composite error in 3	80	0.000

**Table D5: Bangladeshi**

Model test statistics

Null hypothesis for tests	Test statistic	p-value
Inclusion of father having post schooling qualifications in equation 1	3.8	0.05
Inclusion of number of calls to achieve full interview from first contact in equation 2	5.39	0.02
Exclusion of father having post schooling qualifications from equation 3	0.7	0.72
Exclusion of number of calls to achieve full interview from first contact from equation 3	0.9	0.64
Exclusion of father having post schooling & number of calls to full interview from 3	1.49	0.83
Normality of composite error in 1	20	0.00
Normality of composite error in 2	1712	0.00
Normality of composite error in 3	472	0.00

**Table D6: Black Caribbean**

Model test statistics

Null hypothesis for tests	Test statistic	p-value
Inclusion of dummy indicating individual left full-time education before age 16 in equation 1	4.4	0.04
Inclusion of dummy indicating interviewer thought survey respondent co-operated very well 2	7.9	0.01
Exclusion of dummy indicating individual left full-time education before age 16 from 3	0.5	0.78
Exclusion of dummy indicating interviewer thought survey respondent co-operated very well from 3	0.58	0.74
Exclusion of individual leaving f/t education < age 16 & respondent co-operating very well from 3	1.13	0.89
Normality of composite error in 1	44	0.00
Normality of composite error in 2	2635	0.00
Normality of composite error in 3	2714	0.00

**Table D7: Black African**

Model test statistics

Null hypothesis for tests	Test statistic	p-value
Inclusion of dummy indicating mother had no qualification in equation 1	5.6	0.02
Inclusion of dummy indicating interviewer thought survey respondent co-operated very well 2	21.5	0.00
Exclusion of dummy indicating mother had no qualification from 3	4.9	0.09
Exclusion of dummy indicating interviewer thought survey respondent co-operated very well from 3	1.0	0.62
Exclusion of mother having no qualification & respondent co-operating very well from 3	6.37	0.17
Normality of composite error in 1	549	0.00
Normality of composite error in 2	1070	0.00
Normality of composite error in 3	1440	0.00

## Appendix E: Stylised simulations of poverty experience by ethnic minority group

**Table E1: Indian** (1) base case: head of household is male with median hhage, no qualifications,nuclear family with spouse and one child, one member of the hh in paid work, receives no benefits and report no illness.

Characteristics	Poverty persistence rate (si,t)	Poverty entry rate (ei,t)	Pr(poor)	Poverty duration (mean)	Poverty duration (median)	Non-poverty duration (mean)	Non-poverty duration (median)
(1)	0.75	0.4	0.62	3.98	2.4	2.49	1.35
(1) except reduce age by 10 years	0.73	0.44	0.62	3.71	2.2	2.3	1.21
(1) except increase age by 10 years	0.77	0.37	0.61	4.32	2.63	2.72	1.51
(1) except female	0.73	0.41	0.6	3.71	2.21	2.42	1.3
(1) except HoH female	0.78	0.39	0.64	4.58	2.81	2.56	1.4
(1) except female and HoH female	0.76	0.4	0.63	4.25	2.58	2.49	1.35
(1) except has a degree	0.64	0.2	0.36	2.81	1.57	4.95	3.07
(1) except no individuals in paid employment	0.83	0.58	0.77	5.82	3.68	1.73	0.81
(1) except benefit unit in household receives disability/incapacity benefit	0.65	0.32	0.48	2.84	1.6	3.14	1.8
Notes: estimates based on coefficient in Tables 3 and 4 assuming steady state and substituted into expressions 5 & 4							

**Table E2: Pakistani** (1) base case: head of household is male with median hhage, no qualifications,nuclear family with spouse and one child, one member of the hh in paid work, receives no benefits and report no illness.

Characteristics	Poverty persistence rate (si,t)	Poverty entry rate (ei,t)	Pr(poor)	Poverty duration (mean)	Poverty duration (median)	Non-poverty duration (mean)	Non-poverty duration (median)
(1)	0.64	0.54	0.6	2.81	1.57	1.85	0.89
(1) except reduce age by 10 years	0.61	0.56	0.59	2.57	1.41	1.77	0.83
(1) except increase age by 10 years	0.67	0.52	0.61	3.07	1.76	1.94	0.95
(1) except female	0.65	0.51	0.59	2.87	1.62	1.95	0.96
(1) except HoH female	0.59	0.53	0.56	2.44	1.32	1.89	0.92
(1) except female and HoH female	0.6	0.5	0.55	2.49	1.35	2	1
(1) except has a degree	0.58	0.25	0.37	2.4	1.28	4	2.41
(1) except no individuals in paid employment	0.69	0.73	0.7	3.2	1.85	1.36	0.52
(1) except benefit unit in household recieves disability/incapacity benefit	0.49	0.4	0.44	1.96	0.97	2.5	1.36
Notes: estimates based on coefficient in Tables 3 and 4 assuming steady state and substituted into expressions 5 & 4							

**Table E3: Bangladeshi** (1) base case: head of household is male with median hhage, no qualifications,nuclear family with spouse and one child, at least one member of the hh in paid work, receives no benefits and report no illness.

Characteristics	Poverty persistence rate (si,t)	Poverty entry rate (ei,t)	Pr(poor)	Poverty duration (mean)	Poverty duration (median)	Non-poverty duration (mean)	Non-poverty duration (median)
(1)	0.66	0.49	0.59	2.93	1.66	2.04	1.03
(1) except reduce age by 10 years	0.53	0.49	0.51	2.12	1.09	2.04	1.03
(1) except increase age by 10 years	0.77	0.48	0.68	4.4	2.69	2.06	1.05
(1) except female	0.73	0.47	0.64	3.77	2.25	2.11	1.08
(1) except HoH female	0.71	0.43	0.6	3.47	2.04	2.34	1.24
(1) except female and HoH female	0.78	0.41	0.65	4.59	2.82	2.43	1.31
(1) except has a degree	0.66	0.25	0.42	2.94	1.67	4	2.41
(1) except no individuals in paid employment	0.72	0.74	0.72	3.56	2.1	1.35	0.52
(1) except benefit unit in household recieves disability/incapacity benefit	0.5	0.34	0.4	2.02	1.01	2.97	1.69
Notes: estimates based on coefficient in Tables 3 and 4 assuming steady state and substituted into expressions 5 & 4							

**Table E4: Black Caribbean** (1) base case: head of household is male with median hhage, no qualifications,nuclear family with spouse and one child, one member of the hh in paid work, receives no benefits and report no illness.

Characteristics	Poverty persistence rate (si,t)	Poverty entry rate (ei,t)	Pr(poor)	Poverty duration (mean)	Poverty duration (median)	Non-poverty duration (mean)	Non-poverty duration (median)
(1)	0.31	0.15	0.18	1.45	0.59	6.66	4.26
(1) except reduce age by 10 years	0.23	0.17	0.18	1.3	0.48	5.9	3.73
(1) except increase age by 10 years	0.4	0.13	0.18	1.65	0.75	7.67	4.96
(1) except female	0.31	0.15	0.18	1.45	0.59	6.66	4.26
(1) except HoH female	0.31	0.13	0.16	1.44	0.59	7.81	5.06
(1) except female and HoH female	0.31	0.13	0.16	1.44	0.59	7.81	5.06
(1) except has a degree	0.25	0.08	0.09	1.33	0.49	13.22	8.81
(1) except no individuals in paid employment	0.38	0.39	0.39	1.62	0.72	2.56	1.4
(1) except benefit unit in household recieves disability/incapacity benefit	0.25	0.14	0.16	1.33	0.5	7.15	4.6
Notes: estimates based on coefficient in Tables 3 and 4 assuming steady state and substituted into expressions 5 & 4							



**Table E5: Black African** (1) base case: head of household is male with median hhage, no qualifications,nuclear family with spouse and one child, at least one member of the hh in paid work, receives no benefits and report no illness.

Characteristics	Poverty persistence rate (si,t)	Poverty entry rate (ei,t)	Pr(poor)	Poverty duration (mean)	Poverty duration (median)	Non-poverty duration (mean)	Non-poverty duration (median)
(1)	0.11	0.14	0.14	1.13	0.32	7.03	4.52
(1) except reduce age by 10 years	0.13	0.11	0.11	1.15	0.34	9.08	5.94
(1) except increase age by 10 years	0.1	0.18	0.17	1.11	0.3	5.63	3.54
(1) except female	0.13	0.13	0.13	1.15	0.34	7.92	5.14
(1) except HoH female	0.06	0.17	0.16	1.06	0.24	5.74	3.62
(1) except female and HoH female	0.07	0.16	0.14	1.07	0.26	6.41	4.09
(1) except has a degree	0.23	0.07	0.08	1.3	0.47	15.35	10.29
(1) except no individuals in paid employment	0.3	0.34	0.33	1.42	0.57	2.94	1.67
(1) except benefit unit in household recieves disability/incapacity benefit	0.03	0.05	0.05	1.03	0.2	19.18	12.95
Notes: estimates based on coefficient in Tables 3 and 4 assuming steady state and substituted into expressions 5 & 4							

**Table E6: White majority England** (1) base case : head of household is male with median hhage, no qualifications,nuclear family with spouse and one child, at least one member of the hh in paid work, receives no benefits and report no illness.

Characteristics	Poverty persistence rate (si,t)	Poverty entry rate (ei,t)	Pr(poor)	Poverty duration (mean)	Poverty duration (median)	Non-poverty duration (mean)	Non-poverty duration (median)
(1)	0.36	0.08	0.11	1.57	0.68	12.40	8.24
(1) except reduce HoH age by 10 years	0.35	0.08	0.11	1.53	0.66	12.70	8.45
(1) except increase HoH age by 10 years	0.38	0.08	0.12	1.61	0.71	12.14	8.06
(1) except female	0.36	0.08	0.11	1.57	0.69	12.31	8.18
(1) except HoH female	0.40	0.08	0.12	1.67	0.76	11.87	7.88
(1) except female and HoH female	0.40	0.08	0.12	1.67	0.76	11.79	7.82
(1) except has a degree	0.31	0.03	0.04	1.45	0.59	37.74	25.81
(1) except no individuals in paid employment	0.48	0.21	0.28	1.93	0.95	4.86	3.01
(1) except benefit unit in household recieves disability/incapacity benefit	0.32	0.08	0.10	1.46	0.60	13.04	8.69
Notes: estimates based on coefficient in Tables 3 and 4 assuming steady state and substituted into expressions 5 & 4							

**Table E7: White majority** (1) base case: head of household is male with median hhage, no qualifications,nuclear family with spouse and one child, at least one member of the hh in paid work, receives no benefits and report no illness.

Characteristics	Poverty persistence rate (si,t)	Poverty entry rate (ei,t)	Pr(poor)	Poverty duration (mean)	Poverty duration (median)	Non-poverty duration (mean)	Non-poverty duration (median)
(1)	0.35	0.07	0.1	1.54	0.66	13.73	9.17
(1) except reduce age by 10 years	0.34	0.07	0.1	1.51	0.64	13.48	9
(1) except increase age by 10 years	0.37	0.07	0.1	1.58	0.69	14.06	9.39
(1) except female	0.35	0.07	0.1	1.53	0.66	13.53	9.03
(1) except HoH female	0.39	0.07	0.11	1.63	0.73	13.57	9.05
(1) except female and HoH female	0.38	0.07	0.11	1.62	0.72	13.36	8.91
(1) except has a degree	0.25	0.02	0.03	1.34	0.5	43.26	29.64
(1) except no individuals in paid employment	0.45	0.2	0.26	1.8	0.86	5.08	3.16
(1) except benefit unit in household recieves disability/incapacity benefit	0.28	0.07	0.08	1.38	0.54	15.23	10.21
Notes: estimates based on coefficient in Tables 3 and 4 assuming steady state and substituted into expressions 5 & 4							